REAL CORP 2014

Manfred SCHRENK, Vasily V. POPOVICH, Peter ZEILE, Pietro ELISEI (Eds.)

PLAN IT SMART

CLEVER SOLUTIONS FOR SMART CITIES

PROCEEDINGS

of the 19th International Conference on Urban Planning, Regional Development and Information Society

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Clever Solutions for Smart Cities

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Edited by

Manfred SCHRENK, Vasily V. POPOVICH, Peter ZEILE, Pietro ELISEI

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REAL CORP 2014

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PREFACE

Manfred SCHRENK,
Conference Director,
Chairman CORP – Competence Center of Urban and Regional Planning

WELCOME to REAL CORP 2014, the 19th International Conference on Urban Planning, Regional Development, Information Society and Urban/Transport/Environmental Technologies!

"Smart Cities" has become a widely used term for the implementation of information and communication technologies (ICT) into the processes of cities and the built environment, aiming to improve the integration of the physical assets as well as social and environmental capital. Fired by several rankings there seems to be a competition for the title of the "Smartest City".

This kind of hype raises a lot of questions that REAL CORP 2014 will deal with. Can we plan it smart and find clever solutions for smart cities?

During the three conference days we will go deeply into the subject of smart cities and smartness and exchange our knowledge on current topics such as:

- What does "Smart City" mean in terms of quality of life?
- How does it influence the economic perspectives?
- Are the concepts of sustainability and resilience part of "Smart Cities"?
- What about politics and administration, policies and governance?
- How do "Smart Solutions" influence the "hardware" of a city, the urban fabric?
- Last but not least: what is the role of urban/spatial planning in and for "Smart Cities"?

Our conference takes place at a site with long historical background: People started to settle down in today's Vienna area from the Neolithic era, later the spot was used to erect the Roman fortress Vindobona. The history of Vienna dates some thousand years back, and in its history the city has faced lots of changes and challenges. For sure this is going to continue in the future as cities have always been places of change, innovation and competence. We are still facing the effects of economic crisis and we have to deal with environmental issues more than ever before; handling these challenges and still being able to improve our cities and find

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strategies to point out their extraordinary opportunities as centres of interest will confront us with many different views – but which of these views can be considered smart and why?

Therefore, it will be a pleasure to discuss with colleagues from all over the world how we can make use of today's tools and technologies to improve planning for our cities and for the people who live there to improve their quality of life.

REAL CORP 2014 in Vienna lets us compare and present different approaches to smartness including theory and practical examples from all continents – we are happy to welcome around 300 participants from over 50 countries worldwide. 140 presentations and more than 1,000 pages in the proceedings clearly show that there is plenty of room to discuss thoughts, make new contacts, develop new ideas and initiate upcoming projects.

Let me last but not least emphasize that the organisation of this year's conference took place under truly difficult conditions, so I really want to say thank you especially to Clemens Beyer and Christian Eizinger for their huge efforts in the preparation of this event.

Welcome to the Smart City Vienna!
Have a great conference!

Manfred SCHRENK, Christian EIZINGER, Clemens BEYER
and the REAL CORP Team

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reviewed paper

A Back Step before Proposing Smart Interventions. Fitting People Needs with Innovations

Aniana Mereu

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1 ABSTRACT

Nowadays, one of the main subjects of city planning is the environmental impact cities' transformation into smart cities, characterized by an innovative use of technologies and synergies' development between the public and the private sectors. The principal attempt is the increase of the level of well-being and the quality of life. It could pertain to different parts of the city, like suburbs and inner-city. Therefore it is necessary to adapt technologies to environmental and architectural heritage, in order to respect the sustainability principle.

In my PhD research I do a backward step trying to define a methodology to understand needs and expectations of inner-city inhabitants and I apply it to a case study represented by the renewal of Cagliari inner-city, with the objective to increase the residential satisfaction degree of the inhabitants, proposing smart interventions. The paper examines the different phases of the conducted study until now.

2 INTRODUCTION

In the present age, one of the issues that concern planners is represented by the ability to propose interventions that fit people's needs. This intention found its first affirmation in the sustainability principle. Indeed it is important that everybody, both present and future generations, should have the possibility to use the necessary energy supplies in order to achieve a good quality of life. Some planners' work is linked to the elaboration of methodologies that could be applied to define actions and plans with the purposes already mentioned. At this time, different aspects of people's life are being examined in order to pursue a higher level of life satisfaction. One of them is the residential satisfaction related to house and to neighbourhood.

In this paper, my PhD research conducted until now is presented. It has the objective to determine a method of this sort, that involves the use of some statistical models, in particular the discrete choice models, and to apply this technique to a case study. First of all, it has been necessary to outline numerous steps of the method for the purpose of creating a know-how that could be used to analyse well different situations. Then, the technique is applied to the renewal of Cagliari's inner-city, in order to understand city-dwellers' satisfaction degree related to their house and related to the historic neighbourhoods. Having achieved this kind of knowledge allows planners to propose interventions, some of them innovative that are intent on contributing to make the city smarter.

3 METHODOLOGY

The first step of research has been the definition of a methodology, taking the cue from some planning processes and plans in general and from the nature of discrete choice models. In succession its numerous steps are presented:

(1) Context analysis that consists of a territorial analysis, regarding either the city or the territory; in particular, in the case study we are going to present, the attention is focused on the city, and it is important to consider several aspects such as the historic-architectural aspect of urban morphology and the development of the city;

(2) analysis of plans relative to the context examined, so in the case study examined the analysis concerns the inner-city so it should be appropriate to consider urban plans such as the Urban Town Plan (PUC – Piano Urbanistico Comunale), the Detailed Inner-city Plan (PPCS – Piano Particolareggiato del Centro Storico), etc.; it is important to identify plans' objectives, in order not to contradict them in the last phase of research in which we are going to propose interventions;

(3) study of numerous econometric models and analysis of cases study related to the use of discrete choice models, for the purpose established; this step could be useful to understand which models are suitable to describe in the best way the situation we are considering;

(4) experimental part that includes two steps: the first one is the definition of a method to find out information and for instance, the technique could comprehend a questionnaire and a series of interviews

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addressed to people that live in the inner-city or that have interests in the considered context; the second step is represented by the gathering of information constructing a specific dataset;

(5) application of the statistical models and in particular discrete choice models (probit, logit or others such as tobit models) in order to obtain the data processing;

(6) analysis of outcomes that will be different depending on the model used and on the goal of the methodological application;

(7) proposal of interventions which will have to respect the goals of plans considered, and these actions should be oriented to an improvement of the quality of life.

4 CASE STUDY

The case study considered is represented by the renewal of Cagliari's inner-city. The methodology as presented above, is applied starting with an analysis of the history of Cagliari.

4.1 Context analysis

The Cagliari's site has been suitable for the development of a city because it occupies an important position for commercial purposes, being in the middle of the Mediterranean Sea and because, about three thousands of years ago, in this place essential resources such as salt and minerals were plentiful. Hence, Cagliari has been characterized by numerous historic events and it has been dominated by different populations (Colavitti, Usai, 2007). Both dominations and characteristics of the territory influenced the city's structure. In particular, the urban form was affected by different architectural styles and by territory's topography. For instance, during the domination by Phoenicians and Carthaginians (between 700 B.C. and 250 B.C.) there were: the neighbourhood of Castello enclosed by walls to protect the city, the neighbourhood of Stampace where magistrates were located and it was characterized by a temple and a port, the north-west neighbourhood with its necropolis and with the lagoon port for the wheat, the east neighbourhood of Bonaria with a necropolis and another port for the salt. Probably the first urban structure was fan-shaped, with a principal road between the port, the square and the Acropolis, intersected with a road along the sea and the pond. The only part that could have had an orthogonal structure is the neighbourhood of Stampace (Principe, 1988). At about 1000 A.C. Cagliari's urban structure was similar to the current form, with the port that represented a sort of extention of the main neighbourhood of Castello. Cagliari had got a particular urban shape, divided into four sectors, everyone with a defined function and independent from the administrative and military points of view. Since 1800-1850 A.C. Cagliari was represented by four neighbourhoods: Castello, Stampace, Marina, Villanova. These represent the present inner-city. The neighbourhood of Castello represented the administrative centre of the city and it had a spindle structure with numerous squares. It was organized by a road network with principal roads (rugae) that were longitudinal and linked two towers (the Lion tower and the Saint Pancras tower) and by alleys (traversae) that connected the main roads. The houses had numerous floors and the ground floor was used as warehouse. The neighbourhood of Stampace rose up on a place characterized by a regular topography so the roads are parallel to the rugae of Castello, determining tight e long blocks. The neighbourhood of Marina have represented a sort of continuation of Cagliari toward the sea (Romagnino, 1982) and together with Castello represented the main centre of the city. It arose in a very sloping area and it is characterized by alleys and high and tight houses. The neighbourhood of Villanova arose before 1250 A.C. and it is characterized by an irregular grid structure of parcels with a principal road which was parallel to the eastern boundary of Castello. Since 1415 A.C. there was an increase in the number of Cagliari's inhabitants. It caused an increment of construction density in the neighbourhoods of Castello and Marina, where the buildings became higher and the streets similar to tight corridors (Alziator, 2007). The increment of the population and the necessity after the Second World War to provide for an abode to everybody caused a disorganized development of the city structure. An increment in the urbanized surface occurred, occupying level lands so the expansion suited the geomorphologic and microclimatic conditions, with buildings arising in the north-east part and in the east part of Cagliari. Hence, Cagliari's structure can be considered as an upshot of a process of continuous adaptation to the natural conditions of landscape (Colavitti, 2005). Nowadays, some characteristics of housing heritage of Cagliari's inner-city are: numerous houses built before 1919; houses of lower quality than average quality in Cagliari, caused by absence of facilities and services such as heating system, conditioning system, etc.; high percentage of family units composed by one person; percentage of houses occupied by owners is higher than the average percentage of Cagliari (Detailed Plan of Cagliari's Inner-city, pp. 77,78).

4.2 General Cagliari's inner-city plans objectives

In 1858 the architect Gaetano Cima elaborated the first local strategic plan of the city of Cagliari, in which the importance of the inner-city was affirmed but this plan wasn't applied (Malavasi, Zoppi, 1989). After the II World War a chaotic expansion occurred because bombardments destroyed lots of houses and there was the intention of giving people a house as soon as possible. The new plan was approved in 1938 and according to what established by the urban low n.1150/1942, it was changed in 1943. Numerous plans has focused on the renewal of Cagliari's inner-city. Firstly, the strategic plan in 1962 introduced the inner-city protection (Malavasi, Zoppi, 1989). Secondly, another plan, the "Piano Quadro" for the reclamation of inner-city, that became the Detailed Plan of inner-city, concentrated the attention on the requalification. This plan had the objective to establish a link between various parts of the city, in order to incorporate the inner-city in a united view and to preserve values of identity. In detail, its goals are: permanence of current residence (hoping for a better urban quality); construction of new houses after evaluation of accessibility conditions and of the possibility to transform the building heritage; incentive of presence of University students in the inner-city; regard of cultural and environmental resources; recovery interventions for some buildings in order to use them for new functions; amelioration of infrastructures; recovery of historical waterfront. In 1999 the Cagliari's Urban Plan was approved and its main objective was limitation of residential expansion in order to facilitate the recovery of existing building heritage. In particular, the objectives were: limitation of residential growth, requalification of inner-city and proposal of techniques that were economically feasible to make it. In 2006 another important plan was elaborated, the Regional Landscape Plan that puts the attention on different categories such as the inner-city with centres-of-ancient-and-first-formation category. It laid emphasis on the use of traditional techniques and materials to preserve the image of Cagliari's inner-city with the possibility to include technological innovations. All these plans permitted to delineate admissible interventions such as routine maintenance, emergency maintenance, restoration and conservative renewal, property renovation and completion (Detailed Plan of Cagliari's Inner-city). Considering all the objectives mentioned, we can affirm that the recovery can be considered as a way to reintegrate in the inner-city urban functions, given that Cagliari's inner city is characterized by a lack of services.

4.3 Brief digression about some applications of econometric models

This research's objective is the analysis of residential satisfaction degree referred to house and to neighbourhood. Hence, an useful step of this research is the analysis of numerous cases study about this topic. Some researchers such as Francescato, Weidemann and Anderson, Amerigo and Aragones, considered different dimensions of residential environment: affective, cognitive and behavioural dimensions (Francescato, Weidemann et Anderson, 1987; Amerigo et Aragones, 1999). Few scientists concentrated their attention just on some of these dimensions, such as Cooper that considered the affective dimension. Moreover other researchers such as Ha and Weber, Canter and Rees, defined the variables that influence the residential satisfaction considering different elements: socio-demographic characteristics of residents, objective characteristics of houses and relationships with neighbours (Ha and Weber, 1991, Canter and Rees, 1982). Different types of variables are due to researchers' background. For instance, planners generally consider environmental characteristics of houses, services, environmental security and relationships with neighbours, accessibility of functional areas in the residential area, as variables (Sam, Mohd Zain, Saadatian, 2012). The residential satisfaction is seen as a demonstration that inhabitants' needs are satisfied and that they live well in their houses. Different analysis are also linked to different models used to process data. Indeed some scientists preferred using logit or probit models such as Lu, Atkinson, Fang, others factor analysis and path analysis such as Temelova and Dvorakova and Speare (Lu, 1999; Parkes et all, 2002; Temelova et Dvorakova, 2012).

4.4 Experimental part

4.4.1 Elaboration of the questionnaire

The analysis of the cases study mentioned above permitted to take the cue from different kinds of approach and to elaborate a questionnaire. It is oriented towards Cagliari's inner-city residents. Its basis was the

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definition of residential satisfaction. Residential satisfaction is the measure of the difference between current residential conditions of people and desired conditions. The residential environment is defined as house, neighbourhood and relationships with neighbours, together. The questionnaire is realized in order to define all variables that influence the residential satisfaction and the degree of residential satisfaction itself. Having these data permits to apply econometric models in order to define quantitatively the influence of variables on satisfaction degree and to understand causes of dissatisfaction and consequently propose interventions. According to some psychologists it is important to discern between housing satisfaction and neighbourhood satisfaction so to use distinct questions, otherwise respondents can't unconsciously apply this distinction; hence, in the questionnaire there are different questions for residential satisfaction related to house and related to neighbourhood in order to prevent mistakes when city-dwellers answer (Amerigo et Aragones, 1999; Lu, 1999). A Likert scale was used to define the satisfaction degree: 1. Not satisfied; 2. A little bit dissatisfied; 3. Indifferent; 4. Enough satisfied; 5. Very satisfied. Hence, satisfaction degree is an ordered variable. Some questions in the questionnaire demand respondents' and family unit's characteristics. Indeed it is believed that respondent's age, job, education, family composition, have influence on satisfaction degree. Age is an important variable because there is a correspondence between life cycle's stage and expectations, whereas education and job can affect the kind of house in which people want to live. There are a lot of questions about interior housing characteristics, such as surface, number of rooms, heating system, conditioning system, etc.. All these questions permit to identify a condition of comfort in the house and to understand if there is a correspondence between this situation and a high satisfaction degree. Other questions check residents' moves in the past or in the future and they could be important to verify if a resident expresses the real satisfaction degree or not. Other questions try to identify neighbourhood characteristics, facilities and problems in order to understand the link between them and the satisfaction degree towards the neighbourhood and to propose useful interventions at the end of research.

4.4.2 Analysis through econometric models

This step consists in the implementation of some econometric models, after having created a dataset using Stata software. In particular, an ordinal Logit model and an ordinal Probit model are applied because the dependent variable that is the residential satisfaction is an ordinal variable. Hence, two models will be applied in order to have the possibility to compare the outcomes. These kind of models we are going to implement are characterized by a latent regression as presented in succession:

$yi^* = \beta' xi + \varepsilon i \qquad i = 1,\ldots\ldots,n$

where yi* is the latent variable, not observed; xi represents the covariates or independent variables; β is the k-parameters vector and it is the object of inference and evaluation; n is sample's size. We know yi that is the satisfaction degree but we don't know yi* that is the latent variable :

$yi = 0 \quad \text{if } yi^* \leq 0 \qquad \text{with } \mu 0 = 0$

$yi = 1 \quad \text{if } 0 < yi^* \leq \mu 1$

$yi = 2 \quad \text{if } \mu 1 < yi^* \leq \mu 2$

…..

$yi = j \quad \text{if } \mu j\text{-}1 \leq yi^*$

μ are unknown parameters that should be estimated with β (Greene, 1993). The residential satisfaction degree depends on both measurable factors (independent variables xi obtained through the questionnaire), and non-observable factors represented by ε. The yi* in the model describes a continuous preference, not observed, whereas the yi is ordered because it can have just five values (mentioned above). The respondents will express their satisfaction degree that should represent their feelings towards the house and towards the neighbourhood. In an ordered Probit model there is a standard normal distribution for εi and the Var[εi|xi] = 1, whereas in an ordered Logit model εi's distribution is a standardized logistic and the Var[εi|xi] = π2/3 (Greene, Henser, 2008). Assuming that xi has a constant element, we can assume that the first coefficient μ0 is equal to 0. Summing up, application of the econometric models has the objective to evaluate β coefficients for every considered independent variable. These coefficients are important to understand which variables influence mostly the residential satisfaction degree and if they have a negative or a positive influence. A hundred and fifty interviews have been conducted and their data are organized in a dataset and used to implement the model we described above using the Stata software. We can consider our sample a representative sample of the Cagliari's inner-city population. The first step, after having done the interviews, has been the creation of a dataset containing all the variables obtained through the questionnaire and their values. We operated numerous changes to variables in order to have suitable data to use in the ordinal Logit and Probit models, but previously it was necessary to implement a simple linear regression between the dependent variable and the numerical explanatory variables in order to verify absence of multicollinearity. Then, we implemented the models numerous times. The first time we apply Probit and Logit models the degree of residential satisfaction related to house was considered as the dependent variable whereas the covariates were: gender, education, job, age of the respondent, family composition, type of house and possession, internal characteristics such as house surface and balcony surface, the presence of some facilities such as heating system, conditioning system, etc.. Then we implement those models using the degree of residential satisfaction related to neighbourhood as the dependent variable and the covariates were some dummy variables that express the lack of services in the neighbourhood, other variables that explain the presence of problems such as noise, garbage, etc.. An interesting aspect could be the implementation of a model in which the relation between the satisfaction towards the house and the satisfaction towards the neighbourhood are considered. Taking into account the studies conducted in the past about this topic, numerous psychologists affirmed that the satisfaction degree related to neighbourhood can influence the satisfaction degree related to house. We want to implement a model with the satisfaction degree of the house as a dependent variable, and considering the satisfaction degree of the neighbourhood as one of the independent variables, using also a nested model to introduce the variables that explain the satisfaction related to neighbourhood. This is a future step of the thesis. The first econometric model we talked about is:

Soddisfazc = β0 + β1*eta + β2*d_gen + β3*rationucleo + β4*ratiosup1 + β5*_Istudio + β6*_Ilavoro + β7*_Igodimcasa + β8*d_riscald + β9*d_pompe + β10* d_ascens + β11* d_sgacant

In which:

eta = dummy variables set representing respondent's age that is organized in cathegories (eta_categx1=1 if respondent is between 18 and 25 years old, 0 otherwise; similarly for eta_categx2 = 1 if the interviewed is between 26 and 40 years old, eta_categx3 = 1 if the respondent is between 41 and 60 years old, eta_categx4 = 1 if the interviewed is more than 60 years old);

d_gen = dummy variable for gender (d_gen=1 for female, d_gen=0 for male);

rationucleo = factor variable representing the ratio between number of people that live in respondent's house and average number of people in a family considering interviews' data;

ratiosup1 = factor variable obtained dividing house's surface for every resident interviewed for the average surface of respondents' houses in the sample;

_Istudio = dummy variables set for the degree of education of the respondent (istudio1 = 1 if the respondent is graduated or has a school leaving certificate, 0 otherwise; istudio2 = 1 if the respondent has a primary school certificate or a junior high school certificate, 0 otherwise);

_Ilavoro = dummy variables set for the kind of job of the respondent (jlavoro1 = 1 if the respondent is a public employee, 0 otherwise; jlavoro2 = 1 if the respondent is a freelance professional, 0 otherwise; jlavoro3 = 1 if the respondent is a student or a retiree or an unemployed, 0 otherwise);

_Igodimcasa = dummy variables set that expresses the kind of possession of interviewed towards the house (sgodimcasa1 = 1 if the respondent lives in a rental flat, 0 otherwise; sgodimcasa2 = 1 if the respondent is owner of a flat, 0 otherwise; sgodimcasa3 = 1 if the respondent is the owner of a single house, 0 otherwise; sgodimcasa4 = 1 if the respondent is the beneficial owner of a flat, 0 otherwise);

d_riscald = dummy variable for the heating system (d_riscald = 1 if there is the heating system, 0 otherwise);

d_pompe = dummy variable for the conditioning system (d_pompe = 1 if there is the conditioning system, 0 otherwise);

d_ascens = dummy variable for the presence of an elevator (d_ascens = 1 if there is an elevator in the building, 0 otherwise);

d_scagant = dummy variable for the presence of a junk room or a cellar (d_scagant = 1 if there is a junk room or a cellar, 0 otherwise).

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As cited above, before implementing the ordinal Logit model a linear regression model for the dependent variable and the quantitative explanatory variables was implemented through Stata program. No problems of multicollinearity occurred. Indeed, a ordinal Logit model could be applied.

The results of the first model we implemented are:

```
. xi: ologit soddisfazc eta_categx2 eta_categx3 eta_categx4 d_gen rationucleo
> ratiosup1 i.studio i.lavoro i.godimcasa d_riscald d_pompe d_ascens d_sgacant
i.studio          _Istudio_1-2        (_Istudio_1 for studio==diplau omitted)
i.lavoro          _Ilavoro_1-3        (_Ilavoro_1 for lavoro==dip omitted)
i.godimcasa       _Igodimcasa_1-4     (_Igodimcasa_1 for ~mcasa==afapp omitted
> )

Iteration 0:   log likelihood = -168.54721
Iteration 1:   log likelihood =  -154.5344
Iteration 2:   log likelihood = -154.03179
Iteration 3:   log likelihood = -154.02993
Iteration 4:   log likelihood = -154.02993

Ordered logistic regression                       Number of obs   =        150
                                                  LR chi2(16)     =      29.03
                                                  Prob > chi2     =     0.0237
Log likelihood = -154.02993                       Pseudo R2       =     0.0861

------------------------------------------------------------------------------
  soddisfazc |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 eta_categx2 |  -.6280022   1.110931    -0.57   0.572    -2.805387    1.549383
 eta_categx3 |  -1.073229   1.032562    -1.04   0.299    -3.097013    .9505543
 eta_categx4 |  -.7534717   .9836777    -0.77   0.444    -2.681445    1.174501
       d_gen |   .1627012   .3611298     0.45   0.652    -.5451003    .8705026
 rationucleo |  -.4475387    .497397    -0.90   0.368    -1.422419    .5273415
   ratiosup1 |    1.51087   .5916083     2.55   0.011     .3513386    2.670401
  _Istudio_2 |  -.3196608   .4971828    -0.64   0.520    -1.294121    .6547995
  _Ilavoro_2 |   .3877155   .5952546     0.65   0.515     -.778962    1.554393
  _Ilavoro_3 |  -.4398783   .5340986    -0.82   0.410    -1.486692    .6069358
_Igodimcas~2 |   .4689796   .6273792     0.75   0.455     -.760661     1.69862
_Igodimcas~3 |  -.9942119   .9785031    -1.02   0.310    -2.912043    .9236189
_Igodimcas~4 |  -1.253779   1.042937    -1.20   0.229    -3.297899    .7903399
   d_riscald |    .307466   .3602038     0.85   0.393    -.3985205    1.013452
     d_pompe |  -.0793798   .3843266    -0.21   0.836    -.8326461    .6738866
    d_ascens |  -.0827574   .3569776    -0.23   0.817    -.7824206    .6169058
   d_sgacant |   .3111558   .3774456     0.82   0.410     -.428624    1.050936
-------------+----------------------------------------------------------------
       /cut1 |  -4.068754    1.51428                      -7.036688   -1.100819
       /cut2 |  -2.246556   1.376237                       -4.94393    .4508179
       /cut3 |  -1.322869   1.358073                      -3.984644    1.338905
       /cut4 |    1.61132   1.355211                      -1.044844    4.267485
------------------------------------------------------------------------------
```

Fig. 1: Outcomes of the first Ordinal Logit Model implemented.

We can analyse the results considering that the Logit coefficients are in log-odds units and can't be read as regular OLS coefficients. There is not the value of the intercept and we can say that the intercept is absorbed by the first cutoff point. Observing the value of Prob > Chi2 can help us to deduce if the model is ok or not from this value. The number is less than 0.05 so all the coefficients are different from zero and the null hypothesis is rejected. The pseudo R2 value includes the amelioration of the likelihood estimated with this model rather than considering the null hypothesis. The z value tests the hypothesis that each coefficient is different from 1. The higher is the z the higher is the relevance of the variable. Two-tail p-values (P>|z|) test the hypothesis that each coefficient is different from 0. In the ordered Logit model it is useful to check the sign of the coefficients (UCLA Resources to learn and use STATA). So, we can deduce that a bigger family influence negatively the satisfaction degree towards the house rather than smaller families; so smaller families have a higher satisfaction degree than larger families, considering the other variables' values similar. Older people seem to have a lower satisfaction degree related to their house than young people (with an age between 18 and 25 years old). A lower educational level has a negative influence on satisfaction degree, so people less educated are less satisfied of their house than higher qualified people, considering the same characteristics for all the other variables. Paradoxically to expectations, the presence of the elevator and of conditioning system seems to influence negatively the satisfaction in the sense that people that live in buildings with no elevator and no conditioning express a higher satisfaction degree than the other people (always considering the same values of all the other variables). We can also observe that these two variables (d_ascens and d_pompe) are not significant considering that the P>|z| values are big and in particular are 0.81 and 0.83. We observe that women express higher satisfaction than men and we could explain it considering the fact that women generally spend more time at home than men do, being more affectively linked to their house and consequently expressing higher satisfaction. The variable ratiosup1 is a ratio that represents the size of house and we can see that it has a positive influence on satisfaction degree, so bigger is house's surface, then higher is respondent's satisfaction related to its house. Being a student, or a retiree or an unemployed seems to have a negative influence on residential satisfaction degree towards house rather than been a public employee; it could be due to the less economical possibilities for students, unemployed and reteree people to apply changes to their residential condition and to their house in general. Differently, being a freelance professional has a positive influence on satisfaction degree rather than being a public employee. Finally, having a cellar or a heating system have a positive influence on residential satisfaction degree rather than not having them. The cutoff points represent the cutoff values so the threshold values for the probability that the satisfaction degree is 1-“Not satisfied” , 2 – “A little bit dissatisfied”, 3 – “Indifferent”, 4 – “Enough satisfied” or 5 – “Very satisfied”. Hence, for instance if the predicted probability is lower than -4.07 we are going to have “Not satisfied”, etc.. We can check the predicted probabilities and we can see that almost for every observation (interview) the biggest predicted probability is related to 4-“Enough Satisfied” and this probability is higher than 50% in the majority of cases. We have an higher probability related to 5-“Very Satisfied” and 3-“Indifferent” just for few cases.

Then we implement an Ordinal Probit model for satisfaction degree towards house and the results are presented in succession:

```
. xi: oprobit soddisfazc eta_categx2 eta_categx3 eta_categx4 d_gen rationucleo
>  ratiosup1 i.studio i.lavoro i.godimcasa d_riscald d_pompe d_ascens d_sgacan
> t
i.studio          _Istudio_1-2        (_Istudio_1 for studio==diplau omitted)
i.lavoro          _Ilavoro_1-3        (_Ilavoro_1 for lavoro==dip omitted)
i.godimcasa       _Igodimcasa_1-4     (_Igodimcasa_1 for ~mcasa==afapp omitted
> )

Iteration 0:   log likelihood = -168.54721
Iteration 1:   log likelihood = -155.35393
Iteration 2:   log likelihood = -155.26942
Iteration 3:   log likelihood = -155.26942

Ordered probit regression                         Number of obs   =        150
                                                  LR chi2(16)     =      26.56
                                                  Prob > chi2     =     0.0467
Log likelihood = -155.26942                       Pseudo R2       =     0.0788

------------------------------------------------------------------------------
  soddisfazc |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 eta_categx2 |  -.4906967    .652873    -0.75   0.452    -1.770304     .788911
 eta_categx3 |  -.6372653   .6032474    -1.06   0.291    -1.819609     .545078
 eta_categx4 |   -.475534    .578843    -0.82   0.411    -1.610045    .6589773
       d_gen |   .1797358   .2039433     0.88   0.378    -.2199857    .5794572
 rationucleo |  -.2190771   .2744065    -0.80   0.425     -.756904    .3187498
   ratiosup1 |   .7892276   .3018873     2.61   0.009     .1975394    1.380916
  _Istudio_2 |  -.2116097   .2817451    -0.75   0.453    -.7638199    .3406006
  _Ilavoro_2 |   .3673252   .3417519     1.07   0.282    -.3024963    1.037147
  _Ilavoro_3 |  -.1744775   .2973543    -0.59   0.557    -.7572812    .4083262
_Igodimcas~2 |   .1803618   .3520492     0.51   0.608    -.5096419    .8703654
_Igodimcas~3 |  -.5575927   .5922791    -0.94   0.346    -1.718438    .6032529
_Igodimcas~4 |  -.7118773   .5699893    -1.25   0.212    -1.829036    .4052813
   d_riscald |   .2131366   .2011678     1.06   0.289    -.1811449    .6074182
     d_pompe |  -.0881107   .2189914    -0.40   0.687    -.5173259    .3411046
    d_ascens |   .0023302   .2037761     0.01   0.991    -.3970636    .4017239
   d_sgacant |   .1294141   .2181429     0.59   0.553    -.2981381    .5569663
-------------+----------------------------------------------------------------
       /cut1 |  -2.107132   .8285655                     -3.731091   -.4831736
       /cut2 |   -1.29433   .7966991                     -2.855831    .2671718
       /cut3 |  -.8117085   .7896355                     -2.359366    .7359486
       /cut4 |   .8938249   .7861219                     -.6469457    2.434596
------------------------------------------------------------------------------
```

Fig. 2: Outcomes of the first Ordinal Probit Model implemented.

The results in terms of negative or positive influence on residential satisfaction degree are almost the same, except for the variable of presence of an elevator. In this case it seems to have a positive influence on satisfaction degree but also in this case it is not significant, seen the high value of P>|z| that is 0.99. We can observe that also in this case, the variable ratiosup1 that represents the house surface has a positive influence and it is significant. The variable d_pompe that express the presence of conditioning system has a negative influence also using this model, but it is not significant. If we check the predicted probabilities we can see that also in this case the higher probability is related to 4-“Enough Satisfied” in almost all the observations.

Then, the second model, that tries to explain the influence of explanatory variables on satisfaction degree related to the neighbourhood is:

Soddisfazq = β0 + β1*eta + β2*d_gen + β3*rapportocoivicini + β4*d_altrifamiliari + β5*_Istudio + β6*_Ilavoro + β7*d_scuola + β8*d_supermercato + β9*d_poste + β10* d_giardini + β11* d_fermatebus + β12*d_var31 + β13*d_var34 + β14*d_var35 + β15*d_var37

In which:

Rapportocoivicini = dummy variables set that represents the relationship between respondent and neighbours.

d_altrifamiliari = dummy variable that expresses the residence of other familiars in the inner-city

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d_scuola, d_supermercato, d_poste, d_giardini, d_fermatebus = dummy variables that express when they are equal to 1 the absence of that particular service, 0 otherwise.

d_var31, d_var34, d_var35, d_var37 = dummy variables that represent the most frequent problems of the inner-city of Cagliari and they correspond to absence of parking, presence of wastes, traffic, and noise. All the other variables are the same used in the first model implemented.

```
. xi: ologit soddisfazq eta_categx1 eta_categx2 eta_categx3 eta_categx4 d_gen
> d_tranqzona i.rapportocoivicini d_altrifamiliari i.studio i.lavoro quartiere
> x1 quartierex2 quartierex3 quartierex4 d_scuola d_supermercato d_poste d_far
> macia d_giardini d_fermatebus d_var31 d_var34 d_var35 d_var37

Iteration 0:   log likelihood = -188.38222
Iteration 1:   log likelihood = -153.90482
Iteration 2:   log likelihood = -151.01711
Iteration 3:   log likelihood = -150.96298
Iteration 4:   log likelihood = -150.95974
Iteration 5:   log likelihood =  -150.9591
Iteration 6:   log likelihood = -150.95896
Iteration 7:   log likelihood = -150.95893
Iteration 8:   log likelihood = -150.95892

Ordered logistic regression                       Number of obs   =        150
                                                  LR chi2(26)     =      74.85
                                                  Prob > chi2     =     0.0000
Log likelihood = -150.95892                       Pseudo R2       =     0.1987

------------------------------------------------------------------------------
  soddisfazq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 eta_categx1 |   2.385868   1.243808     1.92   0.055    -.0519501    4.823686
 eta_categx2 |  -.1318692   .7030301    -0.19   0.851    -1.509783    1.246044
 eta_categx3 |   .0338594    .536413     0.06   0.950    -1.017491    1.085209
 eta_categx4 |  (omitted)
       d_gen |    .526471   .3808115     1.38   0.167    -.2199058    1.272848
 d_tranqzona |   1.235422   .4905138     2.52   0.012     .2740326    2.196812
_Irapporto~2 |  -1.876499    .557144    -3.37   0.001    -2.968481    -.784517
_Irapporto~3 |  -.9109474   .7207293    -1.26   0.206    -2.323551     .501656
_Irapporto~4 |   11.66992   741.8921     0.02   0.987    -1442.412    1465.752
_Irapporto~5 |   1.123618   .4731823     2.37   0.018     .1961975    2.051038
d_altrifam~i |  -.0271145   .3922093    -0.07   0.945    -.7958307    .7416017
  _Istudio_2 |  -.4222615   .5002836    -0.84   0.399    -1.402799    .5582764
  _Ilavoro_2 |  -.1863877   .6433438    -0.29   0.772    -1.447318    1.074543
  _Ilavoro_3 |  -.2639752   .5535974    -0.48   0.633    -1.349006    .8210557
 quartierex1 |  -.7805241    .643699    -1.21   0.225    -2.042151    .4811028
 quartierex2 |  -.5038201   .6314853    -0.80   0.425    -1.741509    .7338685
 quartierex3 |  -.1204849    .541811    -0.22   0.824    -1.182415    .9414451
 quartierex4 |  (omitted)
    d_scuola |   .5098697   .5081983     1.00   0.316    -.4861807     1.50592
d_supermer~o |  -.4435028   .5726138    -0.77   0.439    -1.565805    .6787997
     d_poste |   .1616444   .5913734     0.27   0.785    -.9974261    1.320715
  d_farmacia |    .308826   .9111098     0.34   0.735    -1.476916    2.094568
  d_giardini |  -.1212487   .4527091    -0.27   0.789    -1.008542    .7660447
d_fermatebus |   .7419845   .8110506     0.91   0.360    -.8476456    2.331615
     d_var31 |   .2797726   .4604194     0.61   0.543    -.6226329    1.182178
     d_var34 |   -.822367    .413129    -1.99   0.047    -1.632085   -.0126491
     d_var35 |    -.22743   .3891568    -0.58   0.559    -.9901632    .5353033
     d_var37 |  -.9698914   .4168591    -2.33   0.020     -1.78692   -.1528625
-------------+----------------------------------------------------------------
       /cut1 |  -3.259664   1.184646                     -5.581526   -.9378012
       /cut2 |  -1.184782   1.128448                       -3.3965    1.026936
       /cut3 |   -.723454   1.124984                     -2.928381    1.481473
       /cut4 |   2.796802   1.159603                      .5240218    5.069583
------------------------------------------------------------------------------
```

Fig. 3: Outcomes of the second Ordinal Logit Model implemented.

We can observe that a variable about the relationship with the neighbours (_Irapporto4) has a very big coefficient and a big value of P>|z|, so it is not significant. Women express higher satisfaction degree towards the neighbourhood than men and being women seems to have a positive influence on this kind of satisfaction. The presence of markets and public green spaces have a negative influence on satisfaction degree, whereas the presence of bus stops, pharmacy and post offices have a positive influence. These findings about the variables d_supermercato and d_giardini are in contradiction with our expectations but they are not significant, considering P>|z| values. The absence of parking spaces (d_var31) has a positive coefficient in the definition of satisfaction degree towards neighbourhood in the sense that absence of parking causes an increase in the rank of satisfaction degree, considering the same values for the other variables. Also this outcome can be explained with the fact that this variable is not significant considering that its P>|z| value is about 0.559. The other problems such as presence of rubbish (d_var34), traffic (d_var35) and noise (d_var7) have negative coefficients, so they have negative influence on satisfaction degree. Finally we can check the predicted probabilities for the different values of the satisfaction degree towards the neighbourhood and we can observe that in the majority of cases the higher probability is related to 4-“enough satisfied”, but in some cases the higher is 2-“a little bit satisfied” or 5-“very satisfied”.

Considering the implementation of an Ordinal Probit model for the satisfaction degree related to the neighbourhood the results are:

```
. xi: oprobit soddisfazq eta_categx1 eta_categx2 eta_categx3 eta_categx4 d_gen
>  d_tranqzona i.rapportocoivicini d_altrifamiliari i.studio i.lavoro quartier
> ex1 quartierex2 quartierex3 quartierex4 d_scuola d_supermercato d_poste d_fa
> rmacia d_giardini d_fermatebus d_var31 d_var34 d_var35 d_var37

Iteration 0:   log likelihood = -188.38222
Iteration 1:   log likelihood = -150.68067
Iteration 2:   log likelihood = -149.80701
Iteration 3:   log likelihood = -149.78458
Iteration 4:   log likelihood = -149.78172
Iteration 5:   log likelihood = -149.78128
Iteration 6:   log likelihood = -149.78122
Iteration 7:   log likelihood =  -149.7812

Ordered probit regression                         Number of obs   =        150
                                                  LR chi2(26)     =      77.20
                                                  Prob > chi2     =     0.0000
Log likelihood =  -149.7812                       Pseudo R2       =     0.2049

------------------------------------------------------------------------------
  soddisfazq |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 eta_categx1 |   1.397719   .7416645     1.88   0.059    -.0559169    2.851355
 eta_categx2 |  -.0707565   .4025859    -0.18   0.860    -.8598104    .7182974
 eta_categx3 |   .0353671   .3062211     0.12   0.908    -.5648152    .6355494
 eta_categx4 |  (omitted)
       d_gen |   .2677285   .2165119     1.24   0.216     -.156627     .692084
 d_tranqzona |   .6976578   .2761681     2.53   0.012     .1563783    1.238937
_Irapporto~2 |  -1.066036   .3153273    -3.38   0.001    -1.684066   -.4480059
_Irapporto~3 |  -.5507622   .3676726    -1.50   0.134    -1.271387    .1698629
_Irapporto~4 |   3.783534   129.1095     0.03   0.977    -249.2664    256.8334
_Irapporto~5 |   .6209009   .2656475     2.34   0.019     .1002415     1.14156
d_altrifam~i |  -.0414339    .221678    -0.19   0.852    -.4759149    .3930471
  _Istudio_2 |  -.3367687   .2919361    -1.15   0.249     -.908953    .2354156
  _Ilavoro_2 |  -.0939604   .3678357    -0.26   0.798    -.8149051    .6269843
  _Ilavoro_3 |  -.1805245   .3132807    -0.58   0.564    -.7945434    .4334943
 quartierex1 |  -.3193464   .3545891    -0.90   0.368    -1.014328    .3756355
 quartierex2 |  -.2094566   .3629554    -0.58   0.564    -.9208361    .5019229
 quartierex3 |   .0091165   .3123687     0.03   0.977     -.603115    .6213479
 quartierex4 |  (omitted)
    d_scuola |   .2554482   .2816296     0.91   0.364    -.2965357    .8074322
d_supermer~o |  -.3199828    .325296    -0.98   0.325    -.9575513    .3175856
     d_poste |   .1653041   .3268746     0.51   0.613    -.4753584    .8059666
  d_farmacia |   .2561195   .5051342     0.51   0.612    -.7339254    1.246164
  d_giardini |  -.0277771   .2522478    -0.11   0.912    -.5221738    .4666196
d_fermatebus |   .4073116   .4526557     0.90   0.368    -.4798772      1.2945
     d_var31 |    .182327   .2628898     0.69   0.488    -.3329275    .6975816
     d_var34 |  -.4499318   .2270027    -1.98   0.047    -.8948489   -.0050147
     d_var35 |  -.1031759   .2248586    -0.46   0.646    -.5438905    .3375388
     d_var37 |  -.5937252   .2359598    -2.52   0.012    -1.056198   -.1312525
-------------+----------------------------------------------------------------
       /cut1 |  -1.785626   .6684301                     -3.095725   -.4755274
       /cut2 |    -.61305   .6421694                     -1.871679    .6455789
       /cut3 |  -.3444725   .6418126                     -1.602402    .9134571
       /cut4 |   1.696742   .6617372                       .399761    2.993723
------------------------------------------------------------------------------
```

Fig. 4: Outcomes of the second Ordinal Probit Model implemented.

The results through this model are almost the same as those with Logit model in terms of negative or positive influence on the satisfaction degree. Variables that have negative influence against expectations are not significant with high values of P>|z|. Differently from the previous analysis, living in the neighbourhood of Stampace seems to have a positive influence on satisfaction degree towards the neighbourhood. The other results are similar and the coefficients are not very different in terms of order of magnitude. If we check the predicted probabilities for this model, we can observe that the situation is quite similar to that obtained using the Ordinal Logit model; hence, in lots of cases the bigger probability is associated to 4- “Enough Satisfied”, but there are several cases in which the higher probability is linked to 2 – “A little bit dissatisfied” and 5- “Very satisfied”.

4.4.3 Proposal of smart interventions

According to what these first results express, we can finally propose interventions in order to increase the residential satisfaction degree and the quality of life of Cagliari’s inner-city-dwellers. Firstly, the absence of some services is determinant in the definition of a low satisfaction degree so it could be important to provide inner-city with some important services such as bus stops, post offices and pharmacies. A sense of isolation came to light from the interviews, related in particular to some parts of the inner-city such as the neighbourhood of Castello. The lack of some services determined a lower residential satisfaction degree towards the neighbourhood. A proposal could be to increase the bus network in these parts of the city, in order to give the possibility to its inhabitants to reach the locations of public services more easily. Indeed, the majority of Cagliari’s inner-city dwellers are elderly people so they have difficulties to move far from their house. Another proposal could be to give people, especially elderly people (who represent an important share of Cagliari’s inner-city population), the possibility to do grocery shopping ordering it through telephone and to receive it at home without any additional cost. Traffic seems to have a negative influence on the satisfaction degree, so we could propose a smart intervention to deal with this issue: we could organize parking areas just outside the inner-city, near its bounds, in order to reduce cars’ circulation; it could be a way to transform Cagliari’s inner-city in a pedestrian area giving the residents the possibility to park inside the inner-city just for a limited time, for instance for a couple of hours, but giving in advance notice of it

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through a short message or a call to a specialised centre that has the mansion to manage inner-city parking spaces. Contextually, parking areas just outside the inner-city should be reserved for residents, giving just one pass to every resident family. Considering relationships with neighbours, very good relations influence positively the residential satisfaction degree, whereas being just acquaintances has a negative influence. So, it could be reasonable to propose an intervention that contributes to ameliorate relationships between neighbours, for instance creating an aggregation centre for every neighbourhood of the inner-city, in which people can spend time socializing, etc.. In order to address another important problem represented by garbage collection which has a negative influence on the residential satisfaction degree, we could propose to create a particular system of rubbish collection characterised by dustbins located underground; in this way we hope to limit the visual impact of garbage in the street corners in order to improve urban cleanliness.

5 CONCLUSION

These are just partial results which will be further developed in the PhD thesis. Other models are going to be implemented especially the most important ones, an ordinal Logit model and a Probit model to explain the influence that satisfaction towards neighbourhood has on satisfaction towards house. This is fundamental in order to identify quantitatively the influence that all the variables considered in the first model together with the satisfaction degree related to the neighbourhood have on the satisfaction degree related to the house. In future steps of the thesis we could also implement the models and we could implement another particular analysis considering separately the four neighbourhoods of Cagliari's inner-city in order to verify if in some of them the results are different from the outcomes just obtained. Finally, we are going to propose a set of interventions based on the outcomes obtained through these different analyses; these actions should fit people needs and expectations in order to pursue a better quality of life and a higher sense of well-being.

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A Simulation of Land Use/Cover Change for Urbanization on Chennai Metropolitan Area, India

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1 ABSTRACT

Remote sensing and GIS technologies are very much useful for finding the Land Use/Cover maps. This is the paper which deals with the Land Use/Cover Change (LUCC) especially to urbanization in Chennai metropolitan area, India for past two decades till present. Chennai is the fourth largest metropolitan city in India with area of 1189 km2 with 4.68 million of population, which is developing rapidly into urban in past few decades. There is heavy need of urban planning for future in Chennai. This research will be a support for urban planning of the future.

The Land satellite data for three decades (1989, 2000 and 2012) and Digital Elevation Model (DEM) for present were collected with 30 meter resolution. Preprocessing of all images was completed. Image classification for mapping LUCC was performed by supervised classification through the maximum likelihood classification for four classes: Water, Rough land, Crop land and Urban. An accuracy assessment has been checked to find the accuracy of the Classification and the overall accuracy is about 87%. Transition probability matrices were calculated for all three time points and compared with each other (1989 with 2000, 2000 with 2012). The result shows that the increase in Urban and decrease in Rough land. Slope map has been created from DEM.

Analyses of neighborhood effects were done to find the probability of land changes due to existing urban cells, which is calculated for each cells surrounded by its three neighborhood cells. Analyses of slope effects for urbanization was done by comparing the slope and the possibilities of change from Rough land and Crop land to Urban. A simple model structure for simulation was created using VBA and GIS. The model applies the neighborhood effects which are similar to Cellular Automata but in this model it is modified by slope effects. Using the simulation urban map was predicted for future trends. These predicted urban maps will provide critical input to resource management and planning support applications, and have substantial social and economic benefit for metropolitan planning and development.

2 INTRODUCTION

2.1 Introduction and Background of the Study

"INDIA lives in its villages," said Mahatma Gandhi, over six decades ago. No longer. At least not in Tamil Nadu, the first major State to reach the historical threshold of 50:50 rural-urban distribution of population. Crowning Tamil Nadu's urbanisation is Chennai, the fourth largest metropolis of India. More people in Tamil Nadu have moved from rural to urban areas the last 10 years compared to other states, according to the 2011 Census data. Tamil Nadu tops the list of urbanised states with 48.45% of its population living in urban areas , followed by Kerala, Maharashtra and Gujarat. In the last 20 years, the rate of urbanization in Tamil Nadu has been rapid. According to the 1991 Census, only 34.15% of the total population in Tamil Nadu was classified as urban but in 2011, it has risen to 48.45%, an increase of 14.3%. Since the 2001 census, the percentage of urban population has risen by 4.41%.

Urbanization is a worldwide phenomenon where all mega cities are rapidly developing due to various factors including population increases, industrialization and rural-urban migration. Though urbanization is a worldwide phenomenon, it's more prevalent in India due to high growth rate over last few decades. Urban planning is a complex phenomenon hence accurate and updated information is needed to develop strategies for sustainable development. The land use maps are used to provide up to date information on the type, location, spatial, distribution and extend of land use/land cover.

In order to use the land optimally and to provide as input data in modeling studies, it is not only necessary to have information on existing land use/ landcover but also the capability to monitor the dynamics of land use resulting out of changing demands. Urban sprawl is a phenomenon that has to be monitored and understood. There are different approaches for modeling spatial dynamics. Models cannot work without data and satellite

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imagery is an excelent source of data. The rapid development of multi-spatial and multi-temporal remote sensing data has now made it possible to monitor urban land-use/land-cover changes in a very efficient manner. Remote sensing techniques have proven very useful in urban mapping (Batty 2008). There is a wide range of techniques used for land use land cover change detection. An attempt has been made here to demonstrate the potentials of remote sensing techniques in change detection analysis of urban land cover by using the technique of comparison of the classified images.

2.2 Research Objective

The aim of this paper deals with the Land Use/Cover Change (LUCC) especially to urbanization in Chennai metropolitan area, India for three time points (1989, 2000 and 2012). And to simulate the urbanization for future using the past data's.

The objectives of the study are

- To classify the Land Use/Cover based on processing the satellite data in three time points (1989, 2000 & 2012).
- To calculate the change of the Land Use/Cover during these periods.
- To analyze the transition probability of the LUCC, especially focusing on both the neighborhood effects and slope effects.
- To simulate the urban growth under the current trend case till 2024.

2.3 Study Area

Chennai is the fourth largest metropolitan area in India, with a population of about 7 million in 2001. The Chennai Metropolis (with a latitude between 12°50'49" and 13°17'24", and a longitude between 79°59'53"and 80°20'12") is located on the Coramandal coast in South India. Topographically plain terrain with few isolated hillocks in the south-west. Average annual rainfall is about 1,300 mm. Chennai has two administrative boundary, the outer boundary is Chennai metropolitan boundary – encompass the suburban areas; the inner one is the corporation boundary, which include only the urban area. Chennai is rapidly getting urbanized from past decades.

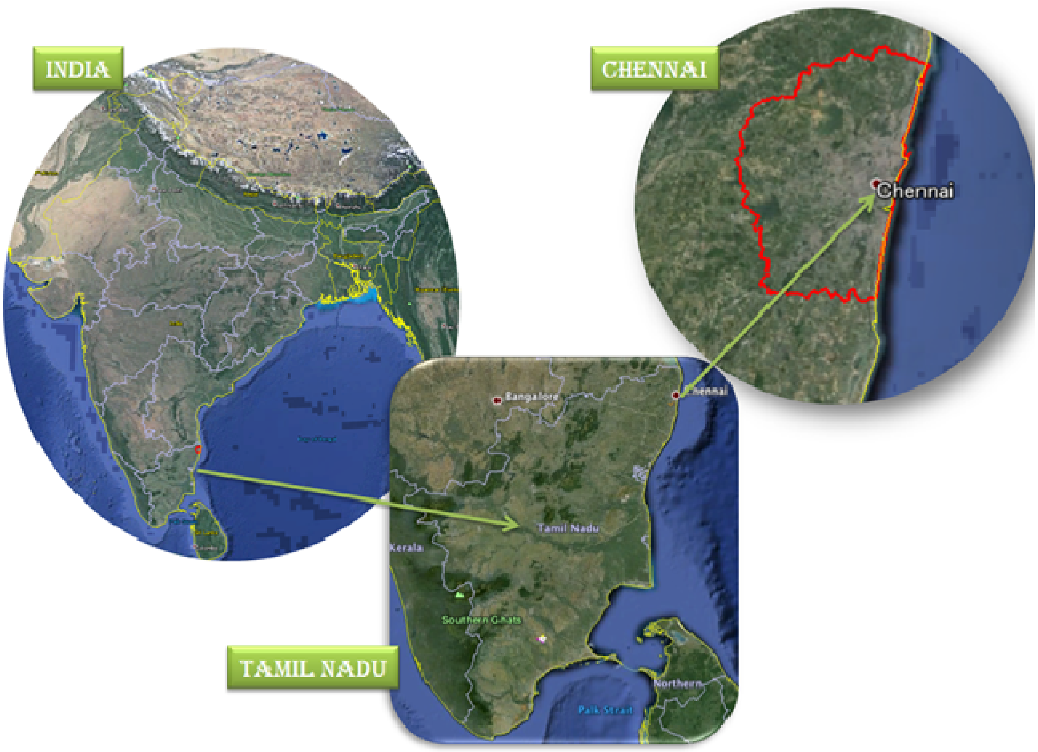

Fig. 1: Location map of Chennai metropolitan area, Tamil Nadu, India

2.4 Existing Research

There are many types of landuse classification (Anderson et al., 2001). It is infered that the land cover change analysis can be done using simulation modelling (Bhatt et al., and Parker et al., 2003). Change analysis can be done using Erdas imagine (Harika et al., 2012) and modelling of land use change can be done using GIS (Laura and Pontius, 2001; Geogr and Fina, 2007). Urban sprawl mapping and land use change analysis using GIS should be given importance while planning (Monalisha et al., 2005)

This research focuses on forecasting urbanization for future using two factors as major, neighbourhood and slope effects. As existing research on relationship between neighbourhood and land use by Muranaka and Arai (2013) has been reported. In their approach, they showed the relationship between neighbourhood and land use, especially the propotion of the number of grid cells each of which has changed its land use from non-urban to urban between time (t and t+dt) and which has k urban cells within its neighbourhood. A simple and stable relationship between the state of the neighbourhood and the land use change in the central site was found by simple calculation of published land use data in Japan. By referring these past researches, neighbourhood effects also plays major role in this research.

3 DATA PREPARATION AND PROCESSING

3.1 Pre Processing

Landsat 5 TM is a best data for classifying Land Use/Cover. Landsat 5 TM data has been downloaded for three times points (1989, 2000 and 2012) with 30 meter resolution. DEM data also has been downloaded for the year 2010 with same 30 meter resoulution from open source. The data specifications has been shown in Table 1.

Name	Source	Resolution	Year of capture
LandSat 5 TM	U.S. Geological Survey (Open source)	30 Meter each	1989, 2000 and 2012
Digital Elevation Model	Advance Spaceborne Thermal Emission Reflection Radiometer (Open source)	30 Meter each	2010

Table 1: Data specifications

Preprocessing of satellite images prior to image classification and change detection is essential. Preprocessing of image data often will include radiometric correction and geometric correction. Geometric rectification of the imagery resamples or changes the pixel grid to fit that of a map projection or another reference image. This becomes especially important when scene to scene comparisons of individual pixels in applications such as change detection are being sought. Geometric corrections are made to correct the inaccuracy between the location coordinates of the picture elements in the image data, and the actual location coordinates on the ground. Radiometric corrections are made to the raw digital image data to correct for brightness values, of the object on the ground, that have been distorted because of sensor calibration or sensor malfunction problems. The distortion of images is caused by the scattering of reflected electromagnetic light energy due to a constantly changing atmosphere. This is one source of sensor calibration error. Now after correcting both the Geometric and Radiometric corrections, now all three years of Landsat Image is ready for classification.

3.2 Image Classification

To examine the urbanization on LUCC, there are four important classes to be classified. They are Water, Roughland, Cropland and Urban. The description of these has been shown in Table 2. All of the visible and infrared bands (bands 1-5 and 7) were used for image classification. Supervised classification through maximum likelihood algorithm was applied to perform image classification. It was preferred because the prior knowledge of study area was known and the data of the study area were also available. In addition, this classification has been found to be the most commonly and widely used classifier. The supervised classification requires training areas for each class. The traning areas were used to define spectral reflectance patterns/signature of each class. The signatures would then be used by classifier to group the pixels into a certain class which has the same spectral patterns. Training areas of each class were created with the assistance of visual analysis on the images through displaying RGB combination and also supporting by the

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ancillary information from the google earth and the prior knowledge of the study area. This classification was done for all three years, 1989, 2000 and 2012.

Land Use/Cover classes	General Description
Water	An area covered by open water such as ocean, river, ponds and artificial aquacultures or fishponds.
Roughland	An area that is covered by shrubs and bare lands.
Cropland	An area that is used for any kind of cultivation such as agriculture, tree crops, or food crops.
Urban	An area has all residential, commercial and industrial areas, villages, settlements and transportation infrastructure.

Table 2: Description of Land Use/Cover classes

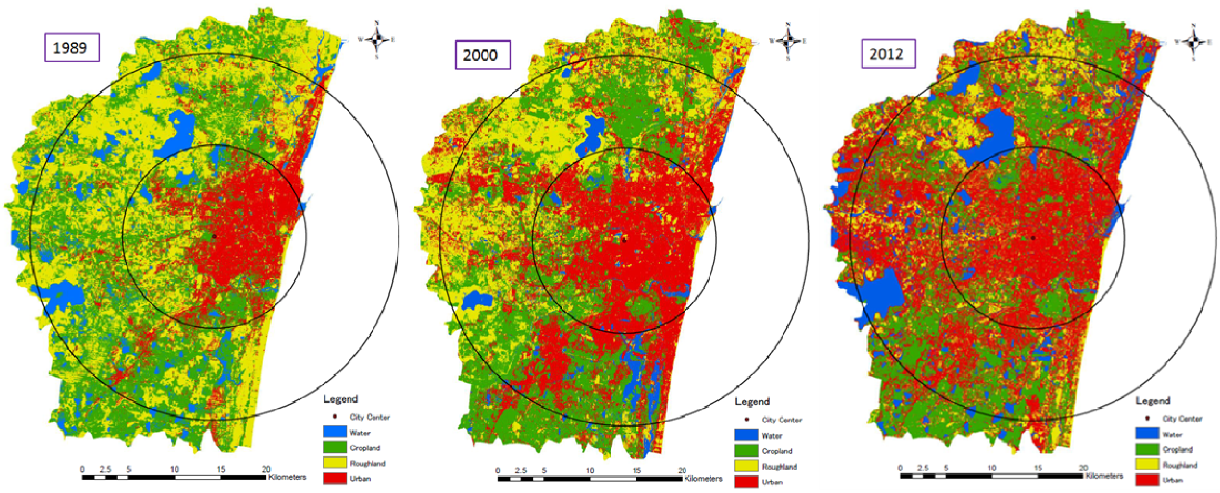

Fig. 2: Land Use/Cover classification for three years (1989, 2000 and 2012)

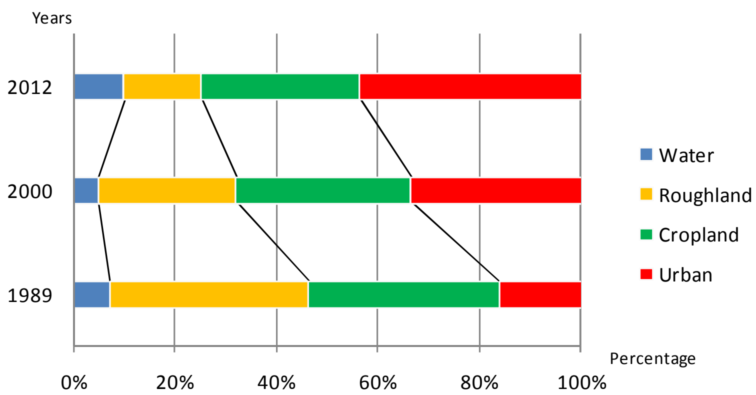

Fig. 3: Comparisons of Land Use/Cover classification between three years

Now after classifying for three years, by seeing the Fig. 2 and 3 it can be understood that, in 1989 the Urban was only 16% but it has been rapidly increased from 16% to 34% in 2000 due to various factors and there was a gradual increase from 34% to 44% in 2012. Hence from this classification and analysis we can understand that Chennai is now urbanizing nearly 50%. And when we see for Cropland on 1989 with 38% which has been slightly decreased from 38% to 34% in the year 2000. And again slightly decreased from 34% to 31% in 2012 . And Roughland has decreased rapidly in the year 2000 from 39% to 27% and it has been again decreased to 15% in the year 2012. Here in our analysis we omit water from analysis, because water won't change much.

3.3 Post Processing

After the image classification, post processing has done to check the accuracy of the classification. Error matrix says how much error the classified image has, and from that it can be known either to reclassify the image or it has good accuracy. Here in this classification the overall accuracy is about 0.87. After checking the accuracy, the kappa coefficient has to be applied. The kappa coefficient is frequently used to summarize the results of an accuracy assessment used to evaluate land-use or land-cover classifications obtained by remote sensing. The standard estimator of the kappa coefficient along with the standard error of this estimator require a sampling model that is approximated by simple random sampling. Formulas are presented for estimating the kappa coefficient. Kappa coefficient is calculated and it is found to be 0.82. After checking the overall accuracy and the kappa coefficient the change maps can be created.

3.4 Slope map

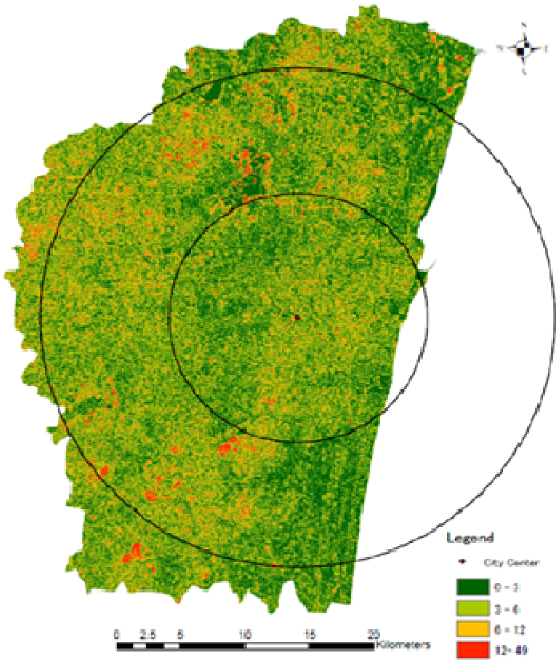

Fig. 4: Slope map for 2010

As said earlier, Chennai has a flat terrain surface. The Fig.4 shows the output of Slope of Chennai metropolitan area. This slope map describes that the red areas reflects the greater slope and green area reflects the lesser slope. It is shown clearly in the map, that Chennai has more than 80% of slope is lesser. The slope is calculated for each pixels. The values of slope of each cell have been extracted for further analysis.

3.5 Change maps

Change detection is the use of remotely sensed imagery of a single region, acquired on at least two dates, to identify changes that might have occurred in the interval between the two dates. This study deals with the urbanization on LUCC, therefore the change from Roughland to Cropland, Roughland to Urban and Cropland to Urban are created. And it has been found that the change from Roughland to Urban is more than the change from Cropland to Urban.The results of the change maps and graphs says that, the change from Roughland to Urban in the period 1989 to 2000 is 7% it has been increased from 7% to 9% in the period 2000 to 2012. And as an average there was a change of 14% from Roughland to Urban in the period 1989 to 2012. The change from Cropland to Urban on the period 1989 to 2000 is 9% it has been decreased from 9% to 5% in the period 2000 to 2012. As a average there was a change of 13% from Cropland to Urban in the period 1989 to 2012. It says that there is always an increase in change from Roughland to Urban. But in change from Cropland to Urban there is some increase in the period 1989 to 2000 and some decrease in the period 2000 to 2012. The percentage of change from Roughland to Urban is more than the change of Cropland to Urban. And there is a minimum change from Roughland to Cropland.

4 ANALYSIS OF LAND USE/COVER CHANGE (LUCC)

4.1 Analyses on Net Change and Transition Probability of LUCC

An important aspect of LUCC study is to address the transition “from-to” processes information of each class over a certain period (1989 to 2000, 2000 to 2012 and from 1989 to 2012). This can be found by the

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Net change matrix. These Net change matrices are calculated from the Cell count matrix. The cell count matrix states, “The diagonal elements represent the area of each class which remains unchanged while the off diagonal elements represent the changes area”. The Cell Count Matrix has been shown in Table 3.

1989 \ 2000	Water	Roughland	Cropland	Urban	Grand Total
Water	32379	37106	23851	5945	99281
Roughland	12425	203195	177152	126481	519253
Cropland	17186	97695	238985	147984	501850
Urban	3491	25672	18697	166754	214614
Grand Total	65481	363668	458685	447164	1334998

2000 \ 2012	Water	Roughland	Cropland	Urban	Grand Total
Water	33843	5856	14505	11277	65481
Roughland	61734	107100	53290	141544	363668
Cropland	29173	44504	273264	111744	458685
Urban	9369	44716	75951	317128	447164
Grand Total	134119	202176	417010	581693	1334998

1989 \ 2012	Water	Roughland	Cropland	Urban	Grand Total
Water	62574	2587	16507	17613	99281
Roughland	40459	132052	144381	202361	519253
Cropland	25150	52195	230069	194436	501850
Urban	5936	15342	26053	167283	214614
Grand Total	134119	202176	417010	581693	1334998

Table 3: Cell Count Matrix between 1989, 2000 and 2012

Now using these cell count matrices, the Net change matrices are calculated. In this study the Water is omitted because there will be only minor changes happen in Water. The Net Change Matrix is calculated for other three classes(Roughland, Cropland and Urban). The Net Change Matrix is calculated by subtracting the earlier year to later year, such as subtracting the Cropland to Roughland in the year 1989 with Cropland to Roughland in the year 2000, and entering the result in the later year. It has been shown in Table 4.

1989 \ 2000	Water	Roughland	Cropland	Urban	Grand Total
Water	-	-	-	-	-
Roughland	-	203195	79457	100809	383461
Cropland	-	-	238985	129287	368272
Urban	-	-	-	166754	166754
Grand Total	0	203195	318442	396850	918487

2000 \ 2012	Water	Roughland	Cropland	Urban	Grand Total
Water	-	-	-	-	-
Roughland	-	107100	8786	96828	212714
Cropland	-	-	273264	35793	309057
Urban	-	-	-	317128	317128
Grand Total	0	107100	282050	449749	838899

1989 \ 2012	Water	Roughland	Cropland	Urban	Grand Total
Water	-	-	-	-	-
Roughland	-	132052	92186	187019	411257
Cropland	-	-	230069	168383	398452
Urban	-	-	-	167283	167283
Grand Total	0	132052	322255	522685	976992

Table 4: Net Change Matrix between 1989, 2000 and 2012

Transition Probability Matrix describes the probabilities of shifting from one state to another in a dynamic system. In each row are the probabilities of shifting from the state represented by that row, to the other states.

The Transition probability matrix is calculated from the Net Change Matrix. The Net Change of each class is divided by its total change and it has been done for all classes and it makes Transition Probability of each class. This Transition Probability Matrix is used to find the probability of transition of each class. As said earlier, this study concentrates only the transition from Roughland to Urban, Roughland to Cropland and Cropland to Urban. The Transition Probability matrix has been shown in Table 5.

1989 \ 2000	Water	Roughland	Cropland	Urban
Water	-	-	-	-
Roughland	-	0.5299	0.2072	0.2629
Cropland	-	-	0.6489	0.3511
Urban	-	-	-	1.0000

2000 \ 2012	Water	Roughland	Cropland	Urban
Water	-	-	-	-
Roughland	-	0.5035	0.0413	0.4552
Cropland	-	-	0.8842	0.1158
Urban	-	-	-	1.0000

1989 \ 2012	Water	Roughland	Cropland	Urban
Water	-	-	-	-
Roughland	-	0.3211	0.2242	0.4547
Cropland	-	-	0.5774	0.4226
Urban	-	-	-	1.0000

Table 5: Transition Probability Matrix between 1989, 2000 and 2012

4.2 Analyses on Neighborhood effects of LUCC

There are many factors which influence the LUCC, but in this study it focus how the neighborhood has been effected the LUCC. This analysis has been done for three periods such as, 1989 to 2000, 2000 to 2012 and 1989 to 2012. The analysis is done for the cell which represents Roughland and Cropland. For the each cell of Roughland and Cropland, the neighborhood cells have been counted for all classes, except Water.

The consideration is to find the changes of each class between each period but the class water and Urban are omitted in the consideration. It has been checked for each cell surrounded by its 3 surrounding cells from each side.It can be said as the neighborhood cells has been found for 7*7 matrix or neighborhood cell range K= 3. This has done using a VBA program. After counting the neighborhood cells, Urban Ratio is calculated using the simple formula.

$$u_i^T = \frac{\#U}{\#C + \#R + \#U}$$

u_i^T: Urban Ratio during T at cell i

#U: Count of Urban cells in the neighbor during T

#C: Count of Cropland cells in the neighbor during T

#R: Count of Roughland cells in the neighbor during T

Urban Ratio states that the possibility of change to Urban due to neighborhood. After calculating the Urban Ratio, Transition Probability has been found. For example, Transition Probability for Cropland to Urban is shown in this formula.

$$TP_{ij}^T = \frac{\#CU}{\#CC + \#CU}$$

TP_{ij}^T: Transition Probability of Urban

#CU: Count of cells from Cropland to Urban

#CC: Count of cells from Cropland to Cropland

Transition Probability ratio is calculated with respective to the Urban Ratio and Change Ratio. The name by itself defines that the Transition Probability Ratio of Neighborhood effects states that the probability of transition for Urban Ratio.These are shown in the graph for three periods.

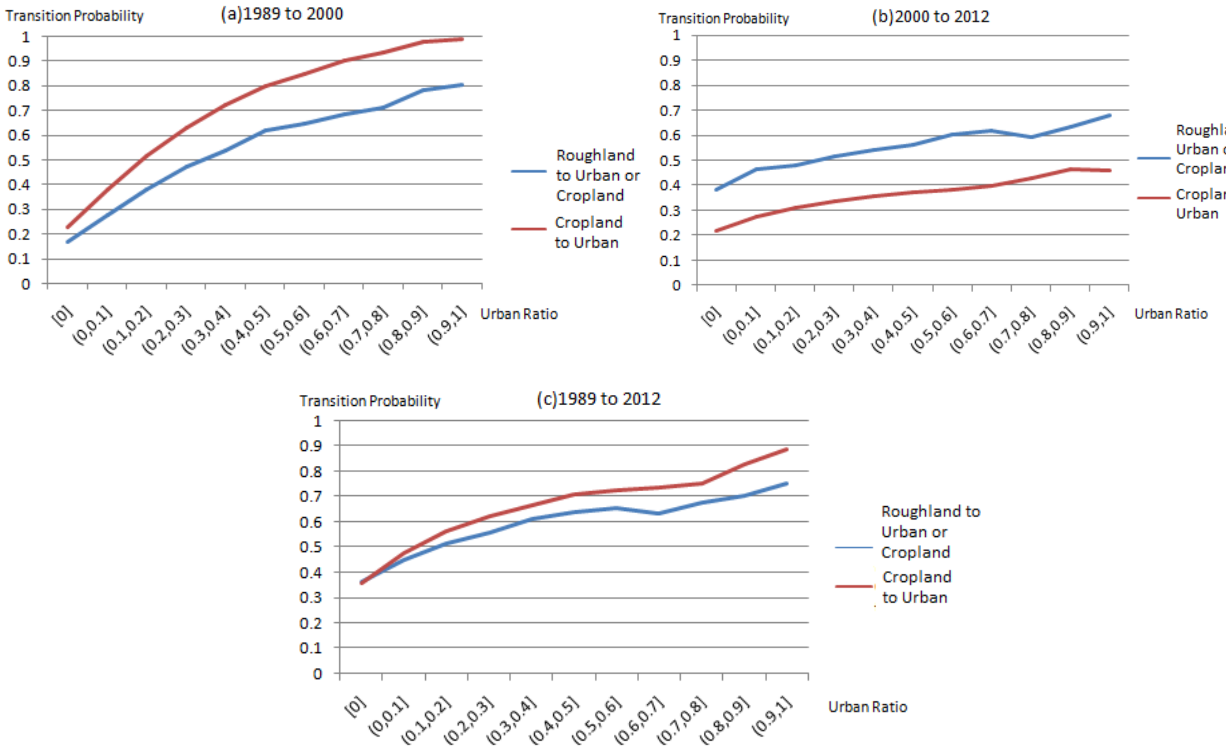

Fig. 5: Relationship between transition probability and urban ratio for three periods

The Fig. 5 shows how much are the possibilities of change to Urban due to the neighborhood effects. Transistion Probability has been found with respect to Urban Ratio. In the inner ring from the city, it is covered by Cropland from 1989 and the outer ring of the city is covered by Roughland.

From the analysis in 1989 to 2000, there is high transition probability of Cropland to Urban, because the Urban growth has been towards south west, and has been grown in inner ring from the city.

But in 2000 to 2012, the Urban development was towards the outer ring, so the high concentration of transition probability change from Roughland to Urban.

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4.3 Analyses on Slope Effect of Transition Probability Ratios for Urbanization

This analysis is to find how slope has been affected the LUCC. Using the surface analysis tool in ArcGIS the degree of slope for each cell of Chennai has been calculated.

It has been found that Chennai has the highest slope as 49 degree. Here the consideration is to find the probability of change between the Roughland to Cropland, the Roughland to Urban and the Cropland to Urban for three periods is calculated.

The slope has been separated into 13 intervals. For each interval of slope the count of each class has been calculated for each period. Net change has been found from the cell count matrix. Transition probability of each class has been found from net change with slope effects as considerations.

$q_{ij}^T(s)$: Transition Probability from i to j during T under slope degree s. $q_{ij}^T(s)$ is defined as a stair–shape function of slope degree s. slope degree s have 13 intervals.

Transition Probability has been calculated with respect to the slope modified functions. Then finally the relationship between the Transition Probability and slope has been calculated and shown in the graphs for each period.

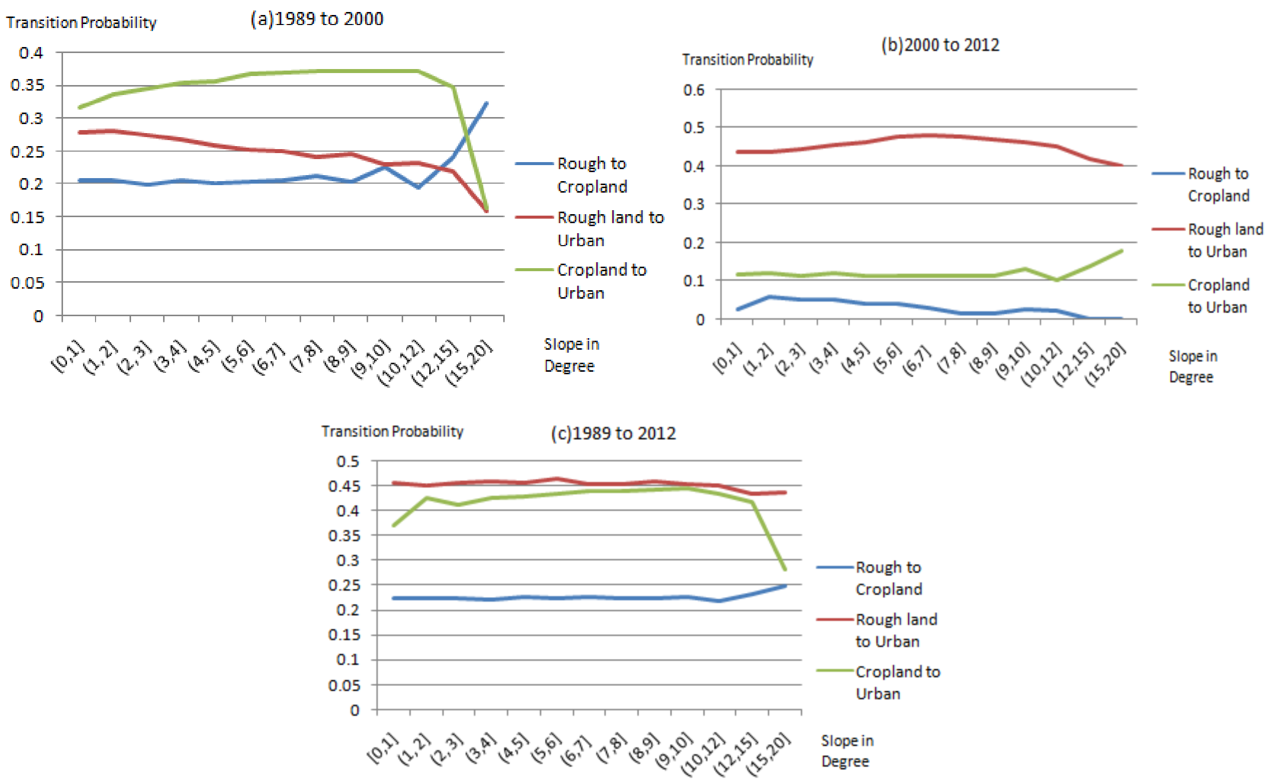

Fig. 6: Relationship between transition probability and slope for three periods

The Fig.6 shows the relationship between the probability of change from Roughland to Cropland, Roughland to Urban and Cropland to urban to the slope slope effect modified functions. While seeing this graph it has been clearly understood that slope and probability of change to Urban are inversely proportional to each other.There is high transition probability from Cropland to Urban in 1989 to 2000, because there is less slope in the inner city when compared to the outer ring from the city. However from 2000 to 2012, Roughland has the high probability to change to Urban because in the period of 2000 to 2012 the transition has done in outer ring that is covered by Roughland.

5 URBANIZATION SIMULATION OF CHENNAI METROPOLITAN AREA TILL 2024

5.1 Model and System Structure

This simulation is a Monte Carlo model by considering neighborhood effects in Cellular Automata model. The model especially predicts the LUCC for future from the past data of 2012. This model predicts for the year 2024 of Chennai metropolitan area. Three major factors has been considered in this model. They are neighborhood effect, slope effect and other effects (population, road effects, and other factors). The neighborhood effect states the transition probability with respect to the neighborhood cell range K = 3. This is as same as the analyses which have been done in the previous chapter. The slope effect states the transition probability with respect to the slope in degree. The other effects have been considered as random factor in this simulation. As this study is based on the urbanization on LUCC, this model only focuses on the growth of Urban from Roughland, Urban from Cropland and Cropland from Roughland. Water and Urban are ignored because there won't be huge change from these too to Urban.

5.2 Trend case and Implications

The Land Use/Cover map of 2012 has been prepared in ArcGIS. The slope map was also prepared in ArcGIS. Both are combined and the output of these both is taken as input for the simulation.Here the simulation is done from 2012 to 2024 under considering the current trend case.

This simulation is a Monte Carlo method by considering neighborhood effects in the Cellular Automata analogy. Transition Probabilities are given as follows.

$$\mathrm{P}_{\mathrm{ij}}^{\mathrm{T}} = \frac{\mathrm{q}_{\mathrm{ij}}^{\mathrm{T}}(\mathrm{s}) * \mathrm{r}_{\mathrm{ij}}^{\mathrm{T}}(\mathrm{u})}{\mathrm{trans}_{\mathrm{ij}}^{\mathrm{T}}}$$

T: Period (2012 to 2024)

$\mathrm{P}_{\mathrm{ij}}^{\mathrm{T}}$: Transition Probability for i to j using T

$\mathrm{q}_{\mathrm{ij}}^{\mathrm{T}}(\mathrm{s})$: Transition Probability from i to j during T under slope degree s

$\mathrm{r}_{\mathrm{ij}}^{\mathrm{T}}(\mathrm{u})$: Transition Probability from i to j during T under Urban Ratio u

$trans_{ij}^{T}$: Base Transition Probability Ratio from i to j during T

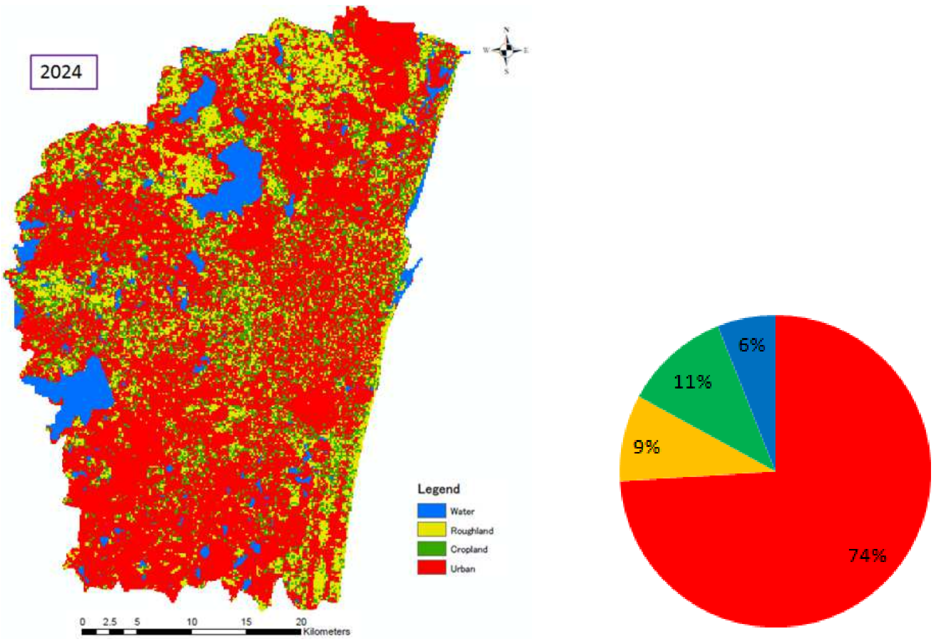

Fig. 7: Forecasted Land Use/Cover classification in 2024 in trend case

This simulation result shows how the city will be in 2024 of the study under current trend. The result of simulation shows that the Urban has increased from 44% to 74%, Cropland has decreased from 31% to 11%, Roughland has decreased from 15% to 9%. Here in this simulation the water is not under consideration so there is no change in Water. The Urban is growing in the south west direction. This simulation is excuted based on only two main factors that are the neighborhood effect and the slope effect. Even though this simulation is simple but it warns that such kind of urban sprawl needs to be controlled based on metropolitan planning. The planners must avoid wasteful land consumption. Policy simulations through the revision and elaboration of the model are hopeful for planners. We illustrate that they planners can using these kinds of simulation methods for future.

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6 CONCLUSION

We reported a series of data works on Land Use/Cover Change in Chennai, at three time points of 1989, 2000 and 2012. As the results, first we had identified high-performance classification on Land Use/Cover with overall accuracy of 0.87 and Kappa coefficient as 0.82. Then we had examined the transition probabilities of Land Use/Cover and had found both the effects of neighborhood and slope for urbanization. These facts should be emphasized. Analyzing these effects, lastly we had also tried a simulation in the current trend case. The result of the simulation shows that there can be seen 30% increase of Urbanized area in 2024. Validity checks and policy simulations remain the further works.

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A Smart Researching and Planning Tool for the Neuralgic Urban Zone: 3D-ZPA

Angelika Psenner

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Fig. 1: series of images showing ground floor facades of a Gründerzeit-street in Vienna’s 9th district © Psenner

1 ABSTRACT

There is a strong and direct relationship between urban street space and the structures and uses of the buildings’ ground floor. When addressing urban development issues the necessity to consider the “**StadtParterre**“ (street-level-environment)—a holistic urban zone of *public*, *private*, and *semi-private spaces*—must therefore be emphasized. In consequence the **spatial representation of Vienna’s street-level environment 3D-ZPA** is covering both *built-up* and *non-built-up areas*, it includes the street as well as the adjacent houses and yards.

Vienna’s official digital map serves as matrix where the individual ground level plans of the flanking buildings is set in—both historical plans and most recent conversion documents are taken into account, so that the morphological evolution of the street-level is reflected. Given the importance of ceiling and building heights the plan is elevated into the *third dimension*, which marks the major distinction from the *Comprehensive Ground Floor Surveys*, originally carried out in the 1960ies (Muratori, Caniggia).

3D-ZPA differs in precision and scale from the current settings of 3D city models that mostly render a distant bird’s eye perspective and that by simply showing the external building perimeters do not provide an objective representation and description of the city’s *interior structure*. **3D-ZPA** precisely represents the buildings’ ground floor; the areas above and below are generically outlined as a rather simple cubic model, so that street profile and day light situation on the ground are reflected.

3D-ZPA yields information about a building’s spatial and functional relationship to public space and topographical environment; qualitative statements can be made concerning use, use-frequency and intensity. It facilitates conclusions regarding use-potential of the ground floor zone and places structural functions of the *street space* in relation to it. Interrelations can be identified, problematic situations considered and resolved in context; thus **3D-ZPA** is providing a fundamental tool for planning *and* research.

Fig. 2: 3D-ZPA © Psenner, pilot test: images of the 3D ZPA

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2 INTRODUCTION

2.1 Actual Urban Situation

Vienna's urban *street-level environment* crisis is a key focal point of the city's urban research and for its administration. Although the rapid population growth (up to twenty thousand people per year[1]) has created an urgent need for additional (living) space[2], ground floor vacancies are still spreading. On the other hand the environmental impact generated by individual motorized traffic has become so critical that it can no longer remain a secondary debate. The current mono-structural form of street space use—while understandable in terms of its historical evolution—does not do justice to urban space with respect to the public good.

We are still a long way off understanding street as a cultural good, as "lived space", but the signs are favorable for reaching a major turning point: in many urban centers, individual motorized transit has reached its maximum capacity; environmental issues have gained prominence and can no longer be relegated to the background;[3] and recent economic and financial crises have shed light on the weaknesses of the current world economic system—a system that largely relies upon resource-intensive forms of mobility.[4]

Fig. 3: ground floor vacancies; urban open space primarily used by the automobile, © Psenner

2.2 Research Questions and Objectives of the Project

In Vienna and several other European cities, the street-level environment requires increasing attention in the form of urban research and administration. This is due to an increasingly problematic rate of vacancy or underuse of the ground floor, while rapid population growth makes the search for additional (living) space an urgent matter. Given current conditions, this population growth over the next several years will also result in a further increase of car ownership and a consequent additional need for parking space.

Living space created by rooftop conversions is mostly accompanied by a sealing of the street-level zone. As a result, no additional living space is actually created; the city merely moves upwards by one floor, which leaves behind a detrimentally affected and depopulated public space. This develop¬ment will ultimately render an already precarious urban environment even more unsustainable.

[1] Vienna's Planning director, Thomas Madreiter, expects population growth on that scale.

[2] The additional requirement of housing space cannot be met by using the city's reserves of undeveloped land alone, therefore in addition to the existing major development areas, living space will have to be created in densely built-up areas.

[3] Failure to meet the Kyoto protocol's climate protection targets for greenhouse gas emissions in the 2008-2012 commitment period will cost Austria 160 million Euros, an amount that the Austrian environment ministry will have to spend on purchasing emission allowances.

[4] Cf. Candeias et al. (eds.), 2011, Globale Ökonomie des Autos.

Fig. 4: Living space created by rooftop conversions is often accompanied by a sealing of the street-level zone. As a result, no additional living space is actually created, the city merely moves upwards by one floor. © Psenner/Nöbauer

The reasons why our cities have been converted into car-friendly milieus are certainly known:

- the car industry's powerful lobby intervened in politics from the very beginning;
- the modern era's guiding concept of separate urban functions (living, working, recreation) eventually increased the volume of traffic;[5]
- the suburbia movement, originating from economical[6], tactical but also military[7] considerations, has lead to a swift development of road infrastructure in outlying urban areas.

Nevertheless, we are aware of historical photographs of our urban streets that indicate a different, highly diverse structure of uses:

Fig. 5: Vienna, Mariahilfer Straße 1914 (Sinhuber/Stumpf 1992: Wien. Metamorphosen einer Stadt; pg.:180)

We also are familiar with images of megacities (such as metropolitan Tokyo with its 35 million inhabitants) where streets, in spite of an enormous volume of transit, are understood primarily as *living space* rather than as traffic corridors (see Krusche and Rost, 2010).

Fig. 6: street view in Tokyo City centre in the morning on a workday, © Psenner

It is necessary to examine the issues concerning the **street-level environment** in Vienna. That is, to consider the facts from the perspective of the urban system and identify ways in which architectural and urban research might contribute to understanding the existing problems. Experience has shown that a networked,

[5] In this context, reference must also be made to older ideas, like Garden City, Ciudad Lineal, The Decentrists, Radiant City, etc.
[6] Cf. Lewis, 2004.
[7] Cf. Plunz, 1990: 278f.

transdisciplinary perspective holds the greatest potential. In order to successfully address public space issues, this study emphasizes the necessity to consider the street-level environment as a whole, rather than focusing exclusively on certain parts of in.[8]

2.2.1 The “StadtParterre”

The **street-level environment concept** refers to the city’s *“Parterre”* as a holistic urban system: it covers both built-up and non-built-up areas. Thus street, ground floor and courtyard are treated as entity, so that interrelations will come to light. We perfectly know that the potentials of ground floor use and the structure of the correlating public street space are directly related to each other.[9]

2.2.2 Research Field

In order to narrow the field of research and render it in specific terms, this study will focus on the **Gründerzeit GZ** period structure.[10] The urban structures that emerged in the period between 1848 and 1918 were laid out on a strict grid and to this day represent a large percentage of the entire urban structure with one quarter of all apartments in Vienna located in GZ buildings.[11] Furthermore the project will focus on **residential streets** in the first place—as they are the ones that so fare (unlike shopping streets or traffic roads) have been neglected from science and administration.

2.2.3 Research Questions

Since urban maps usually end at the building perimeter, little is known about the interrelations between built-up structures, ground floor use, and street use. Urban planning spares little thought for what really takes place inside the buildings lining a street.[12] The proposed study is therefore concerned with the following **main questions**: How did the GZ-ground floor in residential streets work originally (during GZ period)? What are the (historical) interrelations between public space and the life inside buildings?

The study is also dealing with **secondary questions** like: Is it possible for a street-level environment that no longer serves any vital function—where storage facilities, supply rooms, garbage collecting areas, garages and parked cars are taking over—to appeal to potential users? Which architectural and structural interventions have a positive impact on the street-level environment?

2.2.4 Objective of the Study

The objective of the present study is to both retrieve and generate relevant data in the form of a 3-dimensional comprehensive map of the street-level environment (as described in the methodology section: 3D-ZPA). Only when such data is available can conclusions regarding the interaction between the ground floor and street space be drawn. This morphological analysis of the urban street level is intended to yield strong arguments in support of a—possibly radical—rethinking of *street space use* as well as *ground floor architecture*.

[8] See Psenner 2004: In identifying criteria of perception in public space, I focus on architecture as a determining factor. In the process, the interrelations between street space and buildings move into the foreground.

[9] Detailed articles by the author on this issue: Psenner, 2012b, 2011a, 2011b, 2005, 2004a

[10] The GZ structure evolved as part of Vienna’s urban expansion caused by 19th century historical and political developments as well as industrialization. An enormous influx of new residents made Vienna’s population grow from 440,000 in the year 1840 to 2,2 Million (in 1905), making it the fifth-largest city in the world. The architectural style of the GZ period, widespread in 19th century central Europe, was mostly an expression of the aesthetic tastes of a rising and economically powerful bourgeoisie.

[11] 238,100 out of a total of 956,110 apartments (Statistik Austria et al. (eds.): *Österreichs Städte in Zahlen.* Vienna. 2010: 98).

[12] Individual buildings’ planning data, which holds precisely the information that requires clarification, is considered being private from a legal point of view.

3 METHODOLOGY: 3-DIMENSIONAL COMPREHENSIVE STREET-LEVEL MAP (3D-ZPA) "ZUSAMMENHÄNGENDE PARTERRE-AUFNAHME"

3.1 Original Comprehensive Ground Floor Survey: 2-Dimensional (ZGA) – "Zusammenhängende Grundrissaufnahme"

The original, two-dimensional comprehensive ground floor survey (ZGA, Zusammenhängende Grundriss-aufnahme) derives from studies on the relationship between urban morphology and the typology of buildings, such as carried out by Saverio Muratori in Venice, and Gianfranco Caniggia in Florence and Como. Subsequently, Swiss architects and historians utilized such morphological studies: In the 1960s, architects in the Tessin region initiated an inventory that was continued at the Swiss Federal Institute of Technology (ETH) in Zürich in the 1970s, and made further progress when a comprehensive survey of Zürich's urban core was conducted under the direction of architectural researcher Margareta Peters.[13]

A simple cadastral map (*Katasterplan)* or the multi-purpose map in use in Vienna *(Mehrzweckkarte)* show only the perimeter of the buildings; they do not provide a sufficiently objective representation and description of the *interior structure* of the city. A comprehensive plan ZGA of the ground floor level yields information about a <u>building's relationship to public space and the topographical environment</u>: it *visualizes the interrelation between the interior life of individual buildings and the public street space surrounding them.* The comprehensive plan of the *ground floor* level together with the comprehensive plan of the *basement* level (very often ZGAs cover different levels, mostly: ground floor, basement and standard upper floor[14]) are consequently used to examine the relationship among buildings, streets, and yards.[15]

The present study's primary objective is to reproduce and to model the three-dimensional sphere of the urban street-level environment (StadtParterre) in Vienna. To this end, the ZGA, described above, was developed further into the so called: **3D-ZPA** (3-Dimensionale Zusammenhängende Parterre-Aufnahme).[16]

Fig. 7: 3D ZPA, pilot study, © Psenner

3.2 Methodological Adaptations to Relevant Research Field and Research Questions

The existing digital multi-purpose surface map *(Flächen-Mehrzweckkarte)* that documents detailed land use for the entire municipal area of Vienna in a clearly structured rendering, serves as baseline set of data. This

[13] Comprehensive ground floor surveys of the following Swiss cities exist: Bellinzona, Zürich (old town, 1955), Luzern, Bern (old town), Solothurn (1900), Bern (old town), Biel, Tessin, Zurzach, Le Landeron, Baden, Wil SG (old town), Zürich (old town), Zürich (industrial quarter), Zürich (Stadelhofer quarter).

[14] Some ZGA also include a typological register, specifying the particular type of building. The register is based on recurring elements of the ground floor, and its geometrical structure. Examples of scientific use of ZGAs include Georges Grosjean's work, which proved a systematic expansion of the medieval city of Bern on the basis of precisely proportional firewall intervals. (Peters 1999a, 154). A metrological analysis of the ZGA Biel showed that a supposedly flat street facade previously had arcades on its northern face that had simply be closed at a later point in time.

[15] The upper floors are of less relevance to this study in as much as they mostly contain information on the inner structure, or as Peters puts it: "the vertical unity of the building" (Peters 1990, 30).

[16] The ZGA of of Ponticelli, a neighborhood in Naples, has also been complemented with an axonometric plan, which however only shows the buildings skins (Fioravanti/Caniggia: Progettare il Recupero, 1983; cited in: Caniggia, 1986: 336 and 338).

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map represents a fundamental tool for planning, providing a matrix that is completed with ground level plans of individual buildings: original historic building plans, as well as archived building applications and most recently authorized plans. Additionally, given the importance of ceiling and building *heights*, sectional views are also retrieved. The plans and data—all archived at Vienna building authority's planning database (Baupolizei, MA37)—are then reviewed, scanned, categorized, and processed.

In a next step, the official plans are verified on site and adjusted where needed, in particular with regard to the actual use. Subsequently, any additional measuring work required in order to render a sufficiently precise plan must be identified. This process is rather work-intensive, therefore the most suitable/efficient form of digital StadtParterre-mapping shall be identified. The 3D-ZPA is a special form of a 3D urban model, enriched with precise detailed StadtParterre-data and adjusted to eye level.[17]

3.3 Work plan

This study is designed to address the following: theoretical and historical information, fieldwork surveys, and comparative analyses. The research project, intended as an iterative process, will integrate various suitable scientific methods as well as the superposition of the different facets and outcomes of the study. Therefore, the work schedule and timetable do not identify precise dates: project work is overlapping; accordingly the four work packages are to be seen as mostly running in parallel (see the flowchart also).

4 PILOT STUDY

The 3D-ZPA method is being used, tested, and developed further in a still on-going pilot project conducted by the author and partially funded by two science awards granted to the author in 2012 ("WKO-Wissenschaftspreis" sponsored by the Economic Chamber of Vienna; and the City of Vienna's University Jubilee Award). So far the Vienna street level environment has been explored by means of an exemplary street in the 9th district: the *Rotenlöwengasse*. The street—an archetypal Gründerzeit-structure—had been totally rebuilt in the late 19th century.

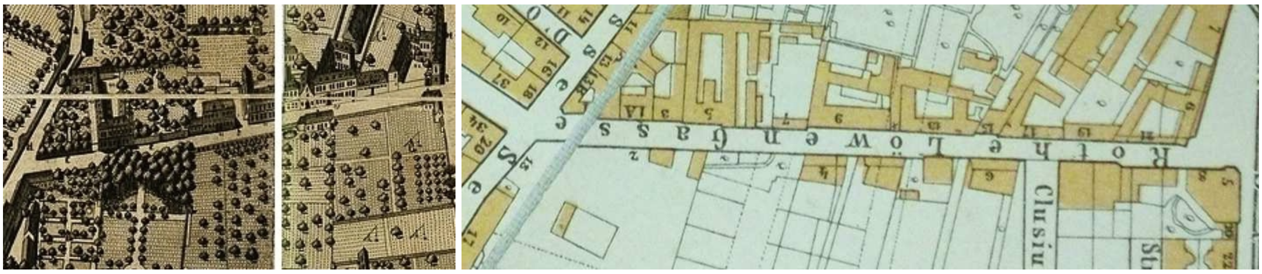

Fig. 8: 3D ZPA, pilot study, © Psenner

The preliminary work covers an in-depth historic approach (theoretical treatise on historical use and on street- and building laws; cf. Psenner 2013, 2012a, 2012b). The elaborately researched **biography of the street** includes detailed information on its outlay (geography, spatial and urban planning), the architectural building development and the precise development of the use of the adjacent ground floors and basements (trade, crafts, industry, housing, etc.)

Fig. 9: 3D-ZPA © Psenner, pilot test: façades and illumination by night

The preliminaries also cover an in sight field study of the *actual* state of the street-level environment: What exactly is going on behind the walls and how does this use affect the public space of the street? What kind of work places can be found there? How is illumination/use frequency by night?

[17] The current settings of the 3D urban model mostly render a bird's eye perspective. Unlike this, 3D navigational tools, such as used by taxi drivers, or Google Earth Street View, adopt an eye-level view. The navigational tools currently available offer no real 3D representations and instead project photographs on 3D urban structures.

The modelling is done with Autodesk Revit® software,[18] which is specifically built for Building Information Modelling (BIM) and which allows a coordinated and consistent model-based approach. Revit supports easily controllable transparency and fade-in/-out effects based on flexible keys for all objects. The *ground floor* is rendered accurately in every detail; whereas general structural data, such as weight bearing elements (outer and main interior supporting walls), access points (stairways and corridors) and the façade (opening axes) provide sufficient data regarding the *standard upper floors*, unless they are directly connected to the ground floor (same procedure concerning the *basement*). The three-dimensional representation of this data is processed with further facts in order to enabling the 3D image to yield information on the use of space (that is: is it living, working, or storage space, are cars parking there? What is the frequency of use?).[19]

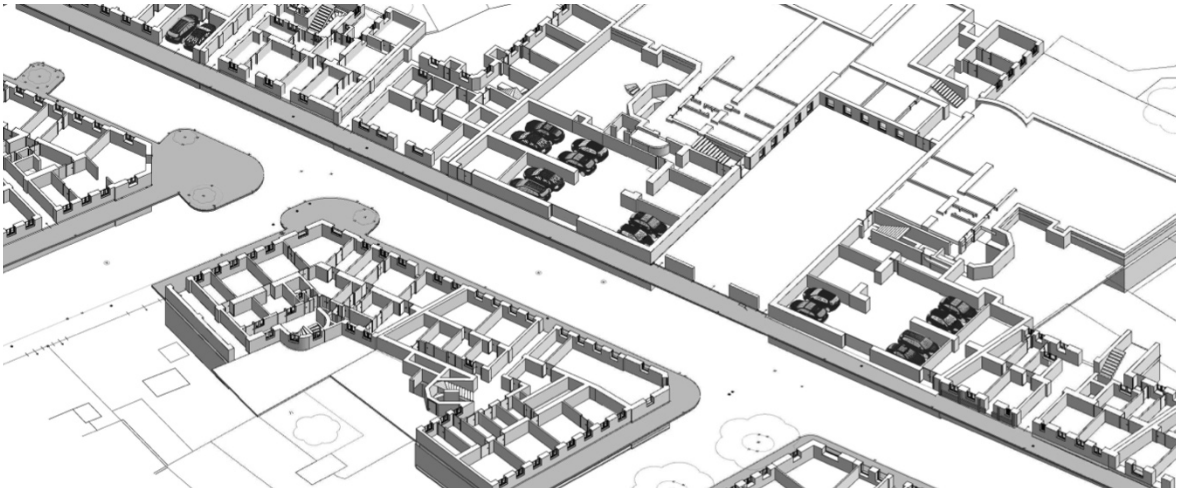

Fig. 10: 3D-ZPA © Psenner, pilot test: axonometric image (detail) of the 3D ZPA model, showing the ground floor

The *axonometric image* of the 3D ZPA model is considered being a valuable form of representation. In a further processing it includes basic information on ground floor furnishing (features like cars/ double parkers). It also will identify intensity and forms of use (using *color codes*, such as *red* for semipublic spaces and spaces with high user frequency, such as offices, shops, coffee houses, studios; *orange* for housing; *green* for garages and storage space; *blue* for vacancies, and so forth).

Fig. 11: 3D-ZPA © Psenner, pilot test: perspective image of the 3D ZPA model

The area above and below the ground floor is broadly outlined in a *Volumsmodel*, with basic data on statics and site infrastructure. Hence, the street profile and the illumination of the ground floor and street level become readable. The facade is interpreted as a permeable interface between building and public space. (Information on the formal design of the facade is available as an option.)

5 PRELIMINARY RESULTS/FINDINGS

The spatial representation of Vienna's street level environment (StadtParterre), including all additional relevant data on the ground-floor, facilitates conclusions regarding the (use) structure and the (use) potential

[18] Revit® is a single application that includes features for architectural design, MEP and structural engineering, and construction.

[19] A further development of the 3D-ZPA will also contain information about Vienna's *Stadtstrukturplan*, a planning tool that identifies some pedestrian-sensible data, like privileged buildings, relevant view axis, approximate indications on intended ground floor usage (shopping streets).

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of the ground floor zone (for example, illumination) and places the uses and functions of the *street space* in relation to it. Thus, interrelations can be identified and problematic situations considered and resolved in context.

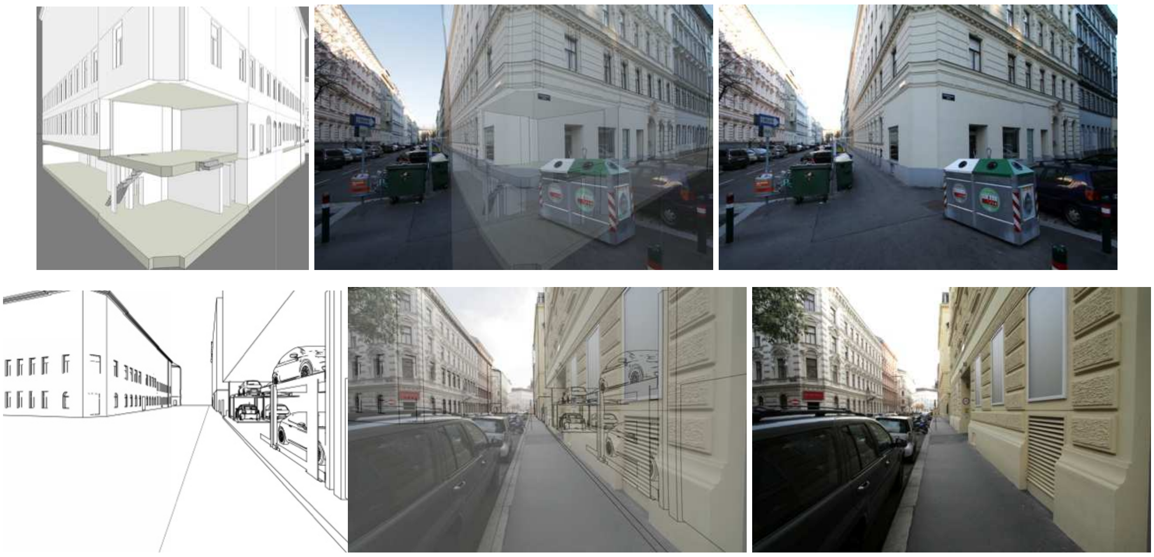

Fig. 12: 3D-ZPA © Psenner, pilot study: images of the 3D ZPA showing different street views in Vienna's 9th district

5.1 Importance of the Expected Results for the Discipline

This study aims to map and clearly describe the **potential** of the **street-level environment**—by inter alia thoroughly analyzing its past development. The status quo is not satisfactory: moving and stationary traffic render the ground floor unappealing and not usable for the public; ground floor vacancies augment and are consequently converted into even more parking spaces. Thus, the city migrates upwards: attics are converted, rendering the illumination of the ground floor even more precarious. It must be expected that the automobile will also ultimately overtake the first floor. This imbalance is mirrored in new constructions: residential buildings often rest on stilts, with use beginning only at a certain height. This study will provide the necessary data, analysis, and argument required to bring urgent change to the existing paradigms.

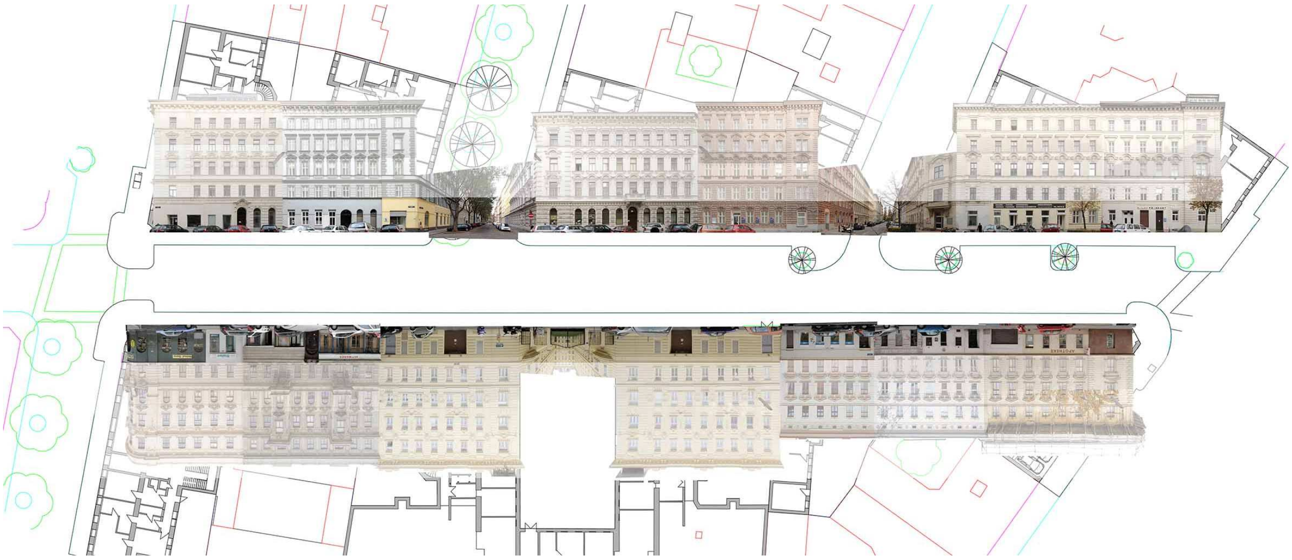

Fig. 13: 3D-ZPA © Psenner, pilot study

One significant prerequisite of successful regulatory measures in urban planning, administration, and economics is a solid and detailed knowledge of the actual architectural structure, current use—and potential use—of the street-level environment. The three-dimensional comprehensive street-level map **3D-ZPA** will realize this information in an easily accessible and locally contextualized form. Thus, the potential of the street-level environment will be clearly identified and can successfully inform urban planning (the initial focus being on Vienna's GZ neighborhoods).

Given the complex micro-analytical capability of the **3D-ZPA**, it will be possible to document vacancies and street-use issues in various neighborhoods and to analyze the contributing economic, traffic and social factors. The systematic 3D-mapping of the built-up structure and inventory of the historic, the actual and the potential ground floor uses will provide a basis for developing long-term views of Vienna's street-level environment, practical guidelines for future interventions in various neighborhoods, and for the (re-)design of individual street complexes.[20]

Expected Benefits:

(1) Using the 3D-ZPA tool, the study will visualize the (historic) interrelation between street space and ground floor use over time. Thus, existing discrepancies will be identified between the private use of street space and the public's interest in the offerings of the street level environment.

(2) This transparent and objective form of visualization of interrelated functions provides a sound argument capable of inciting to action the stakeholders in administration and business.

(3) Concrete improvements in the urban street-level environment can be planned and realized.

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[20] In order to develop a sustainable solution to the various problems that plague the Vienna street-level environment, it will be necessary to employ a systems-oriented view of urban structures. Such a view will take into consideration causes, effects, benefits, and costs as well as consequential costs, resulting in the factual analysis of systemic interrelations as well as identification of a suitable spectrum of key measures. Previously, secondary consequences resulting from a street space overly burdened by parked cars have not been taken into consideration. It is one objective of this study to analyze and represent this interrelation in detail. The primary objective there must be to produce a strong and convincing argument for (re)defining street space in urban centers as *living space* and for enacting this categorization through the law.

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reviewed paper

A Visionary Study on Urban Neighbourhood Models in Kabul City Based on Actual Surveys

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1 ABSTRACT

This paper explores a new neighbourhood model with the primary school district. This scale is well known as Perry's neighbourhood unit theory all over the world. So, this paper deals with (1) the spread and familiarity of Perry's theory especially in Islamic planning context; (2) spatial analysis of current urban neighbourhoods in Kabul City through a survey in district nine; (3) measurement of densities on population, dwelling unit, household, and pupils in the case study area, and (4) visionary proposals on urban neighbourhood models based on several scenarios in the near future and its implications.

The findings are: (1) Gozar is an institutionalized fundamental element of the city governance body in Kabul City; (2) there are wide ranges of spatial sizes and divisions of Gozars; (3) 'Urban Gozar' as an elemental neighbourhood organization in the modern sense is forming through transformation; (4) the neighbourhood unit of Perry can be an appropriate urban concept for urban neighbourhoods in Islamic cities and towns specially Kabul City.

2 RESEARCH BACKGROUND AND OBJECTIVES

Kabul City, the capital and the largest city of Afghanistan is facing a chaotic urban expansion, which is caused by the migration of refugees from the outside area of the city during and after the civil war and destruction. This is slightly different from the typical urbanization process in developing countries. The city that was planned for two million population in 1978, has recently estimated around five million. As for visioning of the reconstruction of Kabul in a Least Developed Country (LDC), not only the physical aspects such as housing supply, infrastructure development and so on are to be examined, the social aspects such as compulsory education, social solidarity establishment and so on are also to be examined sufficiently. Both issues, especially the latter issue closely concerns to the urban lifestyle of Afghan citizens on their own ways.

From such a perspective, our research interest is on community design in an Afghan way. We focused firstly on 'Gozar' as a neighbourhood organization. Gozar is a traditional district unit organized around mosques, which take important placement/ locations, and is so popular in surrounding Islamic cities and towns. However, findings from our survey in Kabul show that (1) it is institutionalized as a fundamental element of the city governance body; but (2) its activity itself does not fully depend to the religion; and (3) there are wide ranges of spatial sizes and divisions. These suggest that 'Urban Gozar' as an elemental neighbourhood organization in the modern sense is forming through transformation. However, the community design for urban Afghan requires a comprehensive spatial standard.

Concerning the requirement for a comprehensive spatial standard and the social requirement of compulsory education, this paper aims to explore a new spatial standard as the primary school district.

For this purpose, this paper addresses: (1) spatial analysis of current Gozars through a case study survey in district nine of Kabul City; (2) estimation of densities on population, dwelling unit, household, and pupils in the case study area and; (3) visionary proposals on urban neighbourhood models based on several scenarios for the ultimate urban growth in district nine of Kabul City.

The visionary proposals are based on scenarios for the possible ultimate urban growth. For this purpose: firstly, the density (dwelling units per hectare) is measured through sampling within the entire city by using aerial maps. Secondly, the measured density is applied to the potential land for development (vacant land, agricultural land) in the cases of well-planned with appropriate density and unplanned as current urban growth. Thirdly, the schools required for the pupils are found in the cases of pupils' full enrolment ratio and the pupils' enrolment ratio as current. Finally, the neighbourhood models are proposed for the well planned and unplanned growth, in both cases of pupils' enrolment ratio.

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3 THE SPREAD AND FAMILIARITY OF PERRY'S THEORY IN ISLAMIC PLANNING CONTEXT

The concept of neighbourhood has existed since centuries ago in different continents of the world (Farah, 2013). The planned residential neighbourhood probably finds its most complete description in Clarence A. Perry's monograph, 'The Neighbourhood Unit, a Scheme of Arrangement for the Family-Life Community', found in volume 7 of 'The Regional Survey of New York and Its Environs' (Dahir, 1947).

Perry's theory came in the first half of the 20th century to give some standards and unified features to the neighbourhood concept. As dimensions, number of inhabitants, services and facilities included etc.

Perry's neighbourhood unit dealt with matters such as transportation, open space, housing, and commerce. The ideal neighbourhood unit was centred on an elementary school and community centre, and bounded by arterial streets. It is an effort to create a residential neighbourhood to meet the needs of family life in a unit related to the larger whole, but possessing a district entity characterized by the strictly local factors (Dahir, 1947).

In Islamic countries like in any part of the world, there were traditional neighbourhood concepts to organize the people's settlement spatially, socially, administratively and sometimes politically and economically (Farah, 2013 and Secil, 2005).

In Uzbekistan it is known as Mahallah, in Iran as Mahalleh, in Turkey as Mahalle, in Afghanistan as Gozar and in part of the Gulf region as Fareej.

Despite their different names, these neighbourhoods were all organized around a religious building: the mosque and sometimes the church (Secil, 2005) and included a school, retail/shops/market, open space and spaces for the community, where not only the representative of the neighbourhood to the upper administration often met with the community to discuss their daily matters and problems (Farah, 2013), but it played a political/juridical role as a decision-making place. It also represented a cultural/spatial and educational place, where women community was also meeting.

Planning these traditional neighbourhoods and setting up the optimal size and population, according to institutions such as community centres or primary schools, not only helped better performance of existing functions, but also reinforced much wider neighbourhood functions such as social relation, education and so on.

Furthermore, with Perry's theory the school represented the centre of the whole neighbourhood and all the houses were built within a walking distance. Perry's neighbourhood unit theory has been followed all over the world, in particular with the advancement of technology, the economic development and the modernization of lifestyle. The advantages of this theory are: the reduction of vehicles' use, hence air pollution and fuel consumption, encouragement of walkability, increase of the pedestrian's safety during the trips between houses and school, increase of the sociability among the inhabitants and for sure ease of control and management of the urban development.

The 2030 master plan of Abu Dhabi in the United Arab Emirates, for example, proposed a model inspired from Perry's concept but based on the traditional Emirati neighbourhood. The new model includes a variety of ethnic groups representing 30% of the inhabitants (called expatriates) and 70% of the original inhabitants of the country (called locals) (Abu Dhabi Urban Planning Council, 2007).

Therfore, one of the significant challenges of the neighbourhood unit is to integrate different socio-economic groups of the society and many ethnic groups together, since they will be sharing the same spaces, facilities, using the same routes, etc.

In our opinion, the neighbourhood model based on Perry's theory can successfully play the role of an urban development tool in Kabul city, facing the uncontrolled urbanization and the absence of an effective master plan. Going back to the traditional neighbourhoods and developing it according to the needs of the Afghan people, their culture, their history and identity can be an efficient tool to control the urban development of the city and organize its urbanization.

Hence, this research comes to study and stimulate the best scenario for the neighbourhood model to be followed in the case of Kabul city; this represents the uniqueness and strength of this research.

So, let us start by defining Gozar as the case study of this research. The term Gozar that literally means pass or passage traditionally referred to areas or divisions where homogenous guilds or people with a common interest were lived. Referring to the literal meaning and common beliefs, Gozar might have been the residences along a main pathway served by a mosque and local shops.

Gradually these homogenous vocational Gozars transformed into heterogeneous Gozars of having diverse vocational groups. Besides, three factors caused the urban transformation of Gozars go through a faster and different way; (1) the expansion of the city in European style in the 20th century that resulted social class segregations; (2) the expansion, according to the master plan of 1978 which resulted planned and unplanned segregations, (3) The recent three decades of war that resulted ethnicity and religious segregations (HABIB and AKTC, 2011).

Gozars now are divisions of social classes, ethnicities and settlement types. However, they are institutionalized as sub-districts of municipal governance, represented by a representative who is elected by residents, approved by district municipality and screened by police department (Kabul City Current Status Report for Urban Development, 2011).

The boundaries are changed according to the extension of urban land, migration of people, and upgrading or widening of roads that sub-divide the Gozars. The changes take place by negotiations of representatives with the residents and adjacent representatives.

To determine the current functions of Gozars, one of the authors, had conducted a survey within four districts of Kabul city. The survey results show that the activeness of Gozar functions (governance, social, physical and safety functions) does not depend on urbanization age or population size, but settlement type (planned or unplanned).

4 CASE STUDY (DISTRICT NINE)

In this section we try to devise the primary school district and adopt it in some scenarios, although the primary school district is not yet set in Kabul.

District nine is chosen as the case area for this spatial analysis, for its location in the inner city zone of Kabul, and having a variety of settlement types, i.e. Planned apartment houses, planned courtyard houses, and un-planned courtyard houses.

As for collecting the data, a site survey was done in 2013. In addition, land use maps of JICA (Kabul City Current Status Report for Urban Development, 2011) and other web based maps were used.

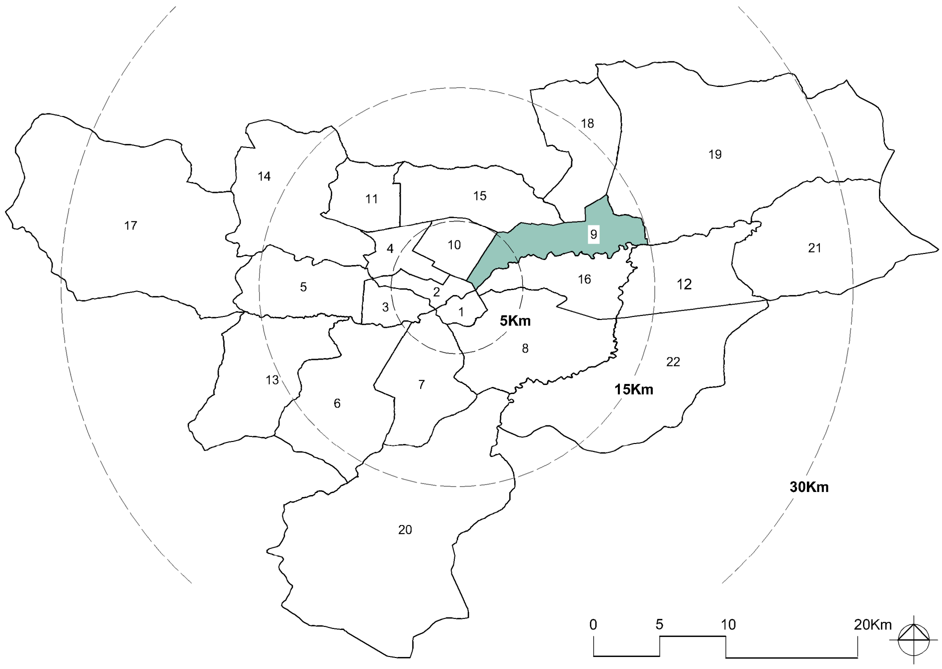

Fig. 1: The District map of Kabul City showing the case study area

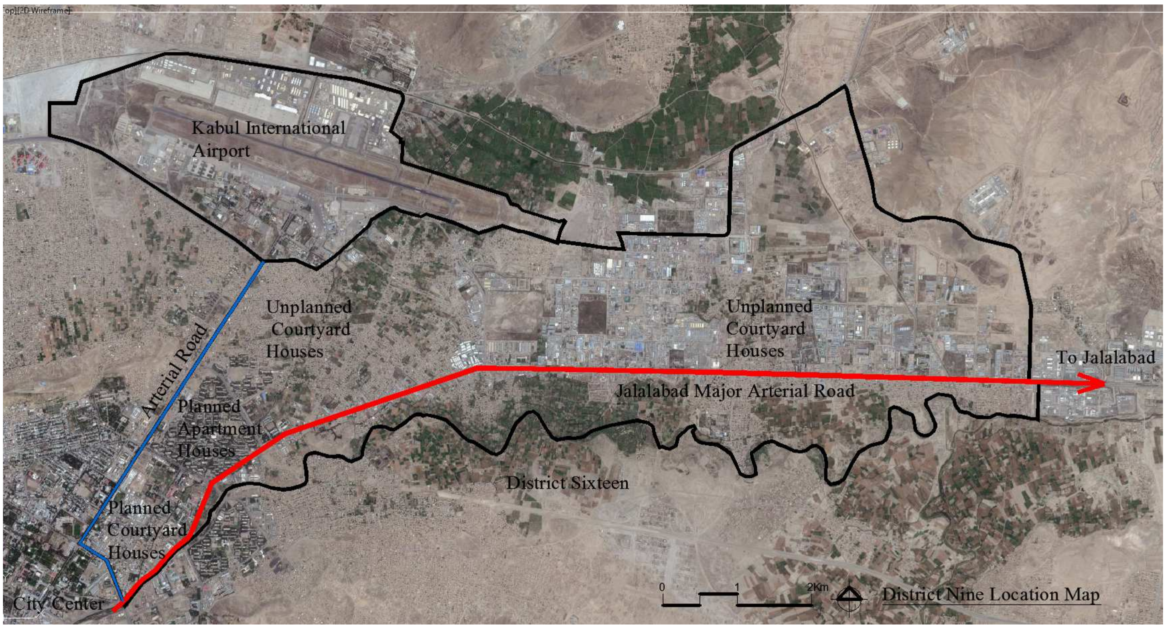

Fig. 2: The location map of District nine

4.1 Current status of district nine

District nine was originally all agricultural land, except the western end that were developed into apartment building settlements according to the 1978 master plan. The agricultural lands still remain in various locations of the district, which are rapidly and illegally changing to residential settlements.

About 36% of the district land is residential land. Agricultural land occupies 20 %, vacant or bare land occupies 12% and industrial land occupies 24% of the district land. The remaining 8% of the land is occupied by some commercial or public facilities that are located outside Gozar boundaries. [Estimations are made according to measurements on Bing aerial maps (2013 Nokia, 2012 Digital Globe)]

4.2 Features of spatial elements, in this case study

4.2.1 Gozar size and boundaries:

District nine is consist of 39 Gozars. The boundaries are mainly the main alleys, streets and roads. The sizes vary from a minimum of 11.8 ha to a maximum of 111.2 ha, but the average size is 43.1 ha. (Table 1)

Basic Statistics	Area (Gross ha)	Area (Net ha)	No. of Households	Population (Net)	Density (Net)	No. of Mosques
Average	43.07	32.63	571.00	5,938.40	181.99	2.26
Max	111.24	82.36	4,500.00	46,800.00	568.22	6.00
Min	11.84	11.22	77.00	800.80	71.35	1.00

Notes: Gross Area includes potential land for urbanization (vacant and agricultural land)
Net Area is the residential area, including the streets and open spaces

Table 1: Sizes of current Gozars in district nine

4.2.2 Primary schools

There are 12 high schools and three primary schools in this district. Since higher-level schools operate also lower level schools in Afghanistan, it can be said that there are 15 primary schools in this district.

The results of the measurements show that pupils' maximum travel distance to primary school is 500m in planned areas, while, in unplanned areas, this distance exceeds 2000m.

For easier transportation, the schools are located near main roads. Thus, the pupils must cross dangerous streets and roads to reach schools.

Basic Statistics	Total Enrolment (Pupils)	Area (Planned ha)	Area (Unplanned ha)	Population	No. of Households
Average	2,319.53	135.08	79.95	15,464	1,487
Max	4,326	251.93	149.10	28,840	2,773
Min	347	20.21	11.96	2,313	222
Area excludes vacant and agricultural Land, includes the streets and open spaces					

Table 2: Sizes of estimated primary school districts in district nine

4.2.3 Mosques

We cannot find the difference in the distributions of mosques over planned and unplanned areas. According to the site survey, there are 88 mosques in this district.

4.2.4 Other public services

Similar to schools, the other urban services are also concentrated in planned areas.

Unplanned areas lack proper open spaces for parks and playgrounds. Children often play in the alleys, near the main roads or at the vacant lands.

Fig. 3: An example of unplanned area, left: children are playing in the alley near their houses, right: pupils walking back to home

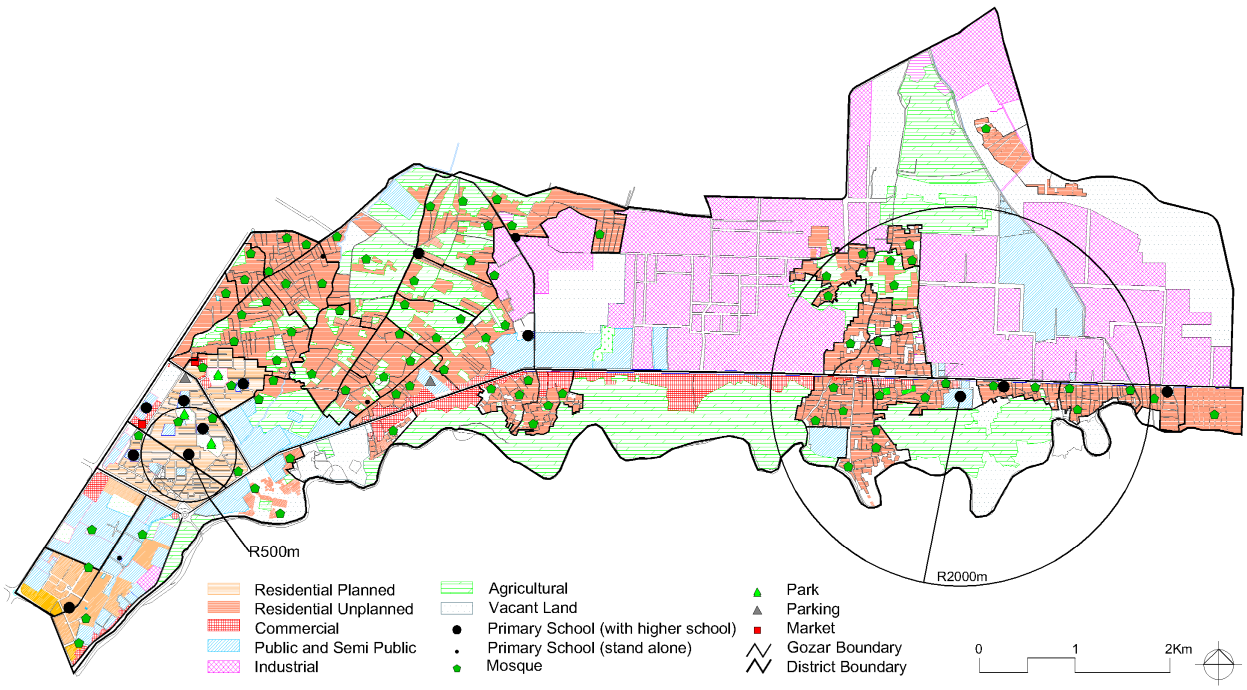

Fig. 4: Land use map of district nine

Commercial areas are mainly taking place along the main roads, streets and alleys in both planned and unplanned areas. They are part of Gozars, and the representative acts as the commercial area's representative, as well.

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For better access, it can be seen that some daily necessity shops are located in the vicinity of the houses, or even they are part of some houses.

5 DEMOGRAPHIC ESTIMATIONS BASED FOR PLURAL SCENARIO

5.1 Estimating the ultimate population

To measure the population for the ultimate urban growth in district nine, the following steps took place.

(1) Measuring the current number of dwellings: The total number of dwelling units was measured by direct counting on the map (Bing maps: 2013 Nokia, 2012 Digital Globe). The result is multiplied by the number of persons per dwelling unit that is taken from the figures by JICA (Draft Kabul City Master Plan, 2011). (Table 3)

The population estimated in this step is used as the current population for district nine in all further calculations.

(2) Measuring the vacant and agricultural land areas (rapidly urbanizing lands): By using the Geolocation function of AutoCAD software application, the areas were measured on Bing maps.

Demographic Indicators	JICA 2011	CSO	Measurements on Map
Area (Km2)	25.5	-	*35.8
Number of dwelling units	-	-	22,271
Number of households per dwelling unit	1.56	-	-
Household size (persons/household)	6.69	6.33	-
No. of persons per dwelling unit	10.4	-	-
Population (persons)	-	250,100	-
* The gross area within district boundaries			

Table 3: Demographic estimations for district nine

(3) Measuring the gross and net density: For measuring the number of dwelling units per hectare, 35 samples having different locations were selected across the city. Those locations were sought that represent various densities.

(4) Calculating the number of dwellings for ultimate urbanized case: The average density found for each type of housing is multiplied by the vacant and agricultural land.

(5) Estimating the ultimate population: The result of step four is multiplied by the number of persons per housing or dwelling unit.

5.2 Measurement of school enrolment ratio

(1) To measure the current primary school enrolment ratio, a school survey was done in district nine during 2013 survey, from which the accurate number of pupils currently attending school was received.

(2) The urban population of the age six to twelve is found from the Afghanistan Statistical Yearbook 2012-13.

Pupils' Enrolment Indicators	Current enrolment ratio according to school survey of 2013 (a) case	Full enrolment ratio according to CSO (b) case
Percentage of pupil's population	15.0%	19.2%
Pupils' enrolment percentage	78%	100%
Pupil's number	34,793	44,471
Pupils' no. in each grade	5,799	7,412
Number of classes for each grade	145	185

Table 4: Estimation of pupils' current and full enrolment ratio

5.3 Scenario assumptions

Considering the urban growth as planned and unplanned, and pupils' enrolment ratio as full enrolled (100% enrolled) and enrolment similar to current state (78% enrolled), four scenarios are assumed. (Table 5)

Population growth in full-built-up state	Pupils' enrolment percentage
A. Estimated population in well-planned case [current population + planned density x (vacant land + agricultural land)]	a. All the primary school aged children are to be enrolled in primary schools (100% enrolment)
B. Estimated population in unplanned case [current population + unplanned density x (vacant land + agricultural land)]	b. Pupils' enrolment percentage to be the same as current enrolment percentage (78% enrolment)
Aa: Scenario 1, Ab: Scenario 2, Ba: Scenario 3, Bb Scenario 4	

Table 5: Scenario assumptions

Specifications		Current State	(A) Full built-up state (Planned)	(B) Full built-up state (Unplanned)
Area		1,272.56	2,416.27	2,416.27
Number of dwelling units		22,271	34,863	43,544
Population		231,618	362,578	452,858
(a)	100 % Pupil enrolment ratio	44,471	69,615	86,949
	Classes required	1,112	1,740	2,174
	Classes required for each grade layer	185	290	362
(b)	Current pupil enrolment ratio (78%)	34,793	54,465	68,027
	Classes required	870	1,362	1,701
	Classes required for each grade layer	145	227	283
* According to the Education Law of Afghanistan, the number of pupils per class is taken 40				

Table 6: Comparisons between the scenarios and the current state

5.4 Vision proposals

To analyse the school coverage for the number of classes, three variations of schools are analysed for each scenario.

5.4.1 Scenario 1

Scenario one, is assumed for the ultimate urbanization in a planned manner of development and full enrolment ratio of pupils.

The primary school district for each size of the school is found by the population, the number of houses and the area that can be covered. The density used for the measurements is taken as the current gross density, which includes the roads and the open spaces.

The population varies by the primary school size. A school size, having 24 classrooms, covers 5000 population. While it reaches 7500 for a school size of having 36 classrooms.

The maximum travel distance is around 350m for the school size of 12 classrooms, 500m for the school size of 24 classrooms, and 600 for the school size of 36 classrooms.

Which travel distance can be the optimum travel distance for the pupils, and is it possible that each Gozar cover a primary school district? To answer these questions, first the current average distance between main roads, is measured by using aerial maps, and then the current Gozar sizes are analysed.

The current distance between most of the main roads in Kabul City is from 500 to 700 meters. Thus, if the school district area is considered as a rectangle of greater than 700m x700m, there is the possibility of interring through traffic in the neighbourhood. So, for the current road system of Kabul city, the safest option for the primary school size in this scenario is the primary school of having 12 classrooms.

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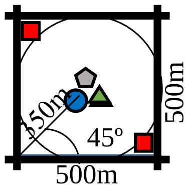
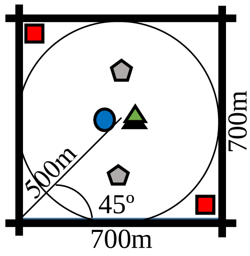
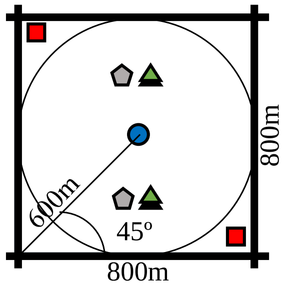
Scenario 1	12 classes primary school	24 classes primary school	36 classes primary school
Total number of classes	1,740	1,740	1,740
Number of primary schools	145	73	48
Primary school district population	2,500	5,000	7,500
Number of households	240	481	721
Primary school district area (gross ha)	22	44	65
Scenario model Primary School Mosque Open Space Shops Main Road			

Fig. 5: Vision models of school district Gozars (full-day school program) full-built-up state for full enrolment of pupils

On the other hand, if we compare the school district size to the average size of Gozar (43.07 ha with an estimated population of 4932), the 24 classroom school district size is the most appropriate size.

Furthermore, Kabul Municipality tries to standardize the Gozar size to 500 houses or dwelling units (Kabul City Current Status Report for Urban Development, 2011). It can be seen that the Kabul Municipality's standard unit size for the Gozar also fits the school district size of having 24 classrooms.

Thus, it can be concluded that the all-day-program primary school size of 24 classrooms or half-day-program primary school size of 12 classrooms is the most appropriate size for the primary school district. This is the most appropriate size for the ultimate urbanization with full pupil's enrolment ratio, according to pupil's walking distance, the current road pattern of the city, the current Gozar size and the standard Gozar size recommended by Kabul Municipality.

5.4.2 Scenario 2

In scenario two (78% pupil's enrolment ratio), the school district size increases for each school size. In a school of having 24 classrooms, the population reaches 6,400 and the number of households becomes 615. The maximum travel distance becomes 500m. In this scenario, the most appropriate size is the school of having 24 classrooms. Thus, one or two Gozars can be combined to make the school district Gozar centred with a primary school of having 24 classrooms.

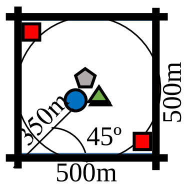
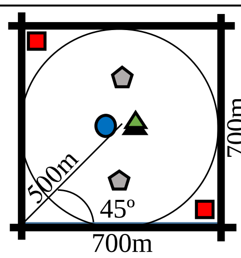
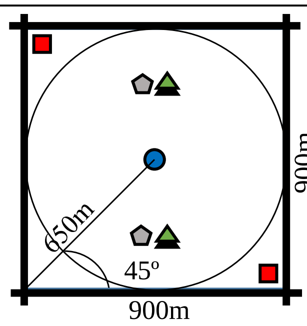
Scenario 2	12 classes primary school	24 classes primary school	36 classes primary school
Total number of classes	1,362	1,362	1,362
Number of primary schools	113	57	38
Primary school district population	3,200	6,400	9,600
Number of households	308	615	923
Primary school district area (gross ha)	28	56	84
Scenario model Primary School Mosque Open Space Shops Main Road			

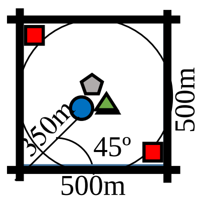
Fig. 6: Vision models of school district Gozars (full-day school program) in full-built-up state for current percentage of pupils' enrolment

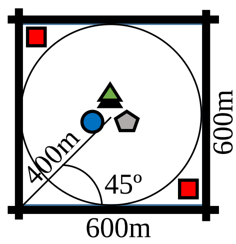
5.4.3 Scenario 3

Scenario three is assumed for the ultimate urbanization in an unplanned manner of development and full enrolment ratio of pupils. In this scenario, the school size of having 36 classrooms makes an appropriate school district Gozar.

Scenario 3	24 classes primary school	36 classes primary school	48 classes primary school
Total number of classes	2,174	2,174	2,174
Number of primary schools	91	60	45
Primary school district population	5,000	7,500	10,000
Number of households	481	721	962
Primary school district area (gross ha)	26	39	52

Scenario model
Primary School
Mosque
Open Space
Shops
Main Road





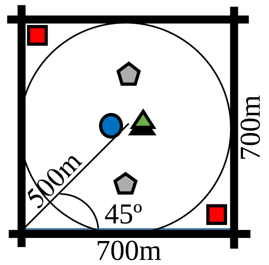


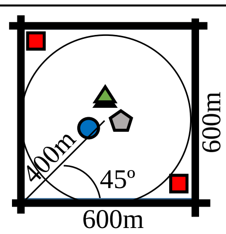
Fig. 7: Vision models of school district Gozars (full-day school program) in unplanned full-built-up state for full enrolment of pupils

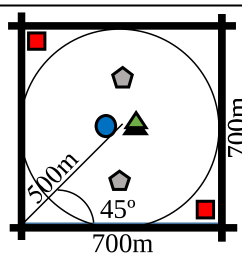
5.4.4 Scenario 4

Scenario four, is assumed for the ultimate urbanization in an unplanned manner of development, and for the enrolment ratio of pupils same as the current. In this scenario, the school size of having 24 or 36 classrooms makes an appropriate school district Gozar.

Scenario 4	24 classes primary school	36 classes primary school	48 classes primary school
Total number of classes	1,701	1,701	1,701
Number of primary schools	71	47	35
Primary school district population	6,400	9,600	12,800
Number of households	615	923	1,231
Primary school district area (gross ha)	33	50	66

Scenario model
Primary School
Mosque
Open Space
Shops
Main Road





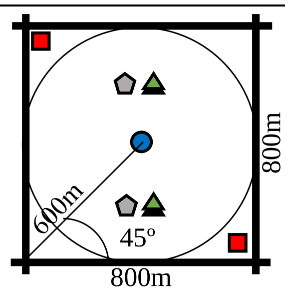


Fig. 8: Vision models of school district Gozars (full-day school program) in full-built-up state for current percentage of pupils' enrolment

According to the four scenarios shown in figures 5, 6, 7 and 8, proposals for school district Gozar could be: (i) centred with a primary school of having 24 classrooms for a population of 5,000 to 6,400 in planned areas; (ii) centred with a primary school of having 24 to 36 classrooms for a population of 5,000 to 9,600; (iii) having one or two Mosques located at the centre or each half of the Gozar; (iv) the boundaries to be determined by the main roads, and the main roads should not go through the primary school districts.

6 CONCLUSION

The results of the survey show a wide variety of sizes of Gozars in Kabul. These suggested that 'Urban Gozar' as an elemental neighbourhood organization in the modern sense is transforming through urbanization. This urbanization requires a comprehensive spatial standard on urban neighbourhood.

Therefore, a new spatial standard is explored as primary school district and also adopted in scenarios under assumptions of planned and unplanned development for full enrolment ratio of pupils and current enrolment ratio.

For this purpose, density, number of dwelling units, population and number of pupils are estimated for the ultimate urbanization (the current agricultural and vacant land transforms to residential settlements).

For each scenario, three options of school districts are assumed. Among them, the most appropriate school district size is recommended by considering (i) the pupils' minimum walking distance; (ii) the current road pattern of Kabul City, (iii) the majority Gozar sizes, and; (iv) municipality's recommended Gozar size.

It is finally concluded that one or two of the current Gozars can be combined to make an appropriate school district Gozar.

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An Urban Sensing System as Backbone of Smart Cities

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1 ABSTRACT

A complex urban ecosystem, with various local climate and air quality influences, emerges within urban structures with interacting anthropogenic and natural factors. These influences have different temporal and spatial characteristics. Human well-being is influenced by a multitude of microclimatic effects, which are elementary for urban planning. These form the basis of intelligent control and design of various processes within urban smart cities. For example, micro climatic modeling helps to get a better understanding of temperature changes in diverse urban areas. Possible consequences of different planning scenarios can be explored in advance. The required data for such scenarios are mainly collected at selected locations by multiple individuals. However, the collection of the complete urban data is expensive and time consuming. The non-standardization of data saving formats and measurement procedures leads to various deviations. In future, all relevant data of a smart city should be available ubiquitously and in real time. The aim of this paper is to present a possibility of data standardization and data saving in a worldwide accessible data base. Furthermore, it should be addressed how the data base has to be structured, where local climate data can be saved, and how the data can be made accessible. The basis for this system consists of the interface between the database and different measurement instruments, whose values are stored directly in this data base. For this reason, the data base is essential for the central data infrastructure of smart cities. In addition, this paper shows how a freely accessible system not only improves the quality of urban life, but also makes it measureable.

2 INTRODUCTION

2.1 Preface

In the course of human history, information and messages have been conveyed in many ways: e. g. oral communication, gestures or pictures, written texts, acoustic or visual signals, and via wire or wireless. The meaning of communication also differs in the way the information reaches the recipient Is the message received directly? Is the message meant for a greater public, or only for one individual? Nowadays, the internet is a popular platform to receive, send, analyse, save and share information [cf. ALLBACH, 2010:3FF]. The human race is moving on from a “Gutenberg galaxy” towards an “Internet galaxy” [cf. CASTELLS, 2005:10]. Therefore, smart cities should accept and adopt the internet and networks with all their information, knowledge and data, and use the positive aspects of those new technologies. “Urban Sensing” is a modern and interesting method to collect data in smart cities.

2.2 What is Urban Sensing?

The so-called “Urban Sensing” is a new method of taking measurements within urban environments. Human beings as well as mobile technical devices can be used as probes [cf. CAMPELL, 2006:1FF]. In connection with the Web 2.0/3.0, urban sensing is a new means of collecting and analysing data. Information that is collected, both actively as well as passively, promises to carry a great potential, and offers new sources of information for planning disciplines and climatology. To discover its full potential, there is a need for new algorithms and programs, that go further than merely processing the input. So, three different settings are possible: Personal scenarios, social scenarios, as well as scenarios concerning society as a whole. Monitoring and analysing one’s own vital signs exemplifies a personal scenario. In social scenarios, information is received by a (firmly) defined group of people and is processed via social networks and data services (e.g. Flickr). The scenario concerning society as a whole is open and involves the general public [cf. SRIVASTAVA; ET AL.; 2006:1F]. One of the biggest strengths of this new method of data acquisition is the potential of monitoring large areas over a long period of time [cf. HOF, 2007:1]. Due to financial aspects, this is often impossible with traditional evaluation and measuring methods. The omnipresence of mobile devices, which stretches all across geographical and demographical spectra, is important in order to gather precise data.

There are already some projects trying to implement urban sensing. One of them is “Noisetube” (www.noisetube.net), which monitors noise levels. Another one is “Waze” (www.waze.com), which combines crowdsourcing, geotagging, traffic information, and map services in real time. In the meantime, the “Pachube Project” was sold, renamed “Cosm” and eventuallyre-entered the market as “Xively” (www.xively.com) [cf. MACMANUS 2011]. “Xively” already owns many functions necessary for saving urban sensing data, howeverthe development, accessibility, and the strategy of private sector enterprises cannot be predicted. A system that records public data should also be a public and democratic system.

2.2.1 Urban Sensing Data

In any case, it is important to be note that the data collected in such an “Urban Sensing scenario” is extremely diverse, which can pose as a problem. There is a plethora of probesbased all over the city, providing a variety of data and information, all differing in quality and conformity. A suitable method to link and blend this data is needed. blending and linking data is a sensitive topic, as it has to be acknowledged that data is available in a multitude of formats, i.e. is heterogeneous, and will need to be converted into a homogenous state. Especially temporal and local factors are often sources of error when it comes to analyzing and interpreting. This is caused by measurement imprecisions. In order to save the data in any given system, standards to convert in a homogenous format have to be defined. Indicators, including firmly defined names and notations, as well as their units of measurement need to be specified [cf. ALLBACH; HENNINGER, 2013].

2.2.2 Why is an “Urban Sensing System” needed?

One could question if such a system is needed. Indeed, internet technology, web services, data bases, crowdsourcing are no longer ground-breaking topics. However, even these allegedly “old-fashioned” topics are still immensely important and have evolved over time (Web 2.0/ 3.0). Furthermore, it is crucial to observe and adapt them and to shake them up. Adapting these topics needs special attention, since adaption is often not as easy as it seems, and often requires a great amount of personal time and dedication. Additionally, it needs to be noted that mash-ups with synergies can develop between two separate technologies, which do not necessarily form a new invention but perhaps a new application. Ultimaltely, the hereby introduced “Urban Sensing System” offers great potential for urban sensing and the decoding of the relationships between city, human being and climate. Climatoligical and data of an individual’s vital signs, and other meta data is stored in a single system which is accessible bi-directionally.

2.2.3 Communication – XML, TCP & UDP as standards for Urban Sensing Data?

To ensure communication between single computers within a network and between different networks, regulated standards are necessary. These standards as well as the group of “Internet protocols” (TCP/IP protocol group/family) regulate the conduct between them. For addressing online, an Internet protocol (IP) is used, which makes every computer addressable via its own IP address. In the broadest sense, the IP address can be seen as a personal computer’s telephone number. A current “IPv4”- version IP address typically has the following format: 192.168.1.79. Since this manner of reference is not intuitive for humans, the “Domain Name System” (DNS) is used to translate and simplify the code into a much more memorable format, e. g. http://www.uni-kl.de. Computer names, whose IP addresses are translated by DNS, feature a characteristic structure, which is known as “Uniform Resource Locator” (URL). Furthermore, the “Internet protocol”, the “Transmission Control Protocol” is located, which ensures that the sent data arrives at its desired destination. Thus, computers, networks and their data are linked through unique addresses. Documents are described by hypertext and are available within a browser by the “Hypertext Transfer Protocol” (HTTP), which uses “Hypertext Markup Language” (HTML) to display the documents’ graphic structure. In this example, the information content is saved in HTML. It is also necessary to implement XML. The “Extensive Markup Language” allows to store and process information and data. The document markup language XML is a subset to the “Standard Generalized Markup Language” (SGML) and is used to add supplementary information to text documents. This addition, called annotation or mark-up, is not part of the actual text, but describes the relation and the structure of textual elements [cf. MOSEMANN; KOSE, 2009:332FF]. Information added through annotation is called metadata. While XML defines the logical structure of documents, it doesn't say anything about the way in which they are displayed. However, it is possible to use XML to define mark-up languages, such as XHTML, which is an XML-based version of HTML. Therefore, XML is not only a mark-up language comparable to HTML, but also a meta language to generate mark-up languages [cf. HITZLER; ET AL., 2008:17FF]. "Mark-ups" are information which enlargethe content of documents by marking certain parts and highlighting connections. The manner in which this is done can be compared to the design of a newspaper, in which spaces, different fonts, titles and positions are used to distinguish single articles. Furthermore, on the one hand, XML is a protocol for recording and managing, and on the other hand, it can represent a group of technologies used to format documents and filter data. On its highest tier, XML is a philosophy for the handling of data. Maximum user flexibility and comfort are achieved by limiting it to a structured and straight form of information. Several performance features ensure XML's success (e. g. the possibility to store and organize information for actual demand). The open standard ensures that the user is not bond to companies or certain software. XML has very rigorous standards regarding the quality of its documents. It demands the strict following of syntax and offers a multitude of methods to test quality. Simple and clear syntax makes it easier to read and analyze XML for both man and machine [cf. RAY, 2002:1FF]. A program called "Parser" is used for checking. It reads XML, validates it, and forwards it for further processing. If the document indicates an error, it is not "well-formed" [cf. RAY, 2002:352]. The distribution and use of XML is supported by the "Open Source" movement with its many adherent programs and by the need for a standardized communication interface [cf. RAY, 2002:1FF].

Just as XML is one of the most popular mark-up languages, UDP (Protocol User Datagram Protocol) is one of the most used protocols for the transmission of data. Typically, it is used for simple question-and-answer protocols (e. g. DNS, DHCP, NTP). One of the characteristics of UDP is that it is a non-connected protocol which does not supervise the correct transmission of data packages. They don't necessarily arrive in the right order and are directly forwarded to the proper application. Some of its strengths are its speed and system utilization, which is much lower in comparison to TCP [cf. NETWORK SORCERY, 2012].

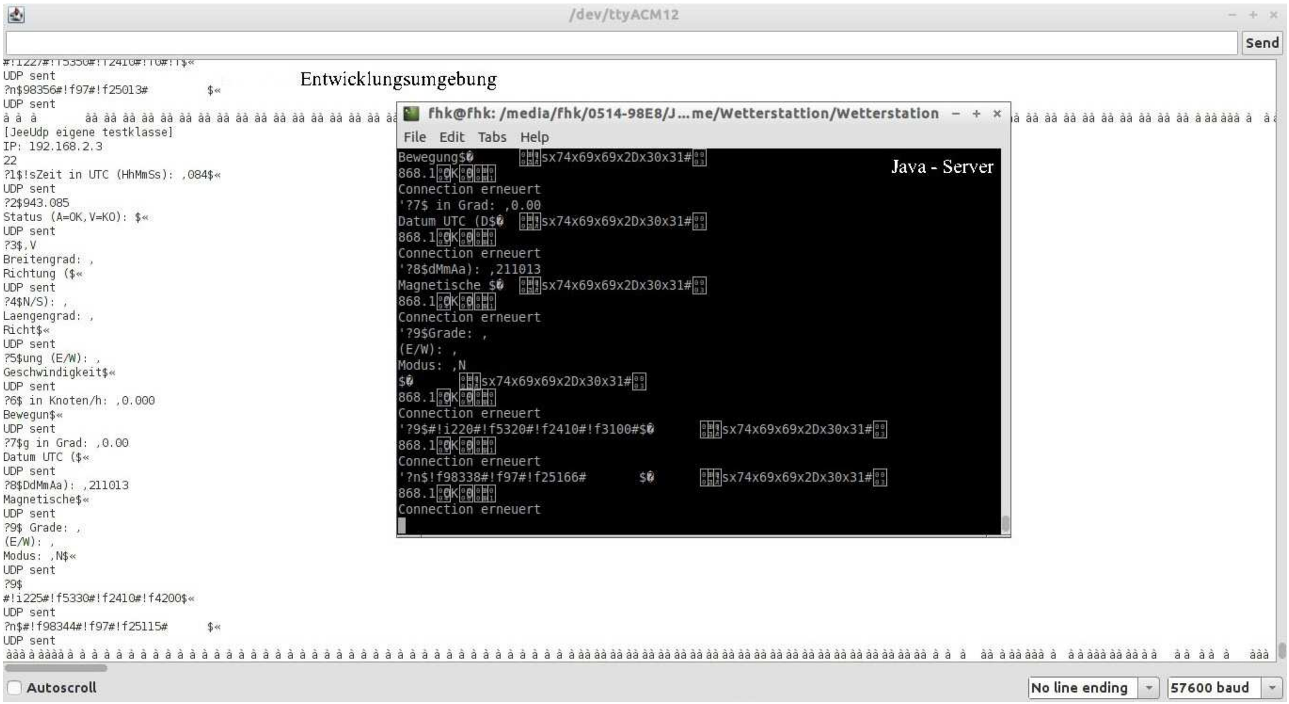

Fig. 1: UDP – runtime – environment of development – sending of climate data.

For this project, UDP protocols were used. They run smoothly and reliably on the low-performance urban sensing devices (Fig. 1). A TCP-connection is not possible with "Urban Sensing System", as this protocol builds up a firm connection, which would require the sender to wait for the server to respond. However, during this waiting period, all important data would get lost. Skirting the waiting time with interrupts is not as easy, as the regulation (e. g. maximum of seven interrupts) at the multitude of sensing device's microprocessors also requires these interruptions. In case of a lost package, two procedures have been developed: In a first step, the whole range of packages is dismissed, before, in a second step, the vacancy is filled with a default value ("0"), which makes it possible to calculate the missing value by interpolation.

Usually, measurements are taken in short intervals (one second), which means that losing data does not have to be a big problem.

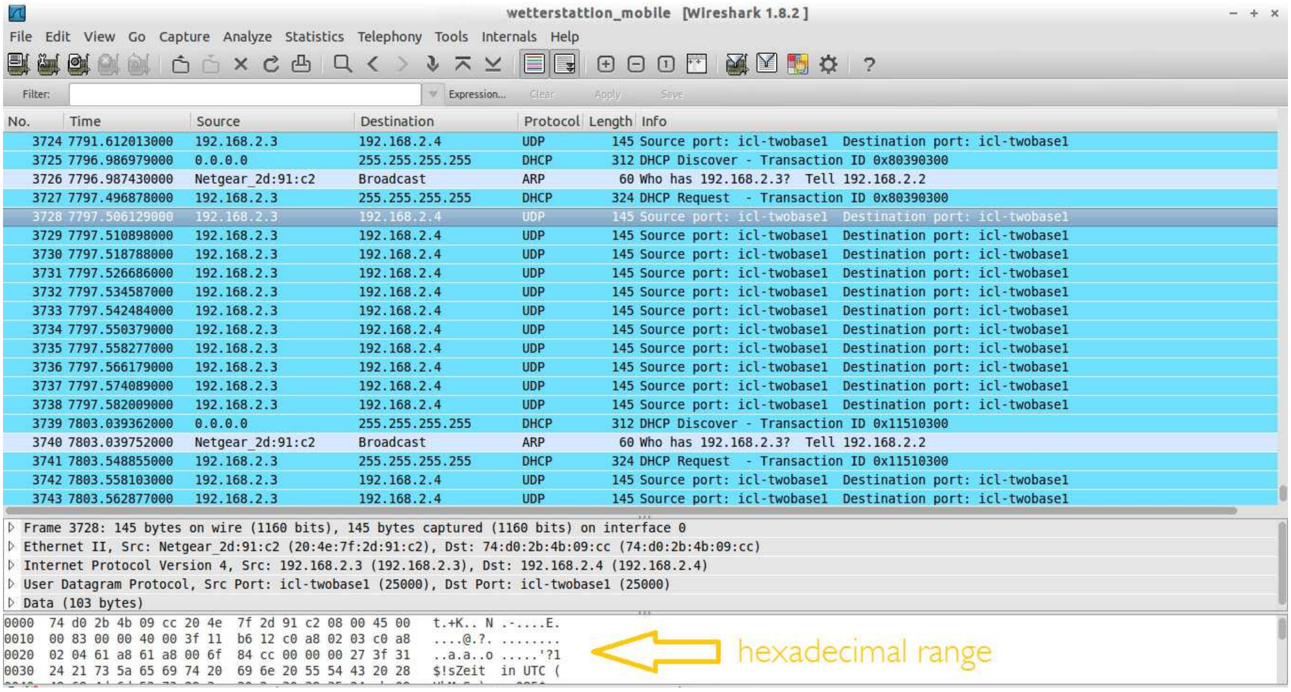

Fig. 2: Wireshark measuring of a network between sensing device and server.

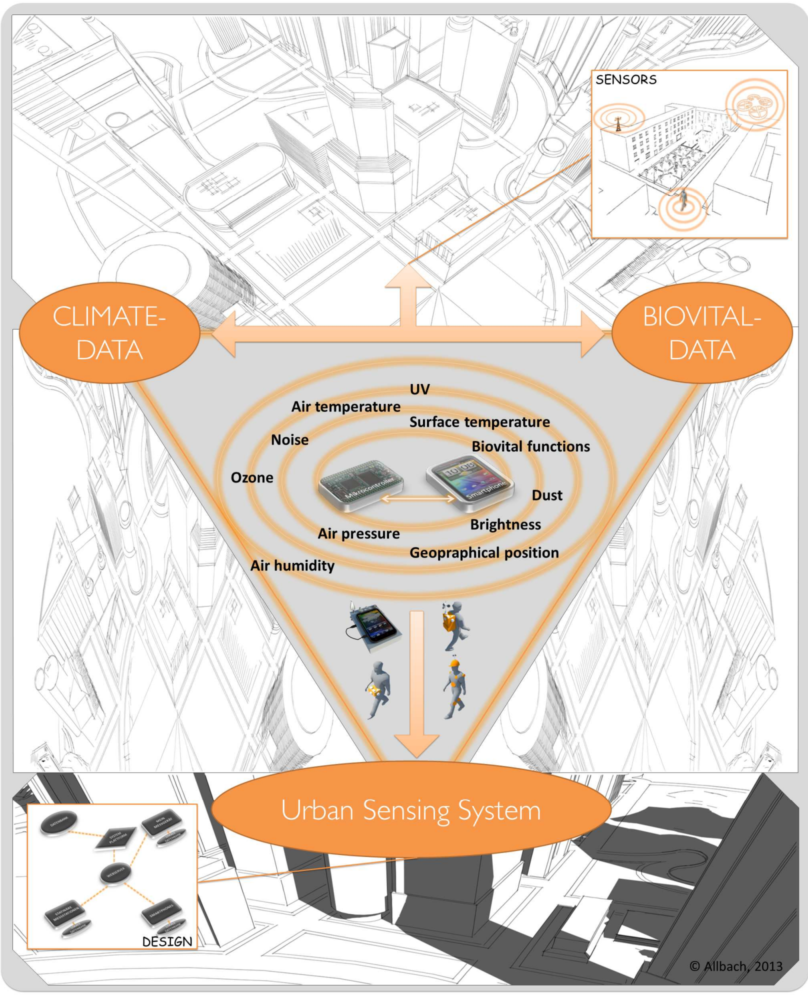

Fig. 3: "Urban Sensing System".

"Wireshark" allows to control data sent over a network connection. Figure 2 displays the connection between "Mobile Sensing Device" (192.168.2.3) and server (192.168.2.4.). The lower window shows the hexadecimal range where a part of the message content is visible. In this case, "?1$!sZeit in UTC (" is the exemplified structure of a message sent via UDP. Number of package ("?!"), beginning of message ("$") and type of variable used ("!s" - "string" in this case), are decoded in this rather cryptic command.

3 "URBAN SENSING SYSTEM"

3.1 Preface – Design

The "Urban Sensing System" is based on the idea of storing geo-referenced data for urban spaces (Fig. 3). This data consists of climate data and data of individuals' vital signs, while a wide array of sensing devices is used as "sensing media" (Smartphones, stationary weather stations, self-constructed mobile weather stations, drones, etc.)

3.2 System requirements

An "Urban Sensing System" needs to fulfil many requirements, such as good availability, connectivity, processing of data volume, stability, performance, storage ability, analyzing ability, openness, expandability, usability and the potential. All of this is necessary to set up user profiles and scenario instances, as well as to create added value for the user by a specific interpretation of the data [cf. ALLBACH; HENNINGER, 2013:1FF].

3.3 Realization

3.3.1 Web-based applications

To fulfill the system's requirements, web-based applications appear suited as a base for later operation scenarios. Web-based applications are typically used in a web-based environment [cf. LANGNER, 2004: 20FF].

Fig. 4: 4-tier design.

Four columns, each representing an architectural tier, are shown in Figure 4: Tier I represents the client, Tier II a web server, Tier III an application server, and Tier IV represents a data base server. A standard web-application only needs Tiers I, II and IV. However, it must be considered that compatible technologies have to be used on the different tiers. For this reason tiers I-III mainly use XML [e.g., LANGNER, 2004:21]. Diverse technologies can be used for the web servers on Tier II. At this point, it must be decided which technology should be used for the development. Java, NET or PHP are options, and each has its strengths and weaknesses. Every application supposed to accept data from Tier I is called "CGI element" (Common Gateway Interface). Usually, Tier II employs Open Source-project Linux as operation system. Java developtechnologies which have the advantage for the user of being both developer as well as platform independent.

In a next step, a web server has to be picked. Provided by the Apache Software Foundation, the Apache Webserver is commonly chosen [cf. LANGNER, 2004:27FF]. The latter is a “servlet container” written in Java. The web-based applications are transferred by “Java Servlets” and/or “Java Server Pages” (JSP). This allows a combination of HTML with conventional Java code without special support for the browser, as needed with JavaScript [cf. SAMASCHKE; STARK, 2005:31]. Java servlets are applications running in a server which is connected with the world wide web, and they are complementary to Java Applets running on websites. Servlets are used for designing programs that receive and send information via a webserver. Java Servlets are an alternative to “Common Gateway Interfaces”, the common programming language for gathering information in the www and export data [cf. LEMAY; CADENHEAD, 2002:732FF]. Besides Java, there are also other alternatives to deploy on Tier II. On Tier III, business logic is implemented. If applications from Tier II intend to retrieve logical functionalities on Tier III, they have to use a “Remote Procedure Call” (RPC). An example for the applications server’s function on Tier III is the inquiry at a bank about where a customer owns its account. Tier II is responsible for producing and releasing a document out of this data [cf. LANGNER, 2004:31]. The lowest level, Tier VI, is the one where data is stored. Many different types and developers of data bases are available. Again, there is an open source-solution, MySQL, among many others. Therefore, theoretically, it is possible to design a high-performance, scalable, web-based application that is independent from both platforms and developers. However, it should be considered that a free-of-charge-program requires experience and a higher effort for configuration [e.g., LANGNER, 2004:35FF].

It is not absolutely necessary to use a 4-tier or 4-column design as it is done here. There are alternatives, the most simple one consists of only two tiers. In this case, the client takes on the task of presenting while the server-level stores the data [e.g., BLANKENBACH, 2007:143FF]. The following section will focus on Tier VI, the heart of data storage in general and in the “Urban Sensing System.“

3.3.2 Data bases – Information Systems

Information systems are supposed to represent a faithful model of a fragment of reality (miniature world) on a system. If something happens that changes the circumstances, it has to be represented accurately. Objects and their relations are abstracted and transferred into the miniature world with the aim of matching the modelling and the reality as precisely as possible. State transformations must be interruptible if errors occur. This is guaranteed by transactions that follow the “ACID” (Atomicity, Consistency, Integrity, Durability) paradigm after GRAY, which uses quality assurance for model states [cf. BELL; ET AL, 2013:1FF]. To ensure current, consistent, and persistent data, the application and information systems require a number of measurements. The use of isolated data leads to some disadvantages, which means that changes in constitutions, dependencies, and relationships can only be modelled roughly. Due to the lack of a central control instance to store and update the data, erratic, missing, or contradicting information is hardly detectable. The commitment to an application creates dependencies of data and restricts the usability of data by other applications. This process leads to a high rate of redundancy which makes it impossible to modify all copies of a set in time. Modifications of operational processes require constant adaption of the application system, which can only be met by introducing further redundancies. Thus, the situation gets worse and worse.

The development of data base systems (DBS) complies with a broad spectrum of requirements, which have to be met by suitable implementation and architecture. It focusses on the realization of the following aims: integration of data and its independent and logically centralized administration, independence of data and the application's neutrality by the logical and physical development of the database, application-programming-interfaces for simple and flexible use of data, integrity checking, protected transactions, parallel and efficient processing of big data volumes, maximal availability, fault tolerance, and scalability [cf. HÄRDER; ET AL, 2001:1FF].

Users of the system and many residents of smart cities are provided with a number of different networks for an infrastructure of data and information exchange. Besides HTML-pages and the simple downloading of data, interactive web-based data and services are gaining influence. Web-cartography is only one example for such a service with “Google Maps” and “Google Earth” as the most well-known ones. While the user interacts with the map, certain applications are running in the background. The request for data is received by a web-server and processed by a map server, which uses a data server to gather the information needed to generate a specific map. The main structure of this process can also be transferred to other requests for information; the exchange of data can be described as a statistical or interactive exchange of data via web applications. Another form of information exchange is done by standardized services, e. g. WMS, WFS and OGC. The latter "Open Geospatial Consortium" has developed a multitude of standards for such web services. It allows communication and data exchange between web-mapping applications and other programs and therefore creates interoperability [cf. MITCHELL, 2008:9FF]. Ideally, web services, which convey data through networks use international standards. One of these standards is the internet protocol as described in chapter 2, which can also be used for geo data. "Web service" describes a service, which uses the standardized XML system of communication, independent from the operation system or programming language, and is available via internet. Web services are based on HTTP as transferring protocol, while XML is used as a markup-language [cf. CERAMI, 2002:3FF]. Both are considered as a key technology for many application scenarios. The use of XML ensures a clear structure of data as well as automatic access and processing by client software. Many concurring technologies have been introduced to the market under the general term "web services" with SOAP (Simple Access Protocol) as the main representative [cf. BLANKENBACH, 2007:205FF].

3.3.3 Structure of the "Urban Sensing System"

For the "Urban Sensing System", a MySQL data base has been used (Fig. 5) as it is free of charge, widely spread and technically mature. In order to get better support, MySQL could be replaced by MariaDB (https://mariadb.com) in the future, which is getting more and more support by Open Source supporters.

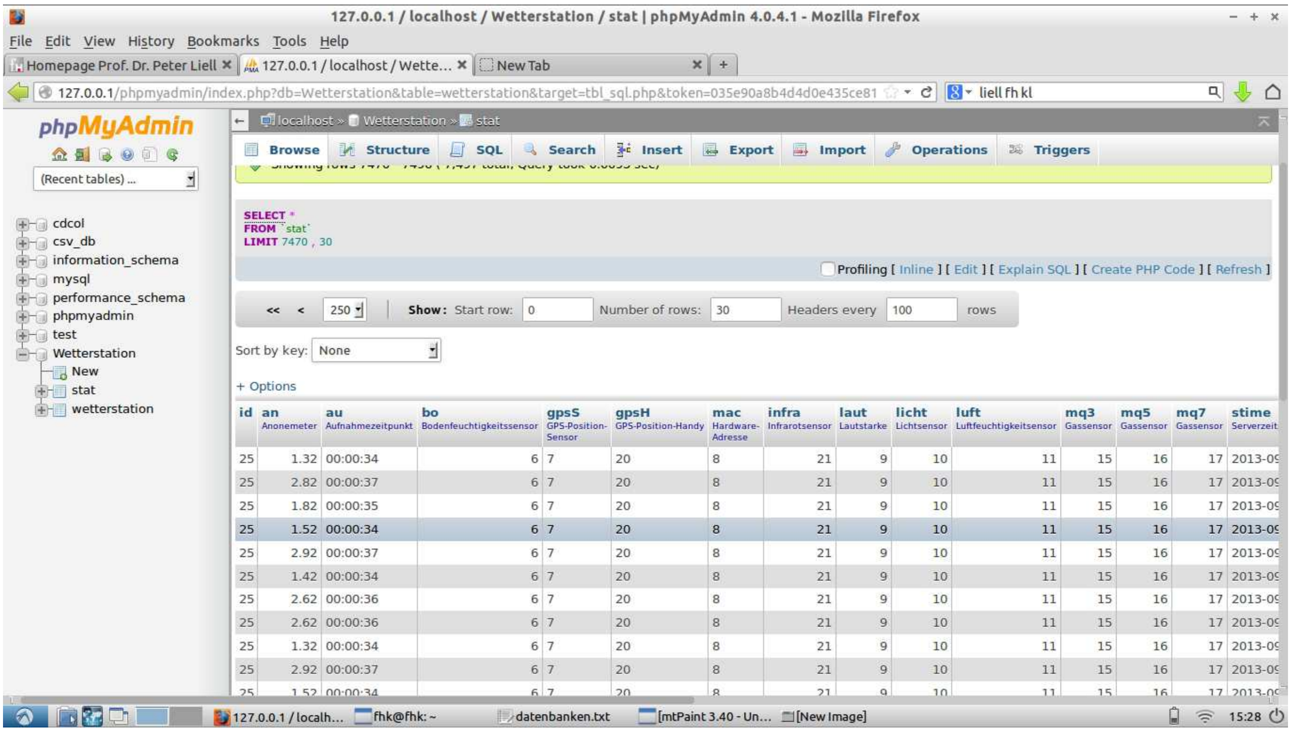

Fig. 5: "phpMyAdmin" – MySQL data base displaying measured climate data (measured by a mobile weather station).

A prototypical web site and various prototypical web-based applications are built on the MySQL data base. Its structure is designed to store all metered data in a chart. A second chart, holding user name, IP, and MAC address of the sensing device, is included in the data base to ensure the correct attribution of the measurement data. Both charts can be linked by SQL commands (e.g., "join").

3.3.4 "Climate data and vital function values in the "Urban Sensing System"

Climate data and values of vital signs are stored in a structure designed for the project, while ID, name, meaning, and type of values (float, int, timestamp) are also defined (Fig. 6). The option "Null" allows a space to stay empty, but it can also be designed to fill the empty space with a value.

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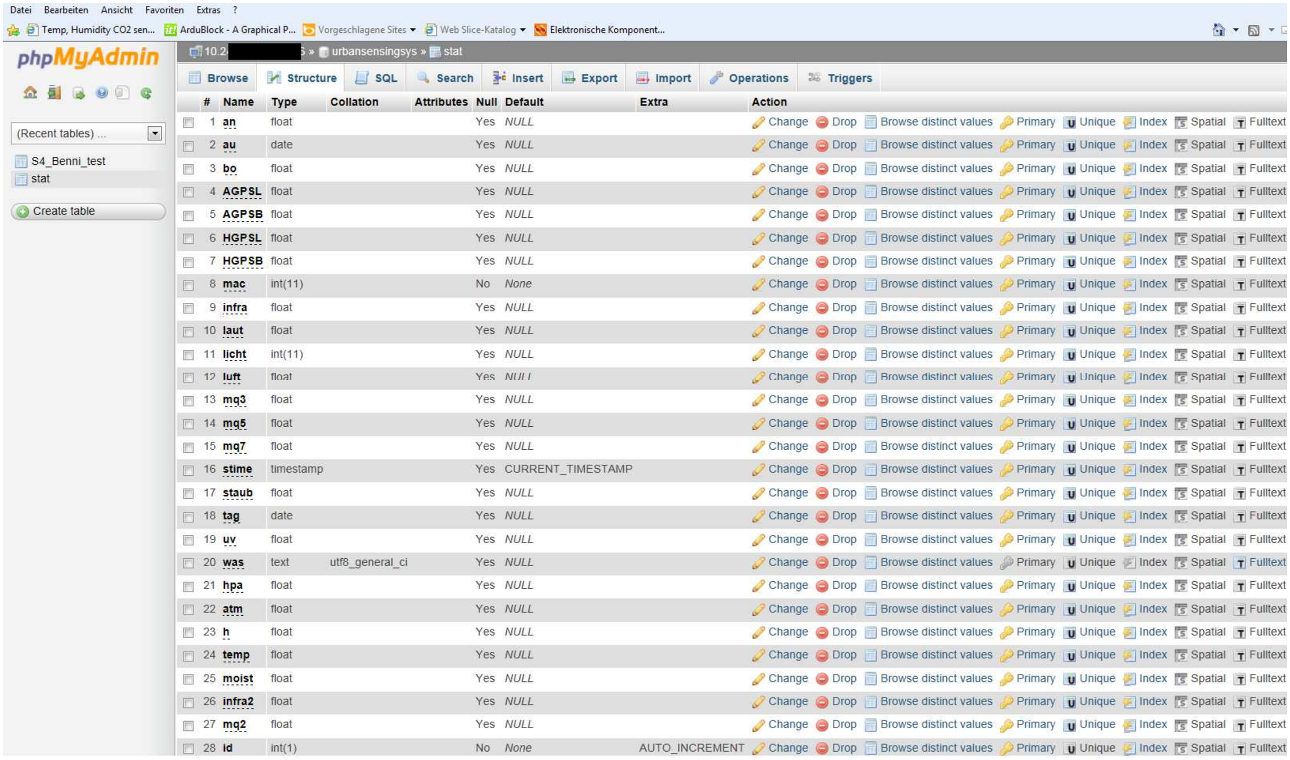
4 VISIONS AND USE-CASES FOR THE "URBAN SENSING SYSTEM"

4.1 Using the "Urban Sensing System"

The "Urban Sensing System" will be tested by an academic hardware club in 2014. Under assistance the pupils will construct a simplified version of the mobile Urban Sensing device (microcontroller-based), which is able to determine air temperature, air humidity, air pressure, light intensity, sound intensity and the geographical position. In terms of vital functions, pulse, skin resistance, skin temperature and skin moisture will also be measured. Further metadata will be saved anonymously. Equipped with these devices, the pupils will go and explore their neighborhood, and the gained data is transmitted to the "Urban Sensing System" and analyzed. This experiment will be interesting as the pupils are all of similar age and are covering the same neighborhood. Additionally, they gain insight into the MINT area (Mathematics, Informatics, Natural Sciences, and Technology) and learn about programming, brazing, and data bases in an active, playful, and age-appropriate way.



#	Name	Type	Collation	Attributes	Null	Default	Extra	Action
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2	au	date			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
3	bo	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
4	AGPSL	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
5	AGPSB	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
6	HGPSL	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
7	HGPSB	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
8	mac	int(11)			No	None		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
9	infra	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
10	laut	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
11	licht	int(11)			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
12	luft	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
13	mq3	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
14	mq5	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
15	mq7	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
16	stime	timestamp			Yes	CURRENT_TIMESTAMP		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
17	staub	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
18	tag	date			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
19	uv	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
20	was	text	utf8_general_ci		Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
21	hpa	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
22	atm	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
23	h	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
24	temp	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
25	moist	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
26	infra2	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
27	mq2	float			Yes	NULL		Change Drop Browse distinct values Primary Unique Index Spatial Fulltext
28	id	int(1)			No	None	AUTO_INCREMENT	Change Drop Browse distinct values Primary Unique Index Spatial Fulltext

Fig. 6: Structure of the data base: names, types, etc.

The stored data can mainly be used for planning, simulation, cartography, and displaying information. The "Urban Sensing System" allows a decoding of the complex relations found in an urban ecosystem.

Many utopias and dreams can be fulfilled by a program which is able to store climate data and vital function values in a single system simultaneously. The huge spectrum of data and the multitude of sensors make it possible to detect problem and at risk areas in real time. In this manner, they can be skirted, repaired, or isolated, for instance, by warning residents of high air pollution levels. Problems caused by traffic noise could be avoided with intelligent road signs, which redirect traffic or reduce speed limits. Finally, the system could act as a signpost to areas with a high quality of life.

More and more people live in urban areas resulting in increased population density. These local settlements have an influence on the global as well as on the regional climate. The question arises to what extent the settlement climate is creating invisible barriers. Furthermore, it would be interesting to examine if local climates compromise or impede particular groups while others might feel comfortable in the same zone. Are certain structures and facilities really barrier-free or do they only appear to be so? This hypothesis could be tested through an "Urban Sensing System."

5 CONCLUSION

Currently, the “Urban Sensing System” is used exclusively by friends and relatives of the developers, because it is still in an early state of development. It is anticipated to make the system freely accessible in the future, which would require it to run smoothly, be available online, and to be difficult to be manipulated. At present only familiar devices are connected; additional information can be entered by the user on a voluntary basis. The system is bound to require the storage of MAC, Email, and IP addresses, which are not communicated to the user of the system. Therefore, privacy is at least partly guaranteed. In terms of privacy, one needs to cast a critical eye over the fact that climatological data and vital function values are displayed with geographical references. Furthermore, it is extremely time-consuming to activate all users manually. Hence, a function to automatically register and activate users needs to be introduced.

A lot of time must be invested in the system’s web presence, especially for design and usability. Currently, the site is nothing but a mere playground to test different techniques. It is envisaged to launch a “Content Management System”, which could simplify registration and administration. The “Content Management System” is planned to be connected to social media, which, along with a possible reward system, motivates users to enter data and contributions to the data base.

In the future, the “Urban Sensing System” is supposed to run autonomously and autarkically. Interfaces with other systems would allow open and voluntary cooperation, such as other mash-ups. Foundations for it have already been set during the developing process.

Measuring the quality of life is a difficult task. In a philosophical context it is not even thought to be possible. Factors influencing the quality of living are evaluated differently by different people. And also, not all measuring values have a positive influence on the quality of life of urban residents. Noise, dust, light intensity and temperature would have both positive and negative influence on human organisms. The “Urban Sensing System” stores all this data in a single system and makes it possible to develop and test new hypotheses.

The “Urban Sensing System” allows the creation of maps of all kinds, such as maps of climate functions or heatmaps.

The possibility to be part of data acquisition (through the Urban Sensing App [cf. ALLBACH; HENNINGER; GRIEBEL, 2014]) allows active participation instead of simply being a passive consumer. In addition to the collection of climatological, vital, and other data in a bottom-up procedure, future versions of the “Urban Sensing System” will introduce a top-down principle to have users receive warnings or recommendations by the system.

Internet and internet technologies offer a multitude of possibilities and are shaped by society, culture, science, and economics. The society is the basis for planning, and so the internet has to become part of planning processes. If a planner wants to analyze the complex system of a city, he or she needs the knowledge about programming and information systems, although bi-directional communication and exchange of knowledge, information, and news is already being simplified by the internet. Hence, the planner has to engage in these new technologies, and constant advanced training in the sphere of informatics is also necessary. Interdisciplinary projects and partnerships with institutions, faculties and companies become more and more important, because this allows the planner to participate in the development of solutions for today’s and tomorrow’s problems in a creative way. A planner who is confronted with structural and social conditions on a daily basis needs to focus on the conditions of knowledge and information. The smart city can only exist by means of smart networks, tools, planners and systems, and the “Urban Sensing System” could be one of those.

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Ancient Smartness of Tomorrow

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1 ABSTRACT

While illustrating results and further implementations of an EU funded project regarding the old underground aqueduct of the Italian city of Siena, the paper proposes a rediscovery of ancient smartness as a by-product of social relation concerning the sustainable use of common goods.

2 BEYOND A MERELY TECHNOLOGICAL INTERPRETATION

The concept of "smart city" is usually associated with the network metaphor (see: Castells, 1996; see also: Scoppetta, 2009) that mirrors the technological evolution occurred within the frame of both post-Fordist restructuring and (neo-liberal) globalisation (see, among many others: Brenner, 1999; 2000; 2004; Brenner & Theodore, 2002; Peck & Tickell, 2002a; 2002b; Tickell & Peck, 2003; Harvey, 2005; Brenner *et al*., 2010; Peck *et al*., 2009; see, in particular: Castree, 2008a; 2008b), so that it is often translated into the idea of urban settings where ITC enable an acceleration of actions and inter-actions among individuals as never happened before: email, mobile and land-line phones, the Internet, satellite TVs and many other functions integrated in web-based communication devices, such as smart-phones and tablet computers. Such iper-technological systems are asked to work smarter not just in the way they make it possible for cities to be intelligent in generating capital and creating wealth, but in co-evolving with these developments and creating environments that produce knowledge in innovation systems. Best (1990), and to a lesser degree Porter (1990), have explained how such flexible production networks could take the form of flexible territorial production systems, as in the well-known cases of Silicon Valley (see, e.g.: Best, 1990; Storper, 1993) and, even if in a different way, the so-called "Third Italy" (see: Becattini, 1989a; 1989b; 1987; 1990; 1991; 2000), both illustrating the context-dependent nature of knowledge (see, also: Amin & Cohendet, 2004) and the need to reject as flawed and simplicistic the distinction between "tacit" and "codified" knowledge.

In the age of late capitalism, when a strong pressure exists for cities to become smarter and smarter: being strongly supported by both EU policies (CEC, 2010) and a number of technology companies (see, e.g.: IBM, 2010), devices and media, such iper-technological narrative – whose roots are to be searched into the notion of "informational cities" advanced by Castells (1996) or Graham and Marvin (1996; 2001) as well as, with a different "nuance", Mitchell (1995; 1999; 2001; 2003) – risks to be too entrepreneurial in outlook. Also given the unavoidable market-oriented images and imaginaries they produce, the pervasive storyline of iper-technological learning networks ends to look like the Foucault's concept of «*dispositif* of power», meaning straightforwardly "apparatus" but also the arrangement or set-up of a web of practices and their attendant discourses (see: Foucault, 1994; see also: Deleuze, 1989). In fact, if we use Foucault's lens to interpret the network metaphor, we find that it undoubtedly fits well in representing an understanding of power as disciplinary power which works throughout society rather than from a centralised source through discursive practice (and discourse-guided practices), being strictly related to knowledge.

But, if detached from a vision clearly oriented towards sustainability, the iper-technological "best-dream" scenario ends to reveal the «unspoken assumption» surrounding the too often «self-declaratory» (Hollands, 2008) nature of smart cities. Sustainability, instead, implies a respectfull use of natural resources as well as appropriate knowledge to manage them: in this sense, both Castells and Graham and Marvin draw attention to the information technologies of the so-called critical infrastructures (water and drainage, energy and the like). Furthermore, sustainability also implies that ICTs can serve as communications that are smart for the way they allow cities to empower and educate their citizens, so that they can become members of society capable of engaging in a debate about their own environment and about the use of common resources «without compromising the ability of future generations to meet their needs» (WCED, 1987).

3 SMARTNESS AS A BY-PRODUCT

3.1 Smart common goods

Thus, a relationship exists between smartness and common resources. This intruduces the broader issue of the commons, a term that has currently become very popular. In fact, even in relation of the ongoing

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structural crisis, in recent times the issue has emerged as a crucial matter, by highlighting the need for a rethinking of the current development model.

Commons are a particular type of goods incorporating a wide range of issues that pose serious questions about the limits of commodification and the primacy of the market. When talking about goods, economists use to focus on ownership, being their reference a society mainly founded on the right of property. As a consequence, they usually distinguish between private and public goods – respectively referring to the governmental and the market sphere – by considering both the possibility of exclusion and the divisibility (or rivalry) in order to design their respective domain. But this view ends up to be challenged by certain kinds of goods that cannot be captured within such categories. On the one hand, in fact, we have the “club goods” (or “shared goods”), which are characterised by both exclusion and indivisibility, as they consist of a sort of “weakening” of the traditional private goods. On the other hand we find the common goods, whose features are no exclusion and rivalry, being them a weakening of the traditional public goods. Furthermore, we cannot consider the commons in a traditional sense, where owner’s rights fit with user’s right: in fact, free pastures of medieval time were progressively enclosed and transformed in private goods. Contemporary common goods, instead, concern more elusive “objects”, such as the quality of air, water and its quality, information and so on, for which the criterion of ownership is no more relevant, while the identification of the owner becomes important relatively to the users’ rights on these resources.

The case of water – which according to Leonardo da Vinci is the “*vetturale della natura*” (that could be translated as “the driver of nature”) – offers interesting insights on the issue, being it the common good par excellence. But, in international laws there is not an universally accepted definition of the “right to water”. An attempt in this direction consists of the Convention on the Law of Non-Navigational Uses of International Water Courses, whose central points are the equitable and reasonable use of water by any riparian state, the harmlessness of hydrological interventions, a cooperative management and the obligation to ensure the protection of basins. However, the fact that the concept of “fair use” remains to be clearly defined as well as the non-binding nature of the principles seem to reveal how the dramatic water shortage – due both to environmental degradation and the exponential increase of consumption – may become a relevant factor in conflicts (Wolf, 1998).

However, the very idea of water as a public good – i.e.: freely available for all – it is not an universally recognised notion. In fact, many believe that only giving a economic value to water, by making it a commodity like any other consumer good, could offer a real contribution to solving the problems of water scarcity: the creation of a water market could allow to trigger balancing mechanisms between supply and demand that, in turn, could make both searching and selling water really cost-effective as well as it could correctly address consumers’ choices in order to rationalise their consumption behaviour. The main argument used to support this thesis deals with the issue of waste: the lack of both adequate infrastructures and maintenance of the existing ones leads to inefficiency due to an ineffective public management, being the latter not economically viable. According to this approach, the existence of a water market would not be the point of arrival but only an intermediate step towards the final stage of efficiency, i.e.: the privatisation of water services. A number of initiatives in this regard have also been supported by international organisations (including World Bank) that have begun to affect their economic aid to developing countries by forcing them to adopt liberalisation and privatisation policies, by asking the retret of governments in favor of private companies (thus opening the way to multinationals). According to the proponents of privatisation, this would be an element of social justice, allowing a more equitable distribution, eliminating market distortions that end up hitting the weakest actors.

Considering water as a common good, instead, involves a process of acknowledgement of its historical and identitary value, which cannot be measured in mere economic terms. The emphasis is placed on management, but also on those “hybrid” and “territorialised” systems which are able to “taking care” of resources that are collectively recognised as «territorial heritage» (Magnaghi, 2006) creating a durable and not just economic wealth. Key principles concern non-exclusivity and resources’ regeneration, which appear as irreconcilable with a proprietary market logic, as they refer to “ancient” cultural elements – such as the collective sharing of primary resources – but they are also able to be reinvented, being knowledge their typical by-product, i.e.: the (intentional or unintentional) «result of processes oriented towards other purposes» (Donolo, 1997).

3.2 Underdeveloped smartness?

Shifting from knowledge infrastructures to knowledge as cultural practice as well as to the relationships between the latter and natural resources means rethinking discourses on technology, by attributing a broader sense to the term. Anthropological research on the (still!) so-called "developing countries" highlight the role of traditional knowledge in achieving sustainability goals based on an appropriate use of natural resources, by establishing the harmony of architecture with the environment, the symbiosis of the techniques of organisation of space with traditions, social habits, spiritual values and the fusion between practical aspects and beauty.

Pietro Laureano (1995) has shown how archaic societies, developed within economies characterised by lack of means, have linked their survival to a careful management and use of natural resources. Against the current model of existence, production and consumption – which has replaced the traditional order in the advanced countries, leading to the exhausting of local resources and feeding the hypertrophic growth of developed areas – Laureano, in fact, proposes the model of self-sufficient and small «hydrogenetic community», based on the transmission of a collective wisdom (i.e.: rules of coexistence that are essential to survive) concerning the ability to act in harmony with the environment, enhancing its potential without depleting it.

This is, in essence, the model of the oasis, whose spatial and social structure is determined by the supply and distribution system of the scarce water resources. A drainage tunnel, the foggara, passes under the village thanks to underground storage tunnels and provides water for both homes and collective laundries. Ancient caves and grottos for collecting water constitute a further element of the system, which is also useful for cooling the indoor air during the warm weather. When outside the village, the water of the foggara is divided into open ducts called seguia. The latter run through the cultivated area of the oasis, by structuring the plot of the different properties through clay brick walls enclosing the soil particles, thereby accentuating the continuity between living tissue and cultivated areas. A "Master of Water" calculates the amount of water that is due to each family. He is the custodian of a complex and ancient knowledge, which is handed down from generation to generation, making him able to carry out the measurements by using specific tools. Through the divisions due to inheritances, marriages or purchases, the shares of water continue to fragment or reunify, so that an intricate system of canals, bridges and connections represents on the ground the evolving of the property system over time: a real "hydro-genealogical plot" recording the succession of generations, family ties and properties within a graph of relationship which is physically built by the network of canals. The fact that we can find again this branced graph in tissues, clothes, hairstyles and tattoos clearly demostrates how such archaic infrastructural system deeply permeates these population's culture.

According to Pietro Laureano, the model of the oasis can be found in many other situations whose complexity and dimension allow us to define them as "oasis city". This is the case of the city of Shibam (Yemen), which is entirely made of clay, as well as the Italian city of Matera, whose "*Sassi*" ("stones", i.e.: Matera's historical houses) are an example of archaic ways of living and manage common resources in the karst areas of Lucania, Apulia and Sicily. This is also the case of Petra (Jordan), a real "oasis of stones", now reduced to only archaeological remains, but described in the oldest texts as provided with canals, pools, fountains and gardens. Historical infrastructures of Italian municipalities of both the Middle Age and the Renaissance – such as the underground aqueduct of the city of Siena – also constitutes an example of such shared social-natural "constructs" that suggest a sustainable linkage between ancient and contemporary "smartness".

4 THE SIENA'S ANCIENT AQUEDUCT AS A KNOWLEDGE INFRASTRUCTURE

4.1 "Concave" and "convex" old cities

According to Victoria Calzolari (2003), old Italian urban centers can be classified on the basis of their particular structure, which in turn is determined by their different relationships with the water system. She distinguishes «concave» and «convex» cities: the first typology (e.g.: Brescia, Florence, Turin) receives from the surrounding mountains and hills abundant waters, which in turn feed springs and fountains, allow the creation of large parks and gardens and, finally, radiate through geometric patterns across the irrigated lowlands. "Convex" cities, instead, are located on hills and spurs from which dominate the plain and use water coming from distant sources. For this reason, water is (was) used sparingly for gardens and orchards, where undemanding plants are preferred. This is the case of cities such as Volterra, Montepulciano, or Todi: these are cities with an harder environmental context, where it was necessary developing a particular knowledge in order to capture, store, distribute, use and re-use water. Such a "water culture" – which today seems to be completely forgotten – not only resulted in the distinctive morphology of these centers, but also in the architectural and social forms. Thus, the aesthetic qualities of ancient cities as well as the peculiar forms of communal social life that have historically characterised them, are due to this harmonious relationship established over time with the environment.

The city of Siena constitutes a perfect example of "convex city": it is located on top of dry ridges, away from the major rivers or mountain ranges, so that it has been forced to develop over the centuries in close relationship with the problem of water supply that has determined its social organisation according to a model based on civic engagement and active and responsible participation in public life.

The old Roman city, built around a probable Etruscan settlement, being isolated on the hill, did not have natural springs inside the urban walls, but only wells connected with cisterns for collecting rainwater. Only in very rare cases, because of the minor depth of the water table, wells drew directly from the latter. Outside the city walls, along the streets of the valley and on the slopes, there were instead a number of wells and springs capturing water veins of secondary water tables.

4.2 The Siena's bottini as a structure of urban social life

Although it is believed that at least some parts date back to Etruscan age as well as it is established that the first works date back to 394, it was during the Middle Age that the realisation of the underground aqueduct (the "*bottini*") started, in order to meet the needs of a city that was already largely consolidated. The construction of the two *bottini maestri* (i.e.: the two main stretches of the aqueduct) of Fonte Gaia and Fontebranda, with their related monumental fountains, was almost exclusively aimed to productive activities and services. As evidenced by a series of archival documents dating back to 1176, a rapid population growth, which began in the 12th century, had in fact increased the need of an efficient water supply and, in 1267-68, there had been advanced a project, then set aside, aimed at the diversion of the river Merse to the city.

The complex and articulated hydraulic system of the *bottini*, whose current extension dates back to 1466, was built in different phases between the Middle Ages and the Renaissance, with the commitment of Siena's engineers such as Mariano di Jacopo (better known as Taccola) and Francesco di Giorgio, who left in their treatises a testimony of a real local technological skill. In these manuscripts are recorded with precision not only the techniques and tools which were used to build the network of the *bottini*, but also more or less imaginative projects of hydraulic engineering: not only studies for canals and river dams or apparatus for lifting and driving water, but also devices to enable man to float effortlessly.

The *bottini* are a still existing and operating network of underground tunnels, which covers a total of 25 km. and can be intended as the "spine" of the old city center. A distinctive feature of such network consists of being connected with a system of artifacts, ranging from the monumental fountains of the different *Contrade* (i.e.: the ancient neighbourhoods of the city center) to the little fountains in public spaces, the wells into the palaces' courtyards and, finally, the canals that irrigate the gardens of the valleys outside the city walls. Around these artifacts the social life was organised: public wells, monumental fountains, the "*fontini*" ("little fountains"), located at the intersections of streets or in representative places in the urban space (such as markets, churches, cemeteries, gateways to the city through the urban walls) are the evident manifestations of the existing inter-relationship among urban structure, social organization and the network of water supply and distribution. In addition, the effective functioning of the water system required careful and daily maintenance which formed the core of a collective wisdom to be handed down from generation to generation – as in the case of the oasis – whose custodian (originally a simple but skilled worker) assumed a prominent role within the community.

Thus, one could say that the *bottini* really constitute the "spine" of the city not only in a morphological sense, being them the internal structure determining the urban form, but also in social terms, as clearly shown by the strict relationship historically existing between the underground acqueduct and the *Contrade*. It is worth remembering that such seventeen ancient neighbourhoods having names of animals or, more generally, a medieval sound[1] are strictly linked to the famous horse race called "*Palio*", where each jockey represents a *Contrada*, and the latter, in turn, is responsible for his funding, and also for celebrations before and after the competition. In the same way, each Contrada funded its own stretch of aqueduct as well as the construction of both its own monumental fountain and the other little public fountains in public spaces, including the one where children were baptised.

Through the realisation of the *bottini* – which are, at the same time, an engineering and architectural work, because of the *Contrade*'s monumental fountains – the city of Siena, characterised by the natural scarcity of water, succeeded in its aim of uniformely providing water supply through a distribution system that was able to reach both public fountains and private wells of individual residences. Beyond a tangible improvement in the quality of life, the *bottini*'s network allowed the city of Siena (which was devoid of natural waters) to compete against Florence (which is crossed by the river Arno) for the primacy in producing wool, i.e.: an activity, which requires an abundant use of water.

4.3 The bottini as a sophisticated engineering and architectural artefact

Underground tunnels are largely practicable and have an average size of 1.70 m in height and a width of 90 cm. The name "*bottini*" is due to the distinctive configuration of the barrel vault (in Italian: "*volta a botte*"), but there are also gable and square sections. The gutter on the ground (called "*gorello*"), where water can flow, is placed in a central position, but it can also be found laterally or in a niche. When they are not excavated directly into the rock (or, sometimes, into pebbles), the lining of the *bottini* is generally made of bricks. Along the way there are, at irregular intervals, some wells called "*smiragli*" or "*occhi*" ("eyes"), which were used in the construction phase for removing the excavated material, ventilating the tunnels and determining both direction and slope of the excavation through the use of plumb lines and a special tool called *archipendolo*.

While the *bottino maestro* of Fontebranda (i.e.: one of the two main stretch of the aqueduct) was excavated starting from only one side (with the consequent disadvantage of a more slowness of the work, due to the cramped space of the galleries, where only one man at a time could work), in the case of the *bottino* of Fonte Gaia – the second *bottino maestro*, whose monumental fountain is that of the famous piazza del Campo – a different method of excavation was preferred: for each of the different wells, multiple teams of diggers proceeded simultaneously in opposite directions and finally re-joined the galleries at an intermediate point. However, the need to realise the *bottino* in a short time led to a tunnel placed at a too shallow level. For this reason, the *bottino maestro* of Fonte Gaia collects a few veins and remains always poor of water despite it measures twice as that of Fontebranda. The latter, instead, is located at a greater depth and captures a large number of veins that, even today, constitute a substantial bringing of water. The project aimed at increasing the flow of the water directed toward Fonte Gaia, getting onto the *bottino* of Fonte Nuova, was entrusted to Francesco di Giorgio, who played the role of "worker" in 1469 and in 1492.

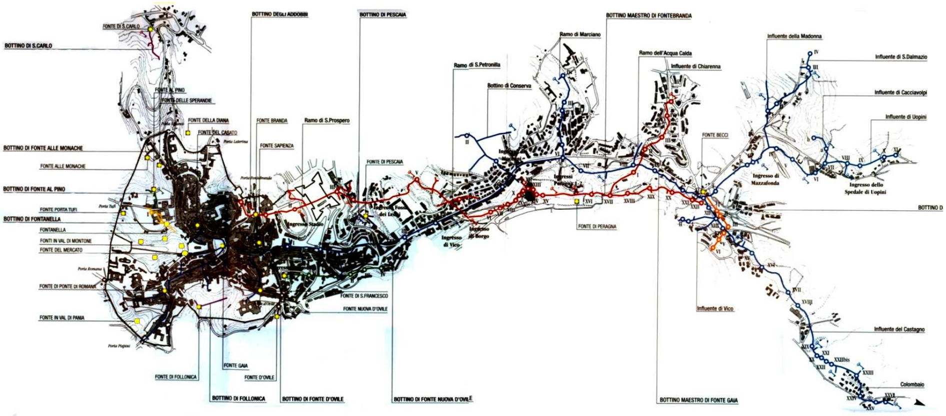

Fig. 1: The city of Siena and the network of the *bottini*.

[1] Such as: *Oca* ("Goose"), *Aquila* ("Eagle"), *Bruco* ("Grub"), *Chiocciola* ("Snail"), *Civetta* ("Owl"), *Drago* ("Dragon"), *Giraffa* ("Giraffe"), *Istrice* ("Porcupine<"), *Leocorno* ("Unicorn"), *Lupa* (the feminine of "wolf"), *Nibbio* ("Kite"), *Onda* ("Wave"), *Pantera* ("Panther"), *Selva* ("Forest"), *Tartuca* ("Turtle"), *Torre* ("Tower"), *Valdimontone* ("Ram valley").

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4.4 Functional structure and social role of the monumental fountains

The maximum development of this supply structure was during the 16th and 17th century, with both the documented presence of numerous private wells connected to the *bottini* and a growing and often unmet demand for new connections. This supply system, however, continued to live for many centuries together with a parallel one that collects and recycles rainwater. Therefore, we can talk about a mixed system, in which drinkable water is provided by fountains, by private wells connected to the *bottino* and by public wells, while water for domestic or craft activities is given by cisterns and agricultural works re-use the water coming from the overflow of the *Contrade*'s monumental fountains.

The latter are configured as public facilities and constitute one of the typical architectural structures characterising the landscape of Siena. In fact, from being simple water points, located along the slopes and in the valleys surrounding Siena, over the centuries such fountains have had an evolution in their architectural forms and uses, with also periods of complete abandonment. However, beyond the architectural differences, the model of the fountains – both their functioning and their single parts – is based on similar criteria.

In fact, it is possible to distinguish only two types of fountain: in the most complex typology the water flowing from the *bottino* was drawn on with containers for drinking and then flowed into a basin (where fish were bred) to be utilised for secondary uses. The cycle continued with the overflow of the basin, which fed a smaller tank, designed to water the animals. Then, water continued to flow into a tunnel inside the brickwork toward the *guazzatoio*, a tank where humans and animals could freshen up, and it ended its cycle coming up in a laundry, located at a level lower than the *bottino*, in order to prevent stagnation. Finally, from the overflow of the sink, it drained into the "white" sewer, which was placed in the downstream part of the complex, in order to feed mills and factories of wool workers and tanners or to irrigate the fields.

The typical location of this type of complex structure was at the arrival of minor routes in the city, close to the secondary access corresponding of the valleys belonging to each *Contrada*, of which it constituted the common good: beyond its function as public utility, through its monumental architectural forms the fountain, in fact, was somehow also entrusted with the role of representation of the *Contrada*'s identity. The monumental fountain of Pescaia – located outside the city wall, close to the Porta di Malizia (one of the gates of the urban walls) – is an example of this typology.

The structures of such fountain are arranged at right angles to the course of the today disappeared ditch of Pescaia and are enclosed in a narrow valley, which is bounded by the ridge of Camollia and by the plateau of Lizza. The original location of the fountain, presumably already existing during the Etruscan period, was near a Roman military road which, coming from Siena, headed towards Fiesole and Volterra. This route will then become a stretch of the Via Francigena, one of the medieval busiest routes connecting Rome with the northern and western Europe. Thus, the fountain of Pescaia was an important stopping place for this journey, which was frequented by merchants and pilgrims going to Rome. Fountains with a simpler structure were instead not far from the main ridges. Being them often hidden in a slower level of the street or along the slopes, they were reachable by means of steep roads or stairways.

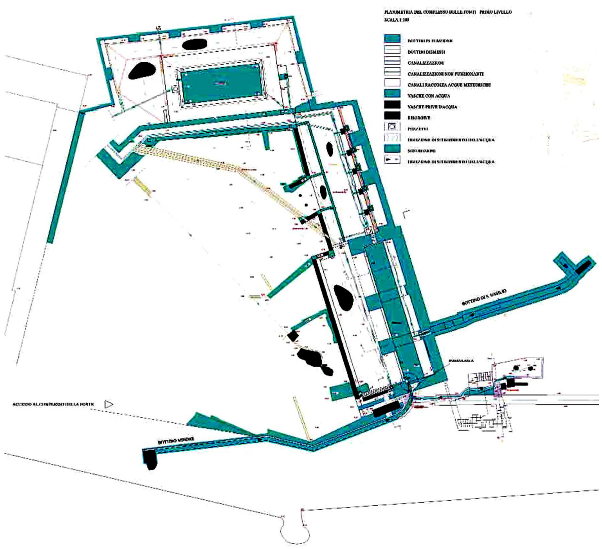

Fig. 2: Scheme of functioning of the monumental fountain of Pescaia..

5 CONNECTING ANCIENT WITH CONTEMPORARY SMARTNESS

5.1 The EU project "Siena city of water"

In the 20th century, the Siena's medieval aqueduct was replaced, for both civil and productive uses, with the modern aqueduct Vivo, relegating for minor uses the water of *bottini* and wells. Beyond the monumental fountains, the current functioning of the *bottini* serves about 200 registered users (although it is estimated that, in the reality, users are at least twice). However, such extraordinary system of underground architectures, which is a masterpiece of the engineering of the 14th and 15th century, is a little-known historical and architectural heritage, consisting of artifacts and documents concerning the culture of water. This poetic world – real city beneath the city, crowded with shadows, noises and invisible matches emerging on the surface with dozens of fountains, wells and tanks – was the subject of a study, funded by the EuropeansCommission as part of the Raphael Programme, aimed at understanding and valorizing such water supply system located both inside and outide the urban walls[2]. However, the theme of the relationship between historical and architectural heritage and water supply system – as well as the possibility to link their valorisation to a more general rediscovery of the culture of water – had already been tackled during the elaboration of the masterplan of the city. Research activities, which ended in January 2000, were oriented by the need to know, from a quantitative and qualitative point of view, the rich repertoire of "materials" that make up this complex system, highlighting the specific relations with both the configuration of the different sites and the specific rules of formation and development of the historic urban structure.

Therefore, through a detailed survey (scale 1:2000) and the subsequent computerised translation, a census of the different elements of the system was carried out, in order to allow the creation of a comprehensive mapping concerning not only the *bottini*, which were classified according to their different types, but also the springs, the fountains and many other minor elements (wells, cisterns, tanks, etc..), by considering them as modes of supply that are alternative to the network. In this way, 58 external fountains (including both existing and missing ones), 16 (historical and modern) monumental fountains, 4 *fontini*, 26 little fountains, 7 (existing and missing) public wells, 135 wells or wells provided with cisterns, 36 cisterns were complexively surveyed inside and outside the urban walls.

At the same time, an archival and bibliographic research was launched in order to link the results to the various thematic maps according to an hypertextual logic, which is particularly effective in terms of representation but also in translating the inter-disciplinary approach of the project, based on the contributions of a variety of specialised scholars, active in different research fields: archivists, historians, geologists, planners, architects, communicators, graphic designers, computer scientists, archaeologists, anthropologists, photographers and videographers. Beyong being the basis for specific insights, the archival research, carried out in parallel with the census, helped in individuating the structure of the whole system, also thanks to the information concerning the elements which are currently missing or modified, the uses established over the centuries, the type of ownership, etc ... In order to organise the vast collected documentation, thanks to the EU partnership, different cataloging standards have been used[3]. The individuation of such a multiplicity of approaches for organising the documentation derived from the heterogeneity of the collected material: unpublished manuscripts and documents, bibliographies, iconographies, old and recent photographs, historical maps and updated carthographies, videos or architectural and geological surveys. Further reasons are to be searched in the articulated research purposes: not only the creation of a specific archive of the Museum of Water (to be realized), but also a reconstruction of the urban history in relation to the theme of water, the divulging of the results by linking European institutions and organisations through virtual networks and, finally, the definition of guidelines for potential interventions on the different artifacts.

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[2] The project "Siena City of Water" was co-sponsored by the municipaality and coordinated by the designers of the Laboratorio Aqua, with the participation of the University of Siena, the Institut Francais d'Amanagement et d'Architecture of the Université de Rouen and the Museu de l'Agua of the Ayuntamiento de Salt.

[3] Not only the criteria used by the Italian Istituto Centrale del Catalogo e della Documentazione (ICCD), but also those of the Fitxa "Inventori del patrimoni cultural del projecte Alba-Ter/Ave", prepared according to the guidelines of the EU Earth program; the cataloging form of the "Inventaire Général des monuments et des richesses artistiques", produced by the Ministère de la Culture together with the French "Institut National de Recherche en Informatique et en automatique" (INRIA), with the contribution of the ERCIM (European Research Consortium for Informatics and Mathematics) and of the European Commission.

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As regards the activities of dissemination and promotion, both on and off line products were developed. Among them, the web-site, which was prapared in order to be further implemented, updated and divided into thematic sections allowing different levels of detail. Beyond the video “Siena and its places of water”, presented at the 3rd World Water Forum, held in Kyoto in 2003, was also produced an interactive CD-Rom whereby one can virtually visit a part of the Bottino Maestro of Fontegaia and then emerge in the famous Piazza del Campo. All along the path – which is displayed on suitable maps and aerial photos giving the virtual visitor’s exact location – insights concerning historical, architectural, hydraulical and geological aspects are included. Furthrmore, the amount of collected documentation finally also allowed the creation of several thematic guides, illustrating both the whole system and its individual elements.

Finally, the EU project “Siena city of water” allowed to make detailed measurements of the monumental fountain of Pescaia, by using innovative techniques (a special photographic equipment and sophisticated software of image processing) to reproduce the elevations. Starting from such survey, restoration works were carried out and a preliminary design for a Museum of Water was subsequently developed.

5.2 Further implementations: the Museum of Water (towards the territorial museum)

The EU project “Siena city of water” was an important moment of knowledge and of renewed sensitivity of the public administration on a public heritage that had been forgotten for so many years. A further effect was an increased awareness towards the many issues related to water as a primary resource, as an object of nature and subject of culture, matrix of landscapes, places, systems and architectural artifacts. Such new awareness of the Administration has been manifested through the creation, into the monumental fountain of Pescaia, of the Museum of Water, opened to the public in 2007. The museum was seen not only as a structure for tourist use, but as a museum of the city, where the water system could become the fundamental key to understanding the urban structure. In addition, the museum was intended in the broadest sense as the museum of the community, i.e.: a laboratory in which the local community could identify, represent its aspirations and develop new cultural strategies towards sustainability.

As the museum merges the multiple outcomes of the research conducted within the EU project, this has contributed to a successful integration of traditional museum functions (i.e.: conservation, exhibition, public services, scientific research and pedagogical purposes) and innovative communication tools (e.g.: multimedia and virtual reality). On the one hand, therefore, the fountain of Pescaia is, at the same time, both the container and the main content of the museum: the site where it is located, its architecture and the hydraulic system are made intelligible and the *bottino* beneath becomes visitable. On the other hand, the museum is set up as a narrative device, which is able to tell both hydrogeological features and technological dimension as well as the collective construction of the urban identity by using a variety of languages and forms of representation for re-assembling the collected fragments of memory in order the re-reading stories and uses of places.

However, the idea of the museum as a multifunctional space focuses not only on the expositive-communicative dimension, but also on its potential as a cultural means towards the possible construction of a new collective awareness about the use of resources and common goods. In this sense, it is not configured as the final point of the process initiated with the EU project, but it is rather the starting point for the creation of a territorial museum. The latter is connected to the idea of water as a landscape matrix, being it an element of creative relationship among «context, concept and work» (Calzolari, 1991). The term «context» refers to «a set of tangible/intangible, natural/cultural, historical/contemporary components, situations and phenomena constituting the background for the single elements and claiming ideas». The term «idea» means «the thought, the creative act, the image, the memory». It «refers to a single person, but can also be understood as a dominant idea in a given situation or cultural context». The term «work», finally, concerns «the created object, the action, the result of good training and technical competence, of a good design, execution and management, the expression of intuition and imagination».

Through all the designed paths inside and outside the urban walls, marked by the presence of «works» – from monumental to minor fountains, from the *bottini* to cisterns and from these to the memory of the wool merchants’ shops; from the wells in the courtyards of palaces to the public fountains of each *Contrada*, to the wells of the rural farms in the valleys irrigated with the drainage water overflowing from the monumental fountains and, finally, to the springs and the most natural contexts – the goal is to build a system involving the museum, the city, the surrounding territory and the settled community, with water as a common thread.

The idea of a territorial museum was, however, already present in the EU project, whose results included, in fact, a series of proposals and concrete indications of the feasibility of the insertion of the Museum of Water in a network of internal and external itineraries connecting the various elements of the system: it was conceived as an expositive space belonging to a larger system involving both the city and the territory.

6 SMARTNESS AS LOCAL ACTIONABLE KNOWLEDGE

As conceived, the museum should trigger a process of collective re- identification, which is a prerequisite for developing a possible “active citizenship”, based on the overcoming of the dichotomy between public and private use, by introducing a notion of “common good” as related to the concept of “neighbourhood” (see: Gorz, 1994). In this sense, the historical relationship between the city of Siena, its inhabitants and water resources is an example of the possible process of building a community to be understood not as a historical fact, but as a project (Magnaghi, 2006), i.e.: as a whole of inhabitants/producers that relate in order to exercise both the care and the collective use of places where they live in durable and sustainable ways allowing “self-reproducibility”. In this sense, the focus is on the concept of self-organisation, i.e.: the inter-relationship between located social actors, capable of (self-)produce representations/interpretations (projects) on their own place (ecosystem), with a widening of participation in decisions concerning the management of resources (Scoppetta, 2009).

The process of social construction of the city of Siena around the theme of water of the *bottini* – which are, in turn, the result of the evolution of engineering techniques, but also of a collective knowledge handed down from generation to generation – can also offer interesting insights on the current rhetoric about the so-called «knowledge society» and «knowledge economy» (see, e.g.: EU, 2007), where the tendency is understanding knowledge as a resource to be sold within the context of global competition, i.e.: within a context that is different from that in which it is developed and concretely implemented. In this sense, the case of Siena is an example of Clifford Geertz’s well-known notion of «local knowledge» (1983), which is not to be generically intended as “wisdom”, but as real technical-practical knowledge which is locally developed and tested in order to solve concrete problems (such as a community’s water supply).

Rediscovering the *bottini* as a socio-spatial structure therefore may be the starting point for the community re-appropriates its own «actionable knowledge» (Friedman, 1987) as well as for its possible re-interpretation, which takes into account of current technological developments. The proposal concerning the restoration and re-use of irrigation channelling that directed water from the overflow of the monumental fountain of Pescaia to the valley belonging to the Contrada goes precisely in this direction. It is intended as a first step of a process of collective learning that can change not only the territory and its uses, but also individual behaviors and practices within a perspective where actors and context could co-evolve (see: Scoppetta, 2009a). Knowledge, in this case, becomes a resource for the «empowerment» of the community (Friedmann , 1987), allowing the passage from «exit», which is the prototype of the market (the consumer changes product), to «voice» (Hirschmann, 1970), which is the prototype of political action.

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reviewed paper

ARchitecture – Augmented Reality Techniques and Use Cases in Architecture and Urban Planning

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1 ABSTRACT

The current topics "Smart City" and "Smart Planning" do not just have to be about big solutions to make cities more efficient. There are also small solutions which can help planners and architects in their daily communication work, opening planning processes for more of the city's citizens and make the processes themeselves smarter. The man-made environment affects every human who lives within it. Especially when changes are made within this environment, every citizen has to be able to form an opinion towards these changes. Not every person affected has a planning or architectural background though, so one has to expect that the spatial perception of each person is to be valued in a different way. Based on these various requirements the ways of internal and outside communication have to be adaptable, and offer an understandable transfer of relevant contents. The available tools are under constant development, resulting in new applications for communicating within the planning process. The focus concerning the communication techniques is on interactive tools. This paper gives a general overview of common augmented reality (AR)-techniques and their specific characteristics and tries to show possible use cases in the fields of architecture and urban planning.

Besides the view on the technical development and the resulting use cases, the consequences and effects of the expansion of the repertoire of methods for planners and architects shall be discussed. The social significance and the resulting changes for urban planning as a whole are also relevant.

2 INTRODUCTION

Visualization and communication belong to the daily tasks of architects and urban planners. With different receivers for the planninginformation, there is a demand for tools which can be used in a variety of use cases. Due to the proliferation of smartphones public access to information expiriences a new dimension. Through a constant internet access, applications (short: apps) to augmented reality-browsers information is available at any time at any place. Communication in the planning process is constantly arising in new applications from these technical developments (Reinwald et al. 2013). The planers repertoire of techniques is also constantly arising because of these technical developments. So having an all time overview on the possibilities for communication by using these tools becomes one of the planers tasks. The works "Urban Planning in the Knowledge Society (Stadtplanung in der Wissensgesellschaft)" (Streich 2005, 2011) and "Real-Time Planning (Echtzeitplanung)" (Zeile 2010) give a first overview on current tools and how they can be used in the daily communication process in planning. Concerning the fast development of new techniques and tools it is necessary to stay tuned to these processes and think about new applications for planning communication. The following paper starts from this point and shows current augmented reality techniques and possible use cases in architecture and urban planning.

2.1 Communication during the Planning Process

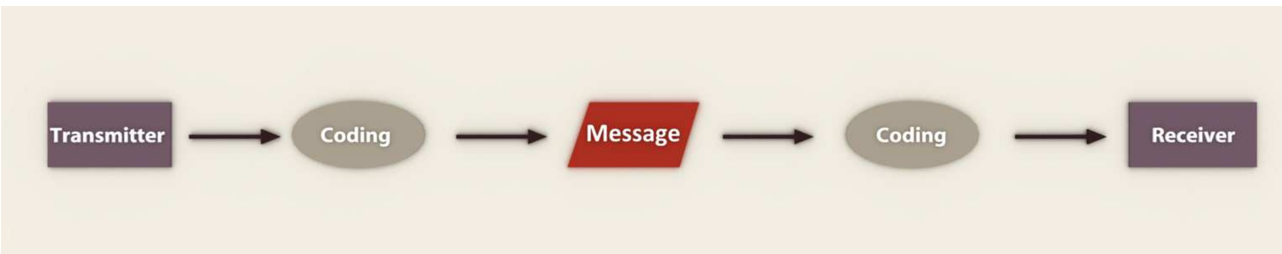

Fig. 1: Communication in plannning processes, based on transmitter-receiver model (Zeile 2010, according to: Fürst & Scholles 2008:198)

The general view on the communication between planners and addressee in the planning process shows that the analytical categories of communication theory can be applied (Fürst & Scholles 2008:198). By using this

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theory it can be explained how a message is coded from the transmitter at the first place and has to be encoded from the receiver. A visualization is a form of coding a message, communication tools have the tasks to support the receiver in the encoding process. Starting with classical hand drawings and models to their computer aided counterpart of CAD-drawings and computer aided modelbuilding, virtual 3D-models (divided into the techniques of hand-pushed-pulled-modelling and parametrical modelling) to renderings of pictures and movies the evolution of visualization is going strong. By using only the visualization in connected planning communication processes the message within can be already encoded by the receiver. At this point, however, the question arises, if the pure visualization is enough to transport the message of the plan. Communication has to be more than just a visualization, it adds an interactive part to the process. Equivalent to the "homo ludens"-approach (Streich 2011:217) lay people learn by playing with planning information and become self-made experts.

2.2 Definition Augmented Reality

The term augmented reality (short: AR) signifies the projection of an additional virtual content into the reality. Augmented reality belongs to the so called human-machine-interaction-methods (Zeile 2010:28). In general augmented reality means the augmentation of human sensory perception (Milgram, Colquhoun 1999). Therefore reality can be augmented by using visual, acoustic or haptic information (Höhl 2008:10). Zo build an augmented reality environment four elements are needed (Zeile 2011):

A computer with the required software, which serves as rendering unit

A tracking system, which locates the position oft he user

A recording device in form of a camera and

Also a display.

If all elements are fulfilled, four different techniques of augmented reality can be differentiated (Höhl 2008):

Projective Augmented Reality (PAR): With the use of a projector digital information are shown on a real object.

Video See-Through (VST): Uses enclosed projection glasses. The additional information is shown on two small displays in front of the users eyes.

Optical See-Through (OST): Uses a semitransparent mirror to show the virtual information instead of enclosed projection glasses.

Monitor Augmented Reality (MAR): This technique displays digital content on a monitor. Camera and render unit play together to build a picture of the augmented environment on the screen.

The latest smartphone and tablet generations are also able to realize a augmented reality environment. It is basically an advanced form of the monitor augmented reality, because the user can now move freely in reality. Only the required software in form of an augmented reality-browser has to be installed to serve the rendering unit. With the built-in sensors like compass, acceleration sensor and GPS-module the tracking unit is provided. The smartphone-camera works as recording device and the monitor displays the augmented environment.

3 AR-TECHNIQUES – STAND OF RESEARCH

Current augmented reality methods can be devided by the form of localisation of the user's point of view and also the type of memory location they use. Depending on the used technique there are some pros and cons. In the following chapters the different AR-methods are introduced and will be discussed.

3.1 Geolocalisation or Marker Based Techniques

The current MAR-methods use two different techniques to locate the users' point-of-view. The so called gelocalisation uses the smartphone integrated GPS-module to locate the user. To realize this kind of augmentation the content is linked to the geoposition, which allows the user to view it when he reaches the point of interest. But the geolocalisation has some problems with the accurancy of the GPS-signal: If the user walks through a street with high buildings or trees, the GPS-signal and the AR-content starts to „jump".

The so called marker based techniques want to solve this problem, because they do not need a GPS-signal anymore. The setting in which the content is supposed to be overlayed is saved on a server in form of an image that works as a marker. If the user scans the counterpart image in reality, the attached content is immediatelly streamed on the smartphone-screen after a server-synchronisation.

On of the well-known augmented reality-browsers is Layar (Layar 2014). Layar combinates the two described techniques of geolocalisation and marker based localisation in one application. To view the content in a geo-layer the user just has to choose the right channel and can now on explore his environment. If he reaches a point-of-interest, the attached content can be viewed. In counter draw to this „passive“ exploration, the user has to become active and scan every single situation while using a marker based augmented reality technique to do the server synchronisation.

The technical restrictions to create this kind of augmented reality environment are reduced to a minimum. It is no more limited to a small group of people who have the know-how to set up the server and build up the contents. Now there are platforms like RADAR-platform of the DFKI Kaiserslautern (Memmel 2013) which can be used for the accomplishment of geolocalised augmented reality-visualizations. The marker based AR-techniques can also be realized by using a platform that uses a graphical user-interface: Layars own new platform „Layar-Creator“ (Layar 2012) uses drag-and-drop functionalities to attach the content to the previously uploaded marker-images.

3.2 Streaming versus Local Storage

The described techniques of geolocalisation and marker-based AR-techniques from Layar always use a server from which the content is streamed to the smartphones. Therefore a mobile internet connection is always required for streaming the content. Simultaneously the quality of the mobile internet connection limits the level-of-detail of the content.

Another approach to solve this problem is to use augmented reality-applications which use their own local stored 3D-model-library. Applications like „AR Media“ (Inglobe Technologies 2014) and „Sightspace 3d“ are using this kind of local memory space. 3D-models can be added to the application built-in library by iTunes-synchronisation (iOS), drag-and-drop (Android) or by sending the models as a mail attachement or Dropbox-synchronisation. To build an AR Media-augmentation the 3D-model is attached to a marker by using a plugin for well-known 3D-modelling applications like Trimble SketchUp. In a second step the augmentation can be realized by scanning a printed version of this marker from within the application. The marker is important for the scaling process of the 3D-model on the smartphone-display.

Sightspace 3D as a similar AR-application combines the techniques to attach a localy stored 3D-model to a marker or by using geocoordinates. If the model is not attached to a marker or a geoposition the user can also define his point of view with one touch on the screen.

The application „AR-Works“ from UR-AR-Limited is third appliation which uses a localy stored model to build an augmented reality visualization. On the contrary to AR Media and Sighspace 3D AR-Works is not available as a mobile application. The AR-Works-viewer is available for PC- and MAC-users and allows to display different varietes of a model, on-and-off-switching from layers and a shadow simulation.

4 USE OF AR IN ARCHITECTURE AND URBAN PLANNING

The following practical examples illustrate the use of the AR methods in urban planning and are also an example of just how well the link between research and practice works with regards to the content.

4.1 Talking Places and Urban Story-Telling

Which opprotunities are offered by the mobile AR techniques with regard to ther use in the fields of architecture and urban planning? Due to the ability to show any content at a desired position, the visualization of historic buildings at their former location or the visualization of structural projects is a given. The aim of the projct “Talking Places” is to enable the reliving of destroyed buildings, either destroyed in the Second World War, or simply temporarily demolished, in the city of Kaiserslautern. Their influence on the city’s history is to be preserved bby using this virtual project (Hesch 2011).

Another filed of application is describing events within the area: By linking audio files to the appropriate geo-position in the urban area, stories can be implemented in the urban space and offered in an audio walk through the city (Dörrzapf 2012).

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Fig. 2: Talking Places (left), Location-based audio (right), (Broschart 2013 using Hesch 2011 (left), Broschart 2013 using Dörrzapf 2012 (right))

4.2 Discover and experience Architectural Culture with all your Senses

In the project "Discover and experience architectural culture with all your senses", a digital tour was created with the use of Layar, in this case leading the users down the "Eisenbahnstraße" in Saarbrücken. The content of the project, conducted in cooperation with the city of Saarbrücken, was to raise the awareness of the architecture from the 50s, since their special features are anot often seen at first sight. Especially in terms of the upcoming modernizations the people's awareness had to be lead towards the preservation of these specific structures. Due to some "bad" reconstructions in the past, the exaggerated details of the 50s had to be restored.

Fig. 3: Architectural culture meets technology (Broschart 2013)

The results were presented to the people during the opening of the "Tag des offenen Denkmals 2013" in Saarbrücken. The digital tour was offered as a guided tour of the "Eisenbahnstraße", also a central information booth with additional information in the form of augmented posters and flyers was offered. For those people, who could not participate in the tour, these contents were also shown in form of an AR Media model placed on a marker ath the information booth (Biwer et al. 2013).

4.3 Discussion of Variants based on different Markers

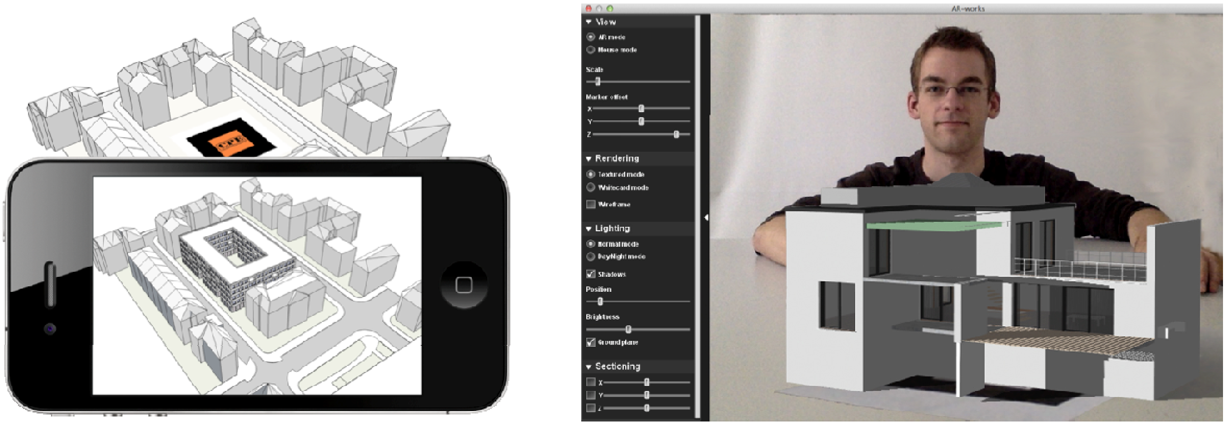

Fig. 4: Discussion of variants based on different markers (left); shadow simulation with AR-Works (right) (Broschart 2013 using Jost 2013 (left), Broschart 2013 (right))

Working with marker-based systems and local storage systems of AR Media or AR-Works, an ongoing exchange during the development of a project would be possible. The customer simply prints out the marker and downloads the latest model. By placing various models on several markers the different variations can be discussed. If these markers are placed in a physically built environment, the effects of the individual variations can be seen and evaluated.

4.4 AR Development Plan

In a development plan determiniations are made which influence individual citiziens on how they can build on their own property. Despite the obligation to publish the plans, the problem remains of a layman understanding the presentation. How should a person from his own opinion on a development plan and express it within the participation process, if he cannot understand the content of the development plan in the first attempt?

Fig. 5: The augmented development plan (own source)

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Based on this difficulty, different possibilities on how building symbols can be transferred into a 3D counterpart were developet into a thesis. With the intention to support citizens in translating the two-dimensional information there must be an adjustment of the dimensionality to reduce the level of abstraction. Not only the presentation of the 3D development plan in virtual environments and virtual globes, but also the area of augmented reality offers a way of communicating the contents of the plan: The plan itself acts as a marker on which the planned constructions are shown superimposed directly on a 3D model (Broschart 2011).

5 DISCUSSION AND CONCLUSION

Each of these techniques has its right to exist, but depending on which one, it might not make sense to use it to display and communicate the requred content. The choice of the tool to be used must therefore always depend on the specific content which is to be communicated.

If streaming can be used to make information of a low level detail accessible to a large group of users, the possibilities of local storage can provide a higher level of detail in terms of file size and complexity of the displayed content. In contrast to the limitation through the mobile internet connection, the AR-presentation in this option is simply restricted by the hardware configuration. If even the possibilities of smartphone or tablet presentations are exceeded, AR-techniques can be used, which are processed by notebooks ore desktop-PCs. If the limitations of the actual AR-model are passed, a higher level of detail can be implemented in a pure virtual environment (Virtual Reality, short: VR).

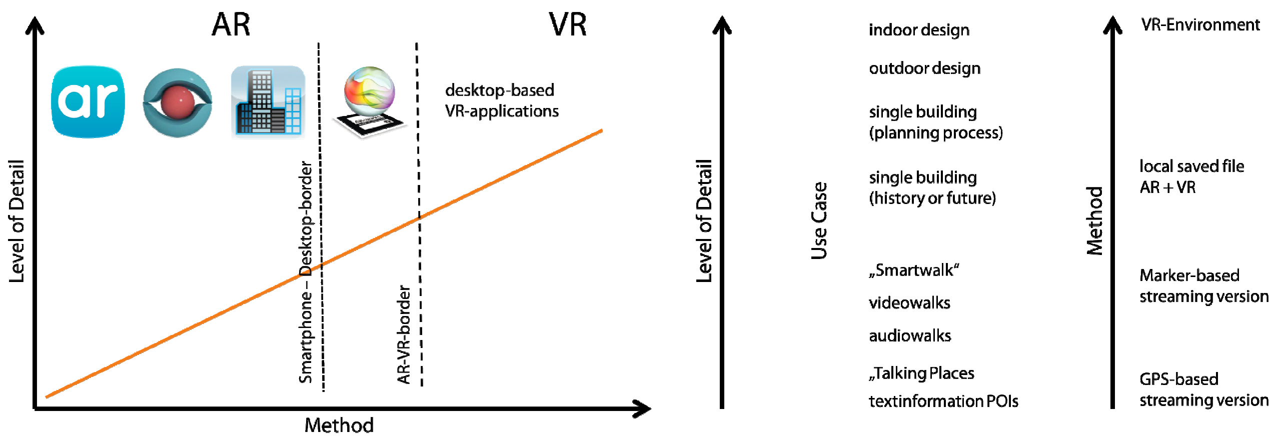

Fig. 6: Realizable level-of-detail and use cases depending on the applied method (Broschart 2013)

Depending on the possible levels of detail, which can be presented by the according applications, corresponding use cases can be derived. Not only textual information, audio or video files, as well as 3D models with GPS or marker based streaming options, but also detailed 3D representations of buildings on a local storage and detailed interiors in a VR environment can be shown.

5.1 Meaning from a social Perspective

What is the use of the presented visualizations and communication techniques from a social perspective? The communication between experts and interested people has the goal of sensitizing the general population for topics concerning architecture and urban planning. Like this, population groups that have only shown slight interest or possibly no interest at all for these topics can be reached. With the playful approach to planning contents, people can learn about topics, which they where not familiar with before. This allows them to form an opinion, which can be expressed in the further planning process. This is of great importance when the planning affects people directly or indirectly and they want to express their concerns in the participation process.

With the use of smartphones, tablets, and all digital media in communication processes, it must be held in mind that this is another option to communicate plans. Social groups, who (still) do not have the needed device, must not be ruled out from the planning and participation process only due to a technical barrier. To prevent this digital dividing, but at the same time offering the people the benefits of new media in the plan communication, guided tours, commented visualizations, etc. could be a solution. In this case the planner takes the role of a mediating notary, whose role is to impart important and relevant information of the planning process for the citizens, so that their own opinions can be formed.

At the same time it must be considered that the presented techniques for the communication in the planning and developing processes are not a one-way street. That means that the flow of information should not only go from the experts to the people, but that the people's opinion of a project is of great importance for a planning office. The combination of these visualization and communication techniques with social media platforms offers the possibility of such a response system. After the local citizens inform themselves with the communication techniques, initially directed as a one-sided flow of information, they can then send their opinion back to the original sender in form of comments. The requirements for a successful communication are therefore guaranteed if the elements of visualization, possibility of interaction, additional comments by the expert (transmitter) as well as a feedback function for the citizen (receiver) are equally respected and used.

Despite the euphoria of the technical possibilities for new communication technologies, the principle should always be kept in mind that the online does not work without the offline! The techniques are to be regarded as an addition to the tools already used by architects or planners. With the use of these techniques, the communication in a planners or architects daily work will be supported, but should not replace the direct conversations and interaction with the people involved!

5.2 Meaning for Urban Planning

By introducing rather serious issues in urban planning in a playful matter, the interest of laymen toward these topics is to be inspired. Like this, they can form their own opinion and in a certain perspective, be made to the experts of the topics cencering themselves. This represents a first step of a development that goes even further: By using smart technologies, which can be used by every person, the field of urban planning is made into a kind of "do-it-yourself-planning". Especially with regards to the combination of social networking technologies and the social desire to communicate, a network society will develop, which will change the understanding of urban planning and thus the area of responsibility of city planners fundamentally. All social groups can use smart technologies with the georeferences, (tag-cloud driven planning), to independently identify problems which they can then discuss among themselves and develop opinions and suggestions in a bottow-up approach.

The role of the planner will have to change, since he is the expert who has to implement the solutions coming from the "bottom-up" approach and check them in terms of accuracy, correctness, and completeness. He therefore needs to adapt to the role of notary or lawyer in the matter of verifying the ideas coming from the citizens (Streich 2012).

6 ACKNOWLEDGEMENT

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reviewed paper

Assessing Smart Locations – the MORECO Project

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1 ABSTRACT

A main criterion of intelligent and smart locations is the fact that they support a resource-saving way of life of the residents. Beside other aspects, the mobility of the residents is a very big part of this lifestyle. In big agglomerations the level of motorization is already decreasing, but in rural regions there is often a lack of public transport options which can be used from the inhabitants instead of their own car.

The European co-funded Alpine Space project “MORECO Mobility and residential costs” aims to improve sustainable mobility and to foster better accessibilities by supporting an optimized polycentric settlement development. The mainly addressed target groups are private households, planners, and mobility actors as well as politicians and decision makers. To fit all different needs, special tools were arranged and developed for each target group during the MORECO project.

These provided tools within the MORECO tool kit are generally possible to be used in every region or municipality to be a part of an overall and strategic mobility management. The adaption level of the tools can be fitted to all local framework conditions as far as the necessary data is available.

In regions where the mobility behavior is mainly car-oriented the tools can be helpful and motivating to improve sustainable mobility offers, especially because there is mostly no possibility to stop directly future urban sprawl according to law. The practical results out of the project can be an incentive for other European regions and municipalities which also prioritize an improvement in the field of sustainable mobility.

2 THE CHALLENGE

Economic and demographic dynamics lead to a decomposition and a change of long-known and traditional planning principles and individual behaviors. Trends like globalisation, an increasing number of older people, an increase of single households, more flexible working forms, and opening hours[1] cause peri-urban areas, rising rents, and changing requirements on public transport services. To counter this development it is more and more important to support a ressource-friendly way of life. This becomes evident in the increased demand for smart cities, a paradigm which shall solve these problems.

When we talk about smart cities or locations, we have to think about the following questions:

- What are smart locations?
- Are smart locations always smart? For everybody?
- How can people be encouraged to move to smart locations?

Referring to the “European Smart Cities” project[2] a smart citiy is defined as “a city well performing in a forward-looking way in these six characteristics (see Fig. 1), built on the ‘smart’ combination of endowments and activities of self-decisive, independent, and aware citizens”. This definition can also be adapted for regions or municipalities.

[1] VCÖ (2003): Mobilität 2020. Trends – Ziele – Visionen, p.21.

[2] http://www.smart-cities.eu/index2.html

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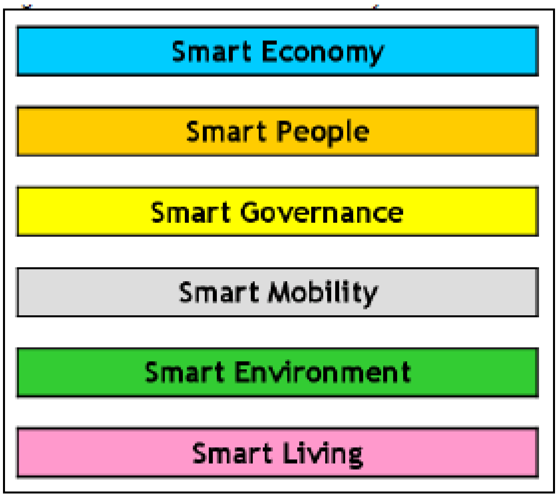

Fig. 1: Characteristics of a smart city (source: http://www.smart-cities.eu/download/smart_cities_final_report.pdf, page 11.)

When we now think about the parts “smart mobility” and “smart living” we realize that one part influences the other very intensely. An important criterion of Smart Living (e.g. Quality of life) covers beside others cultural facilities, social cohesion, and quality of housing. Smart Mobility involves local and (inter-)national accessibility,[3] which is especially important when making a long-term residential location choice. In the end, a city or a region is smart if the inhabitants and people in charge act smart. Corresponding to the question “what are smart locations?” it means that house-hunting individuals or families should choose the location which fits the best to their special needs, especially when it comes to accessibility of work place, school, leisure activities, or shopping facilities. This also includes a sustainable aspect and leads to the next questions: “Are smart locations always smart? For everybody?” A location which fits perfectly for one household referring to the daily ways done by the household members could be inappropriate for another household. It always depends on individual needs and standards of living. Smart locations are defined by the needs of their inhabitants and so there is no common answer or statement if one location is smart in general or smarter than another.

Furthermore, people often tend to move to suburban areas because real estates and rentals are often cheaper than in denser areas. This behaviour is the opposite of smart because the aspect of induced mobility costs is mostly not considered. Moving to suburban areas works fine if daily destinations are also in the surrounding area. But in many cases it causes long travel times to city centres which also means high costs for mobility. Although living space in city centres and other dense areas can be more expensive, it is compensated by decreased mobility costs because of improved accessibility. This knowledge leads to the third question “How people can be encouraged to move to smart locations?” The intention has to be asked here to provide information and tools for a better transparency of the relevant circumstances; not only for individuals or households which choose a location, but also for the responsible persons which have to plan or decide about the future of cities and regions.

The main goal of MORECO is to develop some strategies for these challenges.

3 THE PROJECT

The EU co-funded Alpine Space project “MOR€CO – Mobility and Residential Costs” started in June 2011 and lasts until June 2014. It is a cooperation of 10 project partners located in Austria, France, Germany, Italy, and Slovenia. Municipalities, regions, provinces, or institutes which work togheter with local, regional, national political, and administrative institutions are additionally involved as partners and external experts. All partners bring in different needs, experiences, skills, and backgrounds. Dense areas like the cities of Munich and Salzburg are presented in the project as well as sparsely populated and shrinking regions like Val Belluno. Especially this mixture is necessary to reach a winning mix of tools and strategies and to ensure transferability into Alpine Space regions or other areas. It is the declared aim of the partnership to find new solutions and reach an improved governance process for a better steering of spatial and mobility planning.

[3] http://www.smart-cities.eu/download/smart_cities_final_report.pdf, page 12.

4 THE TOOLKIT

To guarantee usable results at the end of the project, special target groups were defined in the beginning. Each target group should be supported by the MORECO tools to tackle their needs in the field of residential location choices. All tools applied together are the foundation for an overall strategy.

4.1 Households

Beginning on the individual level the MORECO toolkit involves a mobility and residential cost calculator for households to communicate the relation between a residential location choice and the induced mobility costs. Private households shall be motivated to analyze their mobility costs and shall be influenced to choose the most sustainable residential location. There already exist a few mobility costs calculators. Especially in Austria and Germany one can find some very in-detail developed cost calculators for smaller or bigger regions. Of particular importance are the mobility and residential cost calculators for the metropolitan areas Hamburg and Munich, which were developed from the privat planning office “Gertz Gutsche Rümenapp”, as well as the Austrian Mobility Pass for Residential Real Estate, developed from the research institute CEIT Alanova, since these calculators included essential requirements which were also used for the MORECO tools later on . These calculators are characterized by a well-designed, web-based user interface, and a big data base in the background. Beside these highly qualified web calculators of course other mobility and cost calculators do exist which were mostly designed for other (often special special) requirements.

All calculators have in common that a big amount of technical computer skills, money, and working hours is needed for the realization. Since MORECO is an EU Alpine Space project, the intention is to transfer and implement common knowledge to the attending pilot sites. So, creating another tool to calculate residential and mobility costs for individual housholds was not the professed goal, but rather to create a simple tool foundation which all pilot sites can use and work on. This is the reason why the tool for the individual households was created in Microsoft Excel, a programm which is easy to get and work with. This Excel document can be downloaded for free on the project website http://www.moreco-project.eu/ and offers a quick and easy possibility for everybody to get a rough overview about individual mobility and residential costs. As it is not linked with local data to a special region it is not as detailed as one of the mentioned calculators above. However, the benefit is the transparent calculation presented in a separate tab of the Excel document. This calculation can be used for any further development, for example in a detailed local web-based version or a mobile application.

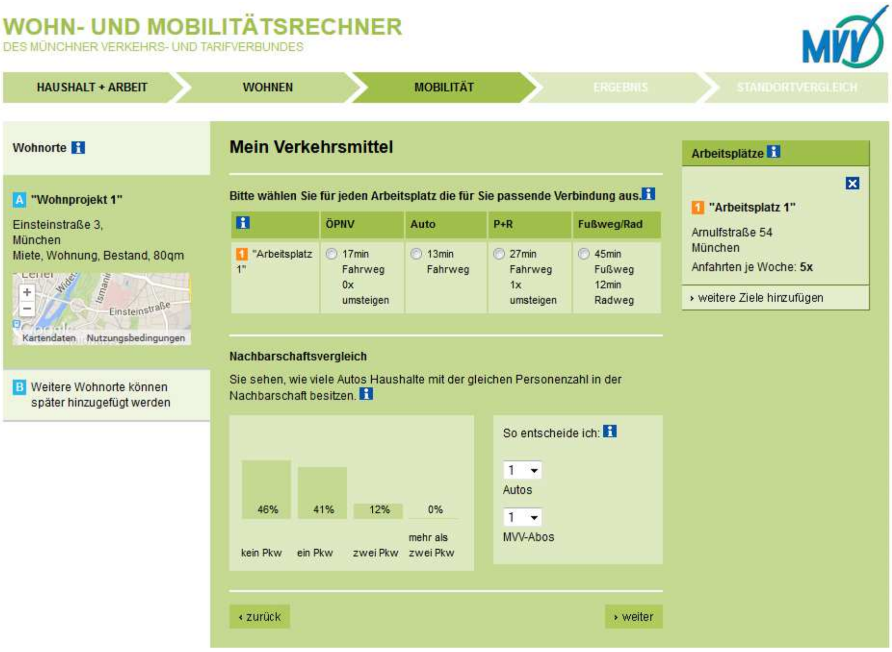

Fig.2: “WoMo” calculator Munich (source: http://womo.mvv-muenchen.de/mobilitaet)

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Fig. 3: Mobility Pass for Residential Real Estate (source: http://www.mobilitaetsausweis.at/advanced_tool/modul2.php)

3. Regular Trips (all household members)

This chart is the foundation for the calculation of your variable mobility costs. Please fill in the reguolar ways which are done in your household from all household members.You can chose between ways done with public transport or done with a car you own. You can specify the car attributes (engine, size, used fuel) in the section "4. mobility costs". You can also add the estimated time you need for one way, this helps to calculate the expected time budget for your chosen ways.

Trip				Public Transport	Means of Transport		
Purpose	Number of trips	Per	Estimated time; one way (in minutes)	Additional ticket price (bidirectional if not covered by season ticket)	Specify car	Total Distance (bidirectional)	Driving profile
Work/School	5	Month	45	€	Car 1	km	Mixed
Work/School	5	Month	20	€	Car 2	km	Mixed
Shopping/Other Tra	2	Month	10	€	Car 1	km	Mixed
Leisure Activities	2	Month	15	€	Car 1	km	Mixed
Leisure Activities	2	Month	20	€	Car 2	km	Mixed
		Month		€		km	Mixed
		Month		€		km	Mixed
		Month		€		km	Mixed
		Month		€		km	Mixed
		Month		€		km	Mixed
		Month		€		km	Mixed

Fig. 4: MORECO Excel-based Cost Calculator for households (source: own graphic)

4.2 Planners and mobility actors

The second tool designated for the target group of planners and mobility actors aims to help the responsible persons to identify suitable locations for settlement development and to compare different locations regarding the level of local supply and public transport accessibility etc. The tool should help to support a sustainable settlement development by using geographical information systems (GIS), models, spatial indicators and geospatial data.[4]

This tool framework is divided into three parts:

- Regional Analysis

This part of the tool describes core indicators like public transport structure, land use, demographic and commuting data etc. Outputs are maps, diagrams and additional explanation texts. The tool indicators are for example distances in minutes and km, number of population, fuel prices, or density values of settlement.

- Settlement Assessment

[4] See: Haslauer, E.; Prinz, T.; Schnürch, D.: Frameworks of MOR€CO Tools for Planners and Mobility Actors, p.3.

The settlement assessment analyses local areas concerning their suitability for residential locations linked to future induced mobility costs for the inhabitants. To producequalified results the tool analyses distances between residential locations and possible work places, shopping facilities, schools, and other public infrastructure facilities.

- Mobility Planning

The third tool part aims to support sustainable mobility planning based on a well-working and well-conceived public transport system. Short ways and a mixed settlement structure are a foundation for an efficient and affordable mobility. Thus the tool tries to foster short ways by showing potentials for future expansion of transport axes or additional stations. The outputs are indicators like for example the accessibility potential, potential number of users (walking distance), or service areas.

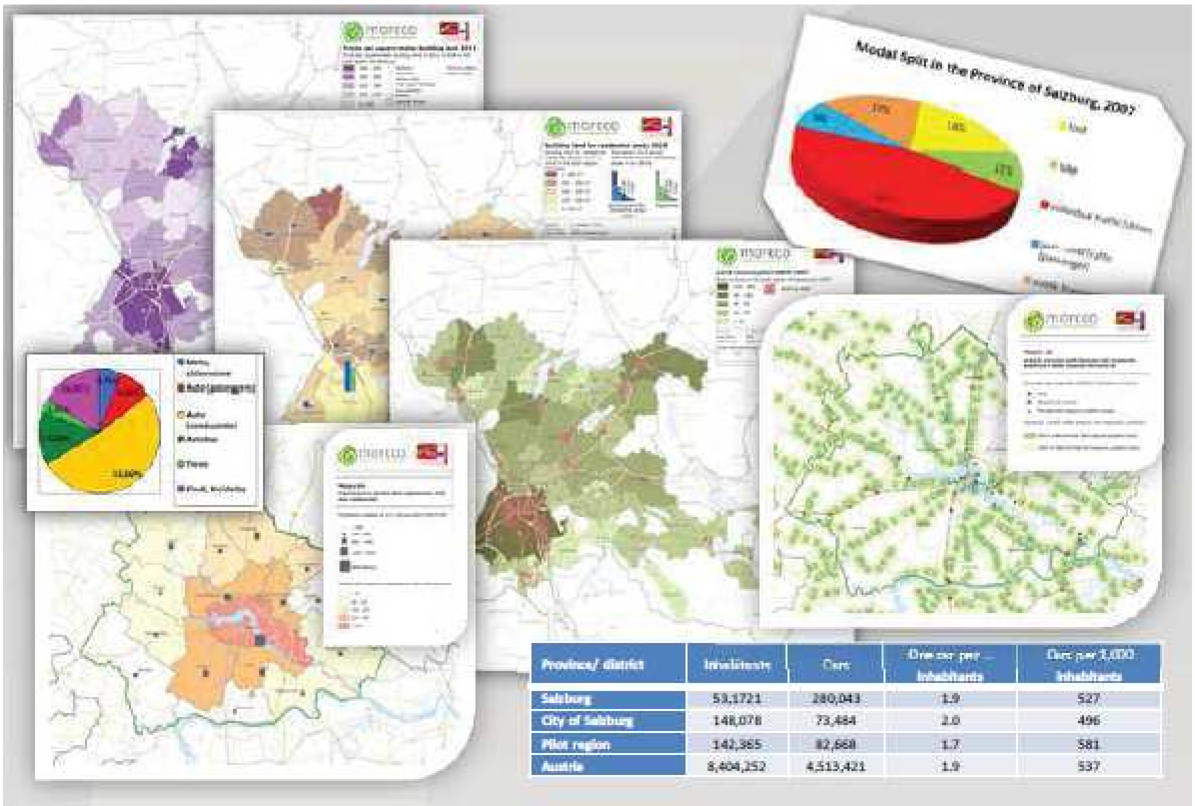

Fig. 5: MORECO tool for planners (source: MORECO Brussels Think Thank Poster, designed by ispace 2014)

During the development it was also the aim to create guiding frameworks for implementing the tools in the different pilot sites.

4.3 Politicians

For the target groups of local and cross-municipal policy makers, MORECO provides a lot of information material, like a broad slide pool to inform themselves and brief other stakeholders or inhabitants concerning the topic of sustainable mobility. This target group was chosen because of their responsibility for the future development of the local settlement structure which includes decisions concerning zoning or public transport aspects. These policy makers are usually politicians or other professionals which have to make themselves familiar quickly with expert knowledge for special occasions. They do not only have to inform themselves, but also transport important messages in a simple and understandable way to the population. The MORECO information tool, that came as a broad power point slide pool, can be a helpful assistance in the field of mobility and residential costs. These power point slides are available for free and are structured into the following subchapters.

- The MORECO project
- Why is MORECO of interest to you?
- Facts, background, trends

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- Impacts on actors
- Good practices/Opportunities for the future
- Practical MORECO tools/MORECO tools for households
- MORECO tools for spatial planners and mobility actors
- MORECO tools for policy makers

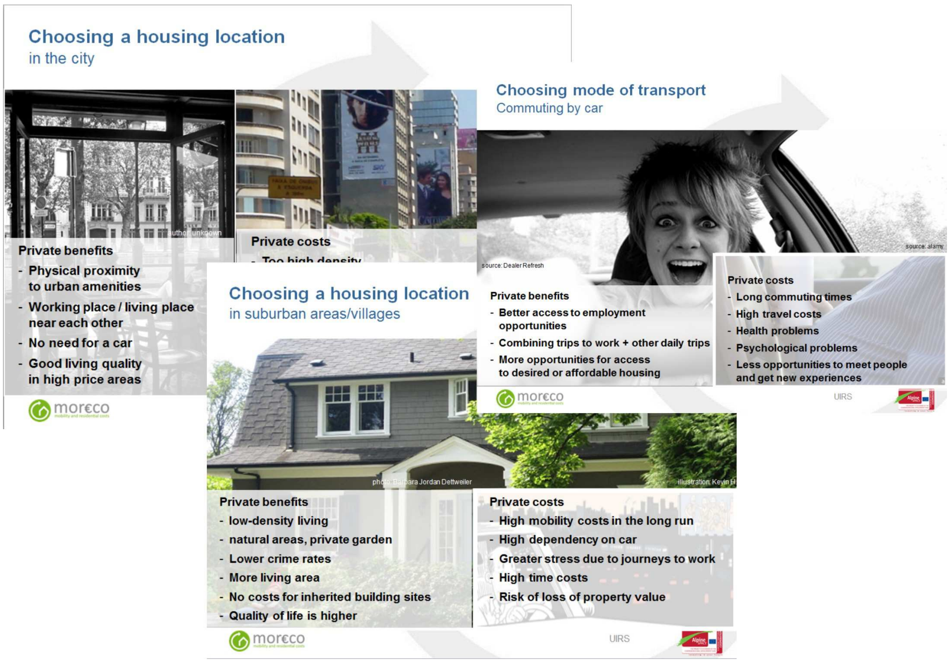

Fig. 6: MORECO slides for policymakers (source: MORECO Power Point deliverables, designed by SIR 2014)

Fig. 7: The household calculator version implemented in the Salzburg pilot site (source: www.moreco.at)

It is possible to use the whole slide pool or just selected files or images. The slides are designed in English language, but also available in German.

5 THE IMPLEMENTATION PROCESS

5.1 State of implementation

Within the MORECO project the pilot sites decided on their own which tools they want to implement. Depending on their local problems and potentials they did not only select the tools, but also decided about the way of implementation which was mostly important for the household calculator. There are already running several versions of the MORECO cost calculator for households in five different pilot sites. From simple translated Excel versions up to detailed developed web-versions various adaptions have been implemented. In the Salzburg region for example a web-based calculator was drafted which includes live interfaces to the local public transport organisation. The results includes suggestions for different public transport tickets which raises the quality of the usability.

In comparison to the Salzburg pilot site, the Slovenian project partners decided to provide at first a simple calculator version of the translated Excel document without live interfaces or maps. It is destined to develop another sophisticated version of the tool in a second step, but it was their intention to provide a fast and simple solution for private households. In the field of the household calculator the adaptions are very diversified, because the further technical development of the Excel version has to be done from the pilot site stakeholders themselves.

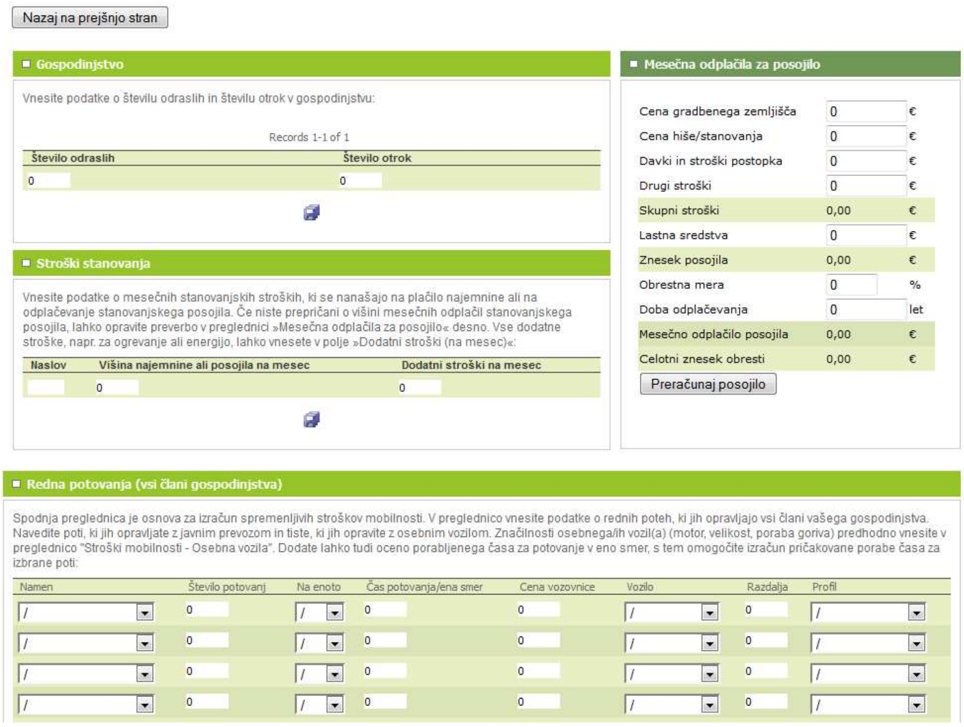

Fig. 8: The household calculator version implemented in the Slovenian pilot site (source: http://moreco.uirs.si/Domov.aspx)

However, the planners tools of the pilot sites are designed as technical frameworks and the pilot sites have to deliver the respective data to the project partner iSPACE (an Austrian research institute) which is the designer of the tool. iSPACE implements the delivered data into the tools and provides the local version for the pilot sites.

5.2 Transferability

In general it is possible for each region or municipality to implement and use all developed MORECO tools. Especially the household tool and the slide pool for policy makers can be used without any great effort. The tool for planners and mobility actors also can be implemented everywhere – according to the available data, different levels of implementation are possible. There already exist a lot of Europe-wide surveyed data, but in a few countries there is still a lack of exhaustive information and in an international comparison the data availability becomes increasingly different. Therfor a general version without any data running in the background was developed as well as a more automatic version with some local data on municipality level was integrated resulting in a trird, almost fully automated version with a large database behind.

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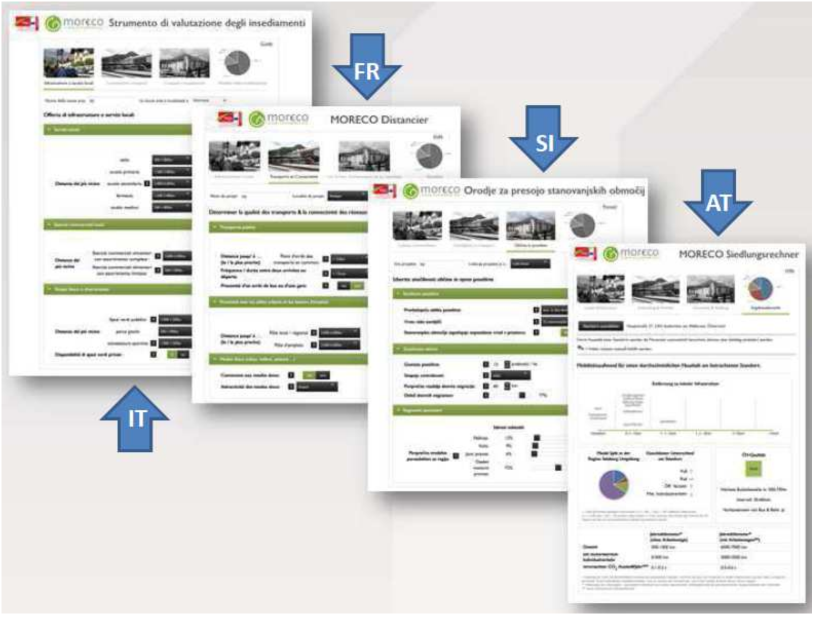

Fig. 8: Implemented planner tools (source: MORECO Brussels Think Thank Poster, designed by ispace 2014)

6 THE CONCLUSION

Out of the MORECO project resulted a handful of tools to raise awarness of the relation between mobility and residential costs from an overall perspective. By defining target groups at the beginning of the project it was ensured to focus on the needs of differently concerned people. The intenstion was also to offer possibilities to each municipality, organization. or other stakeholders which want to implement the tools regardless of their personal or financial ressources. The aim of the project, namely raising awareness of the relation between mobility and residential costs as well as developing tools to inform and visualize, was thus achieved. Furthermore, the implementation process of the tools was part of the common work. Nevertheless, it becomes more and more important now to foster the target groups to use the tools. These tools are a good foundation to support smart cities and regions, but there still remain some unsolvable problems like for example unlogical decisions: individiuals and households which are bonded to areas or places, maybe due to their family, friends, or other social networks, will probably not choose another residential location just because it is more cost-efficient. Social aspects play an important role in this context; but, on the other hand, it can also just be an image of a special area which enhances the attractiveness to live there since the responsibles do not always decide in an altruistic way: Growing regions still have a better image than shrinking ones and this often leads to designations of new building zones in peripheral areas without a good accessibility to public infrastructure.

In general, the long-term goal of the project is to make the topic “mobility and residential costs” a daily matter for (re-)planning of settlement structures. These aspects influence the quality and smartness of residential areas a lot and MORECO can help to assess these smart locations.

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Assessment of BIM Potentials in Interdisciplinary Planning through Student Experiment and Practical Case Study

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1 ABSTRACT

It is argued that Building Information Modelling technology bears significant potentials for enhancement of more integrated design and planning process, and further more for life cylce managament of built environmet. Through creation of a joint model, serving as common knowledge base for parttaking disciplines, the knowledge from the design pahse can easily be transferred into the operational phase. BIM offers a powerfull tool for monitoring, optimization and simulation of building operation, building as such a platform for data transfer and management necessary for the management and governance of the smart city.

This paper will presens the results of the empirical research – a multidisciplinary student experiment carried out at the Vienna University of Technology, with the students of architecture, civil engineering and master of building science. In the course of the empirical research a multidisciplinary design for energy efficient building structure is simulated, using various BIM tools (for architectural and structural modelling and simulation, thermal and light simulation) and testing the interoperability as well as the process integration.

The special focus lies on the test of interfaces, as crucial factor for process integration, satisfaction and efficiency, which was demonstrated in the pilot experiment. Two BIM models "one-platform-BIM" using proprietary interfaces and "open-BIM" using IFC interface will be evaluated and compared in terms of efficiency of data-exchange and transferability, as well as in terms of satisfaction with process and collaboration.

Finally, the results obtained from the experiment will be compared to the experiences gained from the practical case study – BIM use in two planning firms – in order to identify optimization potentials for the planning practice as well as key performance indicators for integrated design supported by BIM tools.

2 INTRODUCTION

2.1 Why Building Information Modelling

The AEC (archtecture, engineering, construction) industry is under growing presssure in terms of reduction of time and cost, and upkeeping of quality with simultaneous increased requirements in terms of energy and ressources efficiency. New tools are needed for increasing of process integration on the one side and for the successful life cycle management on the outher. BIM (Building information Modelling) Tools as emerging technology has been advocated to be able to meet all of the mentioned requirements. C. Eastman (1976), a BIM pioneer, introduced building modelling concept based on the notion of a database of building elements (building description system) in the seventies. The early technology has been developed in 1980, through introduction of ArchiCAD as the first BIM software, however the break through on the market was only possible in the new millenium, due to the maturing of ICT, which again enabled the data exchange between different toos (HVAC, RFM, cost calculation time sceduling – 5D BIM).

Numerous BIM definitions are used by academics and practitioners, ranging from the view as software application, as a process for design and management of the building through out the lifecycle (Aranda-Mena et al, 2008), or as a whole new approach to the practice based on so called integrated project delivery (Prins and Owen, 2010). There is a joint agreement that successful BIM implementation is supported by technology (software, interfaces, data mangement), people, process and policy and carried out in several stages (Succar, 2009): pre-bim, modelling, collaboration and finally integration.

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Through integration of the multiple models of different parttaking disciplines and through capapility of visualization, simulation and management of the building through out the life cycle BIM is a promising tool to support life cycle oriented integrated planning.

2.2 Problem Statement

BIM is experiencing much slower utilization by the AEC practice than the CAD at the time, especially in the Central European region. Even the Western European market is lagging behind the US market in BIM implementation – according to the McGraw Hill (2009) study, the BIM utilization in Western Europe is 36% where as in North America 48 %. The architects are identified as main BIM adopters.

What are the possible reasons? One of them is the still highliy fragmented planning practice, lacking the integrative experience, which is a precondition to successful BIM implementation. Secondly the standards and policies are lacking, differently so in e.g. the United States (Penn State 2012, AIA 2014) or in the UK where BIM is obligartory in publc projects from 2016 (Kiviniemi, 2014). Further on, the investors are important driving force for BIM break through on the market – as long as IFC models are not required by the public investors such as it is the case in the Scandinavian countries (in Finland since 2007, in Norway since 2010) (Wong et al 2010) it cannot be expected that BIM use will be accelerated in the AEC market.

3 RESEARCH DESIGN

3.1 Research intention

This paper presents the first results of the research project BIM_sustain, funded by FFG, carried out as cooperation of Vienna University of Technology and seven BIM software developers and consultants. Through the project the strategies for time- and cost-efficient BIM-supported planning should be developed, where by not only technology issues (software compatibility, data exchange and transfer, information losses) but also people (skills, knowledge) and process (organization of work-flow, model building, coordination, change management) should be assessed, and finally serve as basis for policy making and standardization on national level. The cooperation with the industry enables immediate compilation of customized software solutions and improvement of the tools after identification of the deficits through research.

In order to identify potentials and deficites of BIM in interdisciplinary building design, we organized a student experiment. We simulated a BIM supported integrated design of energy efficient structure in interdisciplinary teams consisting of architecture-, structural engineering- and building science students. The teams worked with different software constellations, two teams in so called one-platform BIM using proprietary interfaces, the other 10 teams in open-platform BIM, using IFC interface. We analysed the people-process-technology triangle, testing process- and software satisfaction (people), efficiency and work-flow organization efforts (process), respectevly software compatibility and data exchange (technology). The simulation thereby enabled quantitative (time sheets, activity protocols, inquiry) and qualitative (focus group interwievs) assessment of the BIM supported planning.

In the next step we analysed the BIM use in two large general planners' offices (both comprising the architectural, structural and HVAC modelling); where one of the offices works with open BIM and the other in one-platform BIM environment. The analysis was carried via open-ended interviews with BIM managers and responsible planners, and the results were compared with the data we obtained from the experiment.

3.2 Student experiment

Through explorative research - an experiment with the students of architecture, structural engineering and master of building science in the framework of the BIM-Sustain research project - we simulated different a collaborative, interdisciplinary design for sustainable building of complex geometry. Thereby an architectural, structural and thermal model should be compiled and optimized by the student teams using various BIM tools. In the winter semester 2012/13 the first experiment was organized serving as pilot, and in the winter semester of 2013/14 the subsequent experiment has taken place. The experience gained through the pilot experiment especially related to the team building, modelling and model exchange, and software combinations was used for the improvement of the following experiment.

In this paper we will present the results of the first experiment, and compare these to the BIM perception in the AEC practice.

In the pilot experiment 40 students took part, forming 11 teams. Each team was using different set up of software combinations for architectural, structural and ventilation modelling, structural calculation, dimensioning of ventilation and thermal simulation, thereby testing the software and the interdisciplinary data exchange (Table 1). Special emphasis was on the assessment of the benefits of one-platform BIM (teams 1 and 2) versus the open-platform BIM combinations (teams 3-11).

Through the analysis of the primary BIM data and related process documentation we were able to identify the heterogeneous problems of BIM supported planning.

Team	Architecture	Structural Engineering		HVAC (Ventilation) (Simulation in TAS)	
	CAD	CAD	FEM	CAD	Calculation
1	Allplan	Allplan	Scia Engineer	Allplan	Allplan
2	Revit	Revit	Sofistik	Revit	Plancal
3	ArchiCAD	Tekla	Dlubal RFEM	Plancal	Plancal
4	ArchiCAD	Allplan	Dlubal RFEM	Plancal	Plancal
5	Revit	Allplan	Scia Engineer	Plancal	Plancal
6	ArchiCAD	Allplan	Dlubal RFEM	Revit	Plancal
7	Allplan	Tekla	Sofistik	Revit	Plancal
8	Revit	Tekla	Scia Engineer	Allplan	Allplan
9	ArchiCAD	Revit	Dlubal RFEM	Plancal	Plancal
10	ArchiCAD	Allplan, Tekla	Dlubal RFEM	Revit	Plancal
11	ArchiCAD	Tekla	Sofistik	Revit	Plancal

Table 1: Teams and software combinations used in experiment

Through so called fault-tree analysis the data flow diagrams were compiled for each group, describing data transfer and software compatibility issues.

The fault-tree analysis shows, that transfer to the building physics software (EDSL TAS, Dialux, Archyphysik) is equally difficult in one-platform as in open-platform BIM, resulting with numerous problems, due to the fact that most of the software does not support IFC interface, but the proprietary interfaces, e.g. Gbxml. Reported problems: roomstamp does not work, software crashes at import, walls are not recognised correctly, blinds are missing, building elements not recognised, missing elements, windows not imported, result with remodelling or complete new modelling in the building physics software. (Fig.1, Fig.2).

In terms of model transfer for structural engineering the one-platform BIM (via proprietary interface) teams report less difficulties, however even here problems appear with complex geometry (round walls) and creation of simplified architectural model is necessary.

The transfer-analysis in HVAC modelling displays as general problem in data transfer via IFC that room stamps are not recognised, or interpreted wrongly.

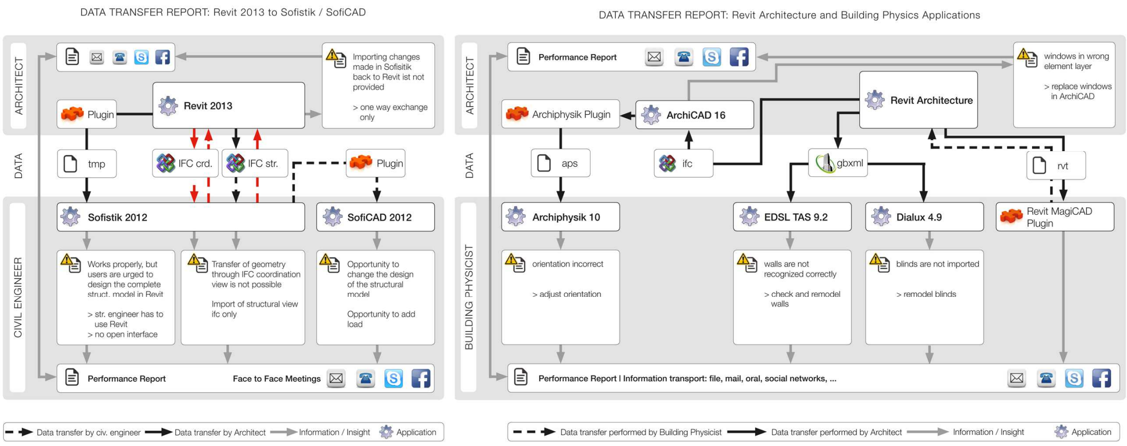

Fig. 1: Fault tree analysis for data transfer to structural engineering and building physics software for Team 2 (one-platform BIM)

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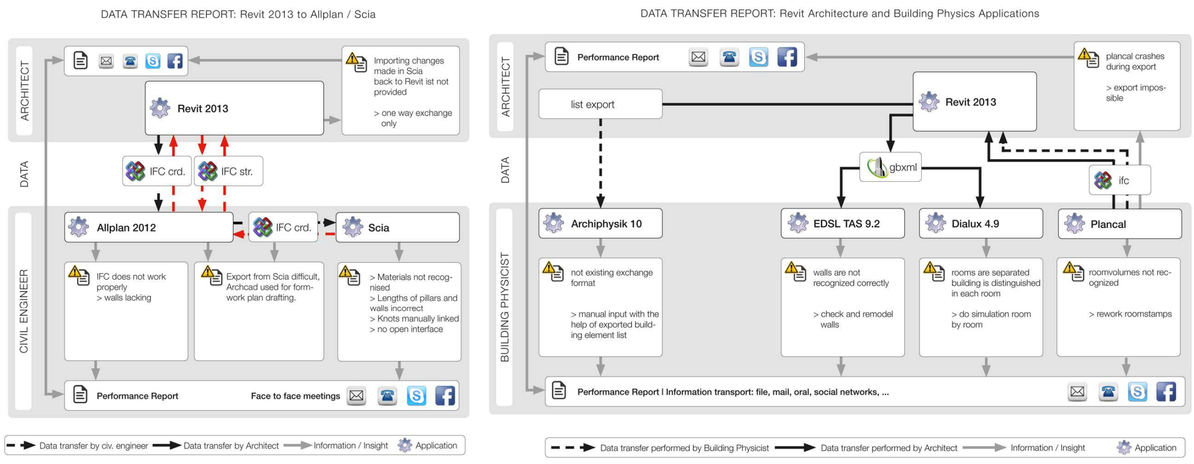

Fig. 2: Fault tree analysis for data transfer to structural engineering and building physics software for Team 5 (open-platform BIM)

For the detailed process-analysis the time sheets were used for the analysis of activities and related time-efforts. This allows drawing the conscusions on the workflows and efficiency of the planning process as well as the identification of the problems. Next to the inquiries for the evaluation of the satisfaction with the software and the planning process, the focus group interviews were conducted for the tree functional groups of architects, structural engineers and building scientists. The content analysis allows the identification of the concrete problems of the each discipline in the context of interdisciplinary cooperation and in the nexts step the compilation of best practices for the improvement of the planning processes.

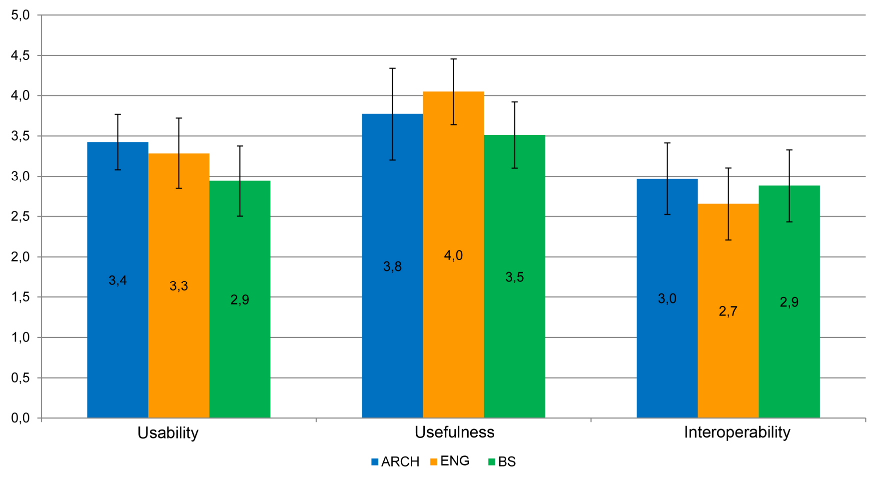

Fig. 3: Results of the inquiry for the technology aspects

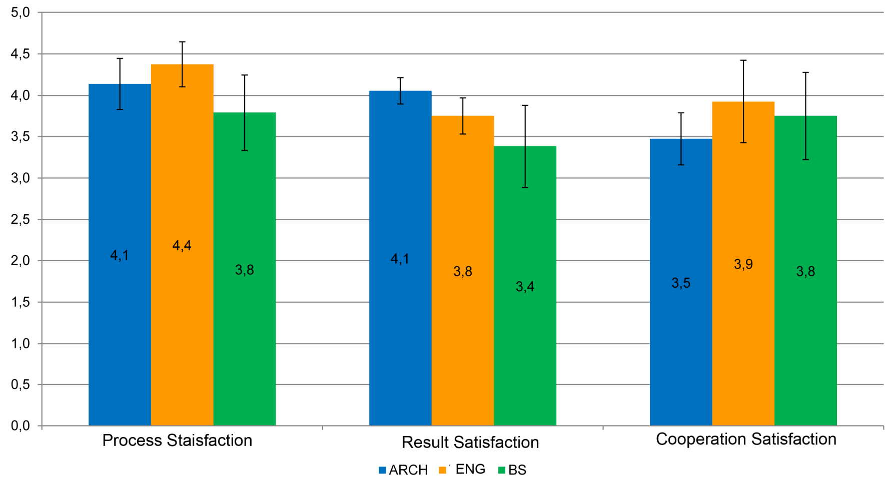

Fig. 4: Results of the inquiry for the people aspects

Focus group analysis shows that the topic of interoperability and content related discussions dominate the focus groups, the early cooperation (team, organization and software) are seen as positive for future work, which implies on necessity of a teaming workshop for the future experiment (or planing practice). Positive experiences outnumber the negative ones, especially with the successive disciplines (structural engineering, HVAC). The stress and time pressure in the latter planning phases require for better time management, which can be met by more careful design of the planning process, through definition of workpackages and milestones.

The inquiries show that interoperability is of great importance for structural engineers and building scientists in the interdisciplinary team, but is seen as very problematic. They are also satisfied with the process and result, where as the architects are less satisfied with the cooperation. (Fig. 3, Fig. 4).

3.3 Case Study – BIM in the planning practice

In order to verifiy the data obtained through the student experiment, we conducted a research of the BIM-use in the planning practice on the cases of two large firms, which both pioneered BIM on the market (early users). Via open ended interviews with BIM managers and responsible planners, following issues were questioned:

1. Which software do you use in the office for:

Architectural design, Structural Modelling, Sturctural Simulation/Calculation, HVAC Modelling/Calculation, Building Physics, Cost Estimation

2. Describe the BIM work-flow in your firm - for which constellations you use 3D data transfer, for which other (2D, lists)? How does the information flow back in the originary model?

3. Where are you experiencing the largest data losses? How do you solve this problem?

4. Where do you see the largest improvement potentials?

5. Can you clearly identify the benefits of BIM in your company?

3.3.1 Case A

Case A is an integrated building design and planning firm, counting to the largest in Europe, using BIM since 2008, comprising architecture, structural and HVAC engineering, construction mangement however no building physics.The services range from the programming, architectural competition till project turnover, including architectural, structural and HVAC building design, planning and management (cost planning and management, site management). The firms' focus is on collaborative integrated design involving architectural, structural and HVAC design. The firm employs app. 500 engineers and architects and is located at several locations across Europe, distributing the work along locations. The firm works in one-platform BIM using Revit for architectural, structural and HVAC modelling. Interviewed were BIM manager and BIM responsible planner (Table 2).

The company works in one-platform BIM (Revit) employing Revit Architecture, Revit Structure via proprietary interface in Dlubal REFEM or RSTAB for calculation, Revit MEP with PlugIn Magi Cad with all of the object libraries for HVAC modelling, Solar and Gebis for Ventilation calculation

5D BIM (cost planning and scheduling) is carried out via ITwo and RIB, by automated calculation through extraction of masses, interfaces for bidding procedure are still in development.

Quality control is carried out using Solibri check for clash detection, check of loadbearing elements, using IFC interface. The firm does not employ BIM assesment management tools or instruments.

3.3.2 CASE B

Case B is a general planer, offering full scope of services from construction planning till project turnover; structural engineering, HVAC, building physics, fire protection; construction management, cost planning and management. The firms' focus is on engineering services and construction management, less on architectural design. The firm employs app. 180 mainly engineers and some architects, consisting of the headquater and two futher smaller locations, also using joint ICT infrastructure and joint project set up. The firm is using BIM since 2011, as open-BIM, which allows working in heterogenous software environment allowing data exchange among specific tools of each discipline.

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Interviewed was BIM manager, who was responsible for BIM introduction, implementation and setting of firm’s standards (Table 3).

Interviewees Categories	BIM Manager	BIM Planner
DATA LOSSES	The largest data losses towards building physics, since these do not read IFC. Further dataloses are experienced towards all firms out of the house – construction companies etc.	It is simplier in the house – all use the same model, more difficult out of the house – problems with construction companies the interfaces do not work, data loss.
BENEFITS	A benefits is better integration, everybody needs to communicate with each other, less clashes (Solibri), finally possibility for quality management,	Time-reduction in project-execution, some projects would not be possible without BIM, due to the time pressure. Design phase is faster.
		Calculation of structure is faster due to the premodelled structure from architectural model.
		Benefits for subsequent planners – e.g indusrial planner can use the digital building model and for the positioning of 3d machines, which before BIM was not possible.
		Quantitative assesment is difficult.
IMPROVEMENT POTENTIALS	Improvement is necessary towards building physics; it takes huge effort to remodel when data is transferred.	Satisfaction – the education is important, easier handling increases satisfaction
	There is still a break between competition and architectural planning (competitions are not modelled in Revit).	Largest amount of time is used for the decision making, which cannot be taken over by Revit
		Definition of the level of deatiling –a lot of effort was put in to too high level of detailing for design model
		Life cycle management : BIM as built who should update the planning stage BIm model?
		Data exchange across locations does not work well, technical problems with central model
		Inhouse: bi directional BIM; out of the house - one way BIM

Table 2: Categorised statements Case A

Interviewee Categories	BIM Manager
DATA LOSSES	Greatest data losses are experienced in the REFM transfer (structural simulation).
BENEFITS	The greates advantage is the workflow systematization as well as the automatised project set up, which substantially contribute to the improvement of collaboration and data exchange.
	Very difficult to asses quantitative BIM benefits – every project is different, how to compare?
IMPROVEMENT POTENTIALS	The highest improvement potentials can be identified in data exchange between building model and building physics, since these do not work with IFC.
	Still dificult is to generate usable 2D drawings from digital modells, that would go along with e.g. ÖNORM standard.

Table 3: Categorised statements Case B

The firm is using a wide spread of different software. Building modelling is carried out in ArchiCad (as originary model), structural modelling in Allplan, calculation in Scia and Tower; HVAC modelling as well as the calculation in Cats (Autocad Plugin), cost planning uses BIM modell for automatised mass and volume extraction for customised xls-based calculation, building physics is using Archphysik, TAS (which is de-coupled from the BIM process) and Dialux.

All of the models are coupled in one joint project-set up in Navisworks or Tekla BIMsight, which carries out collision proof and quality management, directly adressing the affected planners via mail.

Basis for this procedere is the standardised structure for all projects and all disciplines, using the same project set up. The advantage of such set up is, that every user is working in the existing, already known software environment, however in structured way, which enables data transfer and exchange.

From the originary Archicad model both 3D and 2D data is transferred to the structural engineering and HVAC; bidirectional exchange is given between structural model and ventilation model into the originary model.

The firm does not employ BIM assesment management tools or instruments.

4 CONCLUSION

The examined cases, seen in the context of one-platform BIM versus open-platform BIM show similarities in identifed benefits and deficites. In both cases the improvement of data exchange towards building physics tools is seen as the most important issue. Both cases see as largest BIM-benefit the enhancement of integration and collaboration. Both cases identify the necessity of standardization and policy (level of detailing, modelling normative or standard).

The cases confirm the experiment findings, where the transfer towards the building physics software (thermal simulation, daylight simulation) was burdened with numeous problems. Further implication from both experiment and cases, is the necessity for thorough work-flow and process organization - more intensive than in 2D CAD design and planning - in order to gain full BIM benefits.

The experiment and case study could not identify significant advantages in terms of data transfer efficiency of one platform BIM over open-platform BIM. In the experiment, the teams 1 and 2 must employ other BIM software as intermediate step or use Gbxml interfaces to transfer data to thermal simulation software, both cases resulting with data transfer losses, team 1 even experiences problems in the ransfer of structural data using proprietary interface in own family.

The case A, despite working in one-platform environment, uses IFC for quality control via Solibri, and leaves thereby the Revit platform. The BIM manager of the case A even sees a necessity for the building physisc software to support IFC interface, as the universal interface enabling standardized data exchange.

It is questionable if the one-platform BIM as closed system is a viable concept in the practice - as soon as additional consultants or companies are parttaking in the project, a standard must be met to be able to exchange the data bi-directionally, which again is the strenght of open-BIM concepts which allow for infinite expansion and data exchange in the planners network.

The research implies that a thorough analysis of firms' demands, workflows and working procedures is needed as the first step in BIM implementation. Customized solutions for each firm, based on careful design of workflows and communication, generation of joint data-structures and project-set up play crucial role for sucessful implementation. There is no ideal solution (one-platform or open-platform) or out of box solution.

None of the cases is employing a measurement methodology or assesment procedure in order to evaluate BIM benefits or perform benchmarking, which is a wide spread and recognised problem (Barlish and Sullivan, 2012, Bercerik-Gerber and Rice 2010). Therefore, is still difficult to quantitatively determine the business value of BIM, especially in the Central Europan region where the experience with BIM in interdisciplinary planning is limited. In the next step, a metrics system for measurement of BIM benefits and strategies for stage-wise BIM implementation suitable for Austrian market should be developed.

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reviewed paper

Automated Urban Management Processes: Integrating a Graphical Editor for Modular Domain-Specific Languages into a 3D GIS

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1 ABSTRACT

In this paper we present the results of integrating a graphical editor for geospatial processing workflows into a 3D GIS. We use modular domain-specific languages (DSLs) that are tailored to specific application domains. The vocabulary consists of so-called recipes that are grouped into cookbooks representing the language for a certain application domain. Recipes can be reused in multiple cookbooks. This approach allows for a good usability as the user quickly becomes familiar with the domain-specific languages by recognizing common recipes. In this paper we also describe guidelines for choosing the right granularity for recipes which allows for complex rules while using simplest possible recipes. We also describe a workflow for domain-specific language design based on ontologies to identify the correct domain vocabulary. Our approach can be used to automate processing of geospatial datasets in the area of urban planning. To evaluate our approach we use the implemented graphical rule editor in a practical scenario and present it to a user group from the urbanAPI project.

2 INTRODUCTION

Geospatial data is used in a wide range of applications. One of them is urban planning where spatial data is used for urban assessment or simulation of planning decisions as well as environmental and disaster management, etc. These applications often require the domain expert to integrate or harmonize data, to process it in order to derive new information, to use it as input for simulation algorithms, and finally, to visualize data in order to assess the results. Today these steps are mostly performed manually using standard GIS software. This can be quite tedious, especially if the planning scenario is complex and is subject to discussion—be it amongst urban planners and municipal decision makers or even in public. Discussion is inevitable in urban planning and of course a useful instrument to improve urban development. However, expectations of stakeholders often change through discussion. If this happens constantly, urban planners will likely have to process all the spatial data again and again. If they have to do that manually, new iterations will be rather lengthy and presumably expensive. Automated processes can help alleviate this problem.

Today, the amount of spatial data to be analysed and processed grows continuously. For example, modern satellite imagery produces more data per day than it produced during several months a few years ago. There is a growing need to analyse this information for applications such as urban planning. For example, satellite images showing development over several years can be used to estimate or simulate urban growth. Searching LIDAR data for special geological formations can not only help assess areas for urban development but also recognise environmental risks such as landslides. The larger the data to analyse becomes, the more the domain expert depends on automated processes.

One way to automate processes in today's GIS software is to use scripts written in a general purpose language—for example Visual Basic or Python as seen in the proprietary software solution ESRI ArcGIS. On the other hand there are some products such as Safe Software FME Desktop that try to ease the process definition by using graphical elements such as diagrams or graphical workflow representations. However, in recent years another approach—which is actually well-known for quite some time in computer science—has become more and more prominent. In order to allow users with non-IT background to specify complex configurations, rules and workflows, so-called domain-specific languages (DSLs) are used. Such languages have a limited vocabulary that is tailored to specific application domains or even single use cases. DSLs allow the domain experts to express problems in their own words, in fact to program complex workflows without the need for a background in computer science or a deep understanding of programming.

To summarize, for urban planning large amounts of data have to be processed over and over again. Current automation solutions use general purpose languages or other graphical representations that are quite complex, probably hard to understand for non-IT personnel and hence error-prone. Domain-specific languages can help reduce the complexity of a specific problem to an application domain that is well-known to the user—i.e. the domain expert. In this paper we present the results of integrating a graphical editor for domain-specific languages into an existing 3D GIS. We use chainable production rules to allow the user to create sequential workflows. We describe the basic grammar for our languages and the UI elements we implemented. Finally, we evaluate if our solution can be used reasonably in a selected scenario.

3 STATE OF THE ART

Domain-specific languages (DSLs) are languages with the following properties:

- They are tailored to a specific application domain or even to a single use case;
- The language's vocabulary contains words well known to the domain expert;
- The language's expressiveness is rather limited.

The latter means the language cannot be used for general purpose—that's why it is indeed called a domain-specific language—but instead it is a lot easier to understand and to use for non-IT personnel.

In computer science, domain-specific languages have been used for quite some time already. In the IETF protocol specifications, for example, DSLs are very often used to facilitate interoperability because they avoid machine-dependent minutiae such as encoding issues. Apart from that, in the UNIX operating system you can very often find DSLs in configuration files. For example, the Apache HTTP server configuration files are written in a special language using words from the domain of web server configuration—e.g. RewriteRule, Redirect, Proxy, etc. Furthermore, DSLs are also used in database management systems. SQL, for example, is in fact a domain-specific language.

DSLs can be created in various ways. Martin Fowler gives a comprehensive overview over domain-specific language design (Fowler, 2010). He differentiates between internal DSLs and external ones. Internal DSLs are embedded into a host language, most often a general purpose language. External ones have their own custom syntax and grammar.

Modern dynamic languages such as Groovy or Ruby allow developers to create internal DSLs very easily. In Groovy you can even alter the language's syntax by building and traversing arbitrary abstract syntax trees (ASTs) with compiler plugins. Static languages often do not provide such means, but Scala, for example, is known to have been used already for a lot of internal DSLs. For example, Lee et al. developed the Delite Compiler Framework which uses a DSL embedded into Scala (Lee et al., 2011). Delite can be used to execute parallelized code on multiple platforms. The DSL abstracts the code from the actual platform it is executed on. Lee et al. use a technique called language virtualization (Chafi et al., 2010) which allows them to reuse existing Scala compiler components such as lexer, parser and type checker. Apart from that, you can also find embedded DSLs in Java. Albeit being restricted by the host language's syntax so-called fluent interfaces have been widely adopted. Fluent interfaces are often referred to as being internal DSLs.

Compared to internal DSLs, external ones are not restricted by the host language. With the right tool, the language designer is able to do almost anything. Just like general purpose languages, external DSLs are typically created using language recognition tools such as Lex/Yacc or ANTLR, but they can also be created with sophisticated language workbenches such as Xtext.

Graphical DSLs use visual elements. They can be found in areas such business process modelling. For example, BPEL (Business process execution language) and XPDL (XML process definition language) are domain-specific languages defining the execution semantics of business processes. The MIT App Inventor is a tool that allows developers to create Apps for the Android operating system using graphical programming elements. However, App Inventor tries to mimic a general purpose language and therefore goes beyond the scope of typical a DSL.

There are existing tools containing a graphical editor that can be used to specify geospatial operations. For example, with ESRI's ArcGIS ModelBuilder (which is part of the ESRI's ArcGIS Spatial Analyst) users can perform operations such as classification or colourisation on data that matches given criteria. The ArcGIS ModelBuilder is targeted to geospatial applications and therefore only contains operations needed in this domain. This includes spatial indexes (and operations such as "near" or "inside") as well as geometrical operations (such as building buffer polygons). The tool supports 2D data and 2,5D raster data, but lacks support for higher dimensions. 3D city models are nowadays an integral part of the urban planning process.

Such kind of data cannot be processed with the ArcGIS ModelBuilder. The approach presented in this paper, however, can be applied to 3D data.

The use of domain-specific languages in the area of urban planning is rather novel. In one of our previous papers we present a first approach of performing urban policy modelling and making with the help of ICT enabled tools, in particular domain-specific languages (Krämer et al., 2013). We use DSLs to define policy models that can be used during the planning phase, and also for automated evaluation of policy implementations later on. Compared to the approach in this paper, we use textual DSLs—instead of graphical ones—to define the policy model which makes it very readable and easy to understand for domain experts (i.e. urban planners). In order to specify automated workflows, however, we suggest using graphical DSLs consisting of simple conditions and processing steps tailored to the urban planning application domain. With the graphical editor presented in this paper, specifying a workflow is a matter of selecting the right conditional blocks and actions, putting them in the correct order and specifying some parameters if necessary.

4 LANGUAGE SPECIFICATION

In our implementation geospatial processes are described using so-called production rules. They consist of two parts (cf. figure 1):

- The condition (or left-hand side) selects objects from the dataset. In our case, we essentially use a chain of filters here that is applied to the whole dataset. Objects that pass the filter chain will be selected.
- The rule's consequence (or action, or right-hand side) specifies what should be done with the selected objects. In our implementation you can use various pre-defined actions for data manipulation.

Production rules are event-based and can be chained. Executing a rule may alter the dataset. This might let the condition of another rule become true which will then be executed as well. This process is typically called forward chaining. It is an integral part of production rule systems which allows the user to create complex processing workflows.

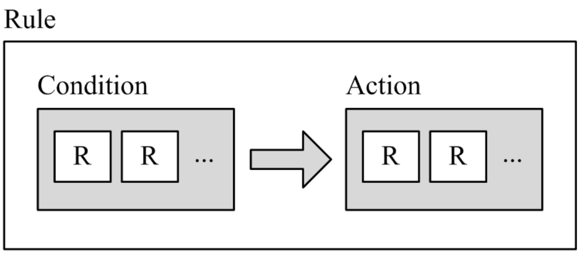

Fig. 1: A production rule consists of a condition (left-hand side) and an action (right-hand side), both containing recipes (here symbolized with 'R'). If the condition evaluates to true, the action will be executed.

In our implementation, rules are specified with pre-defined, reusable components that we call recipes. To improve usability we implemented so-called cookbooks which group recipes by the application they are used in. For example, our rule editor provides a number or recipes to assess data quality. All of them are kept in a cookbook called 'Quality Assurance'. Basically, cookbooks represent different domain-specific languages. The 'Quality Assurance' cookbook, for example, represents the language that contains the vocabulary of the 'quality assurance domain' (cf. figure 2). Most of the recipes in this cookbook use terms specific to this domain, others are rather generic and can be reused in various domains. They are hence assigned to multiple cookbooks. This allows for a good usability as the user quickly becomes familiar with the individual domain-specific language vocabulary by recognizing common recipes.

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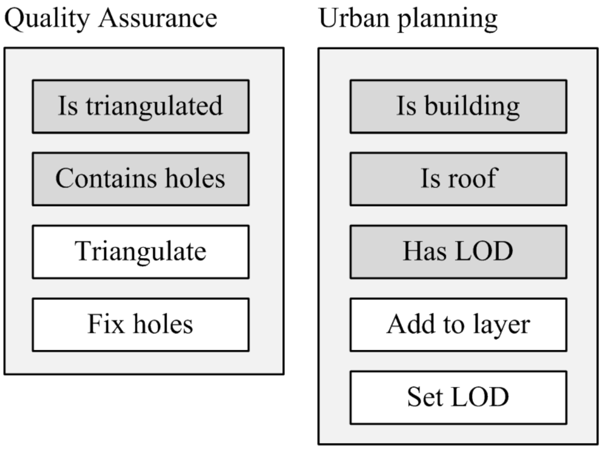

Fig. 2: *Recipes* (conditions and actions) are grouped into application-specific *cookbooks*. In this case, there is a cookbook containing recipes related to quality assurance and another one containing recipes for urban planning.

The recipes that can be used in a rule's condition are functional filters without side-effects. This allows them to be used in arbitrary order. The recipes on the rule's right-hand side are imperative actions that must be executed in the order specified since one recipe might depend on the results of another.

In order to achieve good usability we designed our rule editor as follows:

- The recipes are intended to be self-explanatory for the domain experts. They use domain vocabulary and they do not expose too many technical details to the user.
- The rule editor detects conflicting input and therefore helps users to create correct rules. For example, the rule editor disallows the user to append a recipe to a rule's right-hand side if there is already a recipe that deletes the selected data. Any other recipe would be useless after that.
- We have defined guidelines for granularity (see section 5) in order to enable complex rules while using simplest possible recipes.

Some of the recipes require additional information from the user. Hence the recipes can have parameters. For example, there is an action to extrude a plane from 2D to 3D which needs the user to specify the height. Our rule editor provides forms for the recipe parameters.

5 GRANULARITY

In order to achieve a good usability we took special care to create recipes that are as simple as possible but at the same time as powerful as needed, so rules will be understandable for the domain expert and not too large (i.e. powerful). Condition recipes and action recipes should be categorized as follows:

- **Location**. Recipes from this category operate on the location of objects in the dataset. For example, the data source (web service, file, etc.), the layer the object is assigned to, and so on.
- **Property**. This category contains recipes that operate on object attributes such as colour, texture, metadata, level of detail (LOD), object type, etc.
- **Geospatial**. Recipes from this category are related to geospatial properties of objects in the dataset. For example, height, width and depth of an object, geospatial coordinates, etc.

Each recipe can only be assigned to one category. That means condition recipes cannot filter for properties from more than one category. Action recipes should also only alter properties from one category. For example, it would be violating to create a recipe called 'Colourise and move' which at the same time changes an object's colour and its geospatial coordinates. A better solution would be to create two separate recipes.

In addition to the described categories the actions are divided into three types: add, update and delete. An action recipe which adds an object to a layer is in the 'location' category and is of type 'add'. The three types are similar to CRUD (create, read, update, delete; known from database management systems) and are used to visually differentiate the recipes in the user interface.

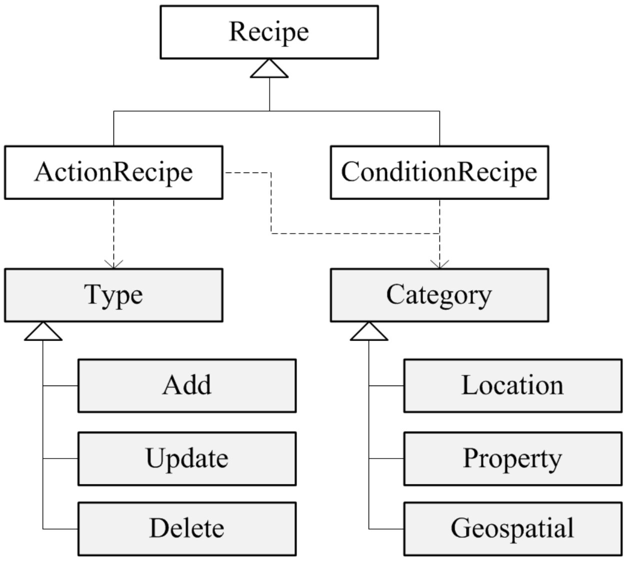

Fig. 3: UML class diagram of the implemented recipe model. Categories help developers to separate concerns and therefore to find the right granularity for new recipes.

6 LANGUAGE MODELLING BASED ON ONTOLOGIES

A domain ontology is a set of concepts (things that exist in that domain), their classification, relations, and terminology/taxonomy (i.e. the words used in the domain to describe the concepts). The definition of a formal ontology is considered an essential step for domain-specific language design or even for any software project (Gašević, 2006).

In this work we aim for creating domain-specific languages that use terms from the user's domain. Ontology building is used in the area of semantic web to identify concepts and relations from a given application domain (Nicola, Missikoff, & Navigli, 2009). Ontologies can be useful for the definition of domain-specific languages where they act as the basis from which the taxonomy, vocabulary, and parts of the grammar are derived. Note that in our approach, ontologies are only used for this specific purpose. We do not need them anymore after we defined the domain-specific language. They are just one step in our modelling process.

In order to create a domain-specific language we suggest the following workflow:

(1) Analyse the application domain.

(2) Create scenarios/storyboards.

(3) Analyse storyboards and look for subjects and objects. Create an ontology and use the subjects and objects as concepts.

(4) Look for verbs. Use them in the ontology as relations to connect subjects and objects. Free verbs that are not related to concepts become actions in your language.

(5) Build sample DSL scripts that use the created ontology and the free verbs.

(6) Review and reiterate if needed.

It is crucial that language modelling is performed in strong collaboration with domain users, so the final language contains the vocabulary that is actually used in the targeted domain and can in fact be understood by the domain experts. In the following example use case a workshop was held where we designed domain ontologies and a domain-specific language on the whiteboard together with the users.

7 EXAMPLE USE CASE

In this section we are going to discuss a use case from the research project "urbanAPI" which is funded from the 7th Framework Program of the European Commission. One of the project's consortium partners is Vitoria-Gasteiz, the capital city of the Basque Country and of the province of Álava in northern Spain. Vitoria-Gasteiz is the European Green Capital of 2012. A network of public zones, green spaces, parks, and boulevards extends over the entire city. It is surrounded by the Green Belt, a narrow semi-natural green area which plays an important role in improving citizens' health and quality of life, as well as raising general environmental awareness throughout the public.

The municipality plans to extend urban green areas and, in particular, to implement an Interior Green Belt that encompasses the city's inner core. For this, parts of the city need to be restructured. For example, the Avenida Gasteiz—one of the main traffic routes—will be refurbished by adding grass, trees and plants. Of course, such a construction project has a high impact on public life. The municipality tries to raise awareness of this project within the public by providing 3D visualisations showing the planned restructurings of the Avenida Gasteiz.

In order to create a 3D visualization the city of Vitoria-Gasteiz needs a 3D city model. They can provide at least two datasets that can be used as a basis to generate such a model: a digital terrain model (DTM) and a dataset containing 2D building footprints from the cadastre. The latter includes various attributes that are useful for this use case. The attribute 'NumberOfFloors', for example, can be used to approximate a building's height by multiplying it by an average floor height of 3 meters.

The municipality wants to build up an automated process that ensures the city model is updated whenever the base datasets have changed. In order to create a domain-specific language that can be used to describe such an automated workflow we have to perform an ontology analysis as described in section 6. One of the first steps is to create a storyboard for this workflow, which—written from the perspective of the domain expert—can be summarized as follows:

"As an urban planner I want to automatically create a 3D city model. As base data I want to use two layers, a digital terrain model (DTM) and a dataset containing 2D building footprints. For each building in the city I know its number of floors from the building footprints dataset. In order to create a 3D representation of a building, I copy its footprint polygon and put it on the DTM. Then I extrude it by the number of the building floors multiplied by 3 meters. I add the extruded footprint to the 3D city model, but only if a respective building does not already exist there."

By analysing the storyboard and looking for subjects, objects, and verbs that act as concepts and relations respectively, we can create an ontology that contains the domain vocabulary needed for this workflow. Figure 4 depicts this ontology. Note that in this paper we only focus on one workflow. The Vitoria-Gasteiz use case is much larger, and so is the final ontology. Figure 4 only depicts a small part of that, in particular the concepts and relations needed to understand the example.

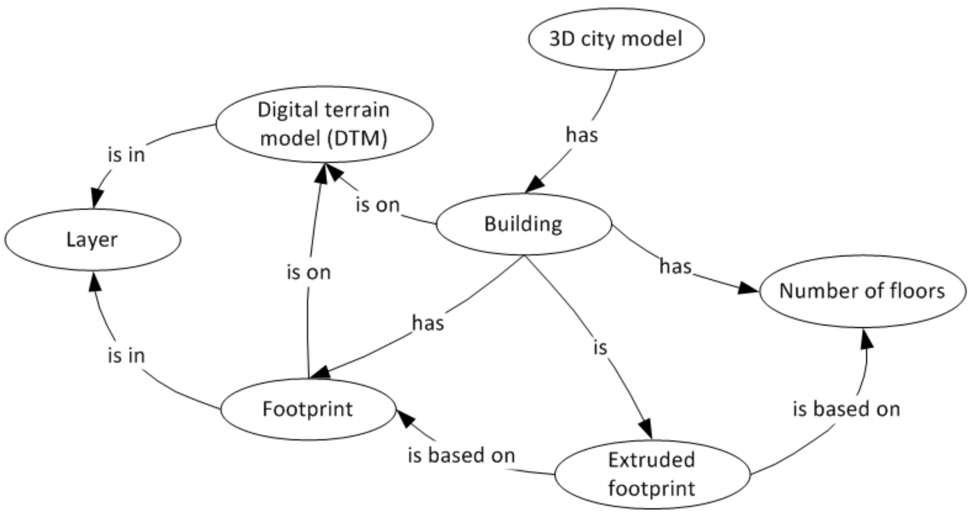

Fig. 4: Domain ontology derived from the example storyboard. Note that the complete Vitoria-Gasteiz use case is larger than the example use case presented here and that this ontology is just an excerpt from the complete one.

There are some free verbs such as 'copy' or 'extrude' that do not appear in the ontology. They are translated to actions in our domain-specific language directly.

The recipes that make up our example DSL are summarized below. They are based on the ontology and the guidelines described in sections 4 and 5 dealing with usability and granularity. Note again that in this paper we can just present a part of the complete Vitoria-Gasteiz use case, and the recipes presented below are just the ones needed to perform this specific workflow.

Conditions

Is in layer

This recipe is for filtering layers. You can specify a layer here and only objects inside this layer will be selected. In this scenario there are two layers, one for the terrain (DTM) and one for the footprints. We use this recipe to select only footprints.

Does not exist in

You can specify a layer and this filter skips all objects which are already part of this layer. With this recipe we can avoid extruding already processed footprints again.

Actions

Copy

This recipe creates a copy of all selected objects, so original ones will not be affected by any of the following action recipes. The copies will be selected while the original objects will be unselected. The Copy recipe is a simple way to back up the original data, in this case the original footprints.

Put on DTM

With this recipe you can lift or lower objects to the height of a digital terrain model. It requires no parameters, because it takes the terrain model below or above the object.

Extrude

This recipe extrudes a 2D footprint polygon with two parameters: the amount of floors obtained from the footprints metadata—i.e. the attribute 'NumberOfFloors'—and the height for a single floor. For example, a footprint with 3 floors and 2.5 meters per floor would be extruded to a height of 7.5 meters.

Move into layer

This recipe moves all selected objects to a specified layer. This recipe is very useful in combination with the copy recipe in this scenario (see rule #1 below).

7.1 Rules

The rules that need to be created for this workflow are as follows (in the order of execution; each rule's condition and action are separated by an arrow '→'):

7.1.1 Rule #1

Is in layer → Copy; Move into layer

The 2D footprints selected with the condition recipe 'Is in layer' are copied and moved into a new layer. After executing this rule there are three layers: the original footprints, the copied footprints and the DTM.

7.1.2 Rule #2

Is in layer → Put on DTM; Extrude

This rule takes the footprints from the copied layer, lifts them to the height of the DTM at the respective geospatial location and then extrudes them as described above.

These rules can be executed to initially create a city model. Later, new footprints can be added. The following additional rule can then be executed repeatedly to keep the city model up-to-date. It affects the dataset similar to the second rule but ignores already extruded footprints.

7.1.3 Rule #3

Is in layer; Does not exist in → Put on DTM; Extrude

The recipe 'Is in layer' selects the original layer of footprints. The 'Does not exist in' filter avoids multiple objects in the layer of already extruded footprints (i.e. the city model). Therefore no 3D building will exist multiple times in the final layer. The actions are exactly the same as in rule #2.

8 INTEGRATION INTO A 3D GIS

The CityServer3D[1] is a client-server system for the storage, visualisation, and processing of spatial data. Geo information from different sources is integrated into an object-relational database and placed in the web at the disposal of different clients. The CityServer3D is most often used for managing 3D city models in the urban management and planning domain.

The CityServer3D AdminTool is a desktop application providing features, such as importing and exporting spatial data into the local workspace or into the CityServer3D database. The tool also offers features for data editing, 3D visualization and quality assurance.

The user interface of the AdminTool can be customized with different views, depending on the customer's requirements. The most used and most important views are the explorer view for an hierarchic overview of the loaded spatial data, the 3D view for visualization and the 2D view for orientation (see figure 5 from left to right). In addition there are pre-built perspectives representing the various views in different alignments.

We integrated the graphical editor in the so-called 'project perspective' (see figure 6). This perspective allows users to create several projects to integrate data sources and to apply automated, geospatial processes to them.

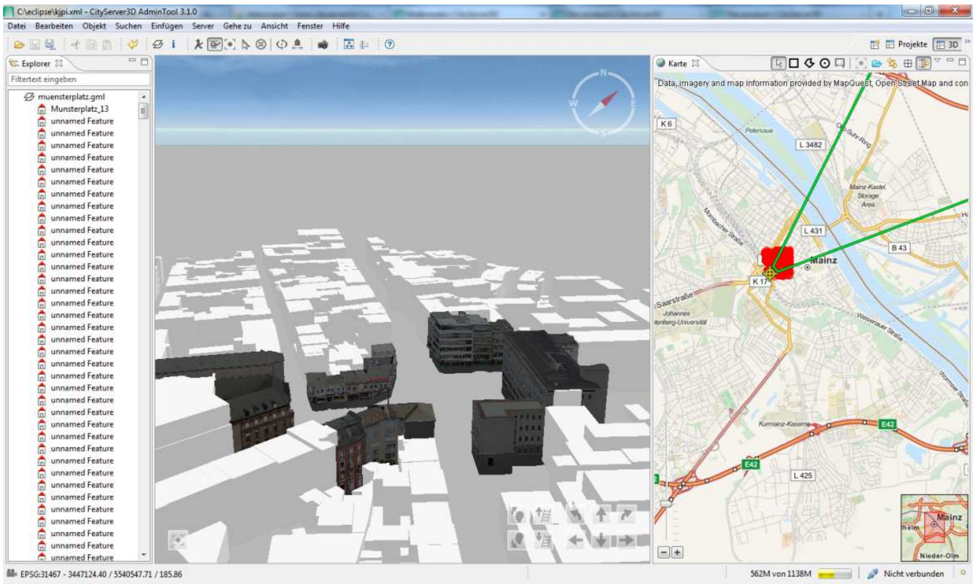

Fig. 5: The CityServer3D AdminTool consists of a data explorer, a 3D visualization and a 2D map (from left to right).

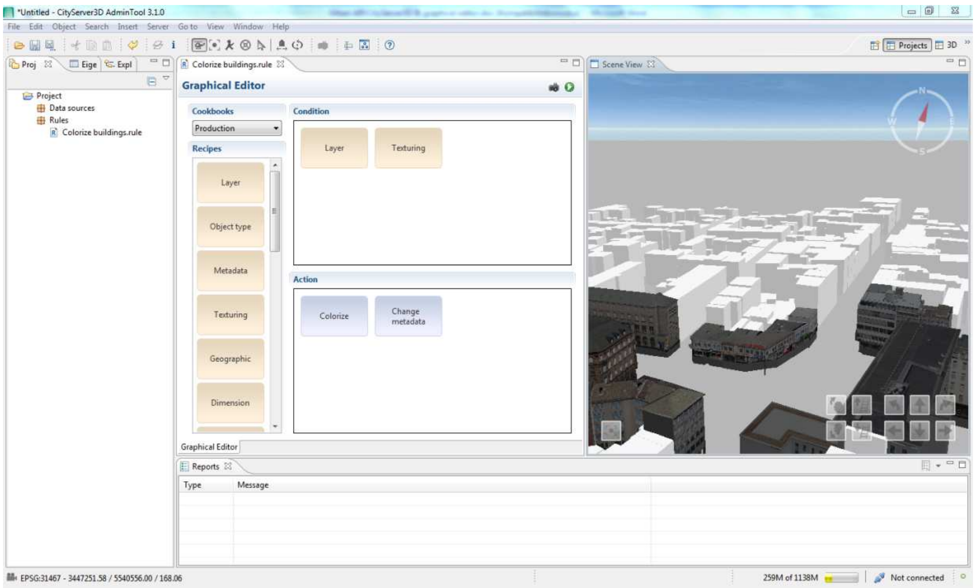

Fig. 6: The CityServer3D AdminTool's project perspective

[1] http://www.cityserver3d.de

The report view (on the bottom of figure 6) is used for feedback while executing a rule. If an object could not be changed or filtered by the rule for any reason, a report will appear in this view with a feedback message and a link to the said object.

The project view (on the left of figure 6) offers the possibility to link specific data sources and grant an overview of all created rules.

The graphical editor itself is subdivided in three parts (see figure 7). The tool bar on the left side contains all recipes available in the selected cookbook. The brown recipes are conditions. They filter objects by different criteria—e.g. appearance, location, size or metadata. The other recipes are actions and differ by their function. Blue recipes are for editing, green ones are for creating and red ones are for deleting data. The action recipes are placed on the lower right side of the editor.

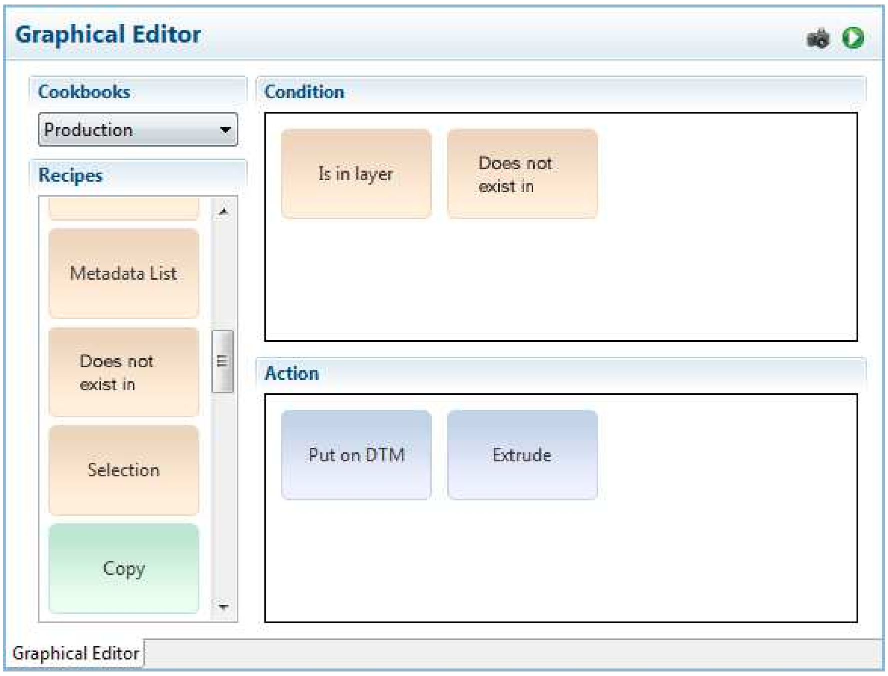

Fig. 7: The user interface of the graphical rule editor

9 EVALUATION

In order to evaluate the usefulness of our implementation a workshop with urban planners from the user community of the urbanAPI project was held. We presented the graphical rule editor and asked participants to design their own workflows with it. We then provided a questionnaire where we asked them to evaluate the rule editor.

From a technical perspective, the evaluation shows that our implementation helps users automate processes and that it is relatively easy to use. They understood its functionalities and purpose and were able to use it to design selected workflows. However, at the current state the editor only provides a small set of recipes that are targeted to use cases in urbanAPI specifically. Due to that, the editor is not yet flexible enough to be used in more advanced scenarios. Consequently, one of the next steps will be to implement more recipes that target a wider range of geospatial/urban use cases.

Additionally, users pointed out that there has to be some introductory material for the rule editor in order to make it easier for new users to understand its concepts and functionality. In the future we will create tutorials that will guide the user through a simple example in order to make them familiar with the rule editor. Finally, the usability of the individual recipes can be further improved by implementing additional features such as greater/less comparison for metadata, selection of extents out of a 2D map, etc.

10 CONCLUSION

In this paper we presented the results of integrating a graphical editor for domain-specific languages into a 3D GIS. We described language elements and how we categorized them into recipes and cookbooks. Recipes are language constructs that can be used in various applications. In order to achieve good usability, we grouped these recipes into cookbooks which actually represent the vocabulary tailored to specific application domains or use cases.

In order to allow the user to specify complex workflows we used production rules that can be chained. Geospatial processing can be rather complex and time consuming, especially if the same process has to be performed over and over again. We think that production rules can help alleviate this problem. However, typically rule-based systems are quite generic and very flexible. This makes them hard to use for domain experts with no background in computer science. We expect domain-specific languages to help domain experts to express geospatial processes in their own words. This makes specifying workflows easier, especially when the language constructs are grouped into recognizable, reusable elements like the recipes we proposed. In this paper we also presented guidelines for choosing the right granularity while designing new recipes. In our experience, these guidelines lead to recipes that are reusable in a wide range of applications and at the same time very understandable for domain experts. We also described a workflow for domain-specific language design that makes use of storyboards and ontologies to identify the right domain vocabulary.

In order to show how our approach works, we presented the implemented user interface and how we applied our approach to a practical scenario. Feedback gained from urbanAPI community was positive and we will continue to develop this approach in the future.

11 ACKNOWLEDGEMENTS

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reviewed paper

Building Smart Applications for Smart Cities – IGIS-based Architectural Framework

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1 ABSTRACT

To solve different kinds of complicated problems which arise in context of intensive development of modern cities a great number of various applications are constantly being developed. The most part of these applications are based on processing big volumes of heterogeneous data gathered from different types of available sources in real time. In the report an architectural framework oriented on building applications for smart cities in shortest time and with minimum spent of resources is suggested. The framework is based on intelligent geo information technologies and includes architectural and technological solutions along with many different computational libraries for building intelligent adaptive applications. Special attention is paid to information and knowledge organization. Different aspects of use of ontologies in the framework is discussed. Main directions of further development of proposed approach are defined.

2 INTRODUCTION

Software applications build for needs of cities have almost always been one of the main consumers of new solutions developed in the sphere of information technologies (IT). Moreover they often define direction for development of technologies and force the IT to onrush continuously to meet constantly increasing requirements.

Unfortunately, the current state of IT as a whole is much more poor than it was several years ago. Following negative tendencies are observed in the IT sphere nowadays.

(1) The sphere of IT gradually loses the status of the sphere in which business is ready to make essential long-term investments without taking into account short term expenses. Today for the majority of enterprises the IT is one of many services which should be estimated in the terms of ROI and moreover, a number of investors want to return earlier invested funds.

(2) Complexity of the developed information systems is permanently increases. One can say that the Moore's law can be applied to information systems.

(3) The level of qualification of IT specialists is gradually decreasing. During last years popularity of technical education significantly decreased. That leds to reduction of the number of highly qualified specialists. IT companies mostly prefer to employ rather cheap foreign programmers.

Along with negative tendencies there are several positive trends caused by two main factors. The first factor is that during the period of information technologies active development many architectural and technological solutions were proposed, implemented and approved. The second factor is that high performance tools, including tools that use artificial intelligence technologies, were build and they have become an essential part of the advanced information systems. The bright example of such systems is intelligent geoinformation systems (IGIS) [1]. Means and tools integrated in IGIS include inference engines, expert systems, libraries of various intelligent algorithms, instruments for data, information and knowledge management.

As a response to this situation industrial approach to software application development and support has been worked out. The main features of the developed approach are following.

(1) Wide use of best practices that are represented in the form of the frameworks.

(2) Use knowledge-oriented technologies for software development.

(3) Assembling information systems using large-scale program modules.

(4) Use various agile decisions and practices [2]. Agile decisions are decisions that can be easy adapted to the specific conditions (contexts). Agility can be presented in different forms, in particular:

(4a) agile software development – the process of software development that allows working with constantly changing requirements;

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(4b) agile architecture – architecture of software that allows develop architecture of systems oriented on solving specific problems of the subject domains;

(4c) agile algorithms – algorithms that are context sensitive and self adjustable.

Nowadays the industrial approach is already successfully applied for building applications in different subject domains [3]. It has become quite obvious that technologies for constructing, developing and supporting agile applications will be further developed. So it is time for specialists in information and communication technologies for smart cities to look towards the industrial approach for building applications and to adapt the proposed solutions to their needs.

Information and communication technologies in modern smart cities are of primary importance as they form the backbone for all integration processes that take place inside and between such spheres as social, economic, industrial, environmental and etc.

The following consequences of integration processes influence directly on requirements imposed to IT solutions:

(1) many software applications were integrated using various technologies and formed a net of interconnected applications that are poorly managed and supported;

(2) in the integrated domains dynamics and complexity of both internal and external processes exponentially increases, furthermore processes as a rule can not be formalized and are unpredictable;

(3) established interbranch relations provide possibility to solve multidisciplinary problems that are much more complicated; besides, experts in one subject domain are forced to solve specialized tasks from the subject domains that are not in the area of their competence.

To meet the requirements of software applications for smart cities, that are capable to support integration processes, IT solutions for smart applications must be developed according to the principles defined below.

(1) Smart applications must be knowledge-centric applications in order to provide possibility for a user to work effectively with them.

(2) Construction of applications must be oriented on integration of technologies.

(3) It is necessary to use a unified high level base platform that can be adapted to concrete subject domain. Using base platform for building applications provides a unified information space, mechanisms of platform adaptation will allow to develop applications in conditions of limited resources.

Taking into account the current state of IT sphere and smart cities, the developed framework must be a knowledge-centric agile framework. Also an unified approach for creation and support domain-oriented applications using the framework and the base platform must be worked out.

In the paper the knowledge based domain-oriented architectural framework for smart cities applications is proposed. In the following section existing frameworks and possibilities of their application are discussed. In the fourth section an architectural approach for constructing domain-oriented applications with the help of the developed framework and the base platform is considered. In the fifths section questions of knowledge management and usage in the framework and the end applications are discussed. Implementation of the framework is described in the last section.

3 ARCHITECTURAL FRAMEWORKS – COMMON SOLUTIONS

In terms of an architectural framework an approach to development software applications is considered [4]. Architectural frameworks are used, first of all, for creation architectural descriptions of end software products, families and lines of products and for developing architectural modeling tools both for one or for groups of organizations. The architectural description is an artifact or set of artifacts that describe the architecture of the developed application. An architecture is an abstraction, that includes concepts and properties of an application.

By today many architectural frameworks have been developed. The most well known and widely applied are the following frameworks: Zachman Information Systems Architecture Framework [5], UK Ministry of Defense Architecture Framework [6], The Open Group's Architecture Framework (TOGAF) [7], Kruchten's "4+1" view model [8], Siemens' 4 views method [9], Reference Model for Open Distributed Processing (RM-ODP) [10] and Generalized Enterprise Reference Architecture (GERA) [11].

The term architectural framework is closely connected with such terms as platform, paradigm and pattern. A paradigm describes the concept, basic states and terms used for developing applications. A platform is an implementation of the framework that provides building blocks for end applications and tools for applications development. Following types of platforms are usually considered: technological, integration and domain-oriented platforms [3]. Domain-oriented platforms are platforms aimed for creating applications for one or several related subject domains or for solving a certain group of tasks. Patterns are complete fragments of program code that can be used many times without modifications and improvements.

Along with typical frameworks listed above a wide range of specialized platforms have been developed. From the point of view of problems that are solved in modern cities it is interesting to consider two of them. The first framework is an intelligent geo information (IGIS) framework described in [1]. This framework provides scientific and technological solutions for a wide range of highly demanded tasks such as monitoring and decision making support at the levels of objects and situations as well as tools and means of artificial intelligence. Along with that IGIS framework allows to organize a convenient workspace for end users. The second essential framework is a framework for data processing and analyses (DPA) [12]. This framework allows processing various types of data including complicated time series of measurements. Results of measurements are continuously gathered using different kinds of specialized instruments that are by now installed almost everywhere both in urban and environmental areas. For the IGIS and the DPA frameworks corresponding platforms have been build. Below a brief description of each platform is given.

IGIS platform. The IGIS platform incorporates the following list of basic components: an inference machine and expert system, a knowledge base system (ontology), visual environment for developing classes and objects of subject domain, visual environment for developing models (script) of the objects behavior in GIS, system for scenario implementation in real time or/and user-defined arbitrary scale with visual display of symbols or images on the background of electronic maps, a decision making support system that provides recommendations during the scenarios playing.

In the IGIS platform an expert system and ontologies are considered as a system of artificial intelligence. Expert systems are used for solving two main tasks: assisting a decision-makers and managing various processes working under control of a scenario. A scenario is the selfsame algorithm with a capacity for parallel execution of some of its branches, it has ontological representation and can be interpreted by inference machine.

DPA platform. The DPA platform contains following basic components: an ontology of measurements and ontology of methods and means of data processing and analysis, means and tools for knowledge extraction from historical data, means and tools for working with business processes, mathematical and empirical methods and algorithms for processing and analysis of large volumes of data, methods and algorithms of preliminary data processing, algorithms of prospecting data analysis, a set of visual tools that can be used for graphical representation and modification of initial data streams, as well as time series and single measurements and the results of their processing.

Special attention in the DPA platform is paid to two moments. The first moment is development of agile algorithms for multidimensional measurements processing received from natural and technical objects in real time and in the delayed mode. The second moment is wide usage of implemented intelligent data processing and analysis technologies, based on both original and commonly used algorithms and patterns.

The IGIS and DPA frameworks are considered to be the core elements of the framework for building applications for smart cities. The specialized frameworks developed for applied domains, for example for the industrial domain [3], can be considered as extensions and included into the described framework for smart cities.

4 DOMAIN-ORIENTED ARCHITECTURAL FRAMEWORK FOR SMART CITIES

The proposed architectural approach is focused on development of a framework for the domain of management and planning of modern cities economy oriented on solving applied problems in various spheres that are a part of cities economy. The framework is described according to the international standard ISO/IEC/IEEE 42010:2011 [13].

The framework is developed using the following basic solutions for constructing software applications (SA) for smart cities:

(1) for constructing architecture of the SA for smart cities Model-Driven Engineering (MDE) methodology [14], based on hierarchy (stack) of architectural models is used. Models are containers for architectural descriptions. The stack contains models of four different levels of architectural descriptions;

(2) SA for smart cities must be implemented according to their architectural description using base program platform that contains program components, modules, common means and tools;

(3) in the process of SA construction available architectural knowledge, including knowledge about best practices is to be obligatory used;

(4) constructing SA includes development of the knowledge base required for solving end user problems and for supporting applications.

To make the first two moments of the listed solutions realizable it is necessary to develop a base program platform and a stack of architectural models, adapted for subject domain of cities economy. The architectural models are build according to the object oriented (OO) models. Thus, it is supposed, that before each system is constructed, an OO model for the application according to [16] is created.

The two last points make the developed applications and the processes of their constructing knowledge oriented. For dealing with knowledge a system of ontologies and solutions for their transformation were developed. The description of the proposed system of ontologies is presented in the corresponding section.

The framework allows to create architectural descriptions for the end applications on the base of their object-oriented descriptions, that can be implemented using the base program platform. The relations between the framework, the object oriented model of an application, the architectural model and the base platform are shown in Fig. 1.

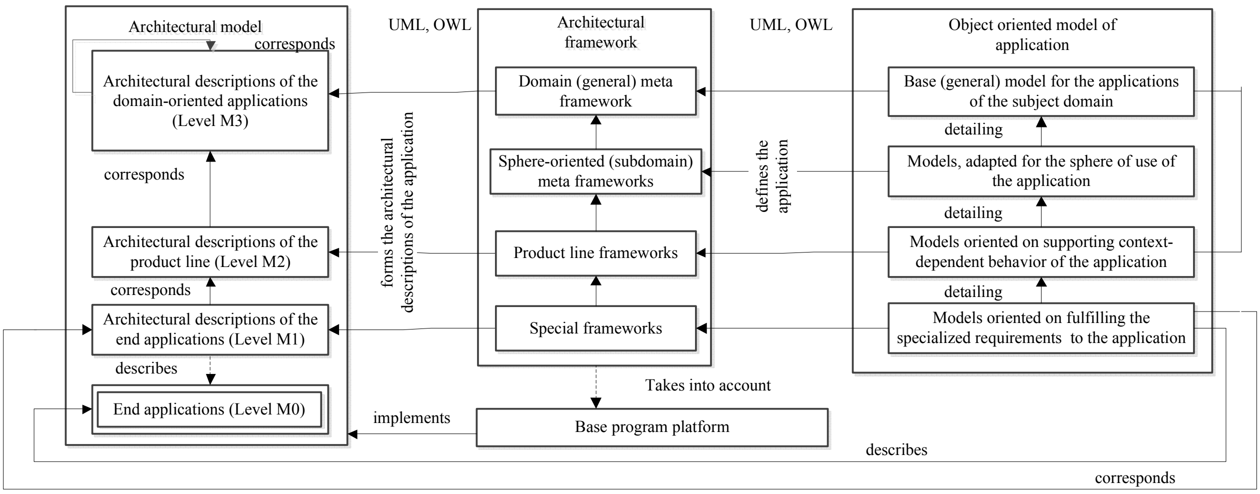

Fig. 1: Main elements used for constructing applications with the help of the domain-oriented architectural framework

Object-oriented model of an application. An object oriented model of an application includes the description of the subject domain, where the application is going to be applied, the tasks that are supposed to be solved and the requirements to the application. The model contains descriptions at different levels of abstraction. The description, that corresponds to the lowest level, is the description of the end application. The description of the highest level is the general description of all applications for the defined subject domain or subdomain. At the middle levels peculiar features of the application that are defined by the possible spheres and contexts of its usage are described.

Architectural model. The stack of the architectural models that are described in a general form in the MDE methodology are adapted for constructing software applications for smart cities. The lowest level of the models hierarchy (level M0) corresponds to the architectural descriptions of the constructed applications. The descriptions reflect requirements imposed to the applications taking into account the groups of users and their specific needs. The level M1 is the level at which descriptions of the applications architecture are defined according to different contexts in which the applications are supposed to be applied. At the level M2 descriptions of the applications adapted for a certain group of tasks or one of the spheres of the subject domain, where the application will be used are constructed. The level M3 is the level, at which the general descriptions of the applications for the subject domain of cities economy or its subdomains are provided.

All models used, at levels M1, M2 and M3, are abstract models. The result architectural description that is created using the proposed hierarchy of models contains a complete architectural description of the developed application including the description of the stakeholders and their concerns, all architectural viewpoints, types of models for each of the viewpoints and architectural rationales [13]. The model types define the language and main notions such as modeling techniques that are to be used for describing view points.

For the stack of the architectural models operations for models transformation based on the developed technique are provided [14]. Application of transformation operations allows to create a new model on the base of one or several existing models. A transformed model and a result model can belong to the same or to different levels. In the first case horizontal transformations are executed and in the second – vertical transformations. Results of horizontal transformations are models of a higher level of abstraction than the transformed models.

Links between different models at one level can be established with the help of binding operations. Almost all elements of models including classes, objects and their properties as well as relations between them can be linked.

To support both transformation and binding operations corresponding set of transformation and binding models according to [14] were developed. The models are represented in a form of patterns and rules.

Architectural framework. The architectural framework is developed according to [13] and adapted to current needs of modern cities. The framework is organized as a hierarchy of frameworks that has the following structure. At the highest level a general domain-oriented framework (DF) is located. The DF is a problem-oriented meta framework that does not apply any restrictions on the architectural solutions of the developed software applications. The domain framework is used for building sphere-oriented meta frameworks (SF) that are aimed to solve problems of one or several related subdomains. The SF form the base for special frameworks. Two types of special frameworks are used – the frameworks for constructing lines of products (LF) and for constructing end software applications (F). The architecture of each end application can correspond only to one F-framework. LF-frameworks and F-frameworks can be build on the base of several SF-frameworks inheriting different concerns, viewpoints and etc. In case a product line is developed F-frameworks are always based on LF-frameworks. Each LF-framework can be used to build multiple F-frameworks, but one F-framework corresponds only to one FL-framework.

The distinguishing features of the DF-framework is that the constructed architectural descriptions allow building knowledge-centric software applications where the applied problems of cities economy are solved using data fusion technologies along with the commonly used technologies implemented in earlier developed applications for the considered subject domain. The data fusion technologies are based on JDL model [15]. Two implementation of JDL model are supported – implementation, oriented on extraction of information and knowledge from initial data that is gathered from measurement instruments or received from data centers developed for the DPA platform, and implementation oriented on solving complicated applied tasks including decision making support provided by the IGIS platform.

Main advantage of the proposed DF-framework is that on its base software applications that provide principally new quality of data processing, information and knowledge about cities economy on the base of existing solutions implemented in IGIS and DPA platforms can be easily constructed.

The subdomain meta frameworks provide means and tools for defining following elements of an architectural description:

- main types of stakeholders, including end-users, operators, acquirers, owners, developers, builders, maintainers and software architects;
- the system of typical interests, including serviceability, cost, maintainability, stability, analyzability, changeability, testability, dependability, modularity, distribution and concurrency;
- viewpoints, including general, algorithmic, capability, system viewpoints, data, information and knowledge viewpoint, object, services, project and standards viewpoints.

Between the enumerated elements main relations such as relations between interests and stakeholders, stakeholders and architectural viewpoints, types of models for each of the viewpoints are considered.

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The LF-frameworks are aimed for building a limited set of the architectural descriptions elements that are formed using the information about the supposed users of the produced software products.

At the level of F-frameworks architectural styles that are supposed to be used for constructing end applications are defined. The following common architectural styles and corresponding architectures are considered: object (component) oriented architectures [16], service-oriented architectures [17], multiagent architectures [18], combined (mixed) architectures. In addition service-agent-service (SAS) architecture was developed that refers to combined architectures. The SAS architecture fits best in most cases for building end applications for smart cities.

Base program platform. The base program platform is a software application, that is used for implementation of the developed architectural descriptions. The platform provides core elements, that are required for building end applications and a wide range of various mathematical libraries, as well as extended means and tools of artificial intelligence inherited from IGIS and DPA platforms and from other integrated platforms.

5 A SYSTEM OF ONTOLOGIES FOR THE ARCHITECTURAL FRAMEWORK FOR SMART CITIES

Ontologies in the SA developed for smart cities are widely used at all stages of the applications life cycle: at stages of SA construction, development, functioning and support. At the stage of application construction experience acquired during the previous developments is actively used. Experience is represented in the form of knowledge using standard formats, in particular, the OWL format [19].

Knowledge-based descriptions of the developed SA supplement the architectural descriptions, build according to the MDE methodology. Thus, the result architectural descriptions of the end applications are sets of descriptions in UML and OWL formats. The OWL descriptions provide information about the main tasks and the developed architectural solutions as well as the descriptions of possible ways of the application further development and modification. The UML descriptions contain detailed information about the solutions of the tasks, in particular the structures of the SA. It is important to note that the two considered descriptions can be transformed one to the other. The problems of the direct and indirect transformations of the descriptions have been worked at for a long time. As a result such means as Metadata Interchange (XMI), Ontology Definition Metamodel (ODM), UML Profile (OUP), that allow to create ontologies using UML descriptions, are available now [20].

The structure of the developed system of ontologies is defined by the hierarchy of the architectural models and frameworks discussed in the section 4. The ontologies provide descriptions of the applications life cycles at the domain level, at the subdomain level and at the level of applied tasks, that are used for describing architecture at the third, the second and the first levels of the architectural model correspondingly.

Along with the main task of building knowledge based architectural descriptions, one can use ontologies for solving following tasks:

(1) ontologies that describe the subject domain are used by analysts for defining problems of the SA construction;

(2) a data base structure can be created from the ontological descriptions of the subject domain;

(3) an architectural descriptions of the user interfaces can be created by converting the information that contains in the ontologies;

(4) in multiple cases architectural descriptions of the constructed applications or their separate components can be build by converting information from ontologies;

(5) using ontological descriptions a system of rules can be defined, that describes behavior of the objects of the subject domain and can be interpreted and executed using standard tools;

(6) ontologies are used as a dictionary that provides descriptions of the main definitions of the subject domain to all stakeholders.

When SA are constructed, a set of ontologies and ways of their usage at the stage of the applications functioning is defined. The ontologies are build partly at the stage of SA construction and partly at the stage of SA development.

At the stage of applications functioning ontologies are used for solving two main groups of problems. To the first group refer problems of data, information and knowledge transformation, to the second – problems of management of the transformation operations.

For SA support and modification special ontologies are developed, that are a kind of slices of ontologies, build at the stage of the SA construction. These ontologies contain limited amount of information that allows understand in short time the general architecture of the applications, estimate their current state and make well-founded decisions about the further changes of the applications structure and/or business logic.

At all stages of the SA lifecycles the following techniques for working with knowledge presented in the form of ontologies are used: i) acquiring knowledge from data (data mining); ii) acquiring knowledge from log files about executed business processes (process mining); iii) enlarging ontologies by adding new knowledge provided by experts; iv) performing logical deduction; v) transformation of knowledge presented in the form of ontologies (aligning, merging, building profiles); vi) representation of knowledge in the form of production rules; vii) building UML and ER descriptions from ontologies.

In the architectural framework the process of building systems of ontologies for end applications is organized on the base of the developed ontological model. The levels of the model and the artifacts of the levels are shown in Table 1.

Level of the ontological model	**Main artifacts of the level**
Domain / subdomain level	Domain / subdomain ontologies
Level of product line	Ontologies that contain information about the solved tasks
Level of the end applications	Ontologies required for the applications functioning, support and modification

Table 1: Artifacts of the ontological model at different levels of application construction.

An ontological model has three levels, that correspond to the SA construction at the domain / subdomain levels, at the level of products line and at the level of end applications. At the third level ontologies for the subject domain or its subdomains are developed. Ontologies for product lines are domain ontologies that additionally contain information about the problems, that are supposed to be solved using developed applications. The main goal of the first level is to build ontologies that are to be used during the stage of the SA functioning as well for the needs of SA support and modification.

Ontologies of the domain and subdomain levels are commonly developed by the experts of the corresponding subject domains. In the processes of the ontologies development in most cases analysts and knowledge engineers are involved as well. Ontologies for product lines and ontologies, used for the software application support and modification, are build by analysts and IT specialists on the base of domain ontologies.

The list of ontologies, applied at the stage of the SA functioning, includes ontologies for solving both specialized and common tasks. Ontologies, oriented on solving specialized tasks, are build by experts The ontologies for solving common tasks are constructed on the base of the higher level ontologies, that are provided by the corresponding domains. For example, for the domain of data processing and analyses a set of developed ontologies contains general formalized descriptions of data of different types and results of its processing, of available algorithms, methods, means and tools for data processing and rules for their application, of the processes that can be used for solving various problems, of the program modules that can be included in the applications, possible providers of the modules and etc.

6 IMPLEMENTATION OF THE ARCHITECTURAL FRAMEWORK FOR SMART CITIES

Proposed solutions for implementing end SA using the architectural framework are agile solutions [2], that are developed within the industrial approach. The solutions are based on the following main principles:

(1) multiple use of knowledge is preferable in comparison with multiple use of program code;

(2) the developed applications have to be based on the integrated set of the existing ready to use technological solutions. Much less desirable but still admissible is to integrate existing solutions at the level of program components and modules. New modules are developed only if there are no other alternatives;

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(3) the implementation of the new program modules must be organized from the point of view of possible subsequent use of the modules. The resources spent on the modules that can be multiply used are significantly more justified than the resources spent on the development of the unreusable modules;

(4) solutions for application implementation have to provide opportunities to modify developed applications structures and business logic on the fly by both IT specialist and applications themselves. For this the description of the applications must be represented using standard interpretable formats. For describing applications in most cases ontologies are used, as, on one hand, they can be considered as means of standardization, and, on the other hand, as means capable to deal with knowledge.

Implementation of SA based on the agile solutions that are supported by the architectural framework are based on the following notions: A - system (agile system), A - process (agile process) and A- application (agile application). A – system is a set of integrated A - applications. A - process is the knowledge-based process of constructing A - applications. A - application is a self-adjustable application that contains a knowledge base and means of artificial intelligence. Two types of A-applications are allocated: static and dynamic A-applications. Both static and dynamic A-applications are constructed using A-processes. Main difference between these types of applications is that static applications don't use ontologies at the stage of their functioning meanwhile in the dynamic applications ontologies are often considered as a core element. Agile applications have a hierarchical structure. At their top level two subsystems are located, that are represented in the form of containers for modules. The first container (B - container) provides implementation of business functions which define functionality of the applications. The second container (A - container) implements functions of management and control of the B - container architecture. A and B containers in separate cases can be considered as modules.

Five types of modules are used in A – applications: A-modules, B-modules, AB-modules, R-modules and V-modules. A-modules are modules with the dynamic architecture that support A-interfaces which provide access to the functions that assure module agility. These modules are executed under control of the A-container. B-modules support B-interfaces and define system functionality. These modules have static architecture and are managed by a B-container. B-modules are able to provide information about their state. AB - modules support both types of the interfaces and interact with the A and the B containers. This type of modules is used most frequently in the applications. R-modules are aimed for working with various types of repositories were initial data as well as meta data is stored. The V-modules contain the implementation of visualization functions and support interaction of an application with an end user.

The considered agile solutions don't impose any restrictions on implementation of interfaces, or on implementation of the containers. Interfaces are described in terms of applied technologies. The containers implement functions of modules integration, their management and control during their life cycle, and, respectively, the containers have to support the chosen technologies.

The concrete technologies for each end SA are selected within F-framework used for constructing end applications.

Usage of the object-oriented approach [17] for building applications supposes that B-containers are business objects (B-objects) described using the high level language or represented in the form of components (.net, CORBA, EJB). A-containers are sets of A-objects that are responsible for managing B-objects and gathering data about the applications functioning. Data processing and analyses is organized in a special subsystem of an A-container or a separate external subsystem.

Service-oriented approach (SOA) [18] can be used for implementation both static and dynamic architectures. Implementation of static SOA implies that a set of service modules (S-modules), which include business services corresponding to B-objects, and agile services corresponding to A-objects are developed. For implementation of SA, business logic on the base of dynamic SOA services can be organized with the help of semantic web services.

Usage of agent technologies in end applications assumes that A-subsystem is a set of agents, that includes personal assistances, business agents, agent managers, agents for agility support, agents for access to metadata and data, agents for support of B2B interactions [19].

Implementation of the enumerated technologies is supported by the base program platform.

7 CONCLUSION

The paper aims to find an approach for building SA oriented on solving different problems in various spheres of modern cities economy. The approach must be able to deal with challenges of modern smart cities in conditions of the quite poor state of information technologies.

In the paper the architectural framework for building SA for smart cities is proposed. Distinguishing features of the framework can be summarized in the following points:

a) the framework is knowledge-based. It means that knowledge is used at all stages of the SA lifecycle (construction, functioning, support and modification);

b) the framework allows to construct SA by means of integration of existing solutions at technological level and at the level of program modules;

c) solutions provided by the framework are agile:

- architectural description of a SA is built on the base of object oriented descriptions;
- architectural descriptions built with the help of the framework can be implemented using the base program platform;

d) the framework is developed according to the actual architectural and technological standards.

The proposed architectural framework described within the paper was developed as a generalization of the developed architectural, technological and program solutions, that were implemented as product lines and separate products and have been successfully used for a number of years already. The following software products defined the structure of the framework and its functions:

- the Ontomap series developed in the Research laboratory of object-oriented geo-information systems of St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences. The Ontomaps are used in Russian Navy for more than five years as the information base of Navy control systems. They are operated in Russian Navy fleet command centers, naval bases and combat information center of Coast Surveillance System;

- the series of software applications for telemetric information processing from space rockets developed in the Research Center of Saint-Petersburg Electrotechnical University. The total number of developed application is more than fifty. The applications are widely used for processing and analyses of initial data, calculation of flight, ballistic and navigation characteristics;
- a set of separate applications oriented on processing environmental parameters. For example, the Decision Making Support System for Arctic Exploration, Monitoring and Governance [21] was developed. The main goal of the system is to synthesize ocean/ice/atmosphere observations and model-based products for the purpose of fast access to the available information on the Arctic environment.

Future work needs to be carried out in the direction of further adaptation of the framework for the domain of cities economy. Adaptation assumes building ontologies on the base of available knowledge provided by existing software products and integration into the framework the earlier developed specialized solutions represented in the form of technologies, program components or modules. It is also reasonable to analyze the possibilities of adaptation and usage of new technologies developed for the spheres not related to the cities economy for processing, analyzes and management of data, information and knowledge of modern smart cities.

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Challenges and Opportunities to Develop a Smart City: A Case Study of Gold Coast, Australia

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1 ABSTRACT

With the rapid growth of information and communication technologies, there is a growing interest in developing smart cities with a focus on the knowledge economy, use of sensors and mobile technologies to plan and manage cities. The proponents argue that these emerging technologies have potential application in efficiently managing the environment and infrastructure, promoting economic development and actively engaging the public, thus contributing to building safe, healthy, sustainable and resilient cities. However, are there other important elements in addition to technologies which can contribute to the creation of smart cities? What are some of the challenges and opportunities for developing a smart city?

This paper aims to answer these questions by developing a conceptual framework for smart cities. The framework is then applied to the city of Gold Coast to identify challenges and opportunities for developing the city into a 'smart city'. Gold Coast is a popular tourist city of about 600,000 populations in South East Queensland, Australia, at the southern end of the 240km long coastal conurbation that is centred by Brisbane. Recently, IBM has nominated Gold Coast as one of the three cities in Australia for its Smarter Cities Challenge Grant. The grant will provide the Gold Coast City Council with the opportunity to collaborate with a group of experts from IBM to develop strategies for enhancing its ICT arrangements for disaster response capabilities. Gold Coast, meanwhile, has potential to diversify its economy from being centred on tourism to a knowledge economy with focus on its educational institutions, investments in cultural precincts and high quality lifestyle amenities. These provide a unique opportunity for building Gold Coast as an important smart city in the region. As part of the research methodology, the paper will review relevant policies of the council. Finally, lessons will be drawn from the case study for other cities which seek to establish themselves as smart cities.

2 INTRODUCTION

With globalisation of cities, and move towards knowledge and information economy, a number of cities are now competing with one another to attract investments, knowledge workers and promoting themselves as smart and intelligent cities. Some of these cities are promoting themselves for attractive lifestyle (such as cultural and natural amenities), knowledge infrastructure (such as universities and businesses) and technologies (such as sensors, mobile technologies and Internet of things (IoT)). Larger cities such as Glasgow, Vienna, Edinburgh, Melbourne, Portland, and Seattle have been at the forefront of these trends (Deakin, 2014). However, now there are also a growing number of smaller cities such as Gold Coast which are showing interest in developing as smart cities. What are the challenges and opportunities for these small cities for developing them as smart cities? What are the competitive advantages they have in terms of manpower, amenities, governance, active private sector initiatives? Is this driven by technologies alone or more seen holistically in terms of people, resources as well as institutions? Is there a strong strategic focus on developing smart cities or are they part of opportunistic and ad-hoc approach to smart city development? These are some of the questions the paper aims to address.

The key objective of the paper is to identify the challenges and opportunities to develop a smart city using a case study of Gold Coast. Based on the review of literature on smart cities and local case study, the paper will develop a conceptual framework for developing smart cities. The paper is primarily an exploratory paper based on review of theoretical literature and policy documents of local government in Gold Coast.

3 TOWARDS A CONCEPTUAL FRAMEWORK FOR SMART CITIES

There has been extensive growth of literature on smart cities in the last two decades (Deakin, 2014; Townsend, 2013; Hollands, 2008; Castells, 1996: Mitchell, 1999; Florida, 2002; Florida, 2004; Graham and Marvin, 2001; Bajracharya and Allison, 2008). Hollands (2008) highlighted the importance of people and human capital rather than just application of information and communications technology (ICT) in improving and transforming cities. Although smart cities are 'wired cities', the use of ICT by itself does not make cities smart. While the focus of smart cities in the past has been related to meeting corporate marketing needs, there is a need for the transition to utilising social intelligence for cities by grounding community led information and communication for cultural and environmental development (Deakin, 2014). Along with focus on technologies, there have been recent works by Landry (2008) and Florida (2002, 2004) who argued for a need to develop knowledge regions and creative cities. Deakin and Allwinkle (2007) summarised the evolution of smart cities from focus on static and limited information via city websites in the 1990s to dynamic and interactive services allowing service transactions to develop platforms for online citizen engagement in 2004/5. Since then, smart cities have focused on the development of digitally inclusive advanced visualisation and simulation. These developments illustrate an evolution from informational to intelligent to now smart city (Deakin, 2014). In recent years, there have been several technologies integrated into smart cities such as cloud computing, mobile devices, radio-frequency identification (RFID) and drones. There is now also a move towards data services being made more openly accessible, democratic and service-oriented around the needs of the local community.

There are a number of useful conceptual frameworks for developing smart cities. For example, Nam and Pardo (2011) identified three key dimensions of smart cities which include technology, people and institutions. They also argued for the need for integration of infrastructures and technology-mediated services, social learning for building human capital and governance for public participation and institutional capacity building. A pan-European research project IntelCities (Paskaleva, 2014) found that governance in terms of collaborative decision-making and action can play an important role in building a smart city and highlighted the importance of boosting local competitiveness by using knowledge networks and integrated e-services and governance. The current thinking is moving away from just a technological approach towards smart cities that utilise a more holistic concept of capitalising on social, cultural and environmental capital as well as higher education, creative talent and the knowledge workforce. Furthermore, local quality of life and local amenities for urban attractiveness and development have been proposed as smart city components (Rappaport, 2009).

Another useful concept comes from IBM's Smarter Planet, an initiative which proposes the use of smart meters, networks and data modelling for making city systems interconnected, instrumented and intelligent, thereby making them more efficient and effective (IBM, undated). It suggests the need for different parts of a city's system to be interconnected and able to communicate to one another. Likewise, it suggests the need for instrumentation of a city's system to be measurable with instruments and meters. Lastly, it suggests the need for intelligence to use the data gathered to automate many related services as well as develop predictive models of likely outcomes for better decision-making in the future. IBM is working with a number of local councils in different parts of the world, including three cities in Australia (Gold Coast, Geralton and Townsville), through their Smarter Cities Challenge Grant, a philanthropic initiative. The areas they work on as part of the program include economic development, public safety, environment and public transport. IBM is pilot testing this concept and framework of instrumentation to reduce waste and develop energy efficiency. Like IBM, other multinational companies such as CISCO and Siemens are all developing projects for smart cities.

A number of cities have taken important steps towards developing smart city initiatives. For example, Amsterdam has emphasised collaboration between government, business and community to develop smart projects on energy savings. It uses instrumental intelligence through smart devices and wireless sensors for enabling citizens and organisations to optimise their practice (for activities such as energy consumption of appliances). It also initiated crowdsourcing, co-creation and open innovation to engage the community to develop solutions for public space and mobility. Southampton City Council has focussed on integrated e-services through the use of smart cards. Melbourne, on the other hand, has focused on developing knowledge precincts with advanced ICT infrastructure and business parks near universities as university-business-government partnerships (Yigitcanlar et. al 2008). Likewise, Hong Kong has developed Cyberport as an enterprize zone for nurturing local and global ICT start-ups and entrepreneurs. With more than 189 ICT incubatees in 2013, the development contains state-of-the-art ICT facilities, shopping mall and five star hotel as well as large residential complex and park with fibre optic and broadband connections (Hong Kong Cyberport Management Company Limited, 2014).

Smart cities have the prospect of being efficient, transparent, resilient, secure and sociable (Townsend, 2013). Townsend (2013) provided a number of suggestions regarding smart cities such as the need to connect and crowdsource everyone with care. Townsend also dealt with issues associated with data such as privacy, data access by poorer communities versus commercial operators, and public ownership. According to him, we need to consider social sustainability in planning for smart services and benefits of open data should also extend to the poorer communities. As part of earlier debates on the 'information age', Castells (1996) argued that there could be growing concerns about the struggle between networked global economies and social identities of the people. Likewise, Graham and Marvin (2001) point out that emerging ICTs and private ownership can contribute to digital divide and splintering of urbanism.

Based on the literature review above, five key themes emerged as important considerations for creating smart cities. These include:

(1) Cultural and Natural Amenities – local amenities that enhance quality of life

(2) Technology – implementation of ICTs for improvement of city systems and functions

(3) People and Skills – attraction and retention of and support for knowledge workforce and businesses

(4) Knowledge and Innovation Precincts – facilities for attracting and generating knowledge workforce

(5) Governance – arrangements and plans for creating smart cities

The five themes above, which are interrelated and not mutually exclusive, are summarised in Figure 1, along with potential factors applicable to each theme.

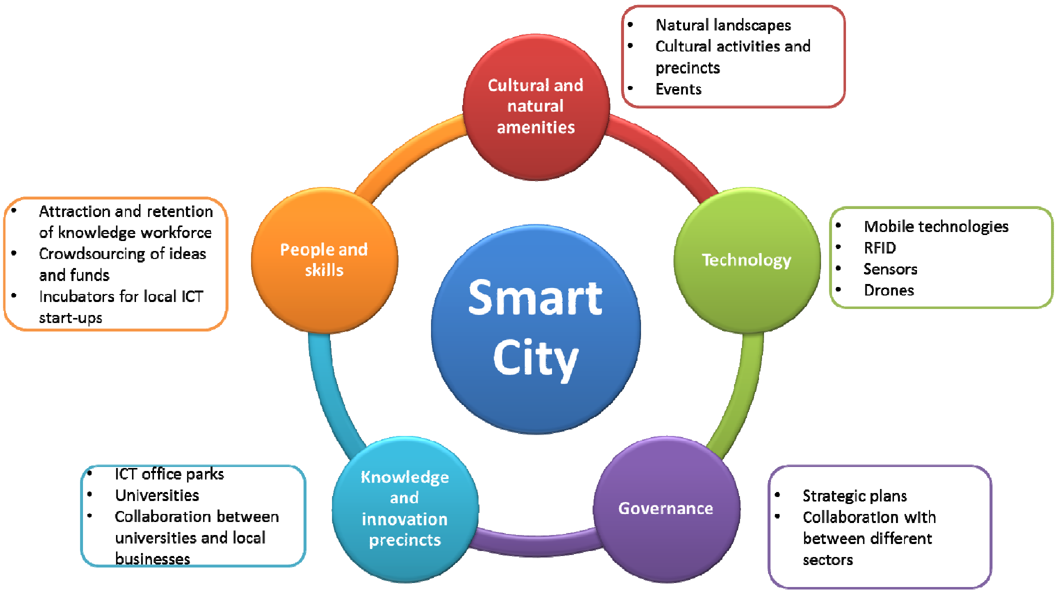

Fig. 1: Conceptual framework for smart cities

The paper now applies the framework to a case study of Gold Coast. Opportunities and challenges in developing the city as a smart city are presented based on the five themes articulated in the framework.

4 INTRODUCTION TO GOLD COAST

Located as part of the larger South East Queensland region with Brisbane and Sunshine Coast, Gold Coast is a coastal city with a population of about half a million. It is the sixth largest city in Australia with rapid growth of population in the past, which has slowed down slightly in recent years. The city's population is expected to grow to about three quarter of a million by 2026. Its economy is primarily based on tourism and construction. Gold Coast promotes itself as a city with natural beauty and relaxed lifestyle as well as an ideal location to live, work and play. While tourism has been an important attraction of Gold Coast, the city also has a foothold in industries such as education, sports, film, marine and IT. As part of its economic development, the Gold Coast City Council (GCCC) aims "to make its mark on the world stage, where knowledge, innovation and commercialisation are the key drivers for growth" (GCCC, 2014). It sees itself as a 'city of opportunity, on the cusp of a transformation change' with the forthcoming hosting of the Commonwealth Games in 2018. To this end, the GCCC has recently begun its journey to develop Gold Coast into a smart city. Figure 2 shows an aerial view of Broadbeach and Surfers Paradise, key activity centres of Gold Coast (Gold Coast Convention and Exhibition Centre, 2014).

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Fig. 2: Aerial view of Gold Coast

The paper now identifies key opportunities and challenges for developing Gold Coast into a smart city under the five identified themes of the smart city framework. The discussion below is based on critical understandings of the city's existing context as well as various policies of local and state governments.

5 CULTURAL AND NATURAL AMENITIES

The first theme is Cultural and Natural Amenities. It is associated with amenities, events and attractions which can enhance quality of life for local communities, thereby attracting knowledge and ICT workers.

5.1 Opportunities

5.1.1 Attractive Climate and Settings

Gold Coast has a subtropical climate with more than 80 kilometres of beaches on the eastern end and ecologically diverse national parks and hinterland on the western side. Gold Coast is home to several historically significant sites and World Heritage Listed rainforests, which are open to the public for visits. As a major tourist destination in Australia, Gold Coast also contains a range of entertainment facilities such as theme parks and wildlife sanctuaries. The city is also rich in sports and recreation facilities for activities such as go karting, skydiving, golf, surfing, ice skating and bowling.

5.1.2 Cultural Precinct and Facilities

The GCCC is facilitating the development of a Cultural Precinct in Surfers Paradise, the city's major tourist destination. The objective of the Cultural Precinct is to showcase local culture, arts and creativity of the Gold Coast community to the world. The project was initialised due to the recognition by the GCCC (2013d, p. 5) that the Commonwealth Games event in 2018, which will attract significant number of visitors to the city, is an opportunity for the city to culturally "shine on the world stage." In addition to the Cultural Precinct, expected to be completed by 2018, there are a number of existing art galleries and museums throughout Gold Coast, which have served as the city's attractions.

5.1.3 Variety of Events

Gold Coast is a city of events where events are organised on a weekly basis. In addition to smaller events which are free or low-cost, the city also holds a number of major events every month. These major events, regularly organised every year, encompass many themes and activities such as filming, sporting competitions, music festivals, animal expos, careers expos, and marathons. A key major event the city is set to host is the Commonwealth Games 2018, for which several programs have been put in place by the GCCC. These initiatives focus on better equipping the city additional transport and community infrastructure, including a light rail system, a Commonwealth Games residential village and additional sporting venues.

In addition to the wide range of events the city hosts, Gold Coast is also rich in event venues and spaces. Some of these venues include the Gold Coast Convention and Exhibition Centre, universities' and hotels' function centres, and sporting stadiums, which have hosted various events in addition to sporting matches.

5.2 Challenges

5.2.1 Public Safety during Events

Public safety during events, particularly major ones, has been a challenge for Gold Coast. One example of an event where public safety is a significant concern is Schoolies, an annual event spanning across three weeks during which more than 50,000 teenagers across Australia visit Gold Coast to celebrate their high school graduation. Schoolies on Gold Coast has been associated with activities such as illegal and excessive intake of alcohol and drugs as well as harmful behaviours (Lam et al., 2013).

5.2.2 Unaffordable Housing Market

According to the 10th Annual Demographia International Housing Affordability Survey, the housing market in Gold Coast is classified as "severely unaffordable" with a Median Multiple[1] figure of 7.7 (Bertaud, 2014, p. 2). Median weekly rent in Gold Coast, meanwhile, was $350 in 2012, requiring young parents to pay up to 80% of their income on rent (Knight, 2012). The lack of affordable housing is a major barrier for Gold Coast to attract knowledge workers.

6 TECHNOLOGY

The paper now considers the Technology theme, which is related to the implementation of several ICTs to improve the manner in which the city functions. Technologies can also play a vital role in attracting knowledge and ICT workers to a city.

6.1 Opportunities

6.1.1 Integration of Smart Technologies

More than 600 wireless sensors have been installed at Springbrook National Park, a 6725-hectare World Heritage-listed rainforest in Gold Coast. The sensors have been monitoring a range of environmental variables in order to track biodiversity restoration progress in the area. The award-winning monitoring system was developed through a joint initiative between Queensland Government, CSIRO and other government agencies (Queensland Government, 2013).

The GCCC established a Safety Camera Network in 1998 to ensure Gold Coast would have a safer environment for local communities and visitors. With 150 cameras operating in key activity centres, the cameras are continually monitored to ensure crime is detected and reported in a timely manner. In 2013, the council funded a trial of mobile cameras to further improve the city's public safety (Stolz, 2013). Moreover, Metricon and Cbus Super, two major sports stadiums in Gold Coast, may be incorporated with spy cameras in the near future. The cameras, which can automatically recognise banned sports audiences at the gate and promptly inform the security, are expected to improve public safety during events (Wilson & Rolfe, 2014).

Provision of better local parking management and infrastructure is one of the key actions in the Gold Coast City Transport Strategy 2031. The council is currently investigating models for integrating ICTs such as wireless sensors into the parking infrastructure throughout Gold Coast. It is expected that data generated from the integrated technologies will be made available to the public. By doing so, the council intends to encourage smartphone apps to be created by local communities for local communities (Tozer, 2014).

6.1.2 IBM's Smarter City Challenge Grant

In 2013, Gold Coast was awarded with IBM's Smarter City Challenge Grant. As part of the grant's arrangement, six experts from IBM cooperated with the GCCC for three weeks. The collaboration is expected to lead to recommendations for improving the city's public safety as well as disaster response capabilities through smarter use of technologies. As the third city in Australia to receive a Smarter Cities Challenge grant, the award is a key opportunity to improve the city's ICT arrangements for public safety.

[1] Median Multiple is the ratio between median house price and gross annual median household income (Bertaud, 2014).

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6.2 Challenges

6.2.1 Funding

With a current annual budget of AU$1.1 billion, the majority of the council funds (79.25%) is planned to be spent on council's operating expenditure (GCCC, 2013a). The council, under the new leadership and system, has been reducing its yearly rate increase since 2012. Therefore, the GCCC's funds will be increasingly limited to services which "ratepayers can afford" (GCCC, 2013a). Implementation of ICTs for creating smart cities can be an expensive process (Bajracharya et al., 2013). As such, there may be limited funding available for developing Gold Coast into a smart city in the future.

6.2.2 Privacy and Security of Data

Data generated and collected from ICTs are subject to privacy and security concerns. Privacy, which arises from data pertaining to individuals, can affect not only personal identity, but also physical wellbeing, personal behaviour and personal communication (Bartoli et al., 2012). It is important to protect the privacy of data relating to individual community members as mishandling of personal information is taken as serious offence by both the government and community. Strict protocols and precedures will need to be employed in order to filter raw data from ICTs and ensure that privacy of individuals is protected.

Data are also susceptible to cyber-vandalism which can lead to inappropriate ownership and usage of personal or sensitive data (Hancke et al., 2013). Cisco has revealed that there has been significant growth in cyber attacks, which now pose a "threat to life" (ABC, 2014). Appropriate systems and procesures should therefore be applied to minimise the possibility of cyber-vandalism on any smart technologies implemented in Gold Coast. The GCCC has recognised the need to ensure privacy and security of data in their smart city vision (Tozer, 2014).

6.2.3 Technology Adaptations by community

As part of the smart city process, data can be crowdsourced from local residents and information products can be disseminated to communities through several ICTs such as smartphones and social media (Bajracharya et al., 2013). Adaptations to these technologies, however, can be a challenge. As a popular retirement destination, Gold Coast is experiencing ageing population. While senior residents aged at least 65 years accounts for 14.4 per cent of Gold Coast population, this figure is projected to increase to more than 20.2 per cent of the city's inhabitants by 2031 (GCCC, undated). Furthermore, due to Gold Coast high costs of living as well as the unaffordable housing market discussed previously, poverty is also an increasingly prominent issue affecting the city's residents (Kane, 2012). Ensuring adaptations to smart technologies among older and lower income groups within the local community in Gold Coast could be a challenge with digital divide in technology adaptation.

7 PEOPLE AND SKILLS

The third theme the paper now examines is People and Skills, which is related to the attraction and retention of knowledge workers and ICT businesses to a city.

7.1 Opportunities

7.1.1 Local Availability of ICT Businesses

A number of ICT start-ups and businesses are located on Gold Coast. As mentioned above, Anittel and CoastalCOMS are located in Gold Coast. CoastalCOMS has been collaborating with the GCCC in monitoring conditions of the city's beaches through the use of cameras, which show live images of the beaches on a web portal. The images are intended to show existing ocean and beach conditions, which assist local residents with planning their beach visits. The website provides real-time information on other environmental variables such as wind directions and temperature. It also collects and displays historical data on Gold Coast's beaches, thereby creating opportunities for future research projects (CoastalCOMS, 2010).

7.1.2 Support for ICT Start-Ups and Workers

Silicon Lakes, a non-profit organisation, is an incubator for ICT start-ups and provides co-working spaces as well as programs for supporting ICT entrepreneurs. It collaborates with other start-up incubators around the world. The company seeks to promote Gold Coast as a "desirable location to start, develop and operate ICT applications, businesses and resources" (Silicon Lakes, 2014).

Gold Coast TechSpace provides workshops for community members to learn about different technologies such as robotics, green technology, hardware and software. Residents of all age groups are invited to join the workshops, which are run weekly. The company provides different levels of memberships to cater for different levels of interests and needs of the community (Gold Coast TechSpace, 2013). With the GCCC as a Founding Partner, TechSpace plays a vital role in creating local ICT workers for the city.

7.2 Challenges

7.2.1 Attracting and Retaining Knowledge Workers

Gold Coast has relatively limited employment opportunities and options. In 2011, Gold Coast's unemployment rate was 7.4% in 2011 in comparison to the national average of 5.6%. Moreover, Gold Coast currently contains the highest number of inter-city commuters among all Australian cities, with more than 26,000 workers commuting to Brisbane, the capital city of the Queensland state, on a daily basis (KPMG, 2014). The limited employment opportunities in Gold Coast may affect the city's ability to attract and retain tertiary students as well as knowledge and ICT workers.

7.2.2 Local Knowledge and Skill Base

According to the 2011 census data, 56.2% of Gold Coast population of at least 15 years of age had not acquired a post-school qualification.[2] Additionally, the majority of local workforce (27.5%) was employed as blue-collar workers, including: traders; machinery operators and drivers; and drivers (Australian Bureau of Statistics, 2011). Improving local knowledge and skill base among current and future generations of workers in Gold Coast is a challenge the city needs to address in its transition into a smart city.

8 KNOWLEDGE AND INNOVATION PRECINCTS

The fourth theme to be applied to the analysis of Gold Coast is Knowledge and Innovation Precincts, which are facilities for attracting and generating knowledge and ICT workers.

8.1 Opportunities

8.1.1 ICT Office Parks

Gold Coast currently offers several office parks which specifically cater for ICT businesses. As part of the GCCC's Pacific Innovation Corridor strategy, Varsity Lakes, a master-planned community adjacent to Bond University has been designated as a specialised IT hub. To this end, it contains Varsity Central which provides offices and spaces for ICT businesses. Several ICT firms are now located in Varsity Central. Examples of IT-related firms in Varsity Central include Anittel, an ICT consultant company which provides IT support to organisations, and CoastalCOMS, which specialises in environmental monitoring via video content analytics. In addition to Varsity Lakes, Southport, the city's Central Business District, has also been designated as a technology hub.

8.1.2 Gold Coast Health and Knowledge Precinct

The state government of Queensland implemented a project to establish the Gold Coast Health and Knowledge Precinct, comprising Gold Coast University Hospital and Griffith University, in Southport. The precinct, now completed and operational, offers cutting-edge healthcare services to local communities. It also provides opportunities for the university's medical students to undertake hands-on training at the hospital. The health and knowledge precinct will not only promote Gold Coast as a desirable location to live for knowledge workers due to availability of high quality health services but also generate additional high quality knowledge workers in the healthcare industry.

[2] Post-school qualifications include qualifications at the following levels: certificate; diplomal; advanced diploma; bachelor degree; graduate diploma; graduate certificate; and postgraduate degree.

8.1.3 Links between Universities and Hospitals

In addition to the Gold Coast Health and Knowledge Precinct, the other two universities in the city are co-located with hospitals. Bond University, located in Robina, is situated in proximity to Robina Hospital, another major state hospital. Southern Cross University, meanwhile, is situated in close vicinity of John Flynn Private Hospital in Coolangatta and Tweed Hospital in Tweed Heads. These universities have been collaborating with the hospitals in providing practical training experience for medical students.

8.2 Challenges

8.2.1 Lack of Connectivity between Knowledge Precincts

As discussed above, the three major knowledge precincts in Gold Coast are located in Southport, Robina and Coolangatta. Due to the oriented design of Gold Coast transport infrastructure, there is currently lack of direct connectivity, particularly by walking, cycling and public transport, between these knowledge precincts (O'Hare et al., 2012). By strengthening transport links between these key precincts, greater links between universities and hospitals can be established.

8.2.2 Lack of Research and Development Collaboration

There is a need for the council to further collaborate with the three universities located in the city, namely Bond University, Griffith University and Southern Cross University. Currently, there is only single focus on one knowledge and health precinct around Griffith University in Southport, which concentrates on the field of health sciences. By collaborating with the universities, greater synergies between universities, local businesses and the council can be developed in order to stimulate the city's research and development (R&D) activities in various fields of knowledge.

9 GOVERNANCE

The paper now looks at the final theme of Governance, which relates to arrangements and plans for creating smart cities.

9.1 Opportunities

9.1.1 Council's Economic Strategies

The GCCC has adopted three primary strategies to promote Gold Coast as a smart and economically sustainable city. These strategies are Economic Development Strategy, Digital Strategy and Pacific Innovation Corridor. Through Economic Development Strategy, the council aims to promote the city as an international destination of choice for businesses. One of the key themes of the strategy is Innovation, which seeks to encourage establishment of new start-up businesses and utilise ICT as part of the city's systems more effectively. The strategy's Cultural theme, meanwhile, seeks to "attract new talent, knowledge workers and investment" by strengthening the city's unique culture (GCCC, 2013c, p. 17).

The GCCC has recognised that a focus on digital economy and strategy can lead to substantial economic benefits for a city. To this end, it has adopted a Digital Strategy, in which ways ICTs and advanced technologies can be integrated to the city's construction, manufacturing and tourism industries are identified. The strategy also outlines the council's approach to enhancing the city's ICT infrastructures.

Pacific Innovation Corridor is a long-term economic development program which has designated 13 precincts across the city as key economic centres. Technology focus has been given to three of the precincts, namely Robina, Southport and Varsity Lakes. Therefore, future planning and development in these communities will have strong emphasis on ICT infrastructure and services. All three strategies discussed above will provide Gold Coast with an attractive environment for ICT workers and businesses.

9.1.2 Digital Enterprise Program

The GCCC applied for and secured funding from the Australian Government to run Digital Enterprise Program workshops. The workshops, available and tailored to individuals and groups, aim to improve the manner in which organisations conduct businesses and deliver services online. The workshops cover a range of topics, including cloud services, teleworking, cyber security, and online presence (GCCC, 2013b). The program plays a vital role in supporting local businesses by capitalising on the potential that ICTs offer.

9.1.3 Open Data Access Project

The GCCC has "committed to publishing priority datasets, in an open manner that facilitates transparency and the development of solutions and tools by Gold Coasters for Gold Coasters" (IT Gold Coast Forum, 2014). To this end, the council has recently implemented an Open Data Access Project to establish a framework for distributing data collected by government authorities to the public. The project aims to ensure the data distribution will allow innovative information products to be available to local communities of Gold Coast. It also seeks to build local capabilities of ICT businesses and provides commercial opportunities for local ICT start-ups (GCCC, 2013e). In late 2013, the GCCC hosted an Open Data Forum, attended by data enthusiasts and developers. The event solicited innovative ideas on how locally collected data can be used and distributed. Another topic covered in the forum was the types of data that would be useful to local ICT businesses and local community members. There needs to be greater involvement of local community in this project, in terms of understanding their needs and concerns, as well as identifying ways in which they can contribute to the project.

9.1.4 Public-Private Collaboration

The GCCC has been actively collaborating with a number of private businesses to spearhead the development of the city's ICT industry and infrastructure. As discussed previously, the council has been working with CoastalCOMS in monitoring beach conditions and acted as a Founding Partner for TechSpace. The Open Data Access Project also strongly involves the private industry in order to ensure appropriate types of data are available publically for the most innovative and useful outcomes for the community.

9.1.5 Opportunistic Approach for Smart City

The GCCC has displayed an opportunistic approach to promoting Gold Coast as a smart city. The council successfully applied for and secured the IBM's Smarter City Challenge Grant to acquire input for its smart city initiatives from the private sector. The council also won the bid to host the 2018 Commonwealth Games, which represents a major prospect to promote the city's profile as well as developing smart infrastructure for events. In 2013, Gold Coast hosted the Intelligent Cities Summit, a two-day conference on smart cities attended by academics, decision makers and corporate executives. The event promoted Gold Cast as one the places "central to the creation and commercialization of innovative new products, processes, and services for global markets" including the development ICT infrastructure and workers (Future Cities Institute, 2013).

9.2 Challenges

9.2.1 Ownership of Data

During the Open Data Forum, data ownership was identified by local ICT businesses as a major barrier to creating innovative information products. While some data on local environment conditions belonged to the local council, others were exclusively owned by state or federal governments. Due to the data ownership arrangements, local developers were unable to create smartphone apps which provide information such as weather warnings in real time. The ICT businesses also cited the need for all data to be available publically in real time in order to create useful products for local communities.

9.2.2 Lack of Strategic and Statutory Directions for Smart City

While the council has displayed an opportunistic and collaborative approach to establishing the city as a smart city, it has not incorporated its intention in this regard in its Corporate Plan 2009-2014, the document charting the city's strategic directions. Likewise, the draft City Plan 2015, the new planning scheme which outlines statutory requirements for planning and development throughout the city, does not specifically mention developing the city as a smart city. As such, there is lack of strategic and statutory directions for creating Gold Coast as a smart city. Figure 3 summarises the challenges and opportunities for developing Gold Coast as a smart city.

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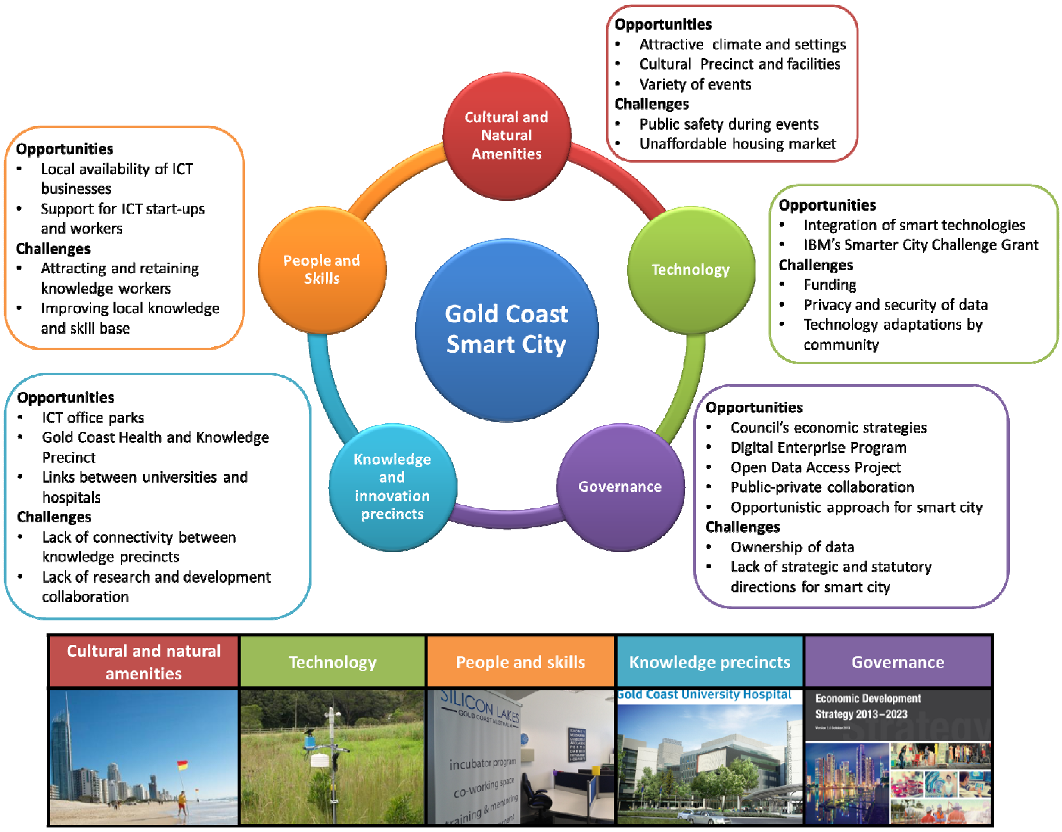

Fig 3: Challenges and opportunities to develop Gold Coast as a smart city

10 CONCLUSION

With cities becoming increasingly globalised and competitive and moving towards knowledge and information economy, the concept of smart cities is attracting interest from city officials, the private sector, local communities and academics. This paper has examined the nature of smart cities through a literature review of the idea. The use of ICTs alone does not make cities smart – other dimensions including cultural and natural amenities, people and skills, knowledge precincts and governance are equally important. These factors were collectively integrated into a smart city framework, which was then applied to the case study of Gold Coast to identify challenges and opportunities in developing the city as a smart city.

Five key lessons for developing smart cities have emerged from the case study analysis. First, to attract and retain knowledge workers, public safety, housing affordability and employment opportunities are important considerations. Second, privacy and security concerns of the community associated with collected data need to be addressed when implementing ICTs for monitoring the built environment. Third, given universities create knowledge workers for the city they situate in, there is a need to establish collaborative links between these universities and other stakeholders, including local council and businesses. Such links can create opportunities for R&D activities and provide practical training to university students, thus providing them with effective transition from the academic environment to the industry. Fourth, data collected by ICTs should be publically available in real time to facilitate the creation of information products and services for local communities. Lastly, while programs and collaboration between the private sector and the public sector are important, smart city development should be embedded as a key objective in strategic and statutory plans for a city and local community needs to be actively engaged in the planning process. By doing so, not only will the transition of the city into a smart city become a planning priority, but the city's future development, driven by the private and community sector, will also be supportive of the smart city objectives.

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reviewed paper

Checking Smartness "On the Ground": Historically Rooted Dilemmas, Future Challenges and Visions for a Smarter Metropolitan Area of Rome

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1 ABSTRACT

Without establishing a link between theoretical reflection and empirical inquiry, "smartness" as well as "smart development" risk to be nothing but what Star and Griesemer (1989) would call a «boundary object» (i.e.: something that can be interpreted in so many different ways). On the one hand, in fact, three main different smart urban development approaches can be distinguished; on the other, existing resources and local weaknesses, possible opportunities and challenges play a relevant role. The aim of the paper thus consists of checking "on the ground" the concept of "smart development" by using as a case-study the city of Rome and its metropolitan area.

2 SMARTNESS AS A "BOUNDARY OBJECT"

Contradictions, ambiguities and even unexpected consequences implicated in concepts, ideas, images and imaginaries rotating around "smartness" require a link between theoretical reflection and empirical inquiry: checking "on the ground" existing resources and local weaknesses, possible opportunities and challenges to be considered for a city – in this case, the metropolitan area of Rome – in order to become "smart" is of paramount importance for assessing the present state and the future perspectives of smart cities. In fact, by using a notion originally proposed by Star and Griesemer (1989), we could say that "sustainable development" – as well as the ITC "declination" of smart cities – is nothing but a «boundary object», i.e.: an "object" (which can be constituted by material objects as well as texts, ideas, programs and so on) that can be interpreted differently, given the different perspective and interests, by the actors involved while retaining a core set of shared meanings, allowing mutual understanding or productive misunderstanding.

As well-known, the very idea of "smart development" was first proposed by Meadows *et al.* (1972), but its "official" roots are to be searched in the concept of sustainability (WCED, 1987): since 1987, when "Our Common Future" established "sustainability" and "sustainable development" as part of the global lexicon, such concepts have become a fundamental theoretical framework for urban and regional studies, but they could also be described as one of the most important pieces of rhetoric characterising the last three decades (see, e.g.: Myerson & Rydin, 1996): as both a "catchwords" and a contentious concepts from the outset, scientific literature on the topic is considerable, and yet books and article come out relentlessly (a literature review on the topic can be found in: Jepson, 2001).

Nevertheless, the idea of "sustainability" – too broad, vague and economically-centred – is far from being an effective paradigm: while many scholars highlight how the meaning of "sustainable development" still remains obscure (Lindsey, 2003; Hanan, 2005), even its best-known definition— «development that meets the needs of the present generation without compromising the ability of future generations to meet their needs» (WCED, 1987, p. 8) — is widely criticised on a variety of environmental, economic and ethical grounds (see, e.g.: Daly, 1989; Daly & Cobb, 1989; Broad, 1994; Skirbekk, 1994). In short: what is at stake is how needs are to be defined and anticipated, and by whom. Not surprisingly, although there is substantial agreement about the conceptual meaning of sustainability in ecological and systemic terms, its translation "on the ground" into physical human settlements remains problematic (Harris & Goodwin, 2001).

3 THREE SMART SUSTAINABLE URBAN DEVELOPMENT MODELS

3.1 Smart growth

According to literature on the topic, three main different urban development approaches can be distinguished. First, the model of "smart growth", which can be understood as an attempt to restrain sprawl through a variety of land-use control and other regional/local policy mechanisms aimed at encouraging more compact development, urban revitalisation/re-discovery, transportation and housing diversity, open space protection, and collaborative decision-making (see, e.g.: APA, 2002; see also: Campbell, 1996). During the 80s, in fact, in many European cities the economic growth has been accompanied with a reduced population density (Newman & Kenworthy, 1999; Bruegmann, 2005), and decentralisation of workplaces and residences is by many considered an almost inevitable tendency in Western Europe (EEA, 2006), while in the Eastern European countries urban sprawl takes place «at a pace which leaves anything experienced in the west far behind» (Schwedler, 1999). As a consequence, during the latest decades, several studies (e.g.: Newman & Kenworthy, 1999; Williams *et al*., 2000; Næss, 1993; 2001) have investigated the performance of different urban spatial structures against sustainability criteria.

The smart growth approach particularly focuses on the relationship between urban form and mobility as it is believed that dense and concentrated urban development is more conducive to sustainable mobility than low-density spatial expansion of the urban area (Newman & Kenworthy, 1999; Næss, 2006; 2009; 2010; Zegras, 2010), so that the compact city is proposed as a sustainable urban form (CEC, 1990; Jenks *et al*., 1996), without considering the relevance of the inhabitants' choices of mode of transportation, which, in turn, are influenced by further factors, such as, for instance, the relative speeds of car and public transport (Næss, 2006). Furthermore, many scholars still tend to focus on a technical invention, as the automobile is, as the cause of the spreading of sprawling pattern, but this is a simplicistic view, since not only the city scale represents a specific challenge, but also cities'structures and mobility patterns are arguably highly complex systems that are shaped in so very different ways depending on the natural, social, economic and political conditions. In fact, the "car regime" actually still is something different within European countries: it characterised West European cities during most of the 20th century to an extent higher than the Soviet Union or the East European countries – where collective solutions and, consequently, apartment buildings were dominating – but lower than USA and Canada, where individual solutions and lifestyles and, thus, single-family homes played a relevant role (Pucher, 1990).

Under smart growth, however, an expansive economy and population are not viewed as necessarily incompatible with environmental protection (Daniels, 2001; Porter, 2002; Ye *et al*., 2005), whereas, instead, what seems to be needed is a critical analysis of overall political-economic structures and mechanisms acting as driving forces towards generally increased consumption levels, single-family housing and mobility schemes, and weak urban land use regulations (Harvey, 2010). In other words, barriers to smart sustainability are to be searched into the capitalist economic system and its growth imperative, competition, uneven spatial development and adversion against regulations.

3.2 New urbanism

Supported by a strong interest group in both US and UK, the model of "new urbanism" (CNU, 2009; Barnett, 2004; see also: Næss, 2011), instead, is strongly design oriented, representing an "architecture of community" that is more humanised in scale and character. With a focus on physical appearance and neighbourhood layout to improve quality of life, it calls for more compact, mixed-use development, housing diversity, architecture that is consistent and sensitive to place, common open space abundance and internal circulation that is pedestrian friendly and oriented (Katz, 1994; Wheeler, 2004). Problems concerning the model of "new urbanism" consist of the fact that the latter is nothing but a "niche solution", which will have to co-exist for a very long time with the inertia of the existing urban built environment: a long-term affair also representing an investment that unavoidably creates strong path-dependencies. Thus, such niches of innovation are smart only in a relative sense, not in absolute terms, since old material structures are rarely being removed to the same extent as new ones are added. Smart urban development, in fact, is not only about promoting the environmentally less damaging solutions, it is also about actively constraining and shrinking the existence of the unsustainable "objects".

Furthermore, the actors promoting such niche solutions and the vested interests they represent seem to be somewhat overlooked, being a little focus on struggles between different interest groups each seeking to realise their specific desired version of a smarter sustainable society: a practice of "offering something for every taste", which appears to be closely tied to the prevailing neo-liberal and economic paradigm and to the related consumerism represented by ever-increasing mobility and soil consumption. Not surprisingly, Krueger and Gibbs (2007) highlight a strong correlation between US cities which have prospered in the so-called "new economy" and those which have adopted sustainable policies, since increasing green public areas, decreasing traffic and road congestion, promoting green energy systems and alternative ways of recycling may be considered as factors in the attraction of talent, tourists, and investors, also contributing to both an increase in housing costs and a fostered process of gentrification: an unintended result that has been defined as «eco-gentrification» (Keil, 2007).

In this sense, the model of new urbanism clearly mirrors discourses of ecological modernisation (Mol *et al*., 2009) as it seems to be permeated by a tacit assumption of continual economic growth, according to which innovation can redefine ecological limits, so that economic growth can be de-coupled from environmental degradation by re-directing production towards environmental goals (Smith *et al*., 2010) and thus promoting a sort of green competitiveness in the market economy (see: Bluhdorn & Welsh, 2007; Vavouras, 2011), without considering the need to ensuring a decent standard of living for the least affluent inhabitants. What is to be highlighted here are risks in policies which are theoretically framed in a smart sustainable approach but which in practice are simply sustaining a green economic growth: in fact they can end fostering inequalities among social groups (Cucca & Tacchi, 2012).

3.3 The "ecological" approach

Finally, the perspective of what can be summarised as the "ecological" approach is local, but its area of concern is systemic, as it considers the community as the product of a collection of interactions that must be kept in balance over time. The aim is to develop communities that do not exceed the limits of nature to sustain them, according to the concept of carrying capacity. This is accomplished primarily through public policies that encourage the replacement of non-renewable energy and other resources, the protection of open space (particularly in relation to biological and natural processes, assets and services), the use of "appropriate" technologies, the reduction and natural assimilation of waste, and local economic and functional self-reliance (Platt, 2004; Kline, 2000; Register, 2002; White, 2002). Nonetheless, as Pellizzoni (2012) argues, the undeniable successes towards eco-efficiency due to new technological and regulatory instruments «look geographically, socially, politically and technologically fragmented», so that they end to be «often questionable in their eventual result».

On the one hand, as the connections it establishes between economic, ecologic and social aspects constitute a cornerstone of the notion of sustainability, according to which profit, planet and people are to be seen not only as reciprocally implicated but as mutually reinforcing, Connelly (2007) argues that the image of three intersecting circles «neatly capture[s] the difference between sustainable development and the previously separated concerns of policy and politics, suggesting not only the holistic scope of the concept but also its characteristic claim to integration». On the other hand, Marcuse (1998) points out two main critical aspects of the concept of sustainability: the first one concerns the limitations imposed by the technology of the present and near future on the ability of the environmental resources to fulfil human needs; the second consists of the barrier, represented by the social organisation of the economic means of production, to the possibility of following a sustainable pattern of development.

Therefore, as Burns (2012) remarks, «rather than precise scientific concepts», "sustainability" and "sustainable development" «are political and normative ideas». As such, they do not imply semantic disputations but political arguments (Jacobs, 1999) because «they are contested and part of struggles over the direction and speed of social, economic, and political initiatives and developments» (Burns, 2012; see also: Davidson, 2009; Krueger & Agyeman, 2005; Bluhdorn & Welsh, 2007). Risks, in fact, concern that «in place of radical new openings» the term could be (and usually is) «attached uncritically to existing practices and policies that might benefit from 're-branding'», on the broader frame of «the re-emergence of market economics and neo-liberal policies», and the consequent attempt «to transform environmental choices into market preferences, following neo-liberal orthodoxy» (Redclift, 2005; see also: Swyngedouw, 2007; 2010; Pellizzoni, 2011; Pellizzoni & Ylönen, 2012).

In fact, although «human well-being, equity, democratic government, and democratic civil society are central constituents of sustainability» (Magis & Shinn, 2009), the social pillar of the concept has entered the political agenda to a limited extent (Dillard *et al*., 2009). On the one hand, despite some exceptions (e.g.: Pòlese & Stren, 2001; Magis & Shinn, 2009; Boström, 2012), especially topics relating to social inequality, justice and inclusion seem to be both less integrated into studies considering sustainability and replaced by more intangible and less measurable concepts, such as "identity", "sense of place", and the benefits of social networks (Colantonio, 2008). On the other hand, traditional themes, such as equity, poverty reduction and livelihood, have instead been gradually left to the broad and independent literature concerning overlapping concepts such as "social cohesion" and "social exclusion" (Pahl, 1991; Littig & Griessler, 2005).

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4 CHECKING SMARTNESS ON THE GROUND: THE METROPOLITAN AREA OF ROME AS A CASE STUDY

4.1 The role of rent and the spreading of illegal settlements

4.1.1 The "real estate block" as collusive oligopoly

At the beginning of the 19th century the city of Rome was surrounded by the vast emptiness of the so-called "Roman Campagna" and a new bourgeois class was emerging. These were the so-called "*mercanti di campagna*" ("countryside merchants"): about 80 former shepherds who accepted to rent lands from aristocratic landlords even with lease contracts based on 15-years prepayments in order to manage all the economic activities linked with the latifund. After the unification of Italy (1860), when Rome began the capital city (1870), such emerging social group – more and more involved in building activities – will constitute a serious obstacle for modernisation: first for its systematic evasion of taxes on agricultural products, and, second, for its complicity with the aristocratic landlords to retard, through false purchase and sale, the selling off of ecclesiastic properties according to the Law no. 1402/1873 (Della Seta, 1987). This coalition constitutes the basis of what, in the mid-20th century, Parlato (1970) will call «*blocco edilizio*» ("real estate block"). As a result, from 1873 to 1881 about a fourth of the land of the Roman Campagna changed its owner, but without being divided in smaller plots, as the law required, so that large and very large latifunds (50% more than 500 ha., 20% between 2,000 and 5,000 ha.) were 396, and owners 204.

Thus, what will become the distinctive features of the urban development of the city of Rome are already highlighted here: first, the assumption of rent (especially "waiting" rent) as *primus movens* for urban development, resulting in a collusive oligopoly of the holders of building areas (Insolera, 1962; Tocci, 2009; Natoli, 1953; Cederna, 1956; 1965; 1991; Della Seta & Della Seta, 1988); second, the weakness of the local public administration, who renounces claiming a non-partisan position (Insolera, 1959). In addition, a cultural debate highly dissociated from the effective management of the city, although architects and planners, as depositories of "specialist" knowledge, tended (and still tend) to establish themselves as members of the ruling class (in: Sanfilippo, 1992).

On such a background, two distinctive movements characterising the cyclical process of urban expansion can be clearly distinguished: a first one consisting of the establishment of legal or illegal settlements as isolated outposts in the rural space, outside the borders defined by the city's master plans; then, a second movement corresponding to their legitimisation through the inclusion within further borders of further plans (i.e.: their "phagocytation" by the urban, but without really "digesting" them). For this reason, differently from north-European countries, urban sprawl in Rome cannot be interpreted as the outcome of sub-urbanisation, guided by the demand for a better quality of life, but rather as the expression of an over-urbanisation: a sort of «overflow» (Scoppetta, 2009). Such double movement – building outposts in the rural space, then including them into master plan thus providing them with public infrastructures and services so that the in-between areas may be granted of planning permissions – means a process of rent accumulation given by the betterment value (i.e.: the increase in the value of land determined by changes in the planning regime). In other words: the increase of the value of land is clearly concerned with planning decisions as the latter may consist of granting of planning permission for a higher value. Both infrastructure improvements and provision of new services are further forms of betterment that increase the value of land.

Parlato's «*blocco edilizio*» (1970), dominating the city for so many years, was a heterogeneous coalition politically supported (and largely favoured) by the right-wing, with a hegemonic nucleus of landlords (widely including the Catholic Church for obvious historical reasons) and financial groups. Among these, the Società Generale Immobiliare (SGI), a land-credit bank controlled since 1935 by the Vatican thanks to money deriving from the compensation by the Italian State within the frame of the Lateran Agreements (Vidotto, 2005; Caracciolo, 1956). In 1945, in fact, the Vatican was one of the four major shareholders (32%, while the other three: 5,1%, 2,9%, 1,8%) (Bartolini, 2001). Such coalition used for rent-seeking what Parlato (1970) has identified as «the ideology of privately owned house» (see also: Rochat *et al*., 1980). In fact, in 1951 a relevant unbalance existed between the total amount of flats and resident families, as many of them arrived in Rome from the central and southern Italy during the final bombing phase of WWII and informally settled outside the urbanised area. They lived in crowded (600.689 families) or overcrowded (520.517) conditions, and less than a half of the inhabited flats were not provided with kitchen, drinking water, bathroom, electrical and gas equipment (103). In 1951, in fact, the urban areas with illegal and informal buildings occupied 1.300 ha. and hosted 150.000 inhabitants (De Grassi, 1979).

In 1948 the SGI promoted the Istituto per l'edilizia economica e popolare (IEEP), a public/private partnership for social housing involving the Vatican, some private banks and some of the major national public or private companies as well as the (public) Cassa per il Mezzogiorno, established for promoting the development of the disadvantaged Southern regions. The IEEP was widely favoured by the funding provided by the so-called "Tupini's Law", and, then, by the Decree no. 399/1947 (then: Law no.22/1950). Thus, after the stop due to WWII, at the end of the 40s the building sector impressively grew. In the decade 1951-1961 the population increased (+32,4%), and between 1951 and 1971 the total amount of flats tripled (from 319.230 to 873.802). Between 1951 and 1958 4.000 ha. were urbanised (+80%). In the decade 1951-1961, at the beginning of the so-called "economic miracle", 253.016 flats were built, corresponding to the city of Genoa (Avarello, 2000). Then, at the end of the 60s, building activities decreased, and between 1971 and 1981 new flats were less than a half than the previous decade (from 301.556 to 141.967). Anyway, the direction of the expansion was always given by land-ownership (precisely: by lands owned by the SGI).

4.1.2 The public, the private and the illegal city

Between 1951 and 1961 a 15% of legal buildings were directly promoted by the public sector, while a 20% was built by more or less publicly-supported cooperatives and the remaining 65% by the private sector. In the 60s, when the total population of the city reached 2,167,285 residents, the total amount of legal buildings provided by both the public sector and cooperatives decreased (4,4% and 5%), while private building activities increased (90%). But such tumultuous expansion could not solve the housing problems, as the housing supply was widely unbalanced towards higher and middle classes. In fact, in 1981 there was an increasing of urban areas with illegal and informal buildings (8.500 ha., i.e.: 28% of the urbanised areas), with 800,000 inhabitants and families living in crowded (29,1%) and overcrowded (21,3%) conditions (Insolera, 1962; see also: Ferrarotti, 1974). The «spontaneous metropolis» (Clementi & Perego, 1983) that emerged in the "Roman Campagna" was made by settlements that «do not seem having any definitive goal», as they are the «result of unstable additions and adjustments», so that each settlement «during a month can be changed; during a year it certainly will», since «the simple possibility in achieving any balance does not have a sense, because there has never been a project to be implemented» (see also: Berdini, 2010).

Even because of the flourishing of both innovative approaches in sociological research (Ferrarotti, 1970; 1974) and Pasolini's literary works (1955; 1959), such dualism between the legal and the illegal city led, however, to the emerging of the periphery as a new active social subject, and this, in turn, during the 70s, resulted in urban struggles for social housing that, finally, led to a shift in both political coalition and urban regime that ended influencing the national policy. In fact, the welfare regime of the new left-wing coalition, by focusing on the periphery utilised the so-called "Fanfani's Law" (Law no.43/1949) for social housing (see: Di Biagi, 2001) in order to increase the "public city" and to compensate with a large amount of public investments for the severe rent speculation of the previous conservative urban regime, occurred outside any regulative framework. The public activism in constructing the city, therefore, increased, and in the 70s the public city reached the 17% of the total amount of built flats. But, however, it remained below average with respect to the other European countries (Dematteis, 1995). Furthermore, the new welfare regime paradoxically ended favouring the "real estate block", as the newly built neighbourhood were located far from the extreme edge of the urbanised areas, and often in-between large privately-owned lands, so that landlords could exploit through the mechanism of the so-called «*saldatura edilizia*» ("building soldering") (Insolera, 1962) the public infrastructure and services that provided their land with an increased value.

During the 60s, several reform proposals were unsuccessfully made in order to eradicate or capture the betterment value created by the planning system. In 1962 the Demo-Christian Minister for Public Works Fiorentino Sullo elaborated a comprehensive bill aimed at requiring prior public ownership of land before any development could take place: no development was to be allowed on private land and the expropriation costs were to be based on the agricultural value of land. Municipalities in turn were to service the bought land and then sell it at a value increased by the costs borne to build infrastructures and utility facilities (Sullo, 1964). But, surprisingly (or not?), the Prime Minister and leader of the Demo-Christian Party Aldo Moro withdrew his support to the reform (which was proposed by a member of his own party!). The latter was subject to a violent campaign of denigration in the national press and portrayed as wanting to "steal homes" from Italians, so that the reform was definitively abandoned in the name of the Parlato's (1970) «ideology of privately owned house».

During the 60s was also approved a new master plan. The plan making process took about 12 years to come to approval, so that the original plan prepared during the 50s had a completely different strategy from the final version: about 5 million people and rooms (2 million more than the current registered population, according to Campos Venuti, 2001) to be accomodated in future years in the city. In this way, private property landowners were granted development rights for about 3 million rooms of which around one third remained unused at the present time. Such overdevelopment still represents one of the major challenges for constructing a really smart sustainable vision.

4.2 The unsustainable metropolitan area of the city of Rome in neo-liberal times

4.2.1 Overflowing outside city limits

The current urban form of the metropolitan area of the city of Rome is the result of the described rent-guided pathway: despite many proposals and also official comprehensive plans aimed at decentralising the urban growth according to polycentric principles, it appears as still centralised, with an extensive and discontinuous outlying "nebula". Expansions, in fact, have been developed around the core area according to the historical radial routes and following subsequent sprawling, which were led by both the direction of public housing neighbourhoods and the spread of illegal suburbia. The result is a fragmented more or less protected rural discontinuity within the urban fringe.

If analysed according to an approach based on the theory of the cities' life cycle (Berry, 1976), the situation in 1961 consists of the first stage of urbanisation. In fact, the settlement pattern is still centralised on Rome (2.167.285 residents, i.e.: 78,1% of population of the Province of Rome) and the space occupied by urban uses (10.262 ha.) is almost 70% of the urbanised area in the Province (Scoppetta, 2009). In 1991, both lower population and settlements dynamics can still be interpreted, according to an evolutive approach, as the effect of the second phase of relative de-centralisation. During the 80s, in fact, Rome lost its population (-2,45%) while the other municipalities grew (+15%). Also the urban land use area in Rome grew (+14.8%). The other municipalities, instead, for the first time overcame Rome, where there was a significant residential de-centralisation. According again to an evolutive approach, the effects of the phase of absolute decentralisation of the 90s clearly appeared in 2001. Rome (2.546.804 residents, i.e.: 68.8% of the provincial population) lost population more relevantly than in the 80s (-187.104, -6.8%) with a smaller increase of urban land uses (34.122 ha, +9.7%) with respect to the previous decade. In the adjacent centres, instead, the increase was +494 ha. (including 350 ha. near the borders with Rome).

However, if analysed as related to the exponential increase in house prices, data gain a different meaning: in Rome, in fact, the real estate sector grew by 4,1% in 2001, by 2,3% in 2003 and by 4,7% in 2004 but, nevertheless, this abundance of supply could not " meet" the growing demand for low-cost housing, which, instead, remained unsatisfied also because of the substantial absence of adequate housing policies (see: Caudo & Sebastianelli, 2007; Berdini , 2008). The association between performances of real estate market and settlement dynamics of Roman metropolitan area seems to suggest, therefore, a different interpretation. Sprawl is not the outcome of a sub-urbanisation stage and of the demand for better quality of life, but it is the expression of a growth trajectory rather tending to an over-urbanisation. In short, the breaking of compact city do not stretch towards a settlement pattern based on diffusion, but – on the contrary - to a kind of demographic-building "overflow" without discontinuities from the more central areas to the suburban ring. In other words: the city of Rome "spontaneously" tends to shift the demand to low-income housing towards the contiguous territories, thus spreading towards the hinterland an extensive and undifferentiated metropolitan suburbia, as the housing demand tends to be simply resolved through the further enlargement of the existing urban form.

According to such trends, therefore, the housing resumption of Rome (especially if devoted to high-income social groups) will allow the absorbing of an insignificant share of the constant (even if low) population growth (recorded in 2005). A main portion of this would be instead absorbed by neighbouring centres, emphasising the widespread nature of settlements, while functions and activities supply and the resulting commuting would continue to focus on the central urban area and its peri-urban periphery. This means that settlement processes of almost equal weight to those in the central area will arise and will result in the disintegration of the historical little-sized surrounding centres through diffusive patterns, by “nebulising” the morphologies of the original polycentric settlement system and thus establishing a substantial homogenisation of different territories. In fact, the forms of such an “overflow” of the city of Rome appear as substantially homogeneous and indifferent to the existing structures.

The peculiarity of such a pattern more clearly appears when comparing data on soil consumption in the Roman metropolitan area with those of similar European territorial contexts: significantly, higher values result not only as concerns the territory of the municipality of Rome, but also and especially the territory of neighbouring centres having higher values than the “rings” of European capitals, which are characterised, in general, by planned settlements.

4.2.2 Neo-liberal planning and path-dependency

During the more recent decades, the historically rooted role of rent in shaping the urban form of the city of Rome has been re-launched by the new-left coalition that has governed the city from 1993 to 2008 through the developer-led planning practice called “planning by doing” (see: Berdini, 2008) – i.e.: single large-scale projects instead of comprehensive plans – whose starting point consists of the establishment of special legislation (Law n.396/90) for the Jubilee, including a more manageable planning procedure based on a public-private agreement (the “*accordo di programma*”).

Such planning practice was presented as a way to overcome what Sullo (1964) had indicated as «the slowness with which plans (do not) come to adoption – slowness that can last ten to fifteen years», which «is not the result, as someone wants to believe, of lack of commitment by administrators and public officers, but it is determined above all by harsh private negotiations for the use of areas to be developed». In fact, once development rights are assigned (and massive increases in the value of land are thus determined), the private developers acquire wide discretion on timing of implementation, since such rights (which are reversible in theory) will never be withdrawn by local administrations so as to avoid major opposition. This highlights what has been identified as a distinctive feature of Italian planning practice (Chubb, 1981; 1982; Fried, 1973), i.e.: dark (sometimes degenerating into illegal) negotiations and networks (see: Raab & Brinton, 2003; O’Toole & Meier, 2005) aimed at influencing urban development towards already available areas or areas of easy acquisition. In this sense, it is worth underlining that, surprisingly (or not?), Italian planning literature (especially the academic) has not taken such a crucial element into consideration, being most of the studies on this subject carried out by British or US scholars (see e.g.: Banfield, 1958; Giordano, 2006). Even in the case of well-known critical scholars, such as Edoardo Salzano and Vezio De Lucia, and although in their works we can find some references to pressures on planning decisions (De Lucia, 2010; Salzano, 2010), such a phenomenon is never interpreted in terms of power relationships.

On the contrary, if analysed by using political lens, in the «triumph of real estate speculation and commercial boxes» (Berdini, 2008) occurred in the most recent decade – i.e.: the most intense real estate cycle since the WWII occurred from 1997 to 2006 – we can find traces of what Peck and Tickell (2002) have called «roll-out neo-liberalism» (see also: Raco, 2005), based on a more active role (rather than a reduction) of the State in facilitating the accumulation of capital. In fact, while the previous phases of speculation had occurred outside any regulative framework (the “illegal city”) and were compensated by public investments of the welfare state (the “public city”), the current trend – resulting in an unsustainable urban form – is legitimised by the new master plan (2003) on the background of the erosion of welfare policies at the local and national level.

By referring to a non-updated idea of merely physical polycentrism (see: Scoppetta, 2011; 2013), the new master plan foresees 18 “new centralities” aimed at de-centralising the main employment locations that are traditionally located into the congested historical city centre. They are planned to be located along railway connections, in close proximity to rail stations with a strategy called the «steel cure» (Marcelloni, 2003), according to which, in the case of a new design scheme, public transport infrastructure must be in place and functioning before the new development is built.

But such new developments – often consisting of a mere juxtaposition between residences and commercial boxes as the only reserves of urban life – have been located into or close to the properties of a few powerful (always the same) developers rather than in close proximity with already existing rail tracks and they have been carried out faster than the public infrastructure necessary to guarantee metropolitan connections. In addition, the promised public infrastructure remained unfinished (being them never started), with a

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consequent strong car-dependent mobility, and, in certain cases, further project financing schemes have then been proposed as a way to find further funds for mobility infrastructures through further residential developments. Finally, in the more recent years, many scandals concerning corruption have arisen especially as regards calls for tenders related to infrastructures, with an impressive illegal appropriation of public funds.

As the new Provincial Territorial Plan foresees not only further centralities (!!) but also road extensions in order to both connect the latter with the city centre and reduce congestion thus causing a higher proportion of the commuters to choose the car mode (Scoppetta, 2012) – whereas faster and better public transport may have the opposite effect (Mogridge, 1997; Næss *et al*., 2001) – things will obviously get worse. Not to mention the lack of criteria for the settlement of garbage disposal installations so that the emergency conditions can be used for favouring always the same landowner by locating such installations on his property or, more generally, for setting aside planning rules concerning the foreseen (and improperly called) “ecological network”.

5 CONCLUSIONS

Rent-seeking policies and dark networks clearly highlight not only «the path-dependent character of neo-liberal reform projects» (Brenner & Theodore, 2002), but also the reasons for which Rome can difficultly be intended as a smart city whatever the privileged approach (smart growth, new urbanism or the ecological). In fact, according to Campos Venuti (2010) «land rent represents the main pathological factor of the real estate regime and it is responsible for all its perverse effects on cities, [...] the environment and landscape». Such effects involve speculation, overdevelopment and reduced resources available for other kind of smart investments in other sectors of the economy and the need to provide for more and smarter infrastructure. In fact, the landowners who benefit from the increase in the value of land cannot be considered among the productive factors as such increment – which is neither the fruit of personal investment nor the consequence of individual efforts – unavoidably ends to result in taking away a quota of national income from the categories which produced it. Therefore, the way for Rome to become a smart city consists of collecting the increase of land value thus forcing developers and landowners to share with the wider community at least a part of the unearned increment they appropriate thanks to practices related with dark networks.

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CitInES Project – Tool for the Sustainable Energy Action Plan for Cities

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1 ABSTRACT

Sustainable Energy Action Plan (SEAP) is the key document in which outlines how it intends to reach its CO_2 reduction target by 2020. It defines the activities and measures set up to achieve the targets, together with time frames and assigned responsibilities. However to orient cities toward a low carbon society, longer lasting investment decisions and organisational changes will be necessary.

In this conttext, the overall objective of CitInES European project is to design and demonstrate a multi-scale multi-energy decision-making tool to optimise the energy efficiency of cities to support the cities for the developemnt and monitoring of their SEAP. To achieve this goal, innovative energy system modelling and optimization algorithms were designed to allow end-users to optimize and monitor their energy strategy through detailed simulations of local energy production, storage, transport, distribution and consumption, including demand side management and coordination functionalities enabled by smart grid technologies.

This paper presents the study case of the municipality of Cesena. This municipality, as a partner of the project, has implemented its SEAP under the tool to assess the impact of the measures taken under several scenarios and monitor its activities to validate the developed software. The different measure adopted to reduce the CO_2 emissions and energy consumption together with an increase of the energy efficiency and use of renewables are such as increase of the green areas, increase of the use of cogeneration, renovation of the building or the promotion the use of PV and thermal solar panels.

2 INTRODUCTION

In March 2007, the European Union (EU) endorsed an integrated approach to climate and energy policy that aims to combat climate change and increase the EU's energy security while strengthening its competitiveness. The policy committed Europe to transforming itself into a highly energy-efficient and low carbon economy. To kick-start this process, the EU set a series of climate change and energy targets to be met by 2020, namely the so-called 20-20-20 target: at least 20% reduction of greenhouse gas emissions below 1990 levels, 20% energy consumption to come from renewable resources and 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency [1].

In this context, the key challenges for Smart Cities and Communities are to significantly increase the overall energy efficiency of cities, to exploit better the local resource both in terms of energy supply as well as through the demand side measures. This will imply the use of energy efficiency measures optimising at the level of districts, the use of renewables, the sustainability of urban transport and the needed drastic reduction of greenhouse gas emissions in urban areas – within economically acceptable conditions - while ensuring for citizens better life conditions: lower energy bills, swifter transport, job creation and as a consequence a higher degree of resilience to climate impacts (e.g. urban heat islands effects) etc.

Local governments manage or oversee all city activities and city development, they play a central role in determining the energy and carbon emissions picture of their cities. They also have direct access to their citizens and are best placed to know their needs and to influence their behaviour. Sustainable Energy Action Plan (SEAP) is the key document in which outlines how it intends to reach its CO2 reduction target by 2020. It defines the activities and measures set up to achieve the targets, together with time frames and assigned responsibilities [2].

Over the past decade a variety of attempts have been made at developing a holistic decision-making tool that will assist cities in developing urban energy strategies by helping them to assess how well they are currently performing (in terms of energy security and affordability and greenhouse gas emissions) and allowing them to evaluate energy strategies - bundles of energy demand reduction measures energy efficiency and supply measures – with respect to tcheir impacts in terms of increase in energy security, reduction in carbon emissions and their capital and operational costs, their cost savings and the ownership of those costs and

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savings as well as the payback periods of the concepts. Each development has originated from a particular discipline and has typically been an extension to the urban energy system as a whole of tools specific to that discipline [3-5].

The software tool developed within CitInES will consider the urban energy system as a whole. It will provide its user with the possibility to assess the financial risk and environmental impacts of a broad spectrum of measures ranging from the reduction of energy demand, the production and transformation of energy, its distribution and storage as well as the optimization of the whole energy system thanks to the communication of its sub-components.

3 METHODOLOGY

CitInES methodology is driven by supply-demand balance methodologies used by Transmission Systems Operators and has been adapted to a more local context [6-7]. It can be divided into the following steps:

3.1 Characterization of the energy demand by usage and type of consumer

The first step is to characterize the consumers by type (old/new apartment buildings, offices, hotels...) and by usage (space heating, water heating, lighting…). Thus, following data should be collected:

- Urban planning: number of buildings of a given type, mean number of inhabitants by building, specific industries description…
- Transport: description of public transport, statistics on mobility…
- Energy use measurement (at city or district level, if possible by type of contract and with a hourly time step)

The details of the useful data are given in the database definition. Then, using CitInES energy demand profile data base, demand curves are to be provided by usage and type of end-user. It is indeed important to split the demand curves by usage and type of consumer in order to be able to build energy demand projections using macroeconomic scenarios.

3.2 Choice of macroeconomic scenarios for long-term energy demand and price evolution

In this step, energy demand scenarios (typically for 2020, 2030 and 2050) will be constructed based on assumptions about long-term evolution scenarios of energy demand by usage and consumers type.

- World macroeconomic models (for instance World Energy Outlook from IEA or scenarios from European Climate Foundation, see www.tsp-data-portal.org for a detailed inventory), which also generate correlated energy prices
- Local context evolution: urban planning, evolution of GDP by sector, forecast of population growth…

These scenarios give typically the annual energy consumption for a given type of consumer and usage, over a period of 40 years.

3.3 Definition of studied energy strategies and characterization of energy generation mix and transmission networks

Once the energy demand scenarios are built, the next step is to define a set of energy strategies to study. Following data have to be specified for each energy strategy:

- the forecast energy mix for each usage and type of consumer i.e. the proportion of each energy carrier (electricity, gas, heat, wood, fuel…) used for a given usage
- local energy generation and storage system: PV cells, waste-to-energy, cogeneration, geothermal energy, heat from industry process…
- transmission and distribution networks (electric, gas, heat, cold)
- demand side management : building insulation, energy efficiency or smart grids
- public transport policies : for instance electrical vehicles introduction

3.4 Definition of uncertainty scenarios (temperature, wind, solar radiation, outages, power market prices…)

The evaluation of energy strategy depends on long-term energy price and demand scenarios, but also on short-term uncertainties scenarios (temperature, wind, solar radiation, outages, power market prices…).

Test cases with a hourly granularity over a year will be built, crossing local historical data (for instance for weather) with CitInES data base. Typically, 10 to 100 test cases (yearly time series with an hourly granularity) will be used for strategy evaluation.

3.5 Scenario simulation

To assess an energy strategy, CAPEX is computed by optimizing local generation and storage capacity to face the demand but also includes required energy network CAPEX costs, while OPEX and fuel costs evaluation is obtained by minimizing costs to match production and demand, taking into account technical and operational energy system constraints. Optimization takes also into account existing and potential energy generation from renewable energy sources. Finally, pollutant emissions are evaluated including direct emissions generated from local energy systems and indirect emissions generated from grid energy supply.

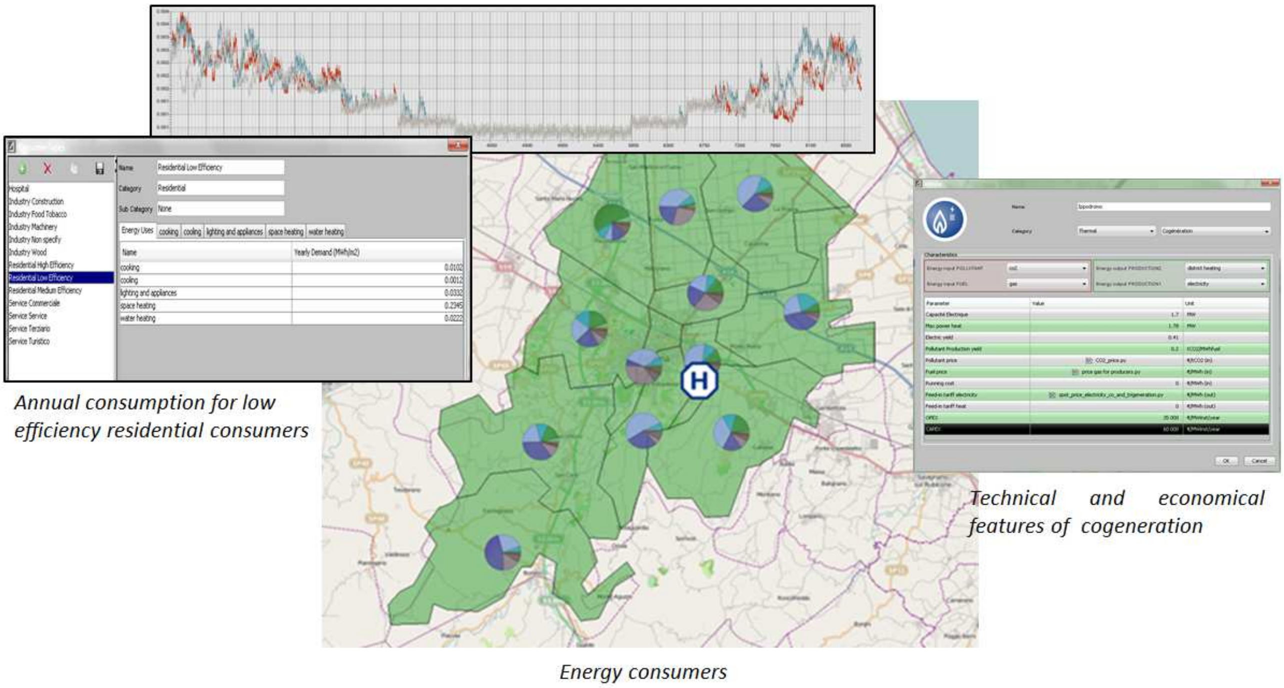

Fig. 1: CitInES software overview – Cesena study case

4 CESENA – STUDY CASE

Cesena belongs to the Emilia-Romagna region of the northern Italy and is situated ca. 15 km away from the Adriatic coast. Together with Forlì, Cesena is the capital of the Forlì-Cesena province that contains ca. 378.000 inhabitants and 30 Municipalities. Cesena itself has a population of ca. 97.500 inhabitants (31st December 2011).

Due to its proximity to many important towns (such as Bologna, Rimini, Firenze and Ancona), Cesena has an important role as a transport hub and is a strategically significant logistical point in Italy (Bologna airport and railway station, harbours of Ravenna and Ancona). In addition, some strategic national routes pass by Cesena.

Cesena has a long established tradition as a centre of manufacturing, specialized in the agro-industrial sector. In comparison to other manufacturing fields, this sector has grown considerably over the last decade. The industrial and demographic pressures require a new kind of approach to the challenge of energy efficiency and environmental impact. There are wide margins for improvement in terms of a sustainable approach to energy consumption and efficiency.

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4.1 Energy networks

Electric grid: Cesena has an extensive medium voltage electric network supplying the residential, service and industrial sector with a total energy consumption of around 490 GWh [8]. Specific information about the high and medium voltage is available together with the location for the electric substations for high-medium and medium-low voltage. The total length of the electric network at high and medium voltage is around 596 Km of electric lines where 14 Km are high voltage [9]

Natural gas grid: To the municipality of Cesena belongs an extensive grid for the distribution of natural gas supplying the residential, service and industrial sector which supplies around 920 GWh of energy [8]. The total length of the gas distribution network piping is around 750 km. Specific information about the material of the pipeline, diameter, length and type together with connection points to the buildings and distribution for each pipeline is available for the Municipality of Cesena [10]

Heating and cooling grid: In the municipality of Cesena are existing six district heating networks delivering heat to residential and service buildings. Specific information about the distribution of the pipelines, connection points to the buildings and the installed capacity is available. The total length of the district heating network is 11 Km of pipelines. Base load is provided by the CHP plants located in the parts of the town called “Ippodromo” and “Buffalini” (inaugurated in 2012). An absorption machine is connected to the CHP installed at Buffalini providing cooling for the hospital “Ospedale Murizio Buffalini”. The remaining district heating grids are micro-grids driven by gas boilers which are connected to 19 gas boilers with a thermal capacity of 21.7 MWt with an annual thermal energy production of around 15529 MWht [11-12].

4.2 Building sector

Technical information about the characteristics, location and activities developed for the residential, service and industrial buildings of the Municipality of Cesena is.

Residential Sector (RS): The residential sector with a total surface of 2.73 km2 represents around the 54% of the total built surface of the municipality. For each residential building the year of construction, the location and if it is use also use for additional purposes (part of the building is use for commercial activities) is available [13]. Around 11% of residential buildings are classified as High Efficiency buildings with energy consumption less than 50 KWh/m2/a, around the 33% are Medium Efficiency buildings with energy consumption between 50 - 200 KWh/m2/a and around 54% as Low Efficiency building with energy consumption higher than 200 KWh/m2/a [14-15]. The Municipality of Cesena does not have specific information related to the share of the electricity and heat consumption by end use. However, statistics at national level were considered as assumptions for the calculations [16].

Service Sector (SS): The service sector with a total surface of 1.197 km2 represents around 24% of the total built surface of the Municipality [13]. Each building is classified according to its main activity in four categories: commercial, tertiary, service and touristic. Commercial buildings include activities such as shops, tertiary cover office building, service comprise all the public activities such as school and touristic covers restaurants and hotels. Most of the buildings are oriented to commercial activities representing around 65%. Service activities, related with the public activities such as school, accounts with around one 23%. Finally, the rest of the surface is designated for service and tourist activities.The Municipality of Cesena does have specific information related to the energy consumption by end use for the service sector. However, national statistics are available about this issue [17].

Industrial Sector (IS): The industrial sector with a total surface of 1.09 km2 represents around the 22% of the total built surface of the Municipality [13]. Each building is classified according to its main activity according Eurostat classification following the ATECO code which is register for each industry of the Municipality of Cesena. The main economic activities are oriented to wholesale, retail and repair of vehicles and motorbikes or manufacture of metal product (Except machinery and equipment) and represent around 86%. Agriculture sector and the production machinery and transport equipment for it which suppose around the 8% of the total. Construction sector represents also relative high share with around the 2.5%. The Municipality of Cesena accounts only with aggregate statistics about the energy consumption by fuel in the overall industrial sector [8]. However, national statistics are available about the share for the fuel consumption for each industrial activity [18].

4.3 Local energy production and green areas

Photovoltaic panels: The Municipality of Cesena accounts with several photovoltaic installations for electricity production. For each installation the location, surface, power capacity together with the year of the connection to the grid is available. The total installed capacity is around 40 MWp with an average efficiency of 14% [19].

Wind Turbines: The Municipality of Cesena accounts with a group of wind turbines installed in the Parco Educativo Sperimentale delle Energia Alternative (PESEA). The installed power capacity is 40 kW which an estimated energy production of 50 MWh considering 1250 hours of operation per year [20].

Hydropower plant: The Municipality of Cesena accounts with a small hydropower plant with a production capacity of 0.3 MW and a nominal production of 0,9 GWh of electric energy [21].

Biogas: The Municipality of Cesena produce biogas in the waste which treated in the in the composting plant in Busca and the local water treatment plant which later is use for the electricity production. The electric installed capacity for the plant is respectively 1200 kW and 330 kW [22].

Green areas: Municipality of Cesena accounts with detail information about the location and surface of its green areas. Its total surface is a round 4162 Ha where are almost the totality are forest, around the 96%, and rest are Park and Gardens

4.4 Indicator

The Municipality of Cesena has defined several indicators to monitor its energy strategy action plan. This action plan has three main pillars: reduction of CO2 emissions, increase of the use of renewable energy sources and increase of the energy efficiency. Following these objectives, five main key performance indicators (KPIs) has been selected to measure the impact of the:

- CO_2 Emissions (kton)
- Reduction of CO_2 emissions (%)
- Primary energy consumption (ktep)
- Energy efficiency improvement (reduction of primary energy consumption) (%)
- Share of locally produced renewable energy (%)

5 SCENARIOS

Several scenario states of the local energy system in Cesena have been study. They are used to assess and compare the pollutant emissions, renewable energy production and energy efficiency of the city, in line with the 20-20-20 objectives, in the past, current or projected situation of the territory.

5.1 2020 SEAP Scenario - Reference Scenario

This scenario is based on the current state of the energy sector in Cesena and the goals collected in the SEAP of the city. This configuration was composed of three parts:

- “2010 real”: snapshot of the city’s situation in 2010. This node consists in the reference situation for SEAP.
- “2012 real”: snapshot of the city’s situation in 2012.
- “2020 SEAP”: situation in 2020 if target is reached for all SEAP actions.

5.2 2020 Projected Scenario

The monitoring process aimed at collecting data about the current situation of the city regarding SEAP actions advancement. This data was used to create a projected situation of the territory in 2020 if SEAP implementation keeps a constant pace.

In this scenario, except for SEAP actions implementation, it was considered that everything in the local energy system has stayed the same as in 2010 and 2012 represents a “theoretical” current situation of the territory which is in line with the covenant of mayor’s guideline.

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Based on this representation of the current situation, the projection of the situation in 2020 if the rhythm of action implementation stays the same was assessed. To create 2020 Projected scenario, the following projecting rules were used:

- A linear projection is used, assuming that the completion rate of the action is linear between 2010 and 2020: If 10% of the action has been reached in 2012, 50% will be reach in 2020
- If the rate exceeds 100% in 2012, the 2012 rate is kept for 2020; it is therefore assumed that the level reached in 2012 is also reached in 2020 (the advancement of action does not decrease), but that the advancement of the actions stops in 2012.
- If the projected rate exceeds 100% in 2020, the 100% rate is kept for 2020; it is therefore assumed that unless the SEAP is reviewed, the targets of actions are not exceeded.

5.3 2020 Alternative Scenario

Based on the analysis of actions effectiveness regarding the cost of the ton of CO_2 emission avoided and on the assessment of potential new actions, an alternative 2020 scenario is built up. This scenario aims at reducing Cesena global costs while keeping the same reduction of CO_2 emissions in 2020 as the ones targeted in the SEAP, to make this objective easier to reach.

The actions effectiveness is mainly assessed using the indicator of the cost of the ton of CO_2 emission avoided, including subsidies for the city such as feed-in tariffs. Fig. 2 shows the application of this methodology to measures adopted in the SEAP together with some additional more.

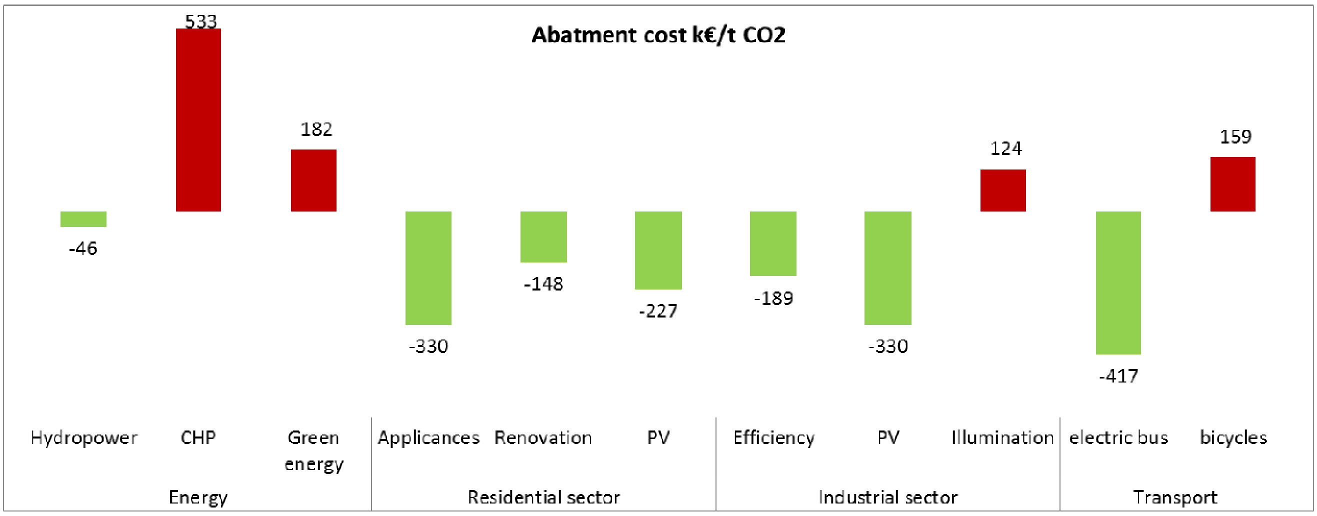

Fig. 2: Abatement cost for several measures

Based on these results shows in Fig. 2, the following modifications were included in the 2020 Alternative scenario (compared to the current SEAP scenario):

- Reduction of the cogeneration implementation rhythm (50% of the SEAP target)
- Keep the importation of Green Energy at the 2012 level (3.6 GWh)
- Increase in the installation of solar panels (double SEAP target)
- For all other actions, the targets of the SEAP were kept unchanged.

Furthermore, three new additional measures has been identified and included in this alternative scenario:

- Replacement of diesel and gasoline buses by electric ones
- Installation of public bikes that reduces the use of private cars
- Increase in hydro power plant production

5.4 Summary of the Scenario

Table 1 summarizes the different actions taken in each of the analyzed scenarios: 2020 SEAP Scenario, 2020 Projected scenario and 2020 Alternative scenario.

	2020 SEAP	2020 projected	2020 alternative
Green areas	Inc. in 160 ha	Inc. in 164.75 ha	Inc. in 164.75 ha
Red. of lighting & appliances comp. in residential sector	Red. of 11 GWh	Red. of 11 GWh	Red. of 11 GWh
Cogeneration	146 GWht + 102 GWhe	110 GWht + 21 GWhe	73 GWht + 61 GWhe
Renovation of the buildings	18% Residential sector		18% Residential sector
PV Panels	61 MWp installed	61 MWp installed	102 MWp installed
Red. of public illumination	Dec. of comp. in 50%		Dec. of comp. in 50%
Red. of electric comp. in the Industrial Sector	Inc. of the eff. in 6%	Inc. of the eff. in 3%	Inc. of the eff. in 6%
Green Energy	Purchase 22 Gwhe	Purchase 18 Gwhe	Purchase 3.6 Gwhe
Buses replacement			50% of diesel and gasoline buses
Public bikes			Red. of 3% of private cars use
Hydro power plant			Inc. in 50% of the production

Sceanrios for the energy sector of Cesena up to 2020

6 RESULTS AND DISCUSSION

6.1 Energy and environmental impacts

Table 2 shows the impact in terms of energy consumption and CO_2 emissions of the measure in each of the proposed scenarios.

	2010	2020 SEAP	2020 Projected	2020 Alternative
CO_2 Emissions (kton)	435	361	398	351
Reduction of CO_2 emissions (%)		17%	9%	19%
Primary energy consumption (ktep)	217	168	193	163
Energy efficiency improvement (%)		8%	4%	14%
Share of local renewable energy (%)	2,6%	8%	7,4%	12%

Table 2: Enegy and CO_2 emission impact for the scenarios

In all the scenarios proposed, there is an improvement in terms of energy performance, use of renewable and reduction of CO_2 emissions. In fact the 2020 projected scenarios, the less ambitious scenario which considers that the rhythm of action implementation stays the same was assessed, achieves a reduction of 9% and 11% in the in the CO_2 emissions and the primary energy consumption compared to 2010. Especially interesting is the increase of the share of the local renewable energy which grows from a 2.6% in 2010 to 7.4% in 2020 mainly due to increase of the installed capacity of PV panels.

The additional measures including in the 2020 SEAP scenario produces an improvement of all the indicators compared with the 2020 projected scenario. Although, the share of renewables is only slight better between both scenario, an important improve in the energy efficiency produce in 2020 SEAP scenario a significant decrease of the CO_2 emissions and the primary energy consumption. These represent 17% and 22% respectively compared with 2010 and double of the improvements compared with the 2020 projected scenario.

Finally, the 2020 Alternative scenario gets the better impact in terms of energy efficiency and CO_2 emissions. In this scenario the improvements in terms in CO_2 emissions are slightly better than for the 2020 SEAP scenario. This is because the increase of the installed capacity of PV panels which compensate the impact of other measures which could produce an increase of the CO_2 emissions such as the reduction of the cogeneration in 50% or the reduction of the green energy purchase to the grid. This measure not only has impact in terms of CO_2 emissions also explain the improvement in the indicator related to the energy consumption and efficiency.

6.2 Economic impacts

The analysis of economic impacts is based on three indicators:

- Investments are considered annualized, with an actualization rate of 7.25%. They were obtained from the study of similar actions lead in Europe and give an order of magnitude of the necessary investments.
- Annual energy savings cost refer to the total energy costs saved within the city (producers, consumers and imports costs), including subsidies.
- The global net value represents the total savings of the city, adding annualized investments and annual energy savings.

Table 3 shows the economic impact for the scenarios. In all the scenarios the adopted measures represent a decrease of the annuals energy savings cost within the city. Nevertheless, in spite of 2020 SEAP and 2020 Projected scenarios have lower investment cost compared to the 2020 Alternative scenario, this scenario is the only one where the global net value is profitable from the economic point of view.

	2010	2020 SEAP	2020 Projected	2020 Alternative
Investments (M€)		27	18	38
Annual energy savings cost (M€)		-20	-10	-41
Global net value (M€)		7	8	-3

Table 3: Ecomical impact for the scenarios

It is important to note that the evaluation of action investment costs has been done with general data using examples of already executed projects, those costs may thus differ from local costs that Cesena should benefit.

7 CONCLUSIONS

This paper presents the study case of the municipality of Cesena. This municipality, as a partner of the project, has implemented its SEAP under the tool to assess the impact of the measures taken under several scenarios and monitor its activities to validate the developed software. The different measure adopted to reduce the CO_2 emissions and energy consumption together with an increase of the energy efficiency and use of renewables. The methodology employed is driven by supply-demand balance methodologies used by Transmission Systems Operators and has been adapted to a more local context.

Several scenarios have been presented and analysed in which different measures are adopted focus in the following objectives: increase the use of renewable energy sources, the energy efficiency and reduce of CO_2 emissions. The 2020 SEAP scenario represents the current state of the energy sector in Cesena and the goals collected in the SEAP of the city. Based on the current situation of the city, the 2020 projected scenario reflects the projection of the situation in 2020 if the rhythm of action implementation stays the same was assessed. Finally, the 2020 Alternative scenarios is built on focus on the analysis of actions effectiveness regarding the cost of the ton of CO_2 emission avoided and on the assessment of potential new actions.

In all the scenarios proposed there is an improvement in terms of energy performance, use of renewable and reduction of CO_2 emissions. In fact the 2020 projected scenarios the less ambitious scenario achieves a reduction of 9% and 11% in the in the CO_2 emissions and the primary energy consumption compared to 2010. In the 2020 SEAP scenario only a slight improvement in the share of renewable is achieve compared to the 2020 Projected scenario. In this scenario the decrease of the CO_2 emissions and the primary energy consumption is 17% and 22% compared with 2010 and the double of the improvements compared with the 2020 projected scenario. Finally, the 2020 Alternative scenario gets the better impact in terms of energy efficiency and CO_2 emissions which is mainly due to higher capacity installed of PV panels compared with the rest of scenarios. Additionally, this scenario was the only one where the global net value is profitable.

The future work will be oriented to assess the impact of additional measures such as the integration of new measures such as the increase of micro-wind turbines and the development of new scenarios.

8 ACKNOWLEDGEMENT

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reviewed paper

City in Transition: Urban Open Innovation Environments as a Radical Innovation

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1 ABSTRACT

In this paper we apply the transition prespective to the field of urban development. As many sectors of our society the field of urban development is undergoing major changes. Commom ways of working and traditional business models fail under the present economic circomstances and are not able to answer to the challenges that climate change, peak oil and the shortage of rare earth minirals present. We view new approaches to the process of urban area development and the introduction of the Smart City concept as prominent examples of potential transitional change in urban development and explore their possible synergies. In order to do so, we use the key concept of radical innovation and find that Urban Open Innovation Environments, such as Fab Labs, have most transitional potential. We conclude with some examples of these environments in the city of Rotterdam and preliminary success factors.

2 SOCIETY IN TRANSITION

Society is in transition: ‘We do not live in an era of change, but we are experiencing a change of eras’ (Rotmans, 2013, with reference to Verhagen, 2011). We are moving towards a sustainable society. Authors like Rifkin (2011) and Freedman (2009) forsee a new industrial revolution based on advanched digital communication and production and energy from renewalble sources. Such fundamental changes are brought about by transitions.

2.1 Transition studies

Over the last decade a new scientific discipline has emerged focussing on the transition of society (Grin et al, 2010, Van der Hoeven, 2010). A growing number of politicians and academics are convinced that only through drastic system innovations and transitions it becomes possible to bring about a turn to a sustainable society. Often reference is made to the Brundtland report Our Common Future (World Commission on Environment and Development, 1987) definition of sustainable development as one ‘that ties in with the needs of the present without endangering the power of future generations to satisfy their own needs,' as inevitable for solving a number of structural problems on our planet, such as the environment, the climate, the food supply, and the social and economic crisis. Sustainable development is not an exclusive type of development that addresses the needs of a select few; it attempts to express the interests of multiple actors in a society as well as the interests of different generations. To summarise, sustainable development is a complex, long-term, multi-level, integrative, multi-actor process (Frantzeskaki et al., 2012).

Transitions are processes of structural change in societal (sub-)systems such as energy, supply, housing, mobility, agriculture, health care, and so on. Transitions come about when the dominant structures in society (regimes) are put under pressure by external changes in society as well as endogenous innovation. Under certain conditions, seemingly stable societal configurations can transform relatively quickly (Loorbach, 2010, with reference to Geels, 2002 and Rotmans et al, 2000). Transitions are conceptualised as societal processes of fundamental change in the structure, culture and practices of a societal system (Frantzeskaki and de Haan, 2009). Table 1 shows the multilevel character of transitions which is central to the systems approach and that researchers have adopted in order to deal with the complexity of transitions.

Transition management types	*Focus*	*Problem Scope*	*Time scale*	*Level of activities*
Strategic	Culture	Abstract/societal system	Long term (30 years)	System
Tactical	Structure	Institutional/regime	Mid-term (5-15 years)	Subsystem
Operational	Practices	Concrete/project	Short term (0-5 years)	Concrete

Table 1: Transition management types and their focus (Loorbach, 2007).

The central assumption is that societal systems go through long periods of relative stability and optimisation that are followed by relatively short periods of radical change. Transitions as processes of ‘degradation’ and ‘breakdown’ versus processes of ‘build up’ and ‘innovation’ (Gunderson and Holling, 2002) have been witnessed in history, e.g., the transition in the mobility system from the horse-carriage to the automobile (Geels, 2004). Transition management offers a prescriptive approach towards governing these processes as basis for operational policy models, and it is explicitly a normative model by taking sustainable development as long-term goal (Loorbach, 2010). Leading transition management scholar and activist Jan Rotmans' (2013) views on the present changes in societal culture, structure and practices are summarised in table 2.

Culture		*Structure*		*Practices*	
Old	New	Old	New	Old	New
Individual	Community	Top-down	Bottom-up	Effectiveness	Affection
Mass production	Tailor-made	Vertical	Horizontal	Efficiency	Trust
Derived values	Created values	Centralised	Decentralised	Control	Autonomy
Linear/carbon-based	Circular/Bio based	Government	Citizen	Rules	Freedom of choice
Financial return	Societal return	Institutions	Lifestyle	Quantity	Quality

Table 2: Transitional changes in culture, structure and practices (based on Rotmans, 2013).

2.2 Present phase of transition: take-off

Next to the multilevel concept (Rip and Kemp, 1998, Geels, 2002), the multiphase concept is central to transition management. Although transitions follow a capricious pattern, from a distance a more gradual pattern emerges following a S-curve, typical for innovation studies, distinguishing between the predevelopment, take-off, acceleration, and stabilisation phases (Rotmans, et al., 2001). At present we find ourselves in the take-off phase, in which efforts should be targeted at facilitating a limited number of radical innovations that have the potential of leading to breakthroughs on a systems level (Rotmans, 2013).

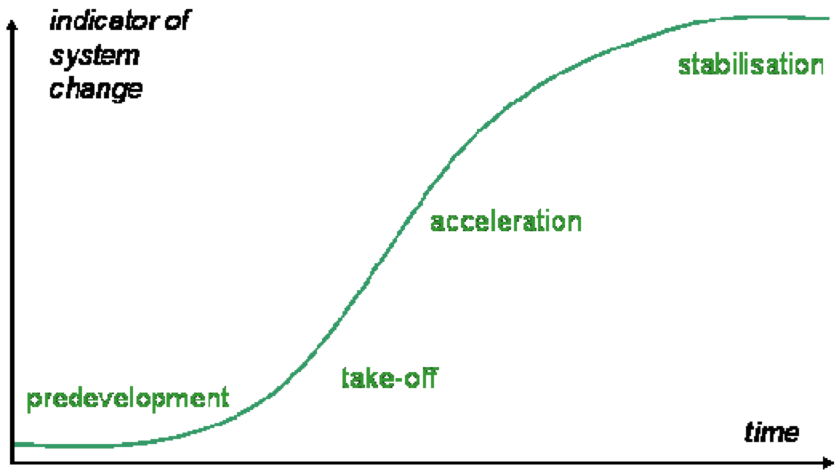

Fig. 1: The four phases of a transition (Rotmans et al., 2001).

2.3 Key concept: Radical innovations

Jonker (2013) explains the essence of the transition towards a sustainable society: Repairing a structurally unsustainable system leads to a patched up unsustainable system. This pattern may only be broken by shifting from a treatment of symptoms within the system to a system change. This calls for radical or disruptive innovations, not only creating new markets and values chains, but in the same time abolish and eventually replace old technologies and business models. This approach relates back to the process of creative destruction as described by Schumpeter (1942).

An example of a radical innovation today is 3D-printing. A 3D-printer turns every consumer into a producer. As such local manufacturing re-emerges and present global manufacturing and distribution systems will change (Brody and Pureswaran, 2013). In a similar manner open data is a radical innovation, challenging the monopoly of governments over information, as is the local production of renewable energy.

In the take-off phase of transition the combination of grassroots radical innovations and changes in the overall external landscape destabilise the system and start its break-down. Within the multilevel model, Rip and Kemp (1998) distinguish between niches, a dominant regime, and an external landscape. In practice, innovations often seem to emerge in niches outside of the leading regime (Kemp, Schot and Hoogma, 1998). When the right niche actors find each other and collate with change minded actors within the dominant regime the configuration of a new regime may emerge and the change becomes irreversible. For the transition to take-off in this way this group of frontrunners requires certain room to experiment and innovate (Rotmans, 2013).

3 URBAN AREA DEVELOPMENT IN TRANSITION

One of the societal (sub-)systems that is undergoing structural change is urban development. In the Netherlands, the traditional market driven way of urban development, involving large real estate developers and municipalities acting actively on the land market, has failed as a result of the financial and economic crisis. Private and public actors are exploring new ways of working together and new actors, such as private individuals and local collectives, have entered the marketplace. As such the field of urban development is the take-off phase of transition and radicale innovations are key to a further development of the process of change.

3.1 Urban area development

Urban area development may be defined as the integral development of a (large scale) area, in all its dimensions, over a long period, with different stakeholders (public and private). There are no clear limits in terms of size, in terms of investment volume or mere square meters. Complexity is the common denominator as both content and context of the development are complex as a result of a certain combination of the elements above. This distinguishes urban area development from common real estate or property development which involves less stakeholders, takes less time and concern one objects rather than an area based portfolio (Peek and Franzen, 2007).

Although there are many differences between urban area development and real estate development, the core activities that have to be undertaken are quite similar. These can be categorised under five main disciplinary aspects: public-private, land, financing, design and image. The way of dealing with these aspects in area development is very different form project development, both in time and in the relation to the context. Figure 2 shows the specific definition of each of the five aspects for urban area development.

Public-private partnership	Establishing a stable basis for collaboration by allocating authority, responsibilities, risks, costs and revenues
Land assembly	The way the land is or can be assembled and zoned determines the area development to a great extent
Financial engineering	Accessing the future value of the development that determines the amount of investment in land, design and construction
Urban design	Deals with creating the spatial outlines for individual buildings, infrastructural and other works
Branding	Enables to communicate about the core-values of the future area upfront and change its reputation

Fig. 2: The five main disciplinary aspects of urban area development (Peek and Franzen, 2007).

Next to these aspect we identify four phases of an urban development process: initiative, feasibility, realisation and management. These phases essentially show the same sequence that is found in real estate or project development, and the two are interlinked. As urban development establishes the preconditions for project development, the latter typically starts its initiative phase in the realisation phase of urban development.

3.2 Past, present and future of urban area development

By defining the disciplinary aspects and phases of urban area development we have constructed a simple framework that helps us to clearly summarise the changes in urban area development in the Netherlands as we have experienced over the last decade. Before the financial and economic crisis started in 2007 large scale urban developments may be characterised as in figure 3, involving a municipality actively purchasing land and developing it in partnership with large private property companies based on a long-term residual financial model and a 'blue print' master plan containing certain landmarks or iconic buildings. The phase of management after the works are complete was not part of the area development process as profits were made at the moment parcels of land and constructed buildings were sold to new owners and public space was transferred to the municipal department of urban management.

Initiative **Feasibility** **Realisation**

Public-private partnership	Marriage between municipality and well-known large property developers until realisation phase
Land assembly	Buy all land upfront using compulsory purchase if necessary
Financial engineering	Land development: Long term land development model involving large investments upfront: 'bathtub'
Urban design	Integral and detailed plan
Branding	Landmarks and city icons

Fig. 3: Typical characteristics of Dutch urban area development before 2007 (Peek, 2011).

After 2007 the lack of available debt finance and the sudden shift from a sellers' market to a buyers' market brought most large scale area developments to a hold. The capacity to (re)develop no longer lies with municipalities and the large property developers. Their 'marriage' dissolved or is in a state of divorce as both actors have to largely depreciate on the land assets they hold.

Management **Initiative** **Feasibility** **Realisation**

Public-private partnership	Municipality facilitates local and small scale initiatives
Land assembly	Limited strategic land purchases with eye for temporary uses
Financial engineering	Land and property development: Limited investment upfront and cash flow from temporary uses
Urban design	Integral vision, detailed in individual plans
Branding	Incubators, bottom-up

Fig. 4: Typical characteristics of Dutch urban area development after 2007 (Peek, 2011).

This situation leaves room for other actors to get directly involved in real-estate development, such as local contractors, present land-owners and users and future users of an area. The involvement of these types of actors results in a more bottom-up approach and a decreased project size. Figure 4 characterises the present state of Dutch urban area development. Most striking is the emergence of appreciation for the present state of the area. Where before a 'tabula rasa'-situation as start of the (re)development was preferred and strived for, currently actors see potential in the existing land use and aim to build on this, limiting investments upfront and benefiting from temporary uses.

In our opinion this type of urban area development does not suffice to answer the challenges our cities face. Especially in the field of sustainability the ability to invest on a larger scale is needed, for instance in infrastructure supporting renewable energy solutions and urban transit systems. In order to do so we advocate an area development process that also involves the future management phase. With this we move away from a development approach focused on risk reduction and profit from a temporary – albeit lengthy – commitment, towards the users' perspective focusing on continuity and long-term value creation combined with a continued utilitarian valuation of the property. Figure 5 characterises our view on the future of urban area development process spanning five phases.

Viewing urban area development mainly as a process of urban management instead of a sort of property development XL offers opportunities for the coupling of juxtaposed (financial) flows in the area to those of the real estate business case. Coupling these flows, such as energy (electricity, gas, heat and cold), water, waste, transportation of people and goods and information, increases the financial base for development of the area and offers opportunities for more sustainable solutions for the future.

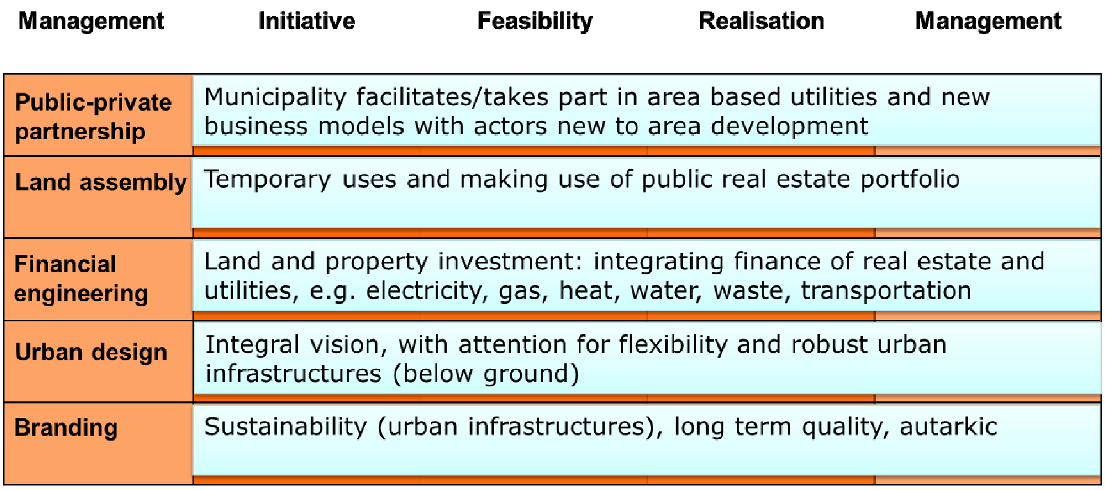

Fig. 5: Characteristics of a future urban area development process (Peek, 2011).

3.3 Key concept: Supply chain integration

We agree with Rotmans (2013) and consider the present Dutch practice of urban area development to be in the take-off phase of a transition process. Changes in the external landscape of area development like a decrease in population in certain regions of the country, changing work patterns (flexible hours and working from home) and space for water resilience, have resulted in a deadlock of the pre-crisis development model. The crisis itself was merely a trigger to reveal the faults of the system. In the meantime on a local level many bottom-up experiments are on their way. People start producing their own renewable energy, individually or in collectives. Others seize this opportunity to design and build their own home. Some experiment developing floating homes for living on water or make use of vacant plots of land for urban farming.

Analysing these niches for the perspective of our vision on the future of urban area development we find that all in some way or another deal with supply chain integration (Peek and Van Remmen, 2012). Some initiatives lead to vertical integration, as end-users take the lead in the development process or emphasis is on the transformational powers of the current owners and users. Others mainly focus on an area based approach to utilities such as energy and water and by that resulting in a horizontal integration of real estate with these adjacent sectors.

4 SMART CITY CONCEPT

Technology is a main driver of innovation. In the field of urban development we find an entire movement based on new technologies under the umbrella of the ‘Smart City’. The Smart City approach has gained a lot of momentum out of the belief that the availability of intellectual capital (or knowledge) and social capital are urban production-factors that determine the competitiveness of cities (Caragliu et al., 2009). Smart City refers to sustainable urban development (smart environment); to the incorporation of information and

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communication technologies in the management of services (smart economy); to the generation of participatory spaces in terms of collaboration and innovation (smart governance). Table 3 gives an overview of the core-aspects of the Smart City approach. As such the concept may serve many different intentions, not touching upon interrelations and contributions to overarching goals, and remains particularly polysemous and vague. This is probably why it has turned into a highly used term when proposing or justifying urban reforms (Tironi, 2013). Smart City is also a successful term for marketing new urban technologies used by multinationals like IBM, Cisco, Siemens, General Electric and Philips.

Why?	*What?*		*How? (technology)*		*How? (organisation)*	
Sustainability	Resources	Utilising	Infrastructures	Communicating	Public	Providing conditions
Resilience	Economy	Adding value	Buildings	Producing	Private	Investing
Quality of life	Politics	Connecting	Places	Meeting	Individuals	Participating

Table 3: Core-aspects of the Smart City approach.

We value the innovative power of the Smart City, but question its transition force as the concept is already captured by the dominant regime with showcases like Songdo International Business District and Masdar City.

4.1 Benchmarking 'smartness'

As no city wants to be a 'dumb' city, the Smart City concept is quickly adapted for benchmarking cities. An example is the Smart City-model ranking European medium-sized cities (Centre of Regional Science, 2007) that defines a Smart City as a city that is well performing in a forward-looking way in economy, mobility, environment, citizenship, quality of life and governance, built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens. These aspect also feature the Smart City Wheel (figure 6) that was introduced by urban and climate strategist Boyd Cohen and that he uses to benchmark the world's major cities (Cohen, 2012a).

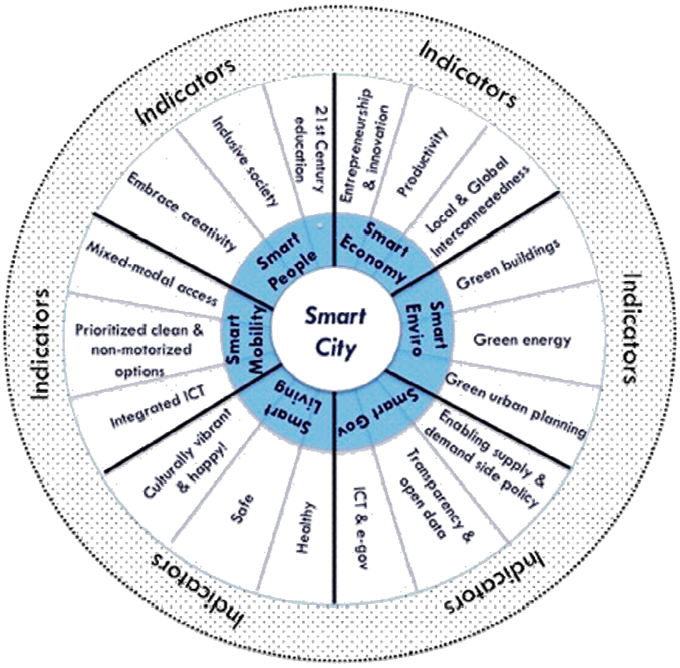

Fig. 6: Smart City Wheel (Cohen, 2012b).

4.2 Key concept: empowering ICT

Although citizens' participation is emphasised and the benchmarks even hint at possible change in roles of government and citizens, the Smart City concept remains, both as benchmark and as marketing tool, highly top-down oriented aimed at better managing and controlling city systems by collating ever-detailed information about real time functioning, and being able to optimise decision making in the immediate, short and long term. Cosgrave et al. (2013) state that 'the Smart City should not necessarily be interpreted as top-down vision delivered solely through government investment. Quite the opposite, the Smart City is largely an organic system of systems (Harrison and Abbott Donnelly, 2011), which comprises an ecosystem of products, services, companies, people and society that are working together creatively to foster innovation within the city'.

From a transition perspective the key concept of the Smart City should be application of ICT that is aimed at empowering citizens, rather than focussed on improving control of city systems. 'Citizens are not only engaged and informed in the relationship between their activities, their neighbourhoods, and the wider urban ecosystems, but are actively encouraged to see the city itself as something they can collectively tune, such that it is efficient, interactive, engaging, adaptive and flexible' as Arup (2011) describes in their Smart City vision.

5 URBAN OPEN INNOVATION ENVIRONMENTS

The combinations of our key-concepts of transition, urban area development and Smart City – respectively radical innovations, supply chain integration and empowering ICT – leads us to believe there is a new type of urban use emerging, next to the traditional mix of residential, offices, retail and leisure, that is able channel the transitional opportunities as described: the Urban Open Innovation Environment. Existing and tested concepts of the Living Lab and the Fab Lab are part of this new typology.

5.1 Open innovation

Radical innovations, supply chain integration and empowering ICT all highly depend on the openness of their respective processes. In contrast to closed innovation, the open innovation paradigm was introduced by Henry Chesbrough (2003) and implies companies opening their innovation processes for the inflow and outflow of knowledge and information. Chesbrough et al. (2006) defines open innovation as 'the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively'.

Open innovation is at the core of Finnish society. Finland has created a bottom-up, dialogical, collaborative and human-centric strategy that is central to its development as a nation (Finland's Country Brand Strategy, 2010). This fresh picture of a people-driven society is based on the idea that the society best develops based on its dynamic individuals and their networks. Since the Finnish EU Presidency in 2006 (The Helsinki Manifesto, 26 November 2006), the EU presidencies have promoted open, ecosystem-based human-centric research, development and innovation in real-life contexts such as liv¬ing laboratories (Living Labs) that engage people (European Commission, 2013).

5.2 Living labs

Centred on co-creation, exploration, experimentation and evaluation Living Labs bring together public and private actors, such as companies and associations, and individuals to test new services or products. They provide a user-centric approach to develop and prototype complex solutions to emerging socio-technical challenges to promote open innovation and involve users early in the desig.. This all happens in a real life context. Their success relies heavily on user co-creation.

However, little attention has been paid so far to the question if and how the participating users could not only be the Guinea pigs (worst case) or co-creators (best case) in a Living Lab setting, but actually become co-owners of the solutions proposed and developed. Results from true co-creation, one might argue, should not disappear behind corporate walls. As it is the case with open innovation, the game logic of Living Labs is still to benefit corporations that are focusing on selling services and technology to governments and other public entities. The accreditation of Living Labs through a single non-profit association – the European Network of Living Labs (ENoLL) headquartered in Brussels – as the legal representative entity of the network, does not exactly paint a more network oriented picture of the Living Lab approach.

5.3 Fab labs

Radical innovation, in the authors' view, is rather to be expected from communities and 'institutions' that adhere to principles of open source, open content and open access. Such communities would need to be inclusive in terms of of societal and systemic innovation to thrive and become sustainable. In the world of software and information, some open source projects have demonstrated such characteristics. While the modern DIY – or Maker – movement is often seen as a hedonistic pass-time activity, its manifestations – Fab

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Labs, Makerspaces and Techshops – are attracting growing interest in many industries. Fab Labs are a global network of local labs, enabling invention by providing public access to digital fabrication. They share an inventory of core capabilities and can be considered a community resource. Makerspaces are similar, often equipped with the same machines, but lacking the global network. Techshop is an a US based provider of state-of-the-art public manufacturing workshops.

Globally, big players have started to fund Fab Labs on a substantial scale. Schlumberger is supporting the development of Fab Labs in Russia, Aramco sponsored the first Fab Lab in Dhahran (Saudi Arabia), and Chevron promised support fort setting up Fab Labs in US communities where it is active. Ford in the US and BMW in Germany are partnering with Techshop to provide their employees with access to digital manufacturing technology for tinkering outside working hours.

More interesting, however, are small-scale but high-tech developments, certainly from a perspective of emerging socio-technical production paradigms. For instance, Barcelona is pronouncing itself as ‘Fab City’ and aims to develop neighbourhood Fab Labs in every city district. The Dutch order of Inventors was a key partner for setting up the Fab Lab in Utrecht. In Amersfoort, the Netherlands, an artists’ collective is effectively transforming a former dye factory into a testbed for the transition town movement, centered around a Fab Lab. The Swiss clean tech accelerator Blue Lion in Zurich is setting up a Fab Lab for its companies.

In the following chapter we shall provide a series of case studies of urban open innovation environments in Rotterdam, the Netherlands, that defy the top-down approach of centrally planned ‘creative hotspots’. They represent not the archetypal grass-roots, bottom-up, counter-culture projects, but stand for a new type of initiatives that appear to operate on a lateral rather than a hierarchical dimension, very much akin to Rifkin’s projection of a shift away from hierarchical power and toward lateral power (Rifkin, 2011).

6 URBAN OPEN INNOVATION ENVIRONMENTS IN ROTTERDAM

In Rotterdam, there are many players who are actively working on combining real estate development and urban planning with the emergent phenomenon of the Maker movement. The incubator Dnamo in Rotterdam decided to refocus its activities as ‘RDM Maker Space’. Urban developer Stipo Rotterdam together with the city council and possibly Techshop are working on converting the Zomerhofkwartier to the making neighbourhood (‘maakkwartier’) of Rotterdam. Other initiatives include the Platform Digital Manufacturing, de Bende with its plans to make crafts-based making accessible, the 3D Print Academy, ‘De Makers van Rotterdam’, an initiative of social enterprises centered around Making, and the ‘Made in 4Havens’, an emerging design and production hotspot.

6.1 RDM Maker Space

RDM Maker Space is based in the former shipyard of the Rotterdamsche Droogdok Maatschappij (Rotterdam Dry-dock Company, RDM) that has been converted to an innovation hub where higher education, research institutions, start-ups and companies are located. The place provides opportunities for sharing knowledge, exchanging best practices, conferences and networking. RDM Maker Space offers access to high-tech manufacturing equipment as well as prototyping and manufacturing services. RDM Maker Space aims to spur innovation and entrepreneurship and to create a place where smart, creative and experienced people with different skills come together and eventually form a large community of makers.

6.2 Zomerhofkwartier

Zomerhofkwartier in Rotterdam, an area in walking distance of the central train station, is almost a textbook example of the aforementioned new style of urban development. The owner of the area has decided on a time-out of ten years to study the potential of the area and its bottom-up initiatives after traditional approaches to development turned out to be difficult and little promising. The time-out approach allows the developer to involve everybody in shaping the neighbourhood. The transitional character of the area attracts the creative industry; and the developer has pronounced the neighbourhood as the ‘maakkwartier’ (making quarter) with an emphasis on the creative and niche manufacturing industry and with a view to possibly attract Techshop to set up a large making facility there. Yet they remain open for others who embrace their philosophy, and remain open to the precise result of such developments (Van den Berk, 2013).

6.3 Made in 4Havens

Made in 4Havens is an emerging initiative in a former but now derelict dockland area in Rotterdam managed by the city council and the harbour board. The area has been designated to house innovative business in the fields of clean tech, medical and food. However, the area is also home to quite a few leading Dutch designers. Made in 4Havens currently serves as a platform to make local design visible and to connect it to local craft and manufacturing. One vision of Made in 4Havens is to integrate the local workforce to complement design with local production (Sant-Barendregt and van Dael, 2013).

7 CONCLUSION

Relocating production and research functions to the centres of neighbourhoods adds to liveability and to the local economy. Instead of focusing on offices, retail or residential areas as the core of urban area development, it call for exploring the possibilities of centring such a developments on a lab like approach. This requires a rethinking of the spaces of production, including the relationships between people and tools and people and the existing authorities. The open nature of a lab-centric approach ensures that government control is limited and provides conditions for radical innovations in the realm of urban development.

Eventually, the emerging lab-centric initiatives might well be developing into new institutions of a radically different type of economy, an economy that fundamentally contrasts the conventional top-down organization of society that characterized much of the economic, social, and political life of the fossil-fuel based industrial era. Its new paradigms are ‘distributed’ and ‘collaborative’, paradigms that appeal to a new generation of people who grew up with the Internet and who have for all their live been engaged in distributed and collaborative social spaces in parallel to the traditional, hierarchical environments of family, school and job.

As such we find the new type of use of the Urban Open Innovation Environment a potential strong change agent for radical innovation in the field of urban area development as they combine supply chain integration and empowering ICT. The success of these new environments large depends on their open character, not being part of the dominant regime of large companies and (governmental) institutions, but also not being trapped by a counter culture driven niche of grassroots/bottom-up actors that are not willing and able to leverage on their efforts. True openness in this respect refers to the ability to not only involve niche players, but make cross-overs to change minded actors within the dominant regime so that though lateral development (Rifkin, 2011) new regimes may emerge and the change becomes irreversible. Fab Labs appear to be more successful in this respect than Living Labs, which mainly benefit the private companies involved and not society at large.

Governments have an important role to play here. For Urban Open Innovation Environments to be truly open certain room to experiment and to innovate is required. Yet, only focussing on the operational level of concrete projects is not enough. For a new regime to emerge efforts on the tactical level have to be made, involving the support of emerging new, lateral ‘institutions’ that are able to generate business from radical innovations. These environments should enable new types of entrepreneurship, such as micro-multinationals, and even social enterprises operating beyond traditional business models. In this way, Urban Open Innovation Environments are able to become a constant force in the field of urban area development making cities in transition more sustainable and resilient, and adding to the quality of life.

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reviewed paper

Competition between Cities and Regions in Europe – Can Smart Spatial Planning Interact with Gravitational Site Location Models for External Investment?

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1 ABSTRACT

However smart a city or a region might be, a wide range of companies (eg in retail and services) use a gravitational model for site location for new investments. If the primary choice model is a gravitational one, being smart will only matter for site location within a region. From a spatial planning point of view, the right question is *'can we influence gravitational site location choice while applying intelligent and consistent long term planning?'*.

First we implement a multi-scalar gravitational analysis of the EU-28 area, allowing to define a gravitational central area. We use the population density dataset (inhabitants per hectare calculated from Corine Land Cover 2006) provided by the European Environmental Agency and Joint Research Center. Spatial statistics allow us to define areas that have significantly more inhabitants and are thus 'gravitational centers'. By applying different influence ranges, we get four different perceptions of centrality. With an influence distance of 100km we see the *european core area,* while on the opposite end a 10km distance gives us a wide range of *central places for services of proximity*. This provides every city or region with insight in the way the gravitational choice model influences investment in regions. For spatial planning, it is almost impossible to influence this with traditional planning instruments. Competition between regions and states on the European level is mostly defined by national (tax) policy and cultural differences.

In a second part, we take a closer look at the regional level. For an equal area around (1) Brussels, (2) Milano-Venezia, and (3) Wien-Bratislava we apply the same spatial statistics calculations with different influence zones. The analysis on a regional level shows clear differences in regional development and in the position of cities within the region. For the Flemish region we confront the pattern of central areas with the statistical analysis of the actual location of firms.

2 INTRODUCTION

In my professional planning experience I worked for several years as a regional planner on the Brussels Metropolitan area, more specific on the Flemish territory surrounding the Brussels Capital Region. Even if there are huge demographic challenges, unemployment and environmental pressure, the only spatial issues that were (and still are) high on the political agenda and much discussed in national media, are large retail developments and car oriented infrastructure. However, during informal discussions with a shopping mall developper, it became clear that car accessibility only comes second to the number of potential clients. The initial location choice thus appears to be a large area, based on a gravitational model. Within this chosen area, other location characteristics are studied, mainly accessibility, land availability, location of competitors and real estate price.

Remarkably, in the Flemish planning practice, we do not have a way to define high potential areas if gravitational firm location models are used. In practice this means that comparison of potential sites (eg in strategic environmental assessments), does not meet the expectations of the company looking for a new site, namely to have the same (number of) potential customers.

In this paper a generic approach to this gravitational model is used, starting from a EU-28 dataset. This approach is used EU-wide and on 3 specific regions, using the same type of calculations with different parameters. For the EU-wide maps, a short reflection tackles the question if this type of maps can be used beyond the analytical value and be incorporated in territorial policies. The regional approach is discussed from a graphical overlay of the results and complemented with planning practice experience in the Brussels periphery: What do the maps show? Is it the same on different levels? How do some maps correspond to other site location parameters eg accessibility and land price? What is the relationship between the percieved patterns and the policy goal of polycentric development?

3 DATA AND CALCULATION

3.1 Population density disaggregated with Corine land cover 2000

The raster data on population density using Corine Land Cover 2000 inventory, as produced by EEA and JRC was used as a starting point. Even if this dataset is based on statistics and land cover data that is 14 years old, it still remains the most reliable source of cross border high resolution population data. Most interesting is the fact that it is closely linked to effective land use on a 1 hectare resolution. It also allows reliable comparisons across the EU28 on the spatial distribution of population.

The grid main characteristics are:

- Geographic coverage: EU27 + Croatia. Some islands and overseas territories missing. Resolution: 100m (1 ha pixels)
- Values correspond to density in inhabitants/km2. to obtain the estimated population in a polygon, divide the sum of pixel values by 100.
- Projection: Lambert-Azimuthal equal area (INSPIRE-recommended)
- ownloadable from http://dataservice.eea.europa.eu/dataservice/ or by request from Javier.gallego@jrc.ec.europa.eu

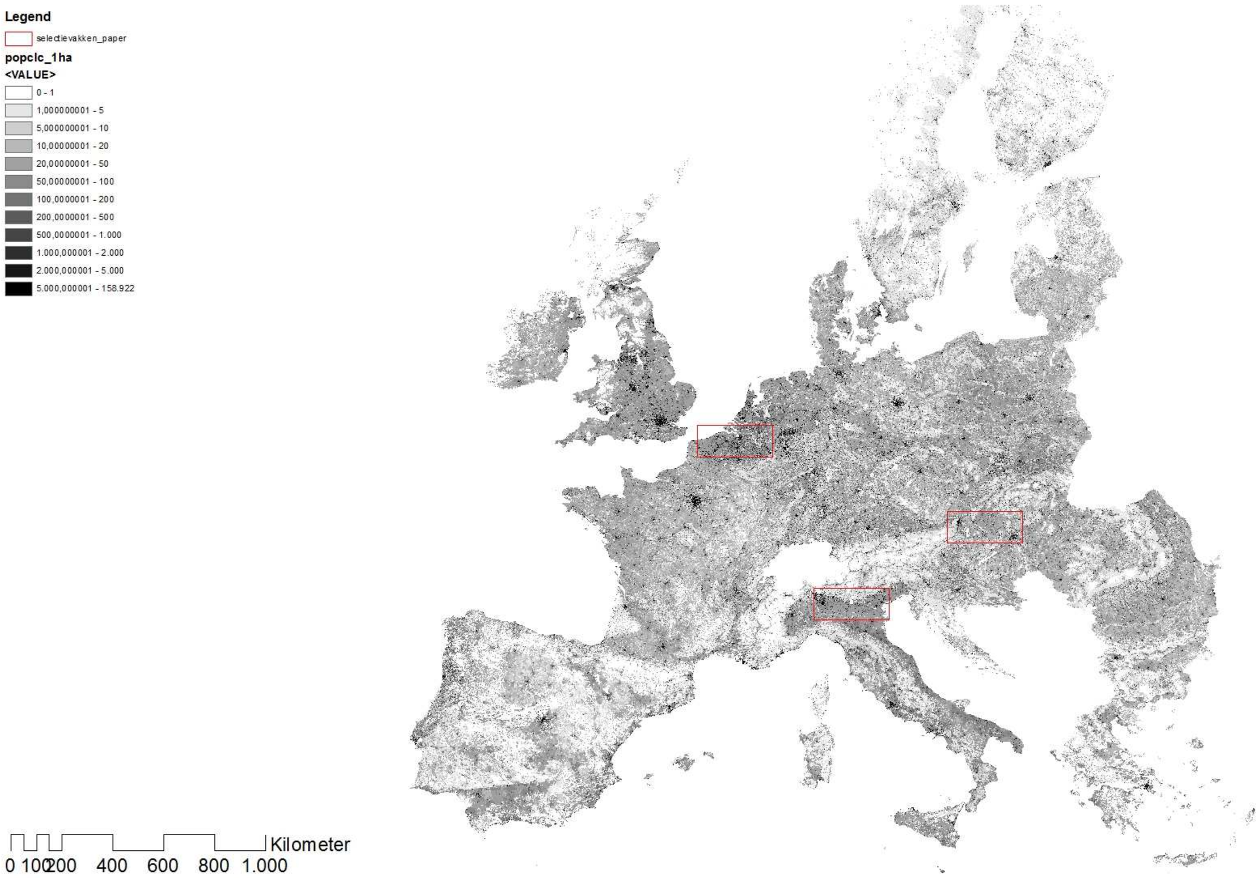

Fig. 1: Population density in EU28. EEA & JRC 2009, with indication of 3 case areas.

3.2 Hot Spot Analysis: Getis-Ord Gi*

The Getis-Ord Gi* method is used for local statistics. To do so the EEA raster dataset is first converted into a point feature dataset. Each 100mx100m pixel is turned into a point with the same value. The complete EEA dataset is too large to work with, we either aggregate the data in 5km x 5km squares, or we work with a smaller case area.

3.2.1 Calculation

The Hot Spot Analysis tool calculates the Getis-Ord Gi* statistic for each feature in a dataset. The resultant Z score tells you where features with either high or low values cluster spatially. This tool works by looking at each feature within the context of neighboring features. A feature with a high value is interesting, but may not be a statistically significant hot spot. To be a statistically significant hot spot, a feature will have a high value and be surrounded by other features with high values as well. The local sum for a feature and its neighbors is compared proportionally to the sum of all features; when the local sum is much different than the expected local sum, and that difference is too large to be the result of random chance, a statistically significant Z score results.

The Getis-Ord local statistic is given as:

$$G_i^* = \frac{\sum_{j=1}^{n} w_{i,j} x_j - \bar{X} \sum_{j=1}^{n} w_{i,j}}{S \sqrt{\frac{\left[n \sum_{j=1}^{n} w_{i,j}^2 - \left(\sum_{j=1}^{n} w_{i,j} \right)^2 \right]}{n-1}}} \qquad (1)$$

where x_j is the attribute value for feature j, $w_{i,j}$ is the spatial weight between feature i and j, n is equal to the total number of features and:

$$\bar{X} = \frac{\sum_{j=1}^{n} x_j}{n} \qquad (2)$$

$$S = \sqrt{\frac{\sum_{j=1}^{n} x_j^2}{n} - (\bar{X})^2} \qquad (3)$$

The G_i^* statistic is a z-score so no further calculations are required.

Fig. 2: Calculations of de Getis-Ord Gi* statistic. http://resources.esri.com/help.

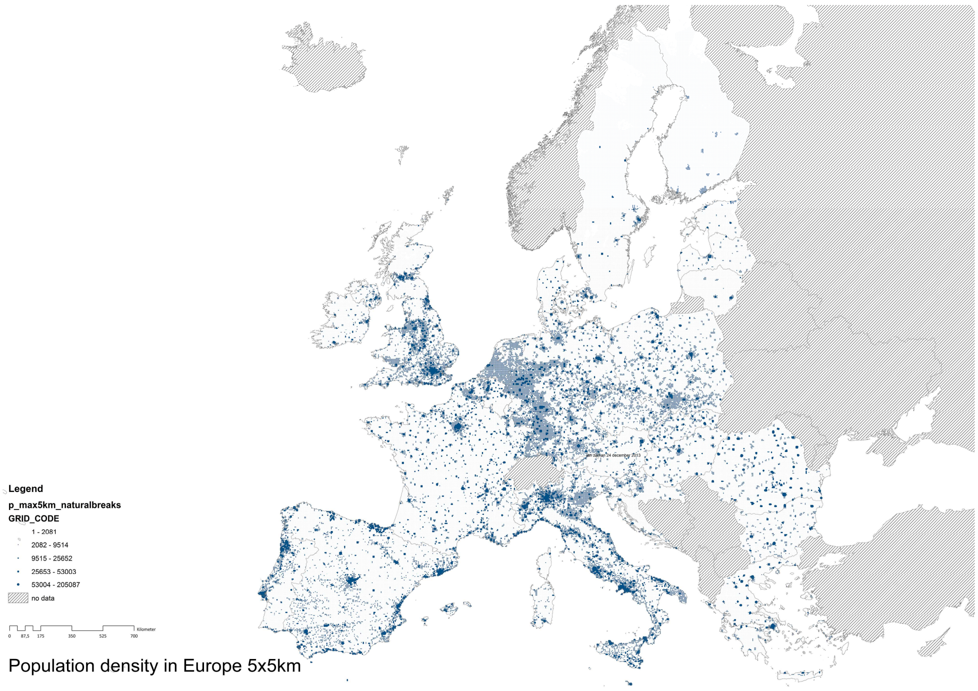

Fig. 3: aggregated population density in EU28. Maximum value appearing in each 5x5km cell.

3.2.2 Interpretation

The Gi* statistic returned for each feature in the dataset is a Z score. For statistically significant positive Z scores, the larger the Z score is, the more intense the clustering of high values (hot spot). For statistically

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significant negative Z scores, the smaller the Z score is, the more intense the clustering of low values (cold spot).

4 ANALYSIS

4.1 EU28

For the complete EEA dataset, values are first aggregated in 5km squares to enable desktop calculations. In this aggregation, we chose not to work with the mean value of all cells, but with the maximum value (Fig.3). This is done to avoid the 'flattening' of the data. The results for the hotspot analysis are much clearer when using the maxima.

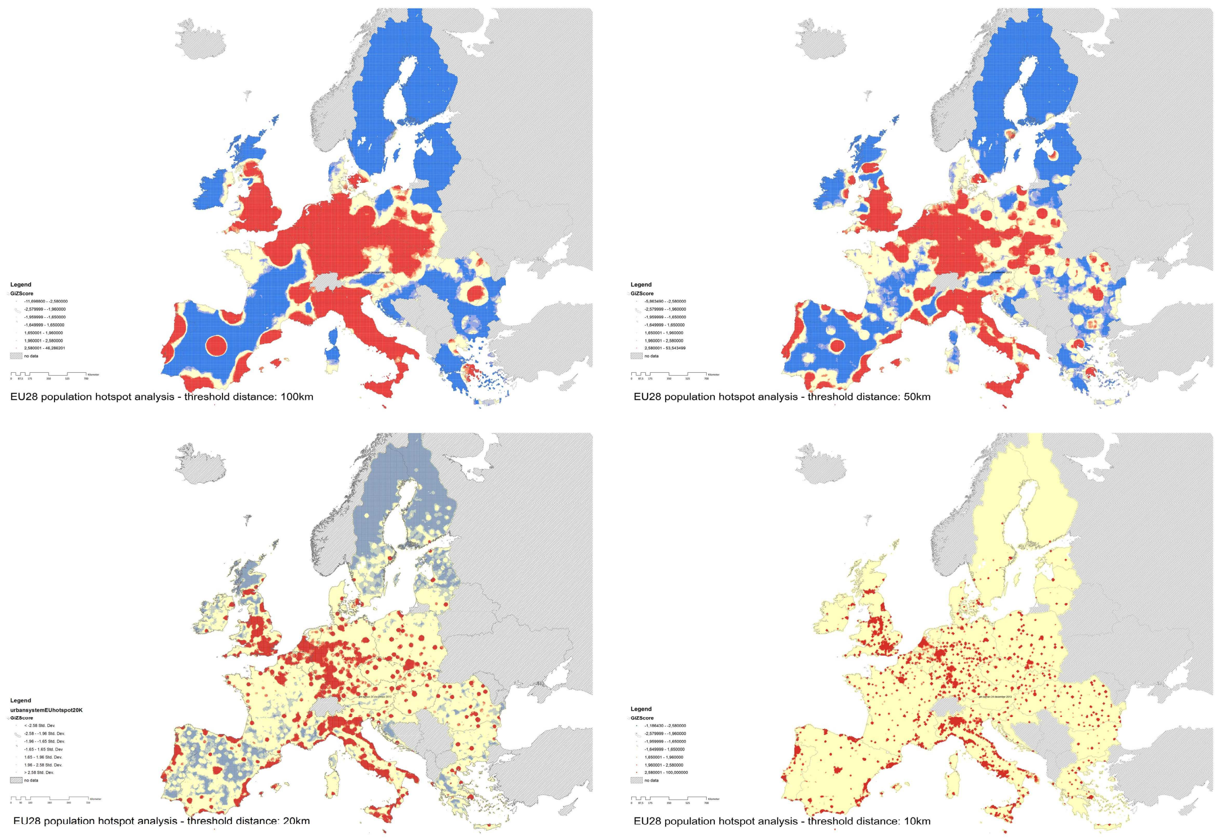

Fig. 4: Hot spot analysis on aggregated population density in EU28. Fixed distance method, 100km, 50km, 20km, 10km influence zone.

The Getis-Ord Gi* statistic is run four times, each with a different fixed distance (Fig 4.). When the influence zone is 100km or 50km we get a general image, which corresponds with how companies might look at Europe from another continent. A large (red) core area is visible, with large periferal zones (in blue) in northern, eastern and southern Europe.

If we further reduce the influence distance, we get a more detailed image on population density. At the same time, the significantly low density areas (dark blue) disappear from the map. This means that for the EU28-level, there are no areas with significantly low results for this local statistic. The mean value is so low, that all 'low' values are within 1,65 standard deviation.

Another interpretation is that the 100km and 50km hot spot analyses give a view on remoteness of some areas in Europe. The dark blue points have no larger cities within the fixed distance.

Besides stating the obvious differences in EU-28, can we use these in regional planning? In my opinion, the harmonized raster data is useful to do benchmark studies and cross-border comparisons between regions. But the link to real spatial patterns gets lost by aggregating the data to a 5x5km pixel. The fact that the dataset is already outdated and no evolution in time is provided, limits the usuability. The same analysis would probably give better results when using data on LAU2-level, with the possibility of mapping evolutions in time. However, obtaining homogenized population data on all EU28 states might prove difficult, as described in ESPON 'Territorial Performance Monitoring'.

4.2 3 Cases

For three cases (Flanders, Wien-Bratislava-Budapest, Milano-Venezia) we selected a sample area. All areas are the same size and have following characteristics (see table 1). On every territory we perform the same 3 hotspot analyses, again with fixed distances, but now 1, 2 and 5 kilometer. Larger or smaller distances do not produce a usefull map. Where Flanders and Milano have comparable statistical values, Wien is clearly different, mainly because of lower total population and lower maximum value.

	Wien-Bratislava-Budapest	Milano-Venezia	Flanders
Number of points	3.700.000	3.529.352	3.215.645
Minimum value	0	0	0
Maximum value	38.000	58.792	48.036
Sum	790.000.000	1.321.720.072	1.501.758.548
Mean	210	374	467
Median	21	36	45
Standard Deviation	1100	1356	1247
Estimated total population	7,9 million	13,2 million	15,0 million

Table 1: Key statistical data of three case areas.

4.2.1 Hotspot analyses

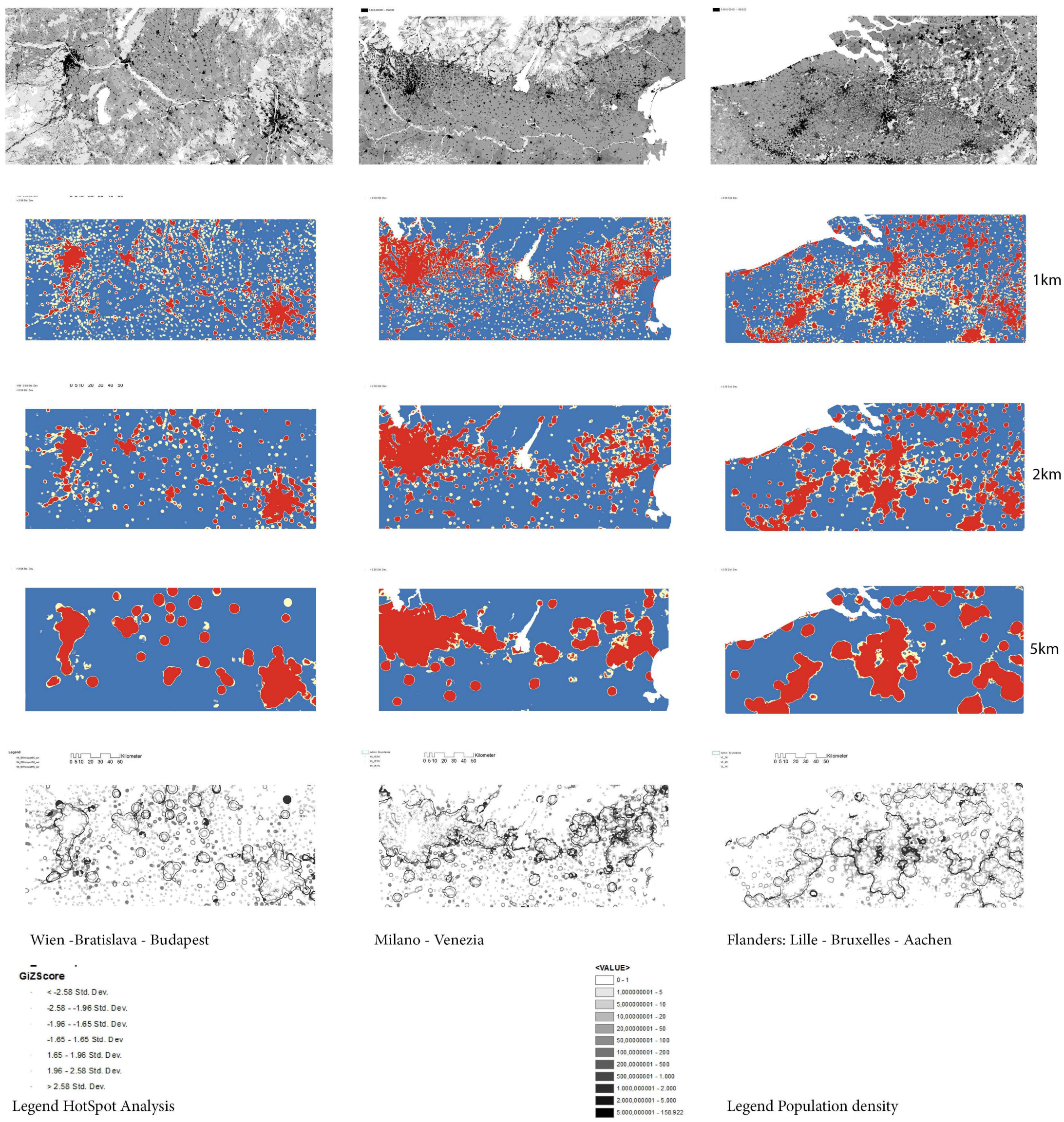

Fig. 5: Hot spot analysis on population density in three cases (Wien-Bratislava-Budapest, Milano-Venezia, Flanders). Fixed distance method, 5km, 2km, 1km influence

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Almost all point get values that are either significantly high or low. For each territory we get a multiscalar approach on the existing population density, which can be useful when assessing if a hierarchy of cities might be a realistic planning policy. However, by superimposing all three analysis, we get them together in one map.

4.2.2 3 patterns

This combined map shows us how different gravitational site location models might interact and which areas will be developed. Personal experience in the Brussels area shows that the black rings coincide with the zones where regional retail investments might locate. Grey delineations are situated around cities with a local service area (eg hospitals, schools, supermarket,...) where the light grey lines are more congruent with changes in real estate prices. In the southern Milano example, (Fig.6) we perceive three types of patterns, which are also visible in the Flanders en Wien-Bratislava maps. The first (1) is a Chistaller-like pattern of cental places, where the more important cities have 3 concentric rings. For regional investment, the area immediately surrounding the city is equally interesting as the more central areas. If the area surrounding the city has fair accessibility and low land prices, this is where development will take place and urban sprawl or ribbon development might be the spatial result.

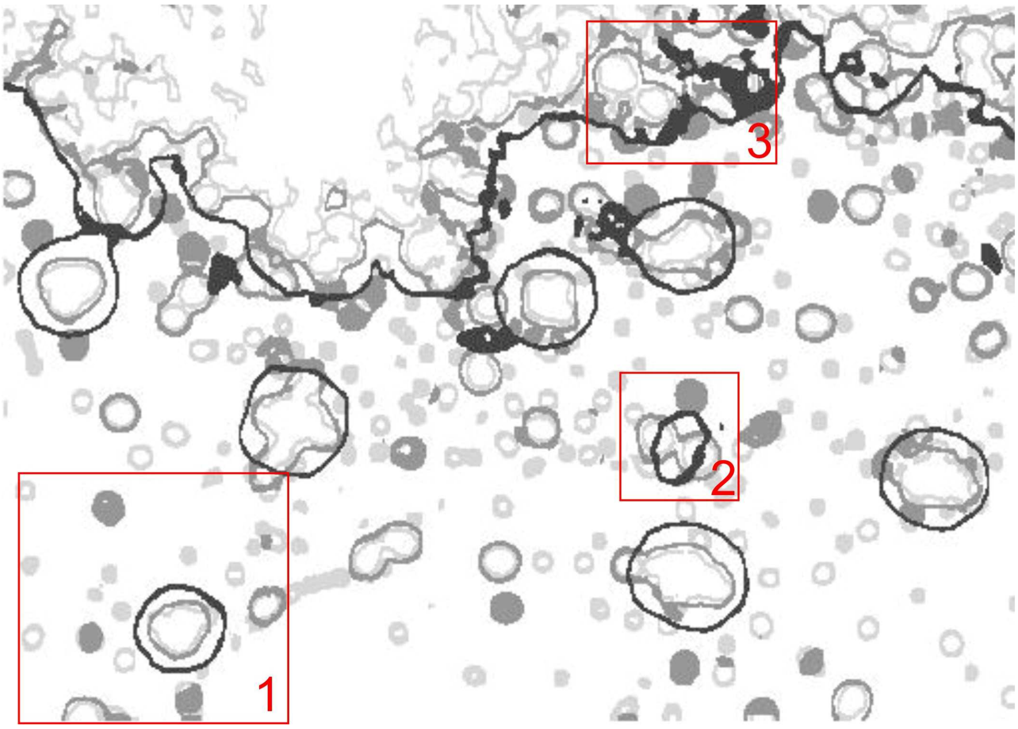

Fig. 6: Overlay of three analysis in one map of southern Milano: (1) Christaller like patterns, (2) a 'twin city' north of Piacenza, (3) 'edge city' development

In the second example, two small cities north of Piacenza are so close that the area of regional interest (black ring) is not one of the cities, but the area between them. This situation is even more difficult to handle. The third example shows an 'edge city' condition south of Bergamo, where all three types of edges (black, grey, light grey) are intertwined.

5 CONCLUSION: ROLE OF PLANNING?

Given the diversity of spatial patters, even in rather small regions, how can spatial planning interact in a such a way that it produces the type of places that are desired in policies, instead of creating the same sprawl everywhere? In the ESPON 'TRACC' project (Transport Accessibility at Regional/Local Scale and Patterns in Europe), Spiekermann and Wegener show the relationship between economies of scale, transport costs and spatial development. 'The economic geography explains regional economic development as the result of the interplay between agglomeration forces (economies of scale) and spatial interaction costs as illustrated by the vertical and horizontal dimensions of the diagram in Figure 7. The theory suggests that the prevailing historical trend of increasing economies of scale and decreasing transport costs has led from isolated dispersed settlements to an ever more polarised spatial structure with a small number of dominant agglomerations (the white arrows in the diagram). If a more balanced polycentric spatial structure is a political objective, either the trend towards increasing economies of scale or the trend towards ever lower transport costs needs to be stopped or even reversed (the solid arrows in the diagram)'. (ESPON & Spiekermann & Wegener, Urban and Regional Research (S&W), 2011, p 53)

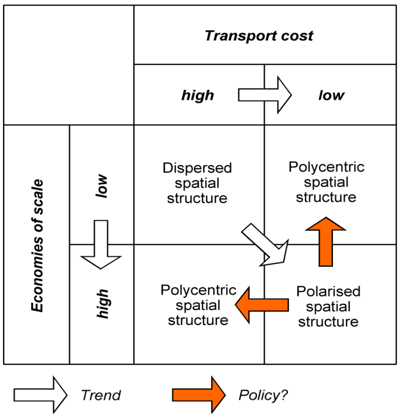

Fig. 7: Economies of scale and transport cost, as found in ESPON & Spiekermann & Wegener, Urban and Regional Research (S&W), 2011, p 53.

On the regional level, the overlay analysis shows that if a polycentric pattern is a political ambition, the territorial strategies and governance will have to be different for all three example areas (Fig 6.). In Flanders the new spatial policy plan aims to enhance the existing polycentric structure and to govern the territory is such a way that municipalities, provinces and regions work together instead of competing.

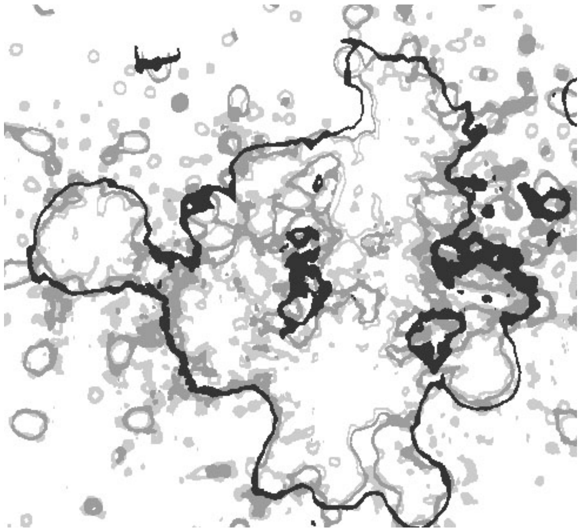

Fig. 8: Overlay of three analysis in one map of central Belgium and Flanders

Understanding how the gravitational model works, and which areas it will promote, is just a first step towards a new type of regional planning where a specific framework provides an adequate policy for different situations. More specific, the overall edge-of-city condition in Flanders and central Belgium will require innovative instruments and a long term political framework to result in a real-life polycentric urban region.

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Concept of "Smart City" and its Practice in Poland. Case Study of Łódź City

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1 ABSTRACT

Paper's objective is to present the concept of "smart city" as an approach to urban development and, on this ground, to analyze urban practice in Polish city of Lodz.

First part of the paper, therefore, will be dedicated to definitional aspects of the "smart city" approach, with focus on determinants and factors included in this concept of multidisciplinary growth. Some aspects of measurement of the concept will also be included. Having the conceptual base settled, concept of "smart city" will be confronted with urban practice of Lodz. The city was chosen based on its recent development: inclusion of multidisciplinary aspects in its growth strategy and good results of implementation of verified urban development programs. Analysis conducted in the practical part of the paper will use both qualitative and quantitative methods and both secondary and primary sources of data and information. Official strategic and program documents of the city will be researched and analyzed, as well as confronted with in-depth interview with policy-makers. Statistical data (regional, national and community) will be used for quantitative methods.

Research will allow for conclusions regarding implementation of "smart city" concept in general, but also for verification of question whether this particular approach to urban development is suitable for countries and areas in different stages of economic development, as analysis will concentrate on a Polish city. In this light – the European Union's single solutions for all Member States approach will be evaluated.

2 INTRODUCTION – GROUNDS FOR THE SMART CITY CONCEPT

Role of cities in modern economy is well described and has become obvious – not only are urban areas places of living for more than a half of population but also (in case of European Union) generate ca. 80% of GDP. The UN estimates (United Nations 2012) that urbanization will get intensified and urban areas will increase their economic impact, as well as will become increasingly important for culture and social relations. At the beginning of urban studies and economic research of urban areas, cities were mostly seen as a 'by-product' of industrialization; currently however, are rather treated as a catalyst of economic change – with intensive correlation of urbanization and economic growth as well as increasing importance of high value added industries, mostly localized in cities. Relation of urbanization and wealth (measured by GDP per head) is illustrated by model elaborated by the World Bank, presented in fig. 1. The model explains 55 per cent of variation of urbanization; however, as a regression model, it does not explains causality.

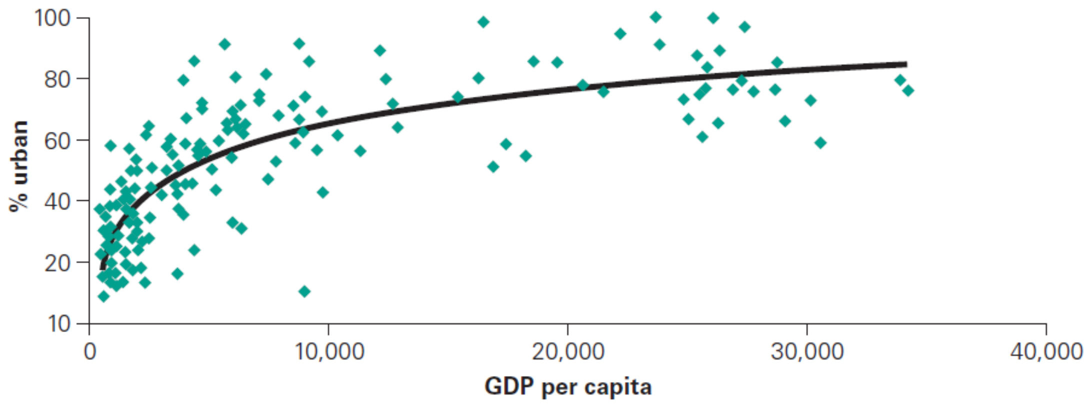

Fig. 1: Urbanization (percentage of urban population) and wealth (GDP per head) in chosen countries, 2000 (in 1996 USD). Source: The World Bank (2006), p. 3.

Increasing economic importance of cities is reflected in urban studies which focus transfers from social science (social relations in urban areas, segregation, social inclusion) increasingly towards economics (management, entrepreneurship, competitiveness). In context of economic research, cities are treated not

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only as a location for entrepreneurial activity, with institutional environment analysis, but also as an economic entity itself, capable of competing with other entities.

Urban development research point to two pillars of urban growth, i.e. entrepreneurial environment and quality of life. Those two elements (represented by companies and people) are significant and necessary for a competitive city to develop (Szczech-Pietkiewicz 2013). Well elaborated in literature and implemented in urban practice concept of urban competitiveness gave grounds for the introduction of the idea of "smart city". Goal of the following paper is to present this concept by its definition, comparison with other urban development notions, as well as elaboration of a synthetic index providing tool for assessment of "smartness" of a city. In this respect, concept of smart city is an extension of urban competitiveness research, by identification and introduction of new dimensions to urban growth analysis, followed by its quantification.

Smart city concept, in its current understanding, combines and gives ground for synergies between competitiveness and sustainable development in urban areas. Urban growth, as observed in last couple decades, came with negative externalities such as inequality and competition among cities, therefore there seems to be a need for policies that emphasize balance, social inclusion and competitiveness at the same time. Goals of sustainable development and competitiveness, however contradictory at first glimpse, can be successfully combined in concept of smart city.

According to the European Commission: „European cities of tomorrow are places of advanced social and environmental progress, while maintaining economic attractiveness and economic growth achieved by integrated approach including all aspects of sustainable development" (European Commission 2011). This definition of future urban development takes into consideration all elements of smart city concept, while at the same time emphasizing that this is the model of growth that EU will be supporting and promoting.

Implementation of the smart city concept at the community level has been started by Commission's initiative „Smart Cities and Communities – European Innovation Partnership" (C(2010) 4701 fin). The goal of this initiative is promotion of sustainable urban development while concentrating on issues of transport, mobility, energy and information and communication technologies (ICT). The project will be supported by the cohesion policy and financed with European funds (mostly with Horizon 2020 means). First step in the initiative's implementation is establishment of SCC Platform (Smart Cities and Communities Stakeholder Platform), as a tool for best practice and information exchange among engaged cities and communities. Further, the European Commission recommends data collection for the purposes of progress monitoring in the area of smart city in the European Union.

3 DEFINITION OF SMART CITY AS AN APPROACH TO URBAN DEVELOPMENT

Current discussion over multi-dimensional urban growth and development quite often uses notions like: intelligent cities, knowledge-based cities, smart cities, learning cities. Large number of these notions and their understanding calls for a common definition of the concept of smart city which is a subject of this paper. First and the most important, differentiation will be made between smart city and intelligent city.

Intelligent city is most commonly defined as an area which uses and enables access to (ICT), using them in management, governance, administration and communication with inhabitants. Such a city will therefore be equipped with intelligent systems of transport management, monitoring of security and public wireless Internet access points. Moreover, intelligent cities are often characterized by intensive concentration of highly qualified work force and representatives of the creative class (R. Florida 1996), capable of creating the knowledge spill-overs. Intelligent city therefore is one that uses available technology in all aspects of management and development: creating intelligent systems of communication with inhabitants (e.g. e-government), creating public transport management and traffic management systems, guaranteeing security and managing urban services (Lombardi et al. 2009). Technology is used mostly with the goal of resources efficiency increase, on the other hand also – to increase quality of life in the city.

One of the most often cited definition of intelligent city is that created by the IBM (IBM 2010). Their definition emphasizes advanced technology use in urban development and planning, it also focuses mostly on urban infrastructure. According to the IBM: „Technological advances allow cities to be 'instrumented', facilitating the collection of more data points than even before, which enables cities to measure and influence more aspects of their operations. Cities are increasingly 'interconnected', allowing the free flow of information from one discrete system to another, which increases the efficiency of the overall infrastructure. To [meet] these challenges and provide sustainable prosperity for citizens and business, cities must become ‘smarter’ and use new technologies to transform their systems to optimize the use of finite resources.”

Criticism of the concept of intelligent cities focuses on the fact that it is questionable to attribute whole complex system of urban areas development to just one factor – in this case technology (Hollands 2008). Despite the fact that impact of modern technologies on shaping urban areas is well documented in literature (Graham and Marvin, 1996), it is unjustifiable to give this one determinant a superior role. Other criticism of intelligent cities concentrates on the social aspect of intelligent systems. One of the risks of excessive use of advanced ICT systems and tools is increasing technological exclusion (digital divide), as some groups of city’s inhabitants may not be able, capable or willing to use them. Therefore, intelligent city is created for an intelligent inhabitant, however intelligence is understood very narrowly, as capacity of cooperating with technology. Graham and Marvin (2001) call this phenomena a splintering urbanism, as development concerns only chosen groups of inhabitants, while increasing fragmentation and polarization in the area. Intensive use of intelligent urban systems (in transport, social security, social capital activation, resources management), even though biased with technological exclusion, may also increase efficiency growths to the extend impossible to obtain by “traditional” methods. For example, automated public transport system can generate more frequent circulation of buses or trains than by using only human knowledge, talent and abilities. Quite similarly, progress in automotive industry and use of modern technologies in vehicles’ production may increase efficiency of urban traffic. Technology can also increase social inclusion by increasing the lengths of senior citizens activity (e.g. ‘self-driving’ cars).

Concept of smart city goes beyond this narrow understanding of development (limited to ICT). Even though there is no one commonly used definition of smart cities, literature of subject proposes two threads of approach to the concept. One approach is to define it as a city where ICT delivers infrastructure for social and economic initiatives concerning economic growth, social capital and higher resources efficiency (Hollands 2008, Komninos 2006, Van Der Meer and Van Winden 2003). Other thread is to assume wider approach, where smart cities are treated as a new urban development paradigm (Giffinger et al. 2007, Caragliu et al. 2011, Neirotti et al. 2014, Lazariou and Roscia 2012). In the latter approach, focus is therefore put on phenomena such as human and social capitals, education and natural environment (Lombardi et al. 2012). Such models of urban development point to smart cities as areas which, on one hand, are a supporting factor for intellectual capital development and well-being growth by institutional system; at the other hand providing a knowledge transfer mechanism for system of innovation. These models however, despite including city management issue, does not concern natural environment and sustainable development issues. It also does not provide tools to research causality (Lombardi et al. 2012, s. 138).

A comprehensive definition of smart city is provided by Vienna University of Technology (VUT) in „Smart cities – ranking of European medium-sized cities”. Basing on literature review, Authors conclude that by the time the report was published (2007), the term “smart city” was used to describe such verified actions in urban areas as: development of ICT in cities; increase of inhabitants education achievements; creation of attractive conditions for business locations, mostly in IT sector; providing modes of communication with inhabitants (e-administration); modern modes of transport; urban development respecting sustainability. VUT therefore, assumes that a smart city is: „well performing in a forward-looking way in these six characteristics, built on a ‘smart’ combination of endowments and activities of self-decisive, independent and aware citizens”. The six characteristics of a smart city are: economy, people, governance, environment and quality of life. With such assumptions, this approach, unlike intelligent city concept, gives grounds to extending analyses of urban progress further than technology, while also reaching beyond urban competitiveness from the point of view of business sector. Therefore, it avoids risk of dedicating urban development strategy to a sole goal of competitiveness growth (by limiting goals to increasing business location attractiveness).

Other definition of smart city present Bakici, Almirall and Wareham (Bakici et al. 2013, p. 135) in their case study of Barcelona, where they state that such cities: „base their strategy on the use of information and communication technologies in several fields such as economy, environment, mobility and governance to transform the city infrastructure and services”. This definition therefore puts ICT in the position of urban development tool and this role is in this case significant, which may prove that Authors lean more toward

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understanding smart city more as an intelligent city. The goal of using ICT in urban management is here obtaining efficiency gains in resources management, job creation, quality of life increase and innovation.

A current and comprehensive definition of smart city is brought by A. Caragliu, Ch. Del Bo and P. Nijkamp (A. Caragliu et al. 2012), in a statement that: „investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance". This definition combines areas almost identical to TUV's approach (human and social capital, transport, ICT, environment, quality of life and democratic institutions), however adds a dynamic analysis by pointing to mechanism and causality between these notions. Significant is also differentiation among goals (sustainable development, quality of life), tools (human and social capital investment, transport and ICT) and mechanisms (effective resource management and social participation), while VUT's approach gave all those aspects the same role.

Current literature also stresses that core concept for smart city is the ability to combine intelligent solutions with particular city's conditions (Deakin 2013). M. Komninos (2008) points to following conditions of smart city development:

- broad spectrum of electronic devices and technology use in cities and communities;
- use of information technologies for quality of life and work increase in the region;
- ICT embeddedness in the city;
- territorialization of the above practice in order to bring people and technology closer together, while encouraging innovation, learning, knowledge and problem solving that technology provides.

Generally, Komninos proposes to defines smart cities as (2008, p. 1): „…territories with high capacity for learning and innovation, which is built-in the creativity of their population, their institutions of knowledge creation, and their digital infrastructure for communication and knowledge management".

Summing up, smart city as a concept of urban development assumes it should include six spheres of growth: economy, people, urban governance, geographic mobility, natural environment and quality of life. These areas should be further supported by information technology systems, provided they are a tool not a goal of development strategy. Smart strategy should also include not only multi-dimensional approach but also city's stakeholders, i.e. enterprise sector, inhabitants and local government.

4 METHOD

Issue of urban development determinants is well embedded in literature, which of course does not mean this list is constant and complete. Researchers still discuss the role of particular factors, their impact on urban growth, their hierarchy and timing. Most commonly analyzed determinants include: innovation (R. Capello, P Nijkamp), creativity (Ch. Landry, R. Florida), entrepreneurship (OECD), quality of life (R. Rogerson) and human and social capital (E. Glaeser). All of these factors are to some extend included in the concept of smart city and extended, by addition of mechanisms, instruments and governance.

Interesting approach to urban development determinants of a smart city is presented in P. Lombardi's paper (Lombardi et al. 2012). Using Analytic Network Process (ANP) method, over 60 indices of urban development is analyzed. Indices are first grouped according to triple helix model, however helix is in this case extended to four dimensions, fourth dimension being civil society. ANP analysis, including relations between priorities (dimensions of the helix) and alternative solutions, gave grounds to grant following weights to particular determinants: (1) entrepreneurial city – 48 per cent, (2) innovative city – 20 per cent, (3) people friendly city – 17 per cent, (4) networked city – 13 per cent.

According to the smart city approach, it is assumed that urban development is analyzed in line with the previously listed six characteristics. All six areas have their justification for urban development in traditional and neoclassical urban growth and development theories, including: competitiveness theory, transport and ICT economics, human and social capital, quality of life theories. Each determinant's impact on urban development can be also verified by correlation analysis with urban wealth, measured by GDP per head. Table 1 presents correlation and p-value results for chosen measurements from each of the six areas with GDP per head PPS. Calculation concerns over 40 European cities, which also serve as sample for the whole analysis presented in this paper.

	Numer of enterprises	Population age median	Administration found helpful (in inhabitants' opinion)	Air pollution is a big problem (in inhabitants' opinion)	City is a safe place to live (in inhabitants opinion)	Multi-modal accessibilty of the city
Correlation	0,435173	-0,20992	0,306024	0,003477	0,356538	0,690771949

Table 1: Chosen indices correlation with GDP per head in urban areas in the European Union. Source: own elaboration based on Eurostat data.

Calculating correlation of chosen smart city measurements with GDP per capita (regarded as a synthetic index for wealth in the urban area) proves that it is the multimodal accessibility that has the strongest relation to urban development. Such result supports the importance of hard infrastructure for cities. Nonetheless, other indices included in the calculation, except for city's inhabitants opinion on air pollution, were also to lesser or greater extend correlated with growth in urban areas which supports the choice of the six characteristic areas for further research of smart cities and choice measurements of measurements in these six areas as proxies for smart city development.

Similar indices for city smartness evaluation were used in A. Caragliu, Ch. Del Bo and P. Nijkamp's research (A. Caragliu, Ch. Del Bo, P. Nijkamp 2011). Their evaluation was based on the correlation of six proxies: employment in entertainment industry, multimodal accessibility, length of public communication system, e-administration (no. of forms accessible on-line) and proportion of population with 3-4 ISCED level education with GDP PPS per head. Analysis presented in their paper, despite moderate levels of correlation between indices allowed for conclusion that the most significant determinants of smart city's development are: existence of the creative class (in line with R. Florida's theories) and multimodal accessibility (in line with New Economic Geography's assumptions).

According to OECD's „Better Understanding our Cities" (1997, p. 23), criteria chosen for a analysis should: be significant for policy-making and application value; have good degree of analytical soundness and be quantifiable. Ever since the report was published, i.e. for over two decades, the state of urban research has changes significantly. The statement that: „it is still not common to study economic processes and products at the scale of cities" (OECD 1997, p. 11) is inadequate, however urban economics may not be considered leading concern of economists. Still, some challenges and recommendations presented by OECD remain current, e.g. still quantitative research in urban studies are rather fragmented and concern chosen spheres of economy (innovation or energy market), they are also territorially limited (regard few Western European cities or are a case study). Moreover, still quantitative analysis is biased by heterogeneity of statistical systems for local level. Therefore, OECD proposed best practices separately for different spheres of urban economy: natural environment protection, energy, economics, sustainable development. Unfortunately, suggested by OECD "mission information" i.e. the need for data collection in urban areas in international dimension, is still valid. Lack of comparative (including international comparisons) and updated data is one of the challenges urban researchers and researchers have to overcome (Goldstein and Sly 1974, Short et al. 1996, Taylor 1999, Florida 2008, Taylor et al. 2011).

Presented in this paper analysis is based on secondary data from Eurostat's Urban Audit which collects data from over 300 EU cities every three years. Collected data concern mostly social and economic development based on over 300 proxies. The database is however updated with considerable delay, and accessibility of data is dependent on local governments or municipality's input, therefore some data is non-available or outdated. Despite this bias, Urban Audit's data allows for international quite detailed comparisons in the territory of the European Union.

Smart city index presented in this paper was elaborated with the goal of simplification of this notion, its quantification and creating a tool for communication in this policy area. Index can be used for international comparisons and ratings and enables drawing conclusions and recommendations for urban development. As every index or model however, it is just a simplification of reality and particular case-studies (cities) require more thorough analysis for a more precise identification of their urban growth pattern.

Proxies for the smart city index elaboration were chosen for the sample of 45 European cities, which may be considered a representative group given their geographic location, size and stage of social and economic development. Proxies represent all six smart city characteristics presented in this paper.

Economy	GDP PPS per capita (EUR) Number of entreprises / 1000 inhabitants Activity rate (%) Unemployment rate (%)
People / Human capital	Median population age Employment rate (%) Number of students (5-6 ISEAD level) / 1000 inhabitants
Governance	Administration found helpful by citizens (0-100 index) Resources are used efficiently in citizens opinion (0-100 index) Inhabitants satisfied with public spaces (0-100 index)
Mobility	Multimodal accessibility (UE-27=100) Number of registered cars / 1000 inhabitants Inhabitants satisfied with public transport system (0-100 index)
Environment	Population density (people/km2) Number of days in a year when ozone concentration exceeds 120 µg/m³ Air pollution is a big problem in inhabitants opinion (0-100 index)
Quality of life	Number of households living in social housing / 1000 inhabitants City is a safe place to live in citizens opinion (0-100 index) Easy to find affordable housing (0 – 100 index)

Table 2: Proxies for the smart city index. Source: own elaboration

Presented in the paper smart city index is not the first attempt of this concept's quantification. Lazaroiu and Roscia's (2012) elaborated a model which may serve as a tool for smart city rating based on 18 proxies. Their model however is based on a more narrow understanding of city smartness (quality of life and human capital issues were not included and model was calculated based on proxies concerning economy, energy, environment, mobility and administration). Moreover, the model was tested on a group of six Italian cities and its application value may be limited by the requirement of consultation with experts in each analyzed area. According to authors' conclusions (G.C. Lazariou, M. Roscia 2012, p. 332): „The example reported in this paper is on a hypothetical smart city and the evaluation of weights, criteria and indicator have not been carried out by experts of the specific fields. In case of a real city, the establishment of correct values requires the experts contribution in the various chosen fields."

Aggregated index presented here provided a tool for comparative studies, rankings elaboration and observation of progress in urban development without broad consultations with experts and policy-makers in every particular area.

Presented index is based on six sub-indices corresponding to six smart city characteristics (economy, people, mobility, governance, environment, quality of life). Proxies for the calculation are presented in tab. 3 together with weight given to each sub-index and proxy. So far, in this first version of the index, each sub-index is given the same weight (1/6) and weights for proxies divided equally within each sub-index. It may turn out necessary, however, that in course of research and consultations, those weights will be altered. The model elaborated for smart city index gives such possibility and it may be used, if further research will justify it.

Value of each proxy was given evaluation on a 1 – 5 scale based on quintiles of order systematization of cities. Therefore, 20 per cent of cities best performing in a sphere estimated by a proxy were evaluated with a 5, while 20 per cent of worst cities was granted a 1. Such parameterization of measurements allowed for full comparability of development of urban areas. Weighted average of points granted for each proxy within sub-index to a city gave value of a sub-index (yet, since proxies are given the same weights it is in fact an arithmetic average).

Aggregated smart city index is a weighted average of sub-indices values. In the presented version of the index each of sub-indices has however the same weight, hence average value is actually equal to arithmetic average.

Alternative approach may be to order cities according to the value of a particular proxy followed by granting them „grades" according to their relative position. In such model, for the sample of 45 cities, a city with third highest value in GDP per capita would be granted 0.93 points. Sum of such grades would then give a synthetic position. This method however limits analysis to the sample group without the possibility of enlarging it with other cities or entities.

Sub-index	Proxy	Weight in sub-index	Weight of the sub-index
Economy	GDP PPS per capita (EUR) Number of entreprises / 1000 inhabitants Activity rate (%) Unemployment rate (%)	25% 25% 25% 25%	1/6
People / Human capital	Median population age Employment rate (%) Number of students (5-6 ISEAD level) / 1000 inhabitants	33% 33% 33%	1/6
Governance	Administration found helpful by citizens (0-100 index) Resources are used efficiently in citizens opinion (0-100 index) Inhabitants satisfied with public spaces (0-100 index)	33% 33% 33%	1/6
Mobility	Multimodal accessibility (UE-27=100) Number of registered cars / 1000 inhabitants Inhabitants satisfied with public transport system (0-100 index)	33% 33% 33%	1/6
Environment	Population density (people/km2) Number of days in a year when ozone concentration exceeds 120 µg/m³ Air pollution is a big problem in inhabitants opinion (0-100 index)	33% 33% 33%	1/6
Quality of life	Number of households living in social housing / 1000 inhabitants City is a safe place to live in citizens opinion (0-100 index) Easy to find affordable housing (0 – 100 index)	33% 33% 33%	1/6

Table 3: Proxies for smart city development and their weights in smart city index.

Other alternation to the method (also considered) is also ranking according to average intervals (instead of percentiles). This operation, given homogeneity of European cities, proved to be inadequate. Since normalization does not regard the distribution of values, in case of extreme values or concentration of values in a small range (as in the case of European cites), normalization brings values in a very tight scale. Normalization (i.e. use of average for proxies) can therefore cause over-representation of proxies in chosen ranges. Overall, use of average values was in this model inadequate and percentile order was used instead.

Values of measurements in presented analysis were ordered in ascending order, i.e. the higher the value the better the grade. Following proxies, due to the fact that lower values are desired in urban development, were ordered in descending order: unemployment rate, median population age, dependency ratio, population density and air pollution as a big problem.

5 FINDINGS

Values of smart city index for the analyzed sample are presented in tab. 4. Finally, out of the group of 45 cities, full data set was obtained for 27 cities but sub-indices values for particular sub-indices have been calculated for larger groups of urban areas.

City	SMART INDEX	Smart Economy	Smart People	Smart Management	Smart Mobility	Smart Environment	Smart Quality of life
Bordeaux	3,97	2,50	4,33	5,00	4,33	3,67	4,00
Groningen	3,96	3,75	3,33	5,00	3,00	3,67	5,00
Rotterdam	3,61	3,00	3,00	4,67	4,00	2,67	4,33
Lille	3,49	2,25	4,00	5,00	3,67	2,67	3,33
Bologna	3,47	4,50	3,67	3,67	4,00	3,33	1,67

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Hamburg	3,40	3,75	2,00	3,33	4,00	3,67	3,67
Praha	3,35	4,75	2,33	3,00	4,33	3,67	2,00
Kraków	3,33	3,00	3,67	4,33	3,67	2,33	3,00
Bialystok	3,28	2,00	3,33	4,00	2,67	3,67	4,00
Amsterdam	3,26	4,25	2,67	3,33	3,33	2,33	3,67
Warszawa	3,21	4,25	3,00	2,33	3,67	3,00	3,00
Paris	3,18	3,75	3,67	3,33	3,33	2,00	3,00
Manchester	3,15	2,25	3,33	4,33	2,33	2,33	4,33
Leipzig	3,06	2,00	2,33	3,00	3,33	4,00	3,67
Ljubljana	3,06	4,00	1,33	3,33	3,00	4,33	2,33
Liège	2,92	1,50	2,67	3,00	3,67	3,67	3,00
London (greater city)	2,89	3,00	3,00	3,67	3,00	2,00	2,67
Brussel	2,85	2,75	3,67	2,67	3,67	2,33	2,00
Bratislava	2,81	3,50	3,00	2,00	2,00	4,67	1,67
Berlin	2,64	2,50	1,67	1,67	2,67	3,33	4,00
Kosice	2,64	1,50	3,00	3,67	1,00	4,67	2,00
Vilnius	2,58	2,50	3,67	1,33	2,67	3,00	2,33
Madrid	2,56	2,00	2,33	2,67	3,33	2,33	2,67
Tallinn	2,56	3,00	3,33	2,00	1,67	2,67	2,67
Barcelona	2,51	2,75	2,67	2,00	3,33	1,67	2,67
Riga	2,38	2,25	3,33	1,00	2,00	2,67	3,00
Sofia	2,29	2,75	2,33	1,00	2,67	3,00	2,00

Table 4: Values of smart city index and sub-indices for chosen European cites. Source: own calculation

Out of the analyze sample group, the best performing cities in the smart city development seem to be medium-sized cities, which rather do not play a dominant role in their countries economy and rather serve as regional centres. Highest value for large cities, large and significant enough to be included in global cities network, achieved Paris. Surprising may also be the position of Barcelona – city dedicated to the idea of smart city and location of numerous smart city initiatives (Bakici et al. 2013). Eastern European cities rank rather low in smart city index but worth noticing is the fact that their position is not lowered due to the indices in the smart economy index but rather quality of life and urban governance factors.

6 FURTHER LINES OF RESEARCH

Smart city index presented in this paper is its first version and requires further research, alternationas and improvements. Potential areas of areas for improvements include mentioned differentiations of weight or enlargement the group of chosen proxies. Changes in weighing system may be introduce with the use of fuzzy-logic method (Lazaroiu, Roscia 2012), building on experts' consultations. This line of changes to the model may also give grounds to building recommendations and policy-making based on the index as change in weight of particular proxy or sub-index may show a potential gain achieved by new urban development activity.

Other line of improvements may include alternations in the range of points granted to cities for their values. So far, calculations were based on 1 – 5 scale, however may be proper to limit the range if extreme values for a chosen proxy are not observed. Then, a range of 2-5 or 1-3 may prove more informative (e.g. when analyzed group of cities rank relatively low in a particular issue globally). This change however requires experts' evaluation and decision.

7 CASE STUDY OF ŁÓDŹ (LODZ)

Lodz is an average-sized city located in central Poland. The choice of this particular case-study is based on an industrial history of the city, as well as its development after economic transformation in Poland. Historically, development of city of Lodz has been strongly related to the textile industry and stated in the industrial revolution period, when industrialization was inevitably followed by urbanization. Typically for urban growth in that era, Lodz grew around large textile production sites, with urban plans being elaborated and implemented by and for large industry owners. Also typically for the Enlightenment philosophical thought, some ideas concerning social development were introduced – with dwellings, schools and hospitals built for industrial workers. Post World War II, Lodz continued path of development relying on hard industries, mostly textiles. With centrally planned economy, city's industrial production grew, yet this growth did not turn into development, especially when it comes to negative agglomeration externalities. These tendencies came especially vivid after the economic transformation and introduction of free-market economy in Poland, leaving Lodz with social challenges non-existent middle class, brain drain towards Warsaw, high rates of crime, low rated of education attainment and employment. Yet, Lodz still remained an attractive location for industrial production, due to the infrastructure heritage, large pools of labor force and central (both Polish and European) location.

Post-transformation development of the whole region of Eastern Europe is characterized with deindustrialization forces, necessary to adjust economies to the free-market service-oriented globalized world. These tendencies did not by-passed Lodz and meant close down of many inner-city plants and large losses of manual jobs, followed by wide range of social problems (crime, unemployment, premature mortality, neighborhood abandonment to name just few). Pattern of deindustrialization, analyzed in urban development literature (Turok and Edge, 1999), has been followed with difficulties to replace lost opportunities or retain work force. Literature of the subject brings different explanations of the process of deindustrialization. In some papers, lower skills intensive production is being moved outside of cities while urban areas remain locations higher level functions (Massey, 1984). Cities are then centers of strategic control, and smaller regional centers lose their significance in economic development. There is also theories bringing similar patterns to the international level, with Sassen's global cities network, as the main example (Sassen, 1994). The same division of labor is here described in international perspective, with offshore, emerging economies acting as regional centers. The network analysis of urbanization is followed by works of Castells who puts emphasis largely on technological advances in economic growth and emergence of informational phase of economic development. In these theories, "economic relationship within cities have become less important than the position of cities within wider international network" (Turok, 2005, p. 39).

Is seems like development of Lodz post-transformation first followed the pattern analyzed in Massey's work. Large pools of low- and medium-qualified labor force made the city attractive location for production of lower ranges of value-added chains. Analyzing the city development in industrial clusters terms, Lodz may have followed the model of product cycle (Vernon 1960, 1966), according to which firms separate stages in life cycle of their products spatially. For example, information- and qualification-intensive activities will be located in urban location which give access to highly skilled work force, as well as allow for face-to-face contacts necessary for information creation and circulation. However, with the further stages of product's life cycle, once the product has been designed, tested and developed, the firm will no longer need sources of non-standardized innovative production. Once the information about the product is standardized and available, the production technique become not only easier to implement but also does not require highly skilled labor. The location of production can be then moved to lower-cost (and lower-skills) areas.

Therefore, city and its region became location of various household equipment production sites, as well as business support centers (mostly call-centers, accounting and computing). As expected, this process did not bring any advances of economic development of the city, nor did it solve growing social problems. A new development strategy of Lodz tried to face these challenges and lead the city to new pattern of growth, which seems particularly interesting.

The strategy ("Integrated Development Strategy for Lodz 2020+") envisages three sources of competitive advantage for the area, namely: industrialization, innovation and creative sectors. Building on the industrial history of the city and its legacy (infrastructure, labor ethos), the city's policy-makers are trying to introduce activities from higher level of value-added chain, more technologically advanced. So far, Lodz has succeeded in attracting R&D centers, which may prevent further loss of qualified labor to Warsaw. The city's industry is still mainly concentrated in textiles (using the still existing infrastructure), yet leaning towards technological advancements (e.g. production of innovative fabrics). On the other hand, great emphasis is put on creating conditions for growth of the creative sectors, based also on factors endowment as the city is home to various artistic schools and universities (film, fine arts, music). In this respect, the city is strongly supporting creative cluster creation, mostly by satisfying demand for locations of artistic activities through means of revitalization. The actions resulted in emergence of two large creative clusters in the city, bringing together large number of small firms of artistic character (Off-Piotrkowska and Księży Mlyn).

The development strategy of Lodz, even though not related per se to the concept of smart city, may be analyzed as such. It stresses a multidisciplinary development of city (with industry as important as art) while not neglecting the hard infrastructural size of urban development. The three priorities of the development strategy are as follows: (1) economy and infrastructure, (2) society and culture, and (3) space and environment. With an overarching goals of efficiency and citizen-friendliness, they all together constitute all fundaments of the smart city concept of urban development, therefore Lodz may be analyzed in these terms.

Main strengths of the city, according to its decision-makers, include (The City of Lodz Office, 2012, p. 20):

- central position in Poland, Europe and in the agglomeration with a population of over a million;
- infrastructural investments carried out in Lodz and the agglomeration, including those in transport with network of national highways and fast trains to/from Warsaw;
- diverse, substantial investment areas that are available in the city;
- competitive costs of carrying out business activities;
- numerous higher education institutions, both public and private, as well as research institutes generating efficient and experienced staff;
- post-industrial heritage – tradition, identity, unique architecture and urban arrangement;
- experience in regeneration of post-industrial structures for education, trade and entertainment purposes;

In the light of strategic documents, survey data and information from the entrepreneurship sector, location of economic activity in Lodz is still mostly chosen for the characteristics of its labor force. As characteristic as it is for the emerging economies, it still bears all weaknesses and risks of low-cost locations. Lodz is not going to turn into an agglomeration include in the international network of cities, nor will it benefit from the new 'informational' phase of capitalism by becoming one of the nodes of international network of information processing and control. Yet, Lodz may still benefit from international labor and capital division, as well as may serve as regional cluster of small firms capable of delivering Saxenian's 'milieux' for innovation. Analysis of the city's development also proves that it is becoming even so often a pool of qualified, yet still cost-competitive, labor – over the last decade number of companies in creative and innovative sectors is increasing. Worth mentioning is also a fact that innovation in Lodz is to some extend driven by revival of textile industry, yet in its current, technology intensive stage. Building on infrastructure, know-how and tradition of the industry in the region, investors are starting to produce and research textile products in Lodz and, moreover, many of the investors are small and medium sized companies.

Attachment of the city of Lodz to the smart city initiatives is also supported by its bid in IBM's "Smarter Cities Challenge", which Lodz finally won (together with other 30 cities around the world). Under this program, Lodz will be consulted by IBM's leading experts as far Was development challenges are concerned. The whole project is valued at 50 million USD and included three-weeks-consultation period, analysis of city's growth, interviews with city's policy makers, academia and business representatives, concluded with recommendations. So far, IBM experts are analysis the area of social transfers in the urban area, which may seem unorthodox for an urban development primary research but as the project is still undergoing, it is hard to evaluate its outcomes yet.

The issue of smart city growth in the context of various stages of economic development (i.e. in developed or low-income countries) has not been widely elaborated upon in literature, neither conceptual nor empirical. This approach is slightly touched upon in Neirotti et al. (2014), as structural factors, with economic development, constitute one of the groups of explanatory variables in their regression analysis.

It seems however, that the concept of smart city may be treated as a universal model for urban development given a wide definition is assumed. If we assume smart city a new paradigm of urban development, and include areas concerning social and human capital, mobility, governance, sustainability, the concept seems appropriate for both developed and emerging economies. Understanding of smart city to just city “intelligence” and its endowment with ICT distorts the picture as it favors both technology and population capable and willing of its use. Cities equipped with ICT are not necessary better cities or more livable cities or even cities more attractive for investors.

Studies and rankings show that the smart city initiatives are elaborated and implemented in cities throughout the world, yet priorities are chosen depending on city or region’s needs. Empirical analysis of those initiatives (Neirotti et al. 2014) proves that the level of economic development (with GDP per capita as proxy) is not as important to implementation of smart city initiatives at all, as it is to the type of actions chosen. The study proves, contrary to conventional knowledge, that cities in developed countries tend to concentrate more on ‘hard domain’ (energy, natural resources, transport, built environment, healthcare and public security) whereas low-income cities are active in projects aimed at innovation capabilities and human capital.

The index elaborated in the presented study also shows that cities from various economies score similarly in the ranking. This analysis is, however biased by the fact that it is geographically limited to EU member countries, therefore the representation of low-income economies is inadequate to global comparative studies.

The case study, its potential and development in terms of smart city concept will be analyzed using the previously elaborated index. Data for the following calculations come from three sources: Urban Audit data base of Eurostat, Bank of Local Data of Polish National Statistical Office and quality of life and quality of public institutions service survey, carried on for the Lodz’s Municipality in 2012.

Fig. 1 shows results in the previously prepared index for Lodz. As Lodz was not include in Eurostat’s survey on quality of life in European cities, other proxies had to be used in this particular case. Number of households living in social housing, for the lack of data, was substituted with declarations on the use of any social assistance by city’s inhabitants (based on the Municipality’s own survey,). Efficiency of resources use, since not accessed by neither the Municipality nor Eurostat, was estimated based on Standard&Poor’s rating. Other proxies remained unchanged compared with the original smart city index and the values come from either Urban Audit or Municipality’s survey on quality of life in the city.

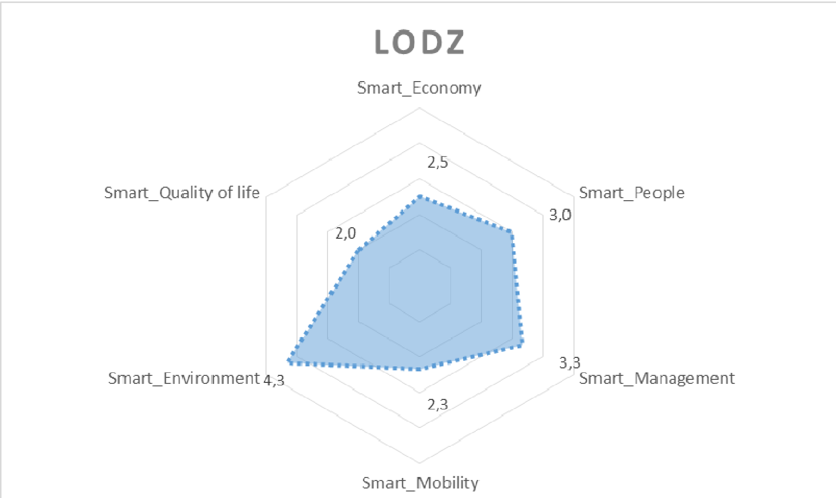

Fig. 2: Smart city index an sub-indices in Lodz. Source: own calculations based on Urban Audit and Lodz Municipality survey data.

The overall point value for Lodz in smart city index comes to 2.90 which ranks the city in the middle of the sample used for the evaluation. It is also a value that is similar to other Eastern European cities. Interestingly however, Lodz ranks relatively well in areas of environment and management, where other Eastern European cities had lower values. In case of Lodz, overall value of smart city index is lowered by quality of life and mobility sub-indices. The mobility issue may be covered in the near future by the extension of high-way and rail-track network around in within Lodz. Furthermore, Lodz has just lounged a large investment in inter-city train system. Overall accessibility of Lodz and mobility infrastructure within the city should increase in the near future and comparing the smart city index throughout next few years might bring interesting results.

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Other area of policy focus should concentrate on social development. High numbers of households living in social housing are to some extend an aftermath of industrial history of the city and its social consequences – unemployment, social exclusion, problems with adjustment to free-market reality.

The fact that Lodz is not following the pattern of smart city development typical for other Eastern European countries may support the hypothesis that smart city is a concept for multi-dimensional urban development suitable for both developed and emerging economies. This particular case study proves that smart city strategy is more dependent on actions and initiatives taken within this particular urban area or region than overall macroeconomic situation of national economy. The fact that analyzed concept covers six characteristics gives possibility to make up deficits in one area by excellent results in others.

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Der Einsatz von Social Media im Stadtmarketing

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1 ABSTRACT

Das Internet löste eine tief greifende Medienrevolution aus, die sich durch die Entwicklungen im Social Media Bereich sowie der Nutzung des mobilen Internets nochmals verstärkt. So hat sich die Art, wie Inhalte heute erstellt, verteilt und wahrgenommen werden, stark verändert (Münker, 2009). Dementsprechend stellt sich auch die Frage, wie ein erfolgreiches Marketing zukunftsorientiert positioniert werden kann und welche Mechanismen im Internet, unterstützt durch Social Media, dafür Potentiale bieten. Sowohl von Beispielen der Marketingstrategien große Konzerne als auch im Marketing von kleinen Kommunen ist dies ablesbar.

Gegenstand dieses Beitrages sind die Ergebnisse einer empirischen Studie (Masser 2013), die den Einsatz von Social Media im Stadtmarketing in der Metropolregion Rhein-Neckar (MRN) untersucht hat und hier exemplarisch vorgestellt wird.

Ziel ist es hierbei, die Gründe und Motivationen, warum Kommunen Social Media in ihren Marketingprozess einbeziehen zu ermitteln oder falls dies noch nicht geschehen ist, die Ursachen dafür zu identifizieren.

Neben der allgemeinen Erläuterung von Zielen im Marketingprozess mit Social Media standen folgende Fragestellungen im Mittelpunkt der Studie: Ist Social Media lediglich ein Instrument um junge Menschen, welche durch klassisches kommunales Marketing nur schwierig zu erreichen sind, anzusprechen? Oder gilt es, das Image gegenüber Außenstehenden (Touristen) zu verbessern? Könnte gegebenenfalls die hohe Aktualität des Mediums ein Kriterium für den Einsatz solcher Marketingkanäle (Facebook, Google+, Twitter etc.) sein?

Daneben wird die Hypothese überprüft, ob das Interesse an Social Media Marketing abhängig von der Größe der Stadt ist oder nicht. Weiterhin wird der Frage nachgegangen, ob Großstädte mehr Social Media Angebote nutzen als kleinere Kommunen.

2 EINLEITUNG

Viele Städte stehen in einem starken regionalen, nationalen und internationalen Wettbewerb um Unternehmen. Die Neuansiedlung beziehungsweise die Bindung vorhandener Unternehmen durch die damit verbundenen Gewerbesteuereinnahmen trägt wesentlich zur Finanzausstattung einer Kommune in Deutschland bei (Deutscher Städtetag, 2010). Auch die Zahl der Einwohner ist vor allem bei der Über- oder Unterschreitung von Schwellenwerten (wie 100.000 Einwohner) ein wichtiger Parameter, da unter anderem die Einnahmen aus dem kommunalen Finanzausgleich an das Erreichen einer bestimmten Größe gekoppelt sind (Jensen, 2013). Auch um Touristen und Geschäftsleute, speziell solche, die in Hotels und Pensionen übernachten, konkurrieren Städte und Regionen. In einigen Fällen gibt es spezielle Konkurrenzsituationen. So werben Städte um Messen oder Großveranstaltungen. Als Beispiel ist hier die Verlegung der PopKomm von Köln nach Berlin zu nennen (RP Online, 2003). Mit dieser Konkurrenz um Messegäste sind auch damit verbundene Steuereinnahmen oder bei Flughafenstandorten der Wettbewerb um Fluglinien (Passagiere und Fracht) zu berücksichtigen. Den Städten und Regionen stellt sich die Frage, wie sie ihr Marketing zukunftsorientiert ausrichten können. Social Media bietet hier neue Ansätze.

Netzwerke und Communities werden immer mehr ein Teil unseres Lebens. Privatwirtschaftliche Unternehmen nutzen Social Media immer häufiger, um Kunden anzusprechen und diese in den Produkt- und Marketingprozess einzubinden. Die Arbeit soll die Chancen, Möglichkeiten und Risiken des Einsatzes von Social Media im kommunalen Marketing darstellen. Eine zentrale Fragestellung lautet: Erkennen Städte den angesprochenen Trend und wie stellen sie sich der neuen Herausforderung?

Folgende Hypothesen werden im Rahmen des vorliegenden Beitrags überprüft:

- Städte haben abhängig von ihrer Größe Interesse an Social Media Marketing: große mehr als kleine
- Bestimmte Ziele oder Zielgruppen sollen durch das Social Media Engagement angesprochen werden

Die Hypothesen wurden mithilfe eines Onlinefragebogens, adressiert an die Kommunen in der Metropolregion, überprüft.

3 GRUNDLAGEN

Im nachfolgenden Abschnitt werden kurz die wichtigsten Begrifflichkeiten rund um das Themenfeld des Social Media Marketings angerissen. Dabei kann nur ein kurzer Ausschnitt beleuchtet werden, da eine umfassende Betrachtung der Thematik mit allen Besonderheiten den Rahmen des Beitrages übersteigen würde. Für weitere Informationen zum Thema wird auf die Arbeit (Masser, 2013) verwiesen.

3.1 Social Media Marketing

Als Social Media Marketing (SMM) wird der gezielte Einsatz von Social Media (Facebook, Twitter etc.) zu Marketingzwecken verstanden. Es kann dazu verwendet werden, Kundenbeziehungen aufzubauen und diese zu stärken, daneben kann der Einsatz Transparenz schaffen. Die reine Präsenz im Medium stellt noch kein Social Media Marketing dar. Social Media steht vielmehr für den Austausch von Content (Inhalten) und Diskussionen unter den Nutzern. Die eingesetzen Inhalte sollten an die Marketingziele einer Organisation oder Institution angepasst werden und positive Auswirkungen auf das Image des Werbenden haben (Bannour & Grabs, 2012; Münker, 2009).

3.2 Zielgruppen des Social Media Stadtmarketings

Betrachtet man eine Kommune aus der Perspektive des Marketings, so weist sie üblicherweise sechs in sich sehr verschiedene Zielgruppen auf: den Bürger, die „Zivilgesellschaft“, Touristen, Unternehmen und deren Beschäftigte, die Region sowie städtische Beschäftigte.

Um diese unterschiedlichen kommunalen Zielgruppen erreichen zu können, muss normalerweise ein Distributionsmix von verschiedenen Medien und Instrumenten (z. B. Tageszeitungen, Werbung in überregionalen Medien, Fachpublikationen, die Präsentation der Kommune auf Messen und Konferenzen, Homepage, etc.) eingesetzt werden (Grabow & Hollbach-Grömig, 1998; Reeg, 2011). Das Repertoire kann durch das Social Media Marketing ergänzt werden.

3.3 Ziele des Social Media Stadtmarketings

SMM bietet dem Anwender einfache, zielgerichtete Tools, um sich zu vermarkten. Es kann so in einer schnellen Art und Weise ein großes Publikum kostengünstig angesprochen werden. Den beworbenen Produkten und Marken wird dadurch eine große Aufmerksamkeit zu teil. Doch es stellt sich dabei auch die Frage, wie Kommunen und Städte dieses Instrument der Produktwerbung für ihr eigenes Marketing nutzen können?

Welche Ziele des Stadtmarketings lassen sich durch Social Media Marketing erreichen oder können in ihrer Durchführung unterstützt werden?

In der nachfolgenden Tabelle 1, basierend auf den Arbeiten von Kuron (1997) und Block & Icks (2010), können die Ziele des Stadtmarketings in Verbindung mit Social Media Marketing exemplarisch veranschaulicht werden.

Die Betrachtung der Ziele des Stadtmarketings in Bezug auf die Umsetzung durch Social Media Marketing diente zur Erarbeitung und Konzeption des Fragebogens. Social Media und Social Media Marketing scheinen für Kommunen interessant, weil sehr verschiedene Zielgruppen (siehe 3.2) erreicht werden können.

4 DURCHFÜHRUNG UND ORGANISATION DER BEFRAGUNG

Die empirische Erhebung der Studie „Einsatz von Social Media im Stadtmarketing“ wurde im Zeitraum vom 15. März 2013 bis zum 05. April 2013 in der Metropolregion Rhein-Neckar durchgeführt. Dabei wurden 61 Kommunen im Namen des Regionalverbandes angeschrieben. Die erforderlichen Adressaten wurden durch die Abgleichung einer Präsenz der Städte in Sozialen Medien ermittelt und über die dort angegebenen Kontaktdaten die jeweilige verantwortliche Person direkt kontaktiert. Bestand kein Social Media Engagement, so wurden Verantwortliche in den Bereichen Marketing, Tourismus und Wirtschaftsförderung angeschrieben. Daneben richtete sich das Anschreiben auch an Institutionen wie beispielsweise den Marketing-Club Rhein-Neckar e. V.

Ziele des Stadtmarketing	**Direkte Auswirkung**	**Indirekte Auswirkung**	**Keine Auswirkung**	**Begründung / denkbare Szenarien**
Handel fördern		X		Indirekte Auswirkung durch Tourismus- und Eventmarketing (Bsp. Weindorf)
Steigerung der Attraktivität einer Stadt/Innenstadt			X	Keine direkte Kausalitätskette erkennbar
Bessere Positionierung der Stadt gegenüber Wettbewerbern Verbesserung des Stadtimages	X			Aktives SMM kann ein modernes und transparentes Bild der Stadt zeichnen
Steigerung der Zufriedenheit städtischer „Kunden“	X			Zufriedenen Bürgern/Kunden steht die Möglichkeit dieses über die Social Media Präsenz zu beschreiben, was weiter beeinflussen kann
Erhöhte Identifikation der Bürger mit „ihrer“ Stadt	X			Direkte Ansprache der Bürger – erzeugt ein „Wir-Gefühl“
Belebung Innenstadt und der Kaufkraftbindung	X			Durch SMM können potenzielle Kunden/Bürger oder Eventteilnehmer angesprochen werden
Steigerung der Effektivität von Einrichtungen und Maßnahmen zur Stadtentwicklung			X	Keine direkte Auswirkung
Erschließung der innerstädtischen Entwicklungspotenziale Stadtstärken und –schwächen ermitteln		X		Eingeholtes Feedback könnte für eine bessere Informationsbasis genutzt werden
Wirtschaftsförderung		X		Keine Mechanismen, um gezielte Förderprojekte zu begleiten oder durchzuführen Lediglich Nutzung zur Kommunikation
Leitbild entwickeln	X			Einfache Einbindung der Bürger → Prozess / Fortschritte können einfach kommuniziert werden Problem: Datenschutz
Bürger besser informieren	X			Schnelle, kostengünstige Information durch die SM
Unternehmen/Bürger an Finanzierungen beteiligen	X			Durch "ground founding" könnten diese beteiligt werden
Leistungen kostendeckend vermarkten			X	SMM relativ kostenneutral, kann aber keine direkten Einnahmen generieren außer Einsatz von Social Shopping - Nutzen fraglich
Verwaltung modernisieren	X			Durch Wikis können Bürger bspw. in die Arbeit der BIS integriert werden. Problem: Datenschutz / Kontrolle der Daten
Bessere Nutzung der Lenkung städtischer Ressourcen			X	Durch SMM können Entscheidungen unter Umständen beeinflusst, aber nicht getroffen werden
Verbesserung der Zusammenarbeit zwischen wichtigen Handlungsträgern in der Stadt			X	Ob sich Handlungsträger von Social Media Beiträgen beeinflussen lassen, ist fraglich
Aufbau innerstädtischer Netzwerke		X		Social Media erleichtert die Kommunikation
Einbindung öffentlicher und privater Akteure im Rahmen einer Public-Private-Partnership.			X	Keine direkte Auswirkung
Freiwilliges Engagement			X	Durch den gezielten Einsatz kann Interesse für solche Ämter geweckt werden – Ansprache der 14- bis 29- jährigen

Tabelle1: Untersuchung der Ziele des Stadtmarketings im Bezug auf die Umsetzung durch Social Media Marketing Tools (Eigene Darstellung, 2013 in Anlehnung an (Kuron, 1997 u. Block & Icks, 2010))

Als Grundlage des Fragebogens diente die Erarbeitungsphase der Diplomarbeit „Der Einsatz von Social Media im Stadtmarketing“ (Masser 2013), die Masterthesis „Neue Medien und Social Networking im Stadtmarketing“ (Schneider, 2011) sowie die Studie „Social-Media-Management: Gut aufgestellt für den Erfolg?“ (Holicki & Kati, 2012).

Der Fragebogen wurde in Papierform beim 15. Workshop der Arbeitsgruppe EDV in der Stadtplanung[1] getestet und dann in leicht modifizierter Form als Online-Fragebogen eingesetzt. Die Vorteile eines Online-Fragebogens liegen auf der Hand. Es entstehen keine Kosten für den Druck und Versand eines gedruckten Fragebogens und der Aufwand für die Übertragung der Daten von Papier in eine elektronische Form Datenbank entfällt. Auch entstehen keine Fehler bei der Datenübertragung, eine Kontrolle wie in analogen Verfahren ist nicht zwingend notwendig. Nach Ablauf der Bearbeitungszeit wurden die Informationen ausgewertet. Dies erfolgte mit Hilfe von MS Excel sowie SPSS, unter anderem um relative Häufigkeiten sowie Korrelationen (Kreuztabellen) zu analysieren. Die ausgewählten Ergebnisse der Analysen werden in Diagrammen dargestellt und erläutert. Mittels dieser sowohl deskriptiven als auch schließenden statistischen Analysemethoden konnten die zuvor formulierten Hypothesen einer empirischen Überprüfung unterzogen werden (Bortz, 1999; Atteslander, 1995). Für die Online-Befragung wurde LimeSurvey eingesetzt. Neben den geringen Kosten stand die einfache und unkomplizierte Handhabung für die Befragten im Vordergrund. Durch den Einsatz von Filterfragen konnte der Fragebogen so gestaltet werden, dass bestimmten Befragtengruppen, zum Beispiel die Gruppe der Kommunen, die Social Media nutzen und die Gruppe, die dies nicht tun, unterschiedliche Fragebogenvarianten präsentiert bekamen. Nicht relevante Fragen wurden dem Befragten nicht angezeigt. In einem herkömmlichen Fragebogen in Papierform sind hierzu zusätzliche Erklärungen und Hinweise im Fragebogen notwendig, die jenen kompliziert und unübersichtlich machen. Eine Telefonbefragung oder persönliche Befragung (Interviewbefragung) war nicht vorgesehen, da der Aufwand für Interviewtermine mit Vertretern von 61 unterschiedlichen Institutionen als zu hoch eingestuft wurde.

4.1 Auswertung der Befragung

Insgesamt wurden 61 Kommunen und Institutionen angeschrieben, wobei 35 der Angeschriebenen den Fragebogen ausgefüllt haben. Somit ergibt sich eine Rücklaufquote von 58 %. Die beachtliche Beteiligungsquote von fast 60 % zeigt, dass das Instrument der Online-Befragung nach Kosten-/Nutzen-Erwägungen mit weitem Abstand die „günstigste“ Vorgehensweise ist. Allerdings haben 11 der 35 Kommunen, die den Fragebogen ausgefüllt haben, nur wenig oder keine Angaben gemacht, manche haben den Fragebogen nur durchgeklickt.

Abschließend kann daher geschlossen werden, dass SMM derzeit für etwas mehr als ein Drittel der Kommunen in einer Metropolregion wie der Metropolregion Rhein-Neckar (ca. 37 %) ein „wichtiges“ Thema ist.

4.2 Ergebnis der Studie oder Gründe für Social Media Marketing

Um eine gewisse Vergleichbarkeit zu schaffen, wurde sich bei der Konzipierung der Frage „Welche Ziele werden mit dem SMM verfolgt beziehungsweise was waren die Gründe, die die Städte dazu bewegt haben, im Social Media aktiv zu werden?“ an der Studie von Schneider „Neue Medien und Social Networking im Stadtmarketing“ orientiert. Diese Evaluation wurde 2010 für die BCSD-Bundesvereinigung City- und Stadtmarketing Deutschland e. V. durchgeführt (Schneider, 2011). Es soll geprüft werden, ob die Ziele beziehungsweise Gründe Social Media Marketing in der Metropolregion Rhein-Neckar einzusetzen, mit den Ergebnissen der Studie (sprich anderen Regionen in Deutschland) vergleichbar sind, ein synoptischer Vergleich folgt.

[1] Arbeitsgruppe EDV in der Stadtplanung; weitere Informationen finden Sie unter: http://www.ag-edv-stadtplanung.de/ag-main.html

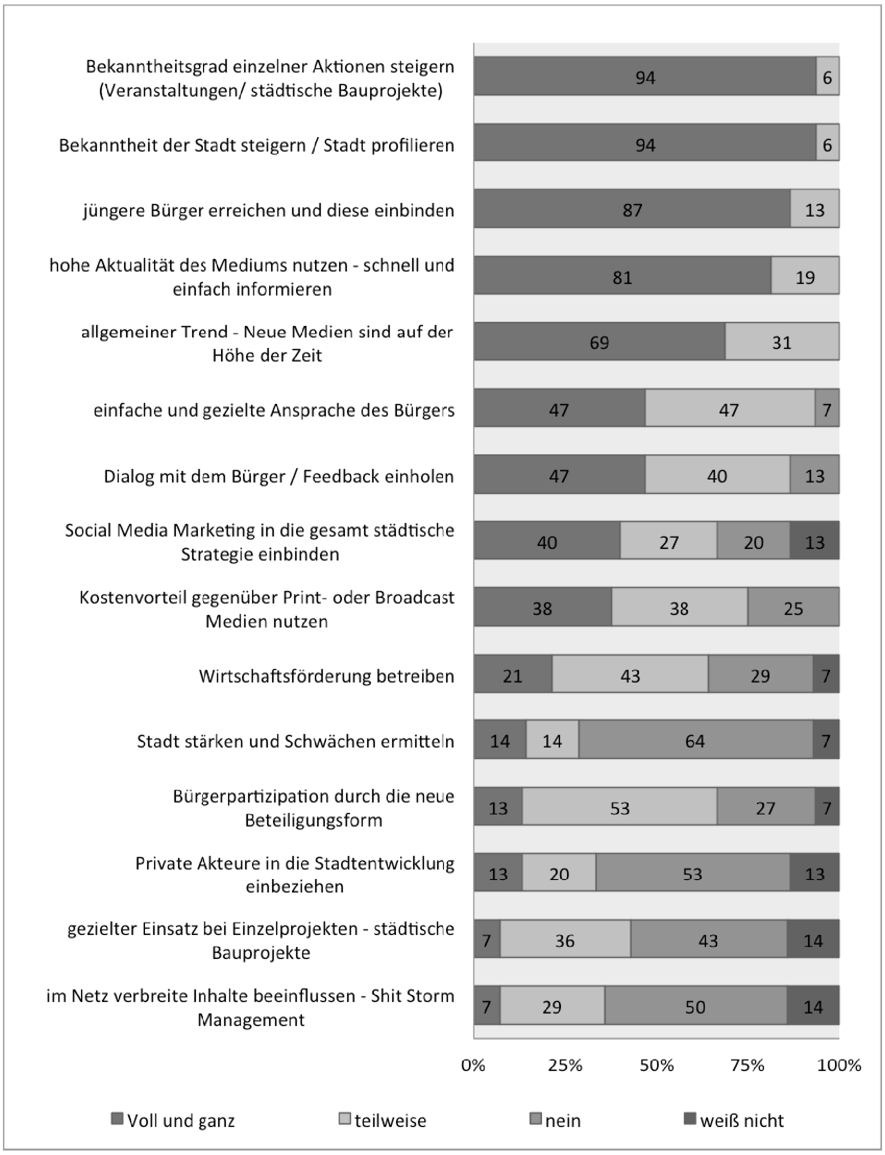

Diagramm 1: Antworten zur Frage: Aus welchem Grund wird / wurde ihre Kommune im Bereich Social Media aktiv? (Mehrfachnennung möglich), n=24, in % (Eigene Darstellung, 2013 in Anlehnung an (Schneider 2011))

Wie Diagramm 1 entnommen werden kann, soll mittels Social Media Marketing vor allem die Bekanntheit der Stadt oder einzelner Aktionen (z. B. Events wie Feste, Märkte, Ausstellungen, Festivals etc.) gesteigert werden. Sehr häufig wurde aber auch angegeben, mit Hilfe von Social Media jüngere Bürger erreichen zu wollen und diese einzubinden. Dies bestätigt die Hypothese, dass die Städte gezielt auf Social Media Marketing setzen, um bestimmte Zielgruppen wie Konzertbesucher zu erreichen. Ebenso wird die hohe Aktualität des Mediums geschätzt, also ein schnelles und einfaches Informieren der Bürger.

Die vorliegende Studie sowie die Ergebnisse der Befragung von Schneider (2011) bestätigen, dass Städte und Kommunen durch Social Media eine jüngere Zielgruppe erreichen, ihren Bekanntheitsgrad steigern und die hohe Aktualität des Mediums nutzen wollen. Die beiden Studien stimmen auch dahingehend überein, dass sich die Städte einen Kostenvorteil durch das im Internet stattfindende SMM versprechen. Man spart vor allem Druckkosten und Sendegebühren (z. B. Kosten für Werbeanzeigen). Ob die Kommunen dabei auch den zusätzlichen Personal- und Zeitaufwand kalkuliert haben, kann an dieser Stelle nicht beantwortet werden. Ein Social Media Marketing Engagement erfordert eine ständige Pflege, um die Aktualität zu gewährleisten (insbesondere Tweets) oder um auf Posts (Facebook) zu reagieren und kritische Entwicklungen („Shitstorm“) frühzeitig entdecken und darauf reagieren zu können.

Die Ziele „einfache und gezielte Ansprache des Bürgers“ sowie „Der Dialog mit dem Bürger / Feedback einholen“ haben bei der vorliegenden Befragung mit jeweils 47 % „voll und ganz zutreffend“ ebenfalls einen sehr hohen Stellenwert für die Befragten.

Dies ist durchaus mit der Aussage zu vergleichen „Dialog mit Interessierten steht im Vordergrund“, welche in der BCSD-Befragung eine hohe Anzahl an Zustimmungen aufweist. Jedoch stellt sich die Frage, wie „Interessierte“ definiert sind. Daneben kann auch der Grund „Dialog mit Kunden steht im Vordergrund“ mit dem „Dialog mit dem Bürger“ gleichgesetzt werden. Hier zeigen beide Studien, dass diese Absicht einen hohen Stellenwert im Social Media Marketing Engagement der Städte besitzt.

74 % der Befragten gaben in der BCSD-Befragung an, dass sie durch Social Media „Chancen sehen, Verbesserungspotenziale zu genieren“ und „Feedback“ einholen wollen. Diese beiden Punkte wurden in der Befragung in der MRN einzeln betrachtet. Jeweils gaben 47 % der Probanden an, dass sie mit Social Media Marketing „Dialog mit dem Bürger / Feedback einholen“ sowie „Stadt stärken“ und „Schwächen stärken“ betreiben wollen.

Im vorliegenden Fragebogen fand die Partizipation des Bürgers nur eine geringe Zustimmung. Dies steht im Kontrast zu der Aussage, dass man mittels Social Media Marketing die Meinungen der Bevölkerung einholen möchte. Der Grund könnte eine unterschiedliche Definition des Begriffes Partizipation sein, der in der Planung beziehungsweise im städtischen Zusammenhang Partizipation eine andere Definition hat wie ein Kommentar eines Users. In der Literatur zu Web 2.0 oder Social Media / Social Media Marketing wird bereits das Bekunden des „Gefallens“ als Partizipation angesehen. In der Planung bzw. im kommunalen Bereich hat Partizipation eine viel tiefere Bedeutung wie lediglich das Äußern einer Meinung. Es bedeutet, dass der Bürger aktiv im Planungsprozess mitwirkt und die Entscheidung mitbeeinflussen kann (Streich, 2011).

Der Punkt „Wirtschaftsförderung betreiben“ hat nur eine geringe Zustimmung. Dies ist etwas verwunderlich, denn gerade jüngere Bürger sollen durch SMM angesprochen werden. Als Arbeitnehmer oder als Jungunternehmer ist diese Bevölkerungsgruppe sehr interessant für die Stadt.

Die ARD/ZDF-Onlinestudie bietet hierfür eine grobe Einordnung mit der Altersklasse von 14 bis 29 Jahren. Diese Alterskatergorie weißt 2012 „zumindest gelegentliche“ Onlinenutzung von 99 % auf.

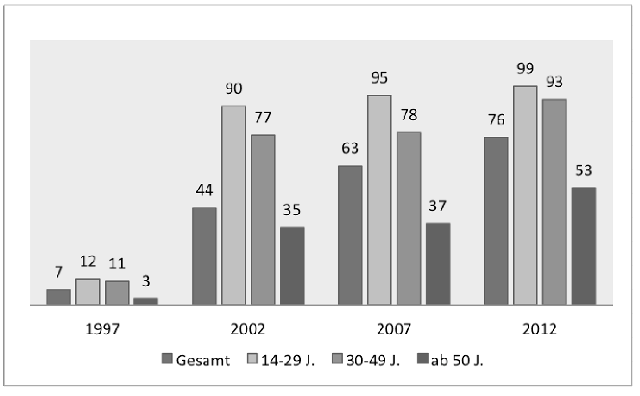

Diagramm 2: Onlinenutzung (zumindest gelengtlich) unterteilt in Altersklassen, in % (Eigene Darstellung, 2013 in Anlehnung an (Mende, Oehmichen, & Schröter, 2013))

Allgemein wird deutlich, dass beide Befragungen ein relativ ähnliches Bild ergeben. Der Dialog mit Bürgern und vor allem den jüngeren Bürgern steht beim Social Media Marketing der Städte im Vordergrund. Sie wollen Besonderes dem jungen Publikum eine Informationsplattform bieten, mit der sie mehr über die Städte erfahren können. Wichtig sind vor allem Konzerte und Veranstaltungen, die dieses Publikum auch ansprechen und eine große Zahl an Besuchern benötigen. Zudem soll ein gewisses Empfinden für die Stadt aufgebaut werden. Es geht den Städten darum, über das Social Media Engagement kostengünstig ihren Bekanntheitsgrad zu steigern. Eine grundlegende Verschiebung der Ziele von Social Media im Stadtmarketing ist seit 2011 nicht zu erkennen (Schneider, 2011).

Die vorliegende Befragung von Städten in der MRN erlaubt eine Analyse nach Größenklassen der Städte. Unterscheiden sich die Gründe nach der Größe einer Stadt und wenn ja, welche Gründe machen vor allem einen Unterschied? Einbezogen in die Analyse wurden nur die Größenklassen, die mindestens fünf Befragte aufzuweisen hatten, damit einzelne „Ausreißer“ keinen allzu großen Einfluss auf die Ergebnisse haben. Betrachtet werden die Angaben für Gründe, die als „voll und ganz zutreffend“ von den Befragten angegeben wurden. Differenziert werden können die Angaben für die Größenklassen 10.000 bis 20.000 (9 Befragte), 20.000 bis 50.000 (6 Befragte) und über 100.000 Einwohner (5 Befragte).

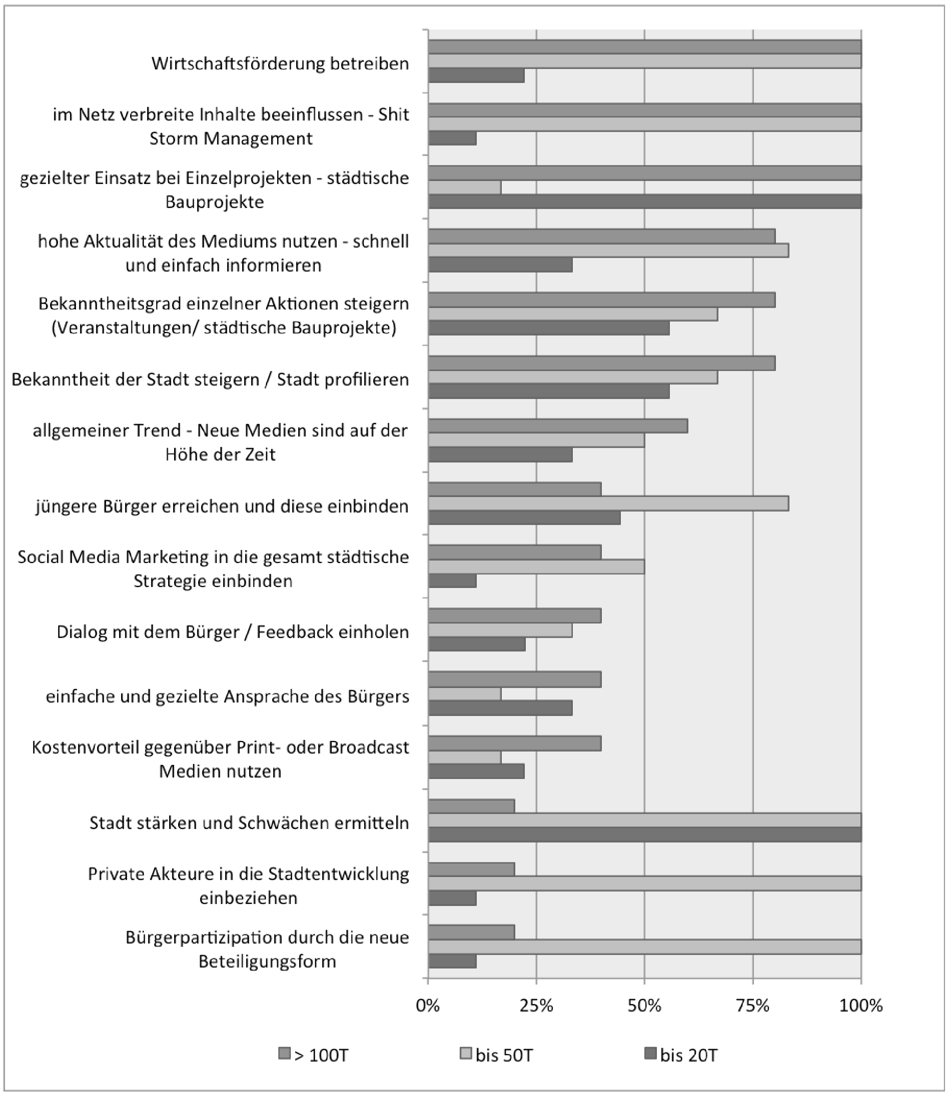

Diagramm 3: Gründe für die Aktivität im Social-Media-Bereich im Bezug auf die Stadtgröße, n= 20, in % (Eigene Darstellung, 2013)

In der Tendenz ist klar, dass die größeren Kommunen mehr Ziele beziehungsweise ihre Ziele mit größerer Intensität anstreben. Aber es gibt – auch wenn man die geringe Zahl der maximal 17 Städte, die zu dieser Frage Angaben gemacht haben, in Betracht zieht - interessante Unterschiede:

- „Stärken und Schwächen ermitteln“: Dieses Ziel haben (fast) nur die Städte beziehungsweise Gemeinden unter 50.000 Einwohner im Blick; dies allerdings zu 100 %
- Dies gilt auch für das Ziel „Bürgerpartizipation durch die neuen Beteiligungsformen“ sowie „Private Akteure in die Stadtentwicklung einbeziehen“
- Ebenfalls zu 100 % haben Kommunen zwischen 20.000 bis 50.000 Einwohnern das Ziel Stärken und Schwächen zu ermitteln
- Kommunen über 100.000 Einwohner verfolgen die genannten Ziele mit SMM im Grunde nicht
- Das Ziel, Jugendliche zu erreichen verfolgen insbesondere die (allerdings sehr zahlreichen) Kommunen zwischen 20.000 und 50.000 Einwohnern
- Die Ziele: „Aktualität“, „auf die Gefahr von Shitstorms reagieren können“ sowie „die Wirtschaftsförderung“ werden vor allem von Kommunen ab einer Größe von 50.000 Einwohnern verfolgt
- Überraschend ist, dass der Einordnung des Social Media Marketings in die gesamtstädtische Strategie nur eine untergeordnete Relevanz zu geordnet wird

    - Lediglich die Hälfte (3 Befragte) der Städte mit 50 000 Einwohnern nennt dies als Grund, im Social Media Marketing aktiv zu werden
    - Bei den Groß- und Kleinstädten wird dieser Grund sogar noch seltener genannt
- Einzelprojekte bekannt zu machen beziehungsweise zu promoten, dies wollen zu 100 % die großen Kommunen (über 100.000 Einwohnern) und die relativ Kleinen (zwischen 20.000 und 50.000 Einwohnern). Möglicherweise spielt hier eine Rolle, ob eine Kommune im Zeitraum der Befragung entsprechende Projekte in Vorbereitung hatte

An dieser Stelle wird wiederum deutlich, dass die Größe einer Kommune einen Einfluss auf ihr Social Media Marketing hat. Während die größeren Kommunen eher „klassische" Marketingziele verfolgen (Wirtschaftsförderung, Stadt- und Eventmarketing), haben kleinere Kommunen auch eher „ungewöhnliche" Absichten wie Stärken und Schwächen der Stadt zu ermitteln und die Bürgerpartizipation zu erhöhen.

Das Ziel die Gruppe der Jugendlichen/ jungen Erwachsen besser zu erreichen, verfolgen alle Befragten aus dem Bereich „Öffentlichkeitsarbeit" und drei Viertel der Befragten aus dem Bereich „Stadtmarketing" (Masser, 2013).

5 FAZIT

Social Media Marketing ist in vielen Kommunen bereits Realität

Social Media wird in unserem Alltag immer präsenter. Die Kommunen als fundamentale Organisationsform des Zusammenlebens in unserer Gesellschaft können sich dem Phänomen nicht verschließen. Die Arbeit zeigt, dass viele, aber noch nicht alle Städte der Metropolregion Rhein-Neckar Social Media Marketing bereits betreiben. Vor allem Kommunen mit touristischen Ambitionen erkennen den Nutzen von Social Media Marketing. Im Gegensatz zu herkömmlichen Marketingkanälen (Massenmedien) können durch Social Media bestimmte Adressatengruppen ganz gezielt mit „maßgeschneiderten" Informationen angesprochen werden und das „rund um die Uhr" und bei laufender Aktualität der Information. Darüber hinaus können Gruppen erreicht werden, die man mit den etablierten Stadtmarketingansätzen nur schwer bis gar nicht erreichen kann. Hier ist insbesondere die Gruppe der 14- bis 29-jährigen zu nennen, die zum Beispiel mittels Tageszeitung nur zu einem sehr geringen Teil erreichbar sind.

Size Matters – Größe ist ausschlaggebend

Die Größe der Kommunen ist für das Social Media Engagement ebenfalls ausschlaggebend. Je größer eine Stadt, desto mehr Social Media Kanäle setzt sie ein und nur bei Großstädten ist eine Strategie hinter dem Social Media Engagement zu erkennen. Kleinere Kommunen nutzen Social Media Marketing im Grunde nur dann, wenn sie spezielle Absichten damit verbinden, das heißt Tourismusmarketing betreiben oder Events bewerben wollen. Eine SMM-Strategie ist nur bei den Großstädten zu erkennen. Größere Städte messen SMM eine wichtigere Bedeutung zu, als es kleinere tun. Dies geht aus der Betrachtung der Ziele und Zielgruppen, welche durch Social Media Marketing angesprochen werden sollen, deutlich hervor. Die Umfrage in der MRN zeigt, dass die wichtigsten Ziele, welche mit Social Media Marketing erreicht werden sollen „Bekanntheitsgrad einzelner Aktionen steigern", „Bekanntheitsgrad der Stadt steigern/ Stadt profilieren" und „jüngere Bürger erreichen und diese einbinden" sind. In der Tendenz zeigt sich, dass die größeren Kommunen mehr städtische Marketingziele beziehungsweise ihre Ziele mit mehr Nachdruck anstreben. Sie verfolgen eher „klassische" Ziele des Stadtmarketings wie Wirtschaftsförderung sowie Stadt- und Eventmarketing. Bei kleineren Kommunen finden sich auch „ungewöhnliche" selten geäußerte Absichten wie „Stärken- und Schwächen der Stadt ermitteln" und „Bürgerpartizipation". In der Regel haben die kleineren Kommunen, die SMM einsetzen aber Touristen oder Gäste von Events im Blick.

Keine Revolution, aber Evolution - Social Media Marketing wird sich als Teil des Stadtmarketings etablieren

Social Media Marketing kann und wird die herkömmlichen Stadtmarketing-Tools zumindest auf absehbare Zeit, nicht ersetzen. Zielgruppen wie Unternehmen erwarten eine „seriöse" Ansprache und Plakate sind immer noch eine ausgezeichnete Werbung für Veranstaltungen. In Kombination mit anderen Werkzeugen des Stadtmarketings eingesetzt, lässt es sich aber sehr gut für bestimmte Zielgruppen nutzen. Social Media muss in die Marketingstrategie der Kommune integriert werden. Auch die Facebook-Präsenz einer Stadt sollte visuelle Bezüge zur Web-Seite der Stadt aufweisen, sodass eine „Handschrift" oder Corporate Identity erkennbar ist. Nur so sind die Vorrausetzungen für eine glaubwürdige Vermarktung über diese Medien gegeben.

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Deteminants of the Value of Houses: a Case Study Concerning the City of Cagliari, Italy

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1 ABSTRACT1

The aim of this paper is to analyze the relationship between housing values and a set of determinants, related both to the urban environment and to the structural characteristics of the housing market, in the metropolitan area of Cagliari. In order to achieve this aim, a sample of residential properties spread across the urban context was taken into account. For every single residential unit we study the value of houses, identified as their estimated value, cadastral value, rent value, value supplied by the National Observatory on Real Estate Market, and finally sale value as related to factors which are identified as relevant variables in several studies concerning the real estate market.

The adopted approach implies data collection concerning value and characteristics of houses. The resulting dataset is geocoded and spatially analyzed, in order to identify spatial autocorrelation of the value of houses and its correlations with respect to the characteristics of houses through the hedonic approach.

The methodological approach relates to the first four of the six conceptual features of smartness, that is economy, environment, governance, living standard, mobility and people, that characterize the theoretical framework which defines *smart cities* (Vanolo, 2014). Moreover, it can be easily replicated and exported with reference to other Italian and European urban contexts and results could be straightforwardly comparable. Policy implications of the findings could be a point of reference for future Italian and European planning policies concerning housing markets and the improvement of the quality of urban life.

2 INTRODUCTION

Our interpretive point of view concerning the value of houses is that this value reflects the quality of urban life. The improvement or decline in the quality of urban life determines benefit or damage to homeowners, since they experience a change in the quality of life, and to landlords, who receive higher or lower rents. So, in our view the value of a house is essentially related to its character of a composite good, which is bought and sold in the housing market as a parcel of characteristics, which determine its market price (among many, Palmquist, 1984, and Cheshire and Sheppard, 1995).

As a consequence, we propose to study the quality of life concerning an urban context through the analysis of the housing market where we observe equilibrium prices concerning purchases and sales of parcels of housing values's determinants. Such determinants are grouped into four distinct categories as follows: i. structural characteristics of the residential unit (such as unit size, distance from the shoreline, qualitative indexes accounting, inter alia, for the building age, the apartment level and the maintenance level); ii. neighborhood demographic characteristics (such as residential density both in the census ward and in the city district in which the property is located, or the number of foreigners living in the district); iii. plan-related characteristics (such as the presence of residential zones within a given distance from the property, proximity to parks or other green areas, and to common public services), and iv. land cover types. In order to analyze the relationship between housing prices and the aforementioned potential constituent characteristics, we pursue an approach based on a hedonic model in order to figure out the general willingness to pay for a specific commodity among the municipal area of Cagliari (Sardinia).

This paper is organized as follows. In the third section we describe the five measures of the value of houses we adopt in our analysis that is, their estimated value, cadastral value, rent value, value supplied by the National Observatory on Real Estate Market, and sale value. In the following section, we discuss the set of variables that we use as determinants of the value of houses, that is, structural characteristics, demographic

[1] This essay comes from the joint research work of the authors. Sections 1, 2 and 7 have been jointly written by the authors. Michele Argiolas has taken care of section 3 and subsection 4.1. Sabrina Lai has taken care of subsections 4.1.1 and 4.2. Corrado Zoppi has taken care of sections 5 and 6. Michele Argiolas and Corrado Zoppi have jointly taken care of subsection 4.1. Sabrina Lai has revised the whole essay and checked for its comprehensive consistency.

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characteristics, plan-related characteristics, and land cover types. The fifth section presents the hedonic methodology which we use to investigate the relations between the value of houses and its determinants.

The following section shows the results of the estimates of the hedonic regression models which use the value of houses and covariates in order to analyze if, and to what extent, the value of houses is related to the covariates altogether. Moreover, we compare the results concerning the different measures of the value of houses used as dependent variables in the hedonic regressions. In the concluding section, we discuss, through their hedonic prices, the influence of the determinants found relevant on the value of houses. This influence could be taken into account to define future planning policies to increase the quality of urban life. Exportabilty to other urban contexts and further developments of the research work are discussed as well.

3 ALTERNATIVE MEASURES OF THE VALUE OF HOUSES

To provide a spatial approach to figure out the real estate market condition is problematic because of both the lack of literature on the topic (Boulay, 2012) and the expected uncertainty that characterizes such kind of analysis. After a general investigation on the national and regional housing market condition, we develop a methodology centered on the appraised market value of a sample of properties located in the main residential zones of the Municipality of Cagliari. The following sub-sections refer to the description of the area of study and the adopted appraisal approach.

3.1 The metropolitan area of Cagliari

Cagliari is the capital and the major city of the second largest island of Italy and of the Mediterranean sea (Sardinia). The island covers a total area of about 24,000 km^2 with an overall population of approximately 1,600,000 people in 2012. As shown in Figure 1, around 150,000 inhabitants reside in the study area and about 250,000 in the surrounding municipalities (ISTAT). An international airport (Elmas) and one of the most important cruise and cargo port of the Mediterranean sea provide the metropolitan area with an efficient transportation infrastructure. This feature, combined with the presence of conspicuous historical/ landscape heritage, makes the city attractive as tourist destination. as confirmed by the annual increase in the number of international travelers (+15.68%) registered in January 2014 by the airport managing company (SOGAER).[2]

Municipality	Population
Assemini	26,607
Cagliari	**149,575**
Capoterra	23,189
Decimomannu	7,954
Elmas	9,064
Maracalagonis	7,592
Monserrato	20,178
Quartu Sant'Elena	69,443
Quartucciu	12,947
Selargius	28,643
Sestu	20,044
Settimo San Pietro	6,577
Sinnai	16,852
Uta	8,007
Metropolitan area	**406,672**

Fig. 1: Population distribution (left) and extension (right) of the metropolitan area of Cagliari (source: ISTAT).

The economy of the province of Cagliari is based, in order of importance, on trade and services, industry, and agricolture. In 2013, a note of the Bank of Italy reported a significant contraction of the regional GDP (-2.8%) and underlined the awful situation of the construction sector caused by both strong decrease in demand of new residential properties and reduction in public investments, as confirmed by the Sardinian section of the Italian association of building constructors (ANCE SARDEGNA), that registered that the sector had hit its worst state since the last forty years. As exposed below, this economic condition is fully reflected in the current state of Cagliari's housing market.

[2] http://www.sogaer.it/it/archivio-news/930-aeroporto-traffico-ancora-in-crescita-nel-2013.html [accessed January 21, 2014]

3.2 Housing market analysis

The latest report published by the National Observatory on Real Estate Market (OMI, 2013) states that the Italian residential property market is experiencing a period of strong stagnation characterized by a significant decrease in the number of property transactions and by a slight reduction in market prices. The report does not consider specifically the metropolitan area of Cagliari, but contains some interesting observations at the regional level. During the period 2004-2012, Sardinia was the Italian region having both the highest annual percentage change in market prices across the national context (about +7%) and the lowest reduction in average market prices throughout 2012 (approximately -0.5%). This particular housing market condition faces with one of the lowest family income at the national level and generates a serious housing affordability problem. As a matter of facts, during the last eight years the recorded housing market affordability index decreased from 12% to less than 4%. Such fall is second only to the affordability index decrease registered in Liguria. The authors of the report argue that this specific housing market situation is mainly related to the current growth of tourism flows and the resulting increase in the number of new potential foreign buyers interested in purchasing holiday homes. More likely, considering the report results and the theory expressed by Shiller (2008) about the US subprime crisis, the potential presence of a housing market bubble can provide an effective explanation of the current market condition.

We study the housing market of the municipality of Cagliari performing an analysis of the estimated market values of a representative sample consisting of 304 apartments spread over 18 distinct market areas. Having regard to the current real estate market stagnation and to the consequent general lack of specific transactional data, to estimate each property's market value, given also the size of the sample, can involve a significant margin of error. For this reason, we use different appraisal approaches and market price references.

For each property, we collect the relative overall gross living area [AREA] and evaluate, in qualitative terms, the potential incidence of the leading quality characteristics in the formation of property prices. As theorized by one of the main national reference on the subject (Orefice, 2007), these characteristics can be grouped in four categories:

- Localization quality (distance from the city center, efficiency of public transportation service, quality of local services, reputation of the area, proximity to open spaces or other natural features, availability of private or public parking lots for tenants and guests).
- Position quality (presence and quality of panoramic views, distance from other buildings and structures / daylighting quality, apartment level).
- Typological quality (building and apartment maintenance level, equipment and mechanical system conditions, building age).
- Economic productivity: potential risk to re-convert the property investment into cash (marketability risk) and legislative risks. Given the impossibility to access information concerning the property owners, we assess marketability risk as related to the overall gross living area and consider legislative risk almost uniform in a given market area.

Quality characteristic category	Incidence among central market areas	Incidence among intermediate market areas	Incidence among suburban market areas
Localization quality	from 5% to 10%	from 10% to 30%	from 15% to 35%
Position quality	from 15% to 25%	from 10% to 20%	from 10% to 25%
Typological quality	from 15% to 30%	from 20% to 25%	from 5% to 20%
Economic productivity	from 25% to 35%	from 10% to 25%	from 10% to 20%
Overall incidence	from 60% to 100%	from 50% to 100%	from 40% to 100%

Table 1. General incidence of quality characteristic categories among central, intermediate and suburban market areas.

Variable	Definition	Mean	St.dev.
EST_VAL	Market value (€/m2) estimated through regression analysis (source: 2013 direct survey)	2,279.77	404.02
CAD_VAL	Cadastral Assessed Value (€/m2) (source: 2013 cadastral register of the city of Cagliari)	714.64	294.76
OMI_VAL	Market value (€/m2) estimated through average market values range (source: OMI)	2,325.56	220.75
RENT_VAL	Rent value (€/m2 for month) estimated through average rent values range (source: OMI)	7.84	0.62
SUPP_VAL	Average list price (€/m2) recorded from other apartments for sale (source: 2013 direct survey)	2,515.00	308.59

Table 2. Definition of alternative variables used for housing market analysis.

Orefice theorizes three general levels of incidence of the above mentioned categories of quality characteristics, depending on the localization of the market area (Table 1). By means of the market values range published by OMI, we adopt the described quality valuation to appraise, for each house, its market value [OMI_VAL] and rent value [RENT_VAL].

In addition, we consider another market value definition [EST_VAL] by estimating a linear regression for each market area. For this estimate, we consider a dataset based on a survey concerning residential property sales carried out in 2013. Considering the market price as the dependent variable and the quality of the features as the explanatory variable, we assess the relationship between prices and quality for each market area. Subsequently, we make use of the resulting regression line to define the market value for each of the 304 apartments. Moreover, we appraise the cadastral value [CAD_VALUE] for each single apartment, by means of the on-line evaluation service provided by the Italian Cadastre.[3] Finally, we estimate the list price [SUPP_VAL] by considering a sample of list prices observed during the first semester of 2013 and comparing each property with the nearest detected apartment for sale.

As reported in Table 2, the difference between this two average market values estimated by means of different approaches ([EST_VAL] and [OMI_VAL]) is not important (about 2%) compared to supplemental costs related to ordinary property transactions (i.e. taxes, mortgage fees, realtor's entitlements, etc.). The mean list price [SUPP_VAL] is approximately 10.3 percent higher than the lowest detected mean market price [EST_VAL], against a national average of 15.3 percent.[4] The recorded mean Italian cadastral value [CAD_VAL] cannot be considered representative of the real estate market. As a matter of facts, it is more than three times lower than the mean market value ([EST_VAL] and [OMI_VAL]) and, in addition, the average assessed month gross rent [RENT_VAL] presents, in pair with [OMI_VAL], the lowest relative standard deviation among the estimated market values. This issue is related to the use of a general market value reference (the OMI report) for the appraisal process. Finally, the average gross living average area of the sample (109.43 m2) is consistent with the average gross living area recorded for the provincial capitals of the main Italian islands (103.5 m2) (OMI).

The general spatial configuration of the housing market in Cagliari is shown in Figure 2. In the Northeastern sectors of the municipality we detect an average unit market value up to 2,000 Euros per square meter (L) and in the Central and Northwestern areas between 2,000 and 2,500 (M). Finally, in the Central and Western parts we observe the highest average unit market value, corresponding to 2,500 Euros per square meter and over (H).

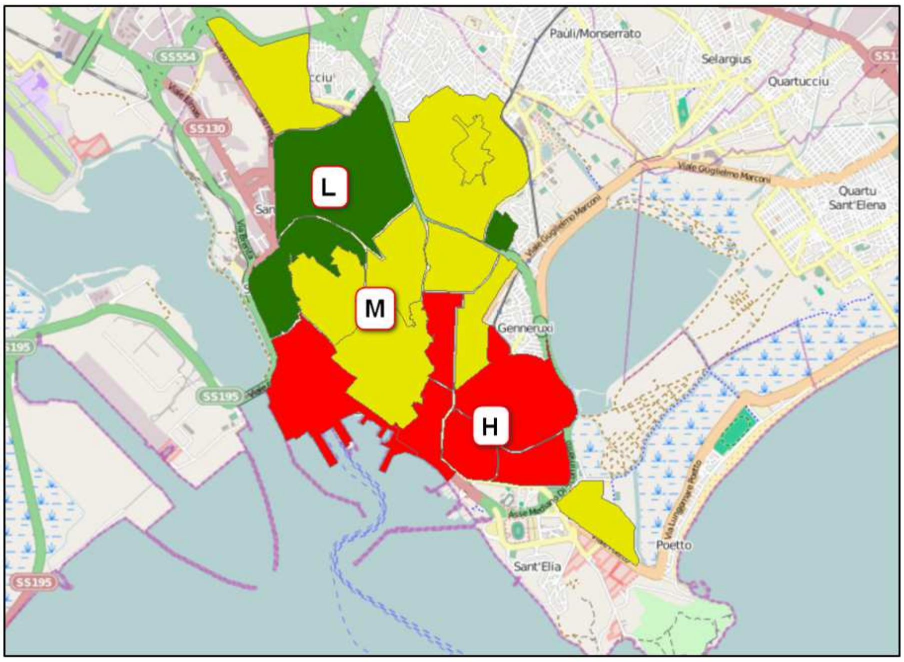

Fig. 2: Average market value ranges detected in the area of study.

[3] http://www.agenziaentrate.gov.it/wps/content/Nsilib/Nsi/Home/Servizi+online/serv_terr/senza_reg/Consultazione+ren dit e+catastali/

[4] The reported national average difference refers to the average gap between the first offer price and the related market price, recorded in municipalities with a population ≤ 250,000 inhabitants (source: Bank of Italy Eurosystem Statistics).

4 FACTORS INFLUENCING THE VALUE OF HOUSES

4.1 Discussion on factors

In the literature (among many, Palmquist, 1984, Cheshire and Sheppard, 1995, Kiel and Zabel, 1999, Zoppi, 2000), a widely accepted classification of factors influencing the value of houses distinguishes those intrinsically belonging to a particular house and those belonging to the house's neighborhood. Palmquist (1984) uses thirty-two variables to define the value of houses in seven United States metropolitan contexts. Twenty-three factors are related to a housing unit, while nine determinants concern the neighborhood where a house is located. Housing unit-related factors include, for example, finished interior area, number of bathrooms, year of construction, etc., while characteristics related to the house's neighborhood are drawn from the census data with reference to the census tract where the house is located, e.g., median age of residents, percentage of workers that has a blue/white collar job, population classified as non-white, and so on. Cheshire and Sheppard (1995) use a similar approach to the definition of the set of factors, but they add characteristics related to the zoning rules established by municipal Masterplans and urban land uses, such as industrial land, land for new residential developments, open space for leisure.

Characteristics of housing units and of the neighborhoods where houses are located could possibly be either positive, in which case they are considered *goods*, or negative, in which case they are considered *bads*. Since the characteristics of neighborhoods where houses are located are locally intrinsically non-excludable and non-rivalrous they can be considered *public goods* or *public bads*. The more the quantity of a public bad, the less the value of houses in the neighborhood, and vice-versa. Under this perspective, Zoppi (2000) analyzes the quantitative negative impact of widespread illegal building activity on the value of houses in the metropolitan area of Cagliari (Italy) by considering illegal buildings as a public bad, that is, a negative characteristic of the neighborhood where a house is located.

In the light of the essays quoted above and of many others which deal with the issue of the determinants of the value of houses, in this paper we use the following taxonomy of the characteristics of houses: i. structural characteristics of the residential unit; ii. neighborhood demographic characteristics; iii. plan-related characteristics, and iv. land cover types.

Structural characteristics of houses are collected through interviews to real estate agencies, landlords, renters and homeowners, and through direct observation. Surely, more reliable estimates could have been obtained, had more precise and standardized databases, such as the American Housing Survey, been available, which is not the case for Italy.

Finished interior area is a characteristic of a house dependent on the prevailing architectural building typologies in a given urban region, which in turn is strictly linked to the way urban planning has been historically implemented. Where urban planning has projected intensive building activity, that is, zones characterized by high densities of resident population, architectural typologies generally consist of tall buildings with several stories. In these cases, houses have small interior areas. Moreover, there is limited space for parking since up to the 1980s, when this was explicitly forbidden, what had been originally projected as parking areas were often sold as shopping areas. On the other hand, in the zones characterized by extensive residential urbanization densities are lower and houses are located in one, two or three-story buildings. In these cases finished interior area is larger and buildings usually have large parking areas in their courtyards. A question that is widely recognized in the literature, with reference to finished interior floor area, concerns the functional behavior of the value of houses with respect to finished interior area. Palmquist (1984, 397) observes that: "one characteristic requires special attention. It would be anticipated that the number of square feet of living space would not simply have a linear effect on price. As the number of square feet increases, construction costs do not increase proportionally since such items as wall area do not typically increase proportionally. Appraisers have long known that price per square foot varies with the size of the house." As a consequence, in our discussion it could be expected that the value of houses is negatively correlated to finished interior area, since we express it as the value per unit of finished interior area.[5]

Two quality factors related to typology and position represent two intrinsic features of the property. Typological quality regards the physical characteristics of the house and, in most aspects (i.e. maintenance

[5] In the first part of Palmquist's citation "price" is the price a house is offered for sale. In this paper, we consider the value of houses per unit of finished interior area.

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level and quality of construction), can be improved by property owners. Depending on the buyer's willingness to pay, the value added or lost by carrying or not carrying out these improvements may not worth the related cost. For example, to renovate an apartment by providing high-end quality finishes can be a cost-rewarding operation in a prestigious district. In a less qualified market area, where potential buyers usually are not interested in supporting the marginal cost of this improvement, the same process has a more limited influence on the value of the apartment. Considering the state of the regional housing market and the multifaceted Italian taste in design and materials, sellers are used to sell the property "as it is" avoiding the risk of supporting additional costs without meeting the expectations of potential buyers. Conversely, position quality cannot be improved by property owners and has a significant influence in price formation, especially for residential units located in multistory buildings. In these cases, features like "presence and quality of panoramic views" or "daylighting quality" can differ significantly according to the apartment level.

Finally, we include the distance from the seashore. In the case of Sardinia, an island which coincides with an administrative region of Italy, the distance from the coast is of particular importance, since the so-called "coastal strip" (CS) is defined in article 19 of the Planning Implementation Code (PIC) of the Regional Landscape Plan of Sardinia (RLP, approved by the Regional Government of Sardinia in 2006) as a "strategic resource, vital for the achievement of sustainable development in Sardinia, that requires integrated planning and management." Under article 20 of the PIC, as a general rule, new development of land and transformation of current land uses are not allowed in the CS. Some exceptions to the general rule are allowed, provided that municipalities and developers abide by regulations and procedures given by the PIC. Due to these particular restrictions in force in the CS, it was believed that the amount of municipal land area included in the CS could be a relevant impact factor on the ability of cities and towns to spend funds allocated for public services and infrastructure (Zoppi and Lai, 2013). So, a proximity-to-coast effect could be expected, since coastal land is demanded for future development. If land-taking processes related to tourism development are forbidden, it seems very possible that land take will occur in the proximity of the CS or in the parts of the CS where exceptions are allowed. This argument is discussed with reference to a different spatial context, by Dewi et al. (2013), who found that the establishment of protected areas (CS-like areas) in Asian and African tropical forestry regions determines an increased exploitation of the marginal lands just outside the protected areas. If a proximity-to coast effect does occur, the value of houses will increase as distance from the coast diminishes.

Neighborhood demographic characteristics are drawn from the most recent demographic survey made available by the municipality of Cagliari. We consider population density, whose correlation with demand for new houses, which could possibly put in evidence a positive agglomeration effect, is underlined by several studies (Sklenicka, 2013; Guiling et al., 2009; Forster, 2006). Population size and the presence of foreign residents, mostly coming from underdeveloped countries, are the other factors we include as determinants of the value of houses. The value of houses is expected to be positively correlated to the presence of foreign residents, whose presence, everything else being equal, is expected to increase the demand for houses, while there is no prior expectation related to the effect of population size, since concentration could cause a negative effect in terms of possible shortage of public services and infrastructure due to overcrowding, but also positive impact, since excess demand for houses could raise their market value.

Plan-related characteristics are the features of the neighborhood where a house is located which are related to the zoning rules of the city Masterplan. We class them into the following categories, identified in the zoning rules through acronyms in parentheses:

- historic center zone ("A" zone);
- residential completion zone ("B" zone);
- residential expansion zone ("C" zone);
- enterprise zone ("EZ" zone);
- parks (open-space leisure areas, "S3" and recreational "G" zone);
- mixed use zone (industrial and service areas, "IS" zone).

The surveyed houses are located either in the historic center zone or in the residential completion zone, where steady residential development has taken place. Houses in the completion zone are more recent, affordable and, at least to some extent, constructed through social housing projects so their value is expected to be lower, everything else being equal.

The historic center zone is a single, dense and central area in the urban fabric; it dates from the Middle Ages and hosts buildings important for cultural, artistic and historic reasons. Specific rules apply to this area, in order to avoid an increase in built volume, preserve the facades and control the building uses. The peculiarity of the historic center zone is that it is not a residential zone. Rather, it is a mixed-use zone, which entails public services, commercial and residential uses. The "B" zones are built-up areas which consist mainly of dense residential blocks. A partially-built area is generally considered to belong to a "B" zone when its area is smaller than 5,000 square meters and more than a 30 percent of the volume has already been built. As a general rule, on a single building lot belonging to a B zone, building is limited to 3 cubic meters per square meter.

Variable	Definition	Mean	St.dev.
Characteristics of housing units, vector HUNIT in (5)			
AREA	Finished interior area (m^2) (source: 2012 direct survey)	109.43	34.89
Q_POS	Position quality (presence and quality of panoramic views, distance from other buildings and structures / daylighting quality, apartment level).	4.52	1.84
Q_TYP	Typological quality (building and apartment maintenance level, quality of construction, equipment and mechanical system conditions, building age).	4.19	1.41
DISCOAST	Distance from the coastline (m) (source: Spatial Dataset of the Regional Geographic Information System of Sardinia)[6]	1788.15	877.80
Demographic characteristics of the neighborhood where a house is located, vector DEMOG in (5)			
DENSITY	Population density in the Census tract (residents/km^2) (source: 2001 National Survey of the Italian National Institute of Statistics concerning population and houses)	21704.12	10632.79
FOR_2012	Foreign residents in the neighborhood (foreign residents) (source: 2012 Survey of the Municipality of Cagliari)	354.17	203.23
RES_2012	Residents in the neighborhood (residents) (source: 2012 Survey of the Municipality of Cagliari)	7645.28	2978.05
Plan-related characteristics of the neighborhood where a house is located, vector PLANREL in (5)			
PL_ZONE	Dummy, location in a residential completion area (source: Masterplan of the City of Cagliari, available at: http://www.comune.cagliari.it/portale/it/puc.wp [accessed January 21, 2014])	0.12	0.33
A_ZONE	Area of the "A" zone in a buffer of 150 m around the location of a house (m^2) (source: Masterplan of the City of Cagliari, available at: http://www.comune.cagliari.it/portale/it/puc.wp [accessed January 21, 2014])	4753.14	11935.82
B_ZONE	Area of the "B" zone in a buffer of 150 m around the location of a house (m^2) (source: Masterplan of the City of Cagliari, available at: http://www.comune.cagliari.it/portale/it/puc.wp [accessed January 21, 2014])	33033.85	14514.09
C_ZONE	Area of the "C" zone in a buffer of 150 m around the location of a house (m^2) (source: Masterplan of the City of Cagliari, available at: http://www.comune.cagliari.it/portale/it/puc.wp [accessed January 21, 2014])	400.78	2262.48
EZ_ZONE	Area of the "EZ" zone in a buffer of 150 m around the location of a house (m^2) (source: Masterplan of the City of Cagliari, available at: http://www.comune.cagliari.it/portale/it/puc.wp [accessed January 21, 2014])	678.98	3287.24
MIXUSE	Percent area of the "IS" zone in a buffer of 150 m around the location of a house (percent) (source: Masterplan of the City of Cagliari, available at: http://www.comune.cagliari.it/portale/it/puc.wp [accessed January 21, 2014])	12.66	11.78
PARKS	Area of the "S3"and recreational "G" zones in a buffer of 800 m around the location of a house (m^2) (source: Masterplan of the City of Cagliari, available at: http://www.comune.cagliari.it/portale/it/puc.wp [accessed January 21, 2014])	24.17	13.68
Artificial land cover of the neighborhood where a house is located, variable LANDCOV in (5)			
LC_URB	Artificial surfaces, urban fabric in 2008 (m^2) (source: CORINE Land Cover Map of Sardinia – 2008 Edition, level 2, code 1.1)	64577.89	9560.18
Spatially-lagged dependent variable (see paragraph 4.1.1)			
AUTOCORR	Spatially-lagged dependent variable, spatial lags of variables reported in Table 2	-0.01	0.41

Table 3. Definition of characteristics of houses and of neighborhoods where houses area located, and descriptive statistics.

The surveyed houses are located either in the historic center zone or in the residential completion zone, where steady residential development has taken place. Houses in the completion zone are more recent, affordable and, at least to some extent, constructed through social housing projects so their value is expected to be lower, everything else being equal.

The historic center zone is a single, dense and central area in the urban fabric; it dates from the Middle Ages and hosts buildings important for cultural, artistic and historic reasons. Specific rules apply to this area, in order to avoid an increase in built volume, preserve the facades and control the building uses. The peculiarity of the historic center zone is that it is not a residential zone. Rather, it is a mixed-use zone, which entails public services, commercial and residential uses. The "B" zones are built-up areas which consist mainly of dense residential blocks. A partially-built area is generally considered to belong to a "B" zone when its area

[6] Available from the Regional Geoportal, at: http://www.sardegnageoportale.it/index.html [accessed January 21, 2014].

is smaller than 5,000 square meters and more than a 30 percent of the volume has already been built. As a general rule, on a single building lot belonging to a B zone, building is limited to 3 cubic meters per square meter.

The “C” zones are either non-developed or partially developed parts of the city (where less than 30 percent of the volume has already been built) bound to be residential areas. Restrictions on built volume are far stricter than those imposed in the B zones and equal to 1.5 cubic meters per square meter per building lot. Furthermore, in order to obtain a building permission, a plan must be approved by the local municipality. This plan must indicate the spatial distribution of the building lots, as well as a portion of the area which has to be handed over to the municipality, in order to build public services and infrastructure. The size of this area depends on the estimate of the number of the future residents, which is estimated on the basis of the amount of the housing volume, therefore on the ratio of maximum volume to the area of the lot.

The “EZ” zones are either non-developed or partially developed parts of the city where an integration of different functions (residential buildings, public facilities and recreational areas) is required. For each EZ zone, the city Masterplan sets specific rules on the combination of functions. For instance, in an EZ zone important for environmental reasons a maximum of 35percent of the area is available for housing areas, and a 0 percent for public facilities, while a 65percent has to be reserved for recreational areas. A stronger residential EZ is characterized by a 93 percent - 7 percent - 0 percent combination. An EZ zone located in spoiled city outskirts is characterized by a 70 percent - 30 percent - 0 percent combination.

There is no prior expectation on the effect of plan-related characteristics on the value of houses except with reference to the presence of parks and mixed-use areas in a house’s neighborhood, which should increase the house’s market value.

The last characteristic is related to land cover. The land cover map of Cagliari was drawn from the 2008 land cover maps of Sardinia made available in 2008 by the Sardinian regional administration,[7] whose nomenclature is based on that of the inventory of land cover carried out in the frame of the European programme COoRdination de l’INformation sur l’Environnement (CORINE).

We consider artificial (urban fabric) surfaces of the neighborhood where a house is located. There is no prior expectation on the effect of this characteristic on the value of houses, since a higher level of urbanization can, to some extent, raise environmental and social quality of urban contexts, but it could be related to the negative impact of services’ and infrastructure’s overcrowding as well.

Finally, we consider a spatially-lagged dependent variable as a covariate related to the spatial autocorrelation of the dependent variable. This question is discussed in the following paragraph.

Table 3 shows the variables which describe factors related to the value of houses and their descriptive statistics.

4.1.1 Autocorrelation-related spatially-lagged dependent variable

If the value of a variable defined with reference to a spatial unit, such as a point where a house is located, is correlated to the values it takes in the closest units, the variable is characterized by spatial autocorrelation. Spatial autocorrelation of the dependent variable in spatial regressions produces biases in the model’s estimates. This issue can be addressed by adding a spatially-lagged dependent variable to the set of covariates (Anselin, 1988; 2003). The presence of spatial autocorrelation of the dependent variable of a model, that is the values of houses described in the previous section is detected through the Moran’s test (Moran, 1950; Anselin, 1988). The Moran’s test concerning the spatial autocorrelation of a variable X which takes values over a finite number of spatial units i, i = 1, …, N, is based on a statistic I defined as follows:

$$I = \frac{N}{S}\frac{\sum_{ij} w_{ij}(x_i - x)(x_j - x)}{\sum_i (x_i - x)}, \qquad (1)$$

[7] The 1:25,000 “New Land Use Map of the Region of Sardinia - 2008 Edition” is actually a land cover maps that covers the whole island. Data were obtained mainly from photo-interpretation of aerial photographs, satellite images, and orthoimages, but other vector data sets (e.g., regional digital cartography) were also used, together with on-site surveys. The maps’ minimum mapping unit (Longley et al., 2001, 151) equals 0.5 ha in urban areas and 0.75 ha in rural areas. Both maps can be freely downloaded from http://www.sardegnageoportale.it/index.php?xsl=1598&s=141401&v=2&c=8831&t=1 [accessed January 21, 2014].

where j = 1, …, N, X is the mean of the components of vector X, Wij is equal to 1 if spatial unit i is spatially-related to spatial unit j, 0 otherwise, and S is equal to $\sum_i \sum_j W_{ij}$. The test assumes that i is normally distributed with a zero mean in case no spatial autocorrelation occurs, which is the null hypothesis of the Moran's test. If the p-value of the test is lower than 5-10%, a spatially-lagged dependent variable should be added to the set of the covariates in order to make the model unbiased, since it is very possible that the values of the dependent variable are spatially autocorrelated. The spatially-lagged dependent variable, named AUTOCORR in Table 3, is defined as follows (Anselin, 1988; 2003):

$$AUTOCORR_i = \sum_j W_{ij}, \tag{2}$$

where i, j = 1, …, N.

The application of the procedure described so far to our study implies the implementation of the Moran's test. We implement a set of Moran's tests using GeoDa[8] by assuming, alternatively, that Wij of (1) is equal to 1 if the distance between house i and house j is less than 500 meters. The reason we choose this distance is that the p-values of the Moran's test for the alternative dependent variables described in the previous section show a peak at 500 meters, so spatial autocorrelation maximizes its significance at 500 meters.

Table 3 shows the results of the Moran's tests at different distances. Descriptive statistics of AUTOCORR are shown in Table 2.

4.2 Spatial analysis of factors

For each of the 304 apartments in the sample, the value of nearly all of the characteristics listed in Table 3 (except for AREA, Q_POS and Q_TYP, which were assessed, for each apartment, by means of on-site surveys) was calculated by performing some kind of GIS-based analysis, as none of them were available "off the shelf". This also meant that various data (both geographic and non- geographic) were collated from different sources (accounted for in Table 3) and, in some cases, also pre-processed. In most cases, GIS-based analyses consisting of combinations of buffering and basic geoprocessing operations were performed. This made it possible to develop a geographic dataset, to calculate the value of each characteristics for each apartment, and to analyze their spatial distributions.

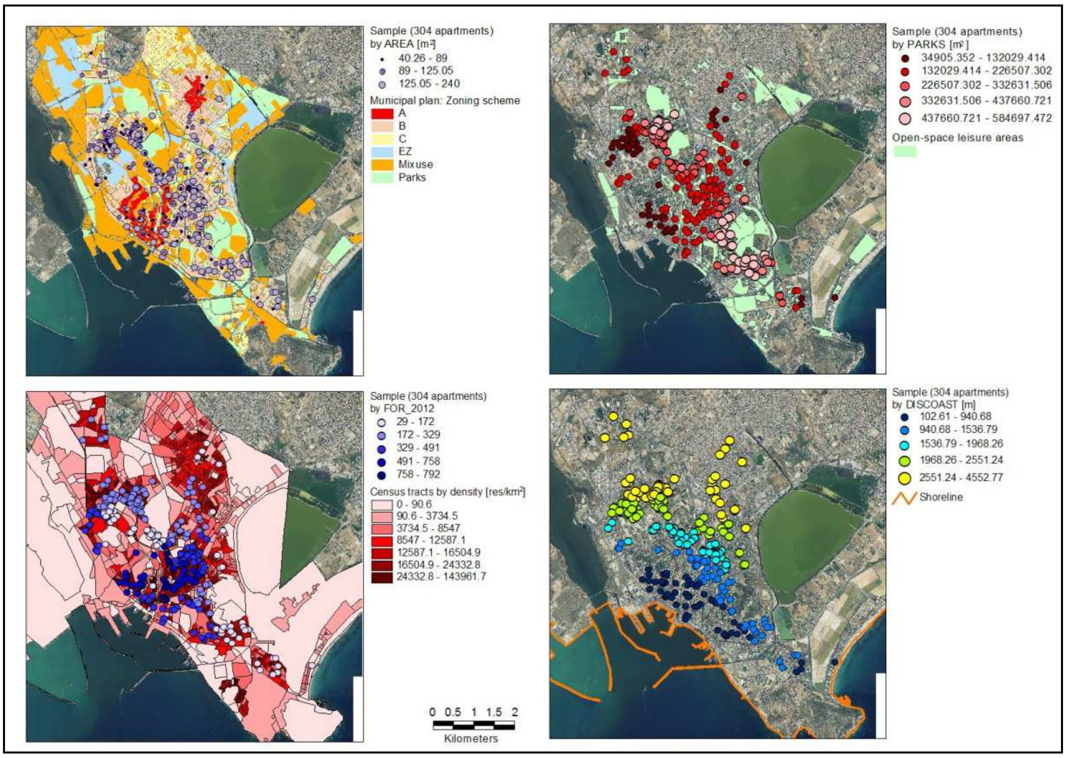

Fig. 3: Spatial distribution of some of the characteristics of houses.

[8] Version 1.4.6. Available at https://geodacenter.asu.edu.

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The spatial distribution of four of the potential determinants of market prices is shown in Fig. 3. In the top-left map (AREA), larger and paler points show the localization of apartments taking the highest values of the finished interior area, by using the zoning scheme of the municipal land-use plan of Cagliari as a background. In the top-right map (PARKS), larger and paler points correspond to apartments surrounded by larger amounts of open-space leisure areas; this map shows a clear spatial clustering of the values, with the central part of the city (also comprising the historic district) taking low values, albeit not the lowest, as these form three distinct clusters around the central part (two to the West and one to the North-East). Similarly, the bottom-left map puts in evidence that the factor FOR_2012 is spatially clustered, meaning that foreigners mostly live in the central districts. Finally, the bottom-right map shows the distribution of the variable DISCOAST, accounting for the distance of each apartment from the shoreline.

5 THE HEDONIC METHODOLOGY

The hedonic methodology considers quality of urban life as a phenomenon embedded into the value of houses through their characteristics. According to the hedonic approach, a house is a parcel of goods. This means that a person who buys a house, buys a basket of amenities (Thaler and Rosen 1976; Dickens 1984; Gegax et al., 1991). What is paid is the arithmetic sum of what the buyer is willing to pay for each of the amenities or is willing to accept as a refund for each of the bads contained in the basket (King, 1976). If we consider this methodology on the supply side, the vendor sells a bundle of goods and is willing to accept a price that is equal to the arithmetic sum of the values of each contained amenities or bads (a negative price in case of a bad). Assuming the housing market to be in equilibrium, that is, assuming that the market of each amenity or bad is balanced, the price of each amenity or bad represents an equilibrium price between willingness to pay (demand side) and willingness to accept (supply side). Each determinant can be sold just as a component of the bundle of goods contained in the housing unit and its price cannot be observed directly from the housing market; however, it can be estimated as a component of the housing price through direct observation of the housing market. This quasi-market price is called a hedonic price and the function which expresses the housing price as dependent on the quantities of the amenities or bads contained in the basket containing the housing unit is called a hedonic function (Ridker and Henning, 1967; Brown and Rosen, 1982; Cropper and Oates, 1992).

The basket of goods a person buys in the housing market can contain not only amenities, but also undesired characteristics, that is, bads. The higher the quantity of bads, the lower the housing price. In other words, the basket paid for by the buyer contains some undesirable characteristics, which decreases his/her willingness to pay.

Hedonic functions have the following form:

$$\begin{aligned} WTP &= h\,(A,B) \\ WTA &= g\,(A,B), \end{aligned} \qquad (3)$$

where: WTP is the total willingness to pay for a house (demand side) and WTA is the total willingness to accept a payment for a house (supply side); A is a vector of amenities or bads that are included in the housing unit; B is a vector of characteristics of the neighborhood where the housing unit is located. WTP is the hedonic demand and WTA is the hedonic supply function. If the housing market is in equilibrium, the observed price of a house is equal to the willingness to pay for that house (demand side) and to the willingness to accept for that house (supply side). In the same way, the marginal willingness to pay (MWTP) for each amenity or bad contained in that house is equal to the marginal willingness to accept (MWTA). This equilibrium price is the hedonic price of that amenity or bad. Notation Hp_i indicates the hedonic price of amenity or disamenity i, i= 1, …, n.

In model (3), there are two hedonic functions, one for the demand side and one for the supply side. The estimation of these two functions implies the availability of data on willingness to pay (buyers) and willingness to accept (sellers). Data on the supply side must be collected by directly interviewing sellers, which is a very cumbersome task. Blomqvist and Worley (1981) have suggested assuming the supply of characteristics as perfectly inelastic at any location. In this case, only one of the two equations of model (3) must be estimated. Palmquist (1984; 1991), Blockstael et al. (1991), and Graves (1991) have studied a modification of model (3) which reduces the number of equations to be estimated by taking data on the housing market transactions instead of willingness to pay. The dependent variable in the hedonic function is the market price of houses which expresses an attained equilibrium between demand and supply. Utilizing data regarding the housing market instead of data on willingness to pay and willingness to accept reduces the hedonic function to a function, P, which expresses the equilibrium of the housing market as follows:

$$P = f(A,B). \quad (4)$$

If a change in the required quantity of an amenity or bad does occur, the value of the change can be calculated by multiplying the hedonic price of the amenity or bad by the quantity change.

The hedonic function operationalizes equations (4) with the form:

$$PRICE = \beta_0+\beta_1 HUNIT+\beta_2 DEMOG+\beta_3 PLANREL+\beta_4 LANDCOV+\beta_5 AUTOCORR+\varepsilon, \quad (5)$$

where the dependent variable, PRICE, is one of the five alternative measures of the value of houses defined in the third section (see Table 2), HUNIT, DEMOG, PLANREL and LANDCOV are the vectors of characteristics of a house (HUNIT), and of a house's neighborhood (demographic, DEMOG; plan-related, PLANREL; artificial land cover, LANDCOV), discussed in the fourth section (see Table 3), and AUTOCORR is the spatially-lagged dependent variables defined through the procedure described in paragraph 4.1.1 (see Table 3).

6 RESULTS

We estimate the five linear multiple regressions indicated in (5), using the five alternative dependent variables discussed in the third section. Results concerning the cadastral value of houses are almost completely non-significant. Moreover, the goodness of fit of the regression is quite lower than in the other four cases, since adjusted R-squared is less than 10 percent. So, we can conclude that cadastral values, which are the values property taxes are based upon, do not represent effectively the value of houses, as it was expected. This outcome indicates that a comprehensive and equity-oriented reform of cadastral values and related property taxes is needed, and that an effective analysis of the factors influencing the value of houses cannot be related to the actual cadaster's. The results of the other four regression models are quite consistent with each other (see the synthesis shown in Table 4).

The coefficients of the variables related to the structural characteristics of houses are almost always significant (p-values less than 5 percent) and show the expected sign. The only case three out of four of them are not significant (p-values greater than 10 percent) is the model where the dependent variable is the average list price recorded from other apartments for sale (SUPP_VAL). Distance from the coast is always significant and presents the expected sign, so we can conclude that proximity to the seashore is one of the most important factors which influences the value of houses in the municipality of Cagliari.

Among the variables related to the demographic characteristics of the neighborhood where a house is located, density is significant just in one case (EST_VAL), and it shows the negative sign, which implies no agglomeration effect. A positive sign, which could possibly be related to an agglomeration effect, does occur only in the case of the model which uses rental value (RENT_VAL) as dependent variable, but the estimate of the coefficient is not significant (p-value higher than 10 percent). The coefficients of the variables related to the presence of foreign residents (FOR_2012) and to population size (RES_2012) are almost always significant. The sign of FOR_2012 is consistent with expectation, while the RES_2012's sign is negative, which indicates that the higher the concentration of residents in the neighborhood where a house is located the less the quality of the urban environment, possibly due to shortage of public services and infrastructure.

Plan-related variables show significant estimates only in three cases: PL_ZONE, EZ_ZONE and PARKS. The value of houses located in the historic center is higher than the houses located in the completion areas (dummy variable PL_ZONE), and the presence of enterprise zone areas in the neighborhood of a house implies a negative marginal effect on the value of the house, which could be explained by the uncertainty which characterizes the future residential and public services and infrastructure lay-out of these not-yet-urbanized areas.

As it was expected, the variable related to presence of public parks in the neighborhood of a house (PARKS) is always positively correlated to the value of houses, and significant in three out of four cases. Nothing can be stated with reference to the other plan-related variables, except in case of A_ZONE, which has a negative and significant effect on the variable related to the market value of houses (EST_VAL), while in the other three cases the effect is negative, but not significant, which indicates that houses closer to the historic center are comparative less valuable, which may possibly be explained by observing that historic areas of the city of Cagliari are often characterized by old urban fabric with lots of obsolescent buildings, roads and public areas, which could make the location of houses less attractive, everything else being equal.

Covariate	**Dependent variable**							
	EST_VAL		*OMI_VAL*		*RENT_VAL*		*SUPP_VAL*	
	Sign (+/-)	*Significance (5%-10%-NO)*	*Sign (+/-)*	*Significance (5%-10%-NO)*	*Sign (+/-)*	*Significance (5%-10%-NO)*	*Sign (+/-)*	*Significance (5%-10%-NO)*
AREA	-	5%	-	5%	-	5%	-	NO
Q_POS	+	5%	+	5%	+	5%	-	NO
Q_TYP	+	5%	+	NO	+	NO	+	NO
DISCOAST	-	5%	-	5%	-	5%	-	5%
DENSITY	-	5%	-	NO	+	NO	-	NO
FOR_2012	+	5%	+	5%	+	NO	+	5%
RES_2012	-	10%	-	5%	-	5%	-	5%
PL_ZONE	-	5%	-	5%	-	5%	-	10%
A_ZONE	-	5%	-	NO	+	NO	+	NO
B_ZONE	-	NO	-	NO	-	NO	-	NO
C_ZONE	-	NO	-	NO	-	NO	-	NO
EZ_ZONE	-	10%	-	5%	-	5%	-	5%
MIXUSE	-	5%	-	5%	-	NO	-	5%
PARKS	+	NO	+	5%	+	5%	+	5%
LC_URB	+	NO	+	NO	-	NO	+	NO
AUTOCORR	+	5%	+	5%	+	5%	+	5%

Table 4. Synthesis of regression models' estimates: sign and significance. If a coefficient's estimate is not significant either at 5% or at 10%, then we put a "NO" in the significance column.

Finally, the land cover-related variable (LC_URB) is never significant, while the spatially-lagged dependent variable is always positively and significantly correlated to the four dependent variables, as it was expected. We have also estimated the log-linear specifications of the five regression models discusses in this paper, which gave results quite similar to those proposed in this section, even though with a slight lower goodness of fit. We omit the detail of these estimates in order to comply with the established length of the paper.

7 DISCUSSION AND CONCLUSION

In terms of policy planning concerning the housing market it can be observed that a reduction in size through the division of large apartments (greater than 120 square meters) in two or more residential units could increase the value of houses, since the variable AREA decreases. The reason is that reduced-size houses are cost-rewarding and allow for effective functional recovery of apartments, whose living area otherwise would be not appropriate for current needs. The variable Q_POS has a significant relationship with the dependent variable EST_VAL, but it should not be effectively targeted for housing policies.

Some aspects of Q_POS, such as the presence of panoramic views, are related to other independent variables such as DISCOAST or PARKS; the variable has a dramatic spatial variability, since Cagliari spreads across seven hills. Moreover, even with reference to the same building, for any residential unit that overlooks the sea or has an excellent sun exposure, it is possible to identify a wide gradient of position quality levels depending on the apartment level and exposition. In addition, position quality usually has its highest influence in price formation in case of high-quality districts, where it is very possible that it works as a specific market segment determinant. For these reasons, Q_POS must be considered as a factor that generates a general market appreciation of position quality.

The variable Q_TYP shows a significant correlation with EST_VAL as well, and produces an increase in the value of residential properties. As stated above, some features of typological quality of houses (i.e. building and apartment maintenance level, quality of construction, equipment and mechanical system conditions) can be improved by landlords and homeowners depending on their cost-effectiveness or personal needs related to the use value. In order to increase cost-effectiveness margin, policies that focus on improving the quality level of neighboring urban spaces, with particular reference to green and transportation facilities, can lead landlords and homeowners to renovate private and common parts of their building. Such kind of public investment can possibly have a direct impact on the local community by both encouraging private development and improving citizens' quality of life.

In the rest of this concluding remarks we use GIS to comment and discuss policy implications of our results through some spatial representations. Such GIS-based representations are easily reproducible with reference to other urban areas, provided that the value of the characteristics here analysed are available, and they allow for a pretty straightforward spatial interpretation of the results.

We started by simulating a "what-if" scenario by building upon the results of the linear multiple regression that uses EST_VAL as the dependent variable: for each apartment, we estimated the magnitude of the impact on the variable EST_VAL, that is the percent change that would occur if a single explanatory variable (among those that are generally significant, as shown is Table 4, and that can be driven in some way by means of appropriate policies, that is, the area of the house, AREA, the distance from the coast, DISCOAST, and the endowment of recreational areas (PARKS) had increased by a given quantity – that is, ten percentiles in that variable's distribution.

Figure 4 presents the results of this process: the greatest change in market price is produced by implementing policies that increase the variable PARKS, as EST_VAL could increase up to 6.61 percent if the value of this characteristic increased by ten percentiles (Figure 4, center); as the map shows, the market price would increase unevenly across the city, as both the lowest and the highest variations are strongly clustered. Policies affecting either the characteristic AREA or the characteristic DISCOAST would produce a consistent decrease in market prices, but not as significant (in quantitative terms) and not as spatially clustered as that produced by varying the value of PARKS. Such spatial representations provide decision makers with clear indications on which are the "best" possible areas that policies should target in order to affect market prices.

The results obtained with reference to Cagliari's urban area allow generalization for two reasons. On the one hand, no similar empirical studies have been implemented to analyze the determinants of the value of houses in other Italian conurbations by means of the hedonic approach. This is most likely due to the scarce availability of data to implement this evaluation. On the other hand, it is not possible to compare the situation of the urban area of Cagliari to a situation in which a more flexible, participatory, faster and bottom-up planning process was implemented. This kind of situation would have probably encouraged people to lobby in favor of effective planning policies concerning the housing market, since the established planning process has been developed quite homogeneously in all of Italy, and counter-examples are very rare.

Secondly, empirical results give credit to the view that there would be benefits for the public providing utilities concurrent with development. This finding is relevant in Florida, which has enacted concurrency rules that require this as a condition of development approval; no development with inadequate infrastructure may be allowed (Auerhahn, 1988). This is a controversial policy, since it can slow development or raise development costs. Rigid separation between right to build and property right allows the Italian cities to determine how much developers must pay to compensate the local communities for the increased pressure on the existing public infrastructure and services. This is different from the approach in the United States, where the question is addressed on a case-by-case basis. There, some local governments levy "impact fees." These are very similar to the building permit fees levied in Italy, since they are based on estimates of the public costs of providing needed public facilities per dwelling unit to be constructed (Lillydahl et al., 1988; Nicholas, Nelson 1988; Nicholas et al., 1991).

Urban fringe development, for example, frequently utilizes septic tanks without adequate public utilities. At some point in the future, the public extends public water and sewerage, paying for it in one of several ways: using general tax revenues, special assessments of benefited properties, user charges, or some combination of these. The Boston Zoning Code establishes that the developer's submission of a project to the city must include an evaluation of the Proposed Project's impact on the capacity and adequacy of existing water, sewerage, energy, and electrical utility systems, and the need reasonably attributable to the Proposed Project for additional systems facilities (Boston Redevelopment Authority, 1991). The City of Boston and the developer must be aware of the cost of urban transformation, but there is no established sum the developer must pay to build new public infrastructure and services. This is left to the free negotiation between the city and the applicant.

French legislation gives cities the task of establishing the contribution developers must pay to obtain their building permits, adopting an approach that lies between the Italian and the United States ones. When a *plan d'occupation des sols* is approved by a city, payments to obtain building licenses cannot be revised and are deterministically established. However, in this case, there is plenty of room for free negotiation (République Française, 1983).

Moreover, in light of the empirical results relating to the determinants of the value of houses, it would be interesting to explore if, and to what degree, planning policies aimed at qualitative improvements of houses would develop in a United States or French context had local developers be discouraged due to very high development costs.

Adopting a general holistic perspective that regards different conceptual characteristics of smart cities, this empirical work defines and implements a research methodology and design to evaluate the monetary value of the extrinsic and intrinsic characteristics of houses as determinants of the formation of market price of houses. This research methodology and design offers powerful tools to define city fiscal policies which could successfully deal with value generated by urban residential expansion and smart governance. This is implemented through an analysis of the housing market, through direct observation of human behavior in appreciating and identifying a value of environmental qualitative resources that contribute to enhancing their smartness in terms of living standard and environment. The more reliable the information, the more effective policy decisions can be in order to convey part of the generated value to the cities' economic development, that is to their economic smartness. Regarding this issue, a sound institutional framework is necessary to allow the cities to implement zoning regulations and fiscal policies to deal with the determinants of the value of houses. This would be based on negotiation with developers, landlords, homeowners, and local communities, along with detailed and standardized territorial information systems and databases regarding the housing market in order to provide urban policy-makers with access to factual information concerning transaction prices and, if possible, intrinsic features of the sold properties.

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European Academic Smart Cities Network – Renewable Urban Energy Systems, Sustainable Mobility and ICT Technology Nexus for Smart Cities Studies

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1 ABSTRACT

The European Academic Smart Cities Network (EU-ASCIN) project at the University of Applied Sciences (UAS) Technikum Wien, founded by the municipal government of the city of Vienna in November of 2013, aims to set up an academic smart cities network in Central and Southeastern Europe. Within the framework of the project, cooperation with national and international universities and research institutions will be established.

The UAS Technikum Wien already offers study programs with some of the main topics of smart cities concept, such as smart energy, smart environment, and smart mobility. In the context of the project, these study programs will be evolved by introducing the concept of smart cities. In the first step, the introduction will be performed as courses of existing programs, and finally it could result in an independent joint or double degree program.

International cooperation with partner universities, research institutions, and other academic networks should stimulate the development of the smart cities study programs through know-how exchange, stuff and student mobility, and future joint projects.

For the further development of the project and support of the new study program, a Web-based platform will be established. The platform will provide up-to-date information concerning technological progress, new concepts, introduced legislative regulations and current events in the area of smart cities. Information will be presented on different levels of complexity depending on the target audience students, teaching staff, or people simply interested in smart cities. After completion of the project, the platform will act as point of information for academic education and research.

The proposed paper will point out the general framework, the main objectives and the current state of the project progress.

2 INTRODUCTION

2.1 Motivation

Smart City Vienna is the initiative introduced by the municipal government of the city of Vienna in 2011, which aims to "…consistently and continuously modernize the city in order to significantly reduce energy consumption and emissions without having to forego any aspects of consumption or mobility"1. The main objectives of the initiative are reducing CO2-emission resulting into achieving EU-targets, reducing energy consumption through increasing the use of renewable energy concepts, promoting multi-modal transportation possibilities thereby reducing individual motorized transport share and place Vienna as modern center for research and technological development. An important topic of the initiative is the integration of citizens in the smart city concept, by providing the possibility for participation in decision-making process. By increasing interest of the wide public about responsible and considerate use of the natural resources, the concept of smart city can be invoked into live.

Academic education contributes in the wide extent to research and innovation and is an important component of the smart cities implementation process. Currently, the institute of Energy Systems and Electrical Propulsion at the Technical University Vienna is the only academic project partner involved in the Smart City Vienna initiative. The initiative designates only limited involvement of the academic education in the implementation of the smart cities concept. The EU-ASCIN project aims to fill this gap in the Smart City Vienna initiative and to contribute to the development of an independent smart cities study program.

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2.2 Project Framework

2.2.1 Involved Institutions

The UAS Technikum Wien got involved in smart cities sub areas through existing study programs. On the one hand bachelor´s program Transport and Environment extensively covers the area of Smart Mobility. On the other hand bachelor´s program Urban Renewable Energy Technologies and master´s Renewable Urban Energy Systems are dealing in the large extent with the sub areas of Smart Energy and Smart Environment. UAS Technikum Wien has already participated in a number of national and international projects in the research area of renewable energy systems in the past several years.

UAS Technikum Wien is the only institution responsible for the realization of the EU-ASCIN project. Departments "Information Engineering and Security" and "Renewable Energy" have commonly submitted the project proposal. These two departments are responsible for the technical implementation of the project with the goal to increase competence in the smart cities sub-areas smart mobility and smart energy and to initiate cooperation with other academic organizations.

Project management of EU-ASCIN underlies the area of responsibility of MOOSMOAR Energies OG, which is an external consulting company with the main emphasis on renewable energy systems.

Endowed professorship for career field research and gender mainstreaming and diversity management representative are also involved in the project implementation process. The sub-goals of the EU-ASCIN project are examination of the existing job market and consideration of the gender aspects. The questions to answer from this point of view are: which job options are offered by the market, which areas are still not covered by existing educational programs and what are future job positions resulting from developments in the smart city area.

In the light of the latest research programs, which aim to establish equal opportunities despite differences in age, gender, cultural and ethnic backgrounds, education, career and other fields of life, gender and diversity aspect should also be considered. Thus, EU-ASCIN pursues the idea of equality from begin on in form of consistent screening of the project activities with respect to diversity and gender equality.

One of the main ideas of the EU-ASCIN project is the establishment of the partner cooperation on the academic education and research level. For this purpose several project partners were chosen.

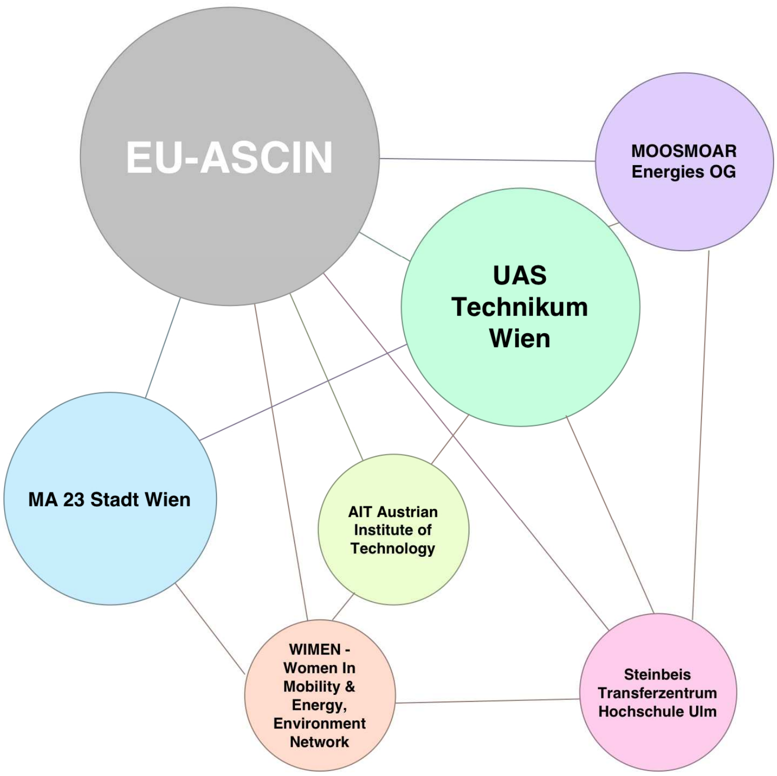

Fig. 1: EU-ASCIN project partners.

Project partners` main role is to contribute with their ideas, their own contacts and partnerships, their professional know-how to the development of the academic network and smart cities study program. Those cooperation partners include Austrian Institute of Technology (AIT), Women In Mobility & Energy, Environment Network (WIMEN) and Steinbeis transfer centre at the university Ulm in Germany. AIT, department Energy and Mobility is the program coordinator of the EU-Initiative for smart cities and project manager of the "Joint Programme for Smart Cities of the European Energy Research Alliance"2.

UAS Technikum Wien and AIT are involved into EU strategy-process for education – SET Plan Education and Training Initiative for Photovoltaic Solar Energy. WIMEN is network of women, which perform extensive work in the areas of mobility, energy and environment. Steinbeis center for decentralized and renewable energy systems maintains the European Network of Danube Universities. University Ulm areas of research are smart grids, smart cities and renewable energy. The cooperation between University Ulm and UAS Technikum Wien exists since 2012. Cooperation was performed in form of a summer academy "Green Waves Summer School" with emphasis on renewable energy.

The involvement of the project partners includes several workshops and meetings during the whole project run-time. As mentioned above, cooperation partners contribute with their know-how and participate in the project in role of councillors in cases where their knowledge is needed. Second point of this cooperation is collective elaboration of the smart cities study program, where project partners can share their work experience and practical knowledge. This contribution is essential, as the study program should cover the future needs of the job market. Further goal of this cooperation is the joint maintenance of the set up educational and informational platform, where project partners can provide relevant information for the students, lecturers and people involved.

2.2.2 Project run-time and funding

EU-ASCIN project proposal was submitted within the framework of the 14. Announcement of Universities of Applied Sciences Funding Program "Internationalization of Education and Research" provided the municipal government of the city of Vienna. Project is planned for the total run-time of 3 years, starting in November of 2013. The set up Web-platform and implemented smart cities study program will be maintained after project completion.

2.3 Project Goals

EU-ASCIN aims to establish an academic network in the area of smart cities based on the cooperation with international universities in Central and Southeastern Europe. Bachelor´s degree programs Urban Renewable Energy Technologies and Transportation and Environment as well as master´s degree programs Renewable Urban Energy Systems and Intelligent Transport Systems at the UAS Technikum Wien are extensively involved into sub-areas of smart cities. Within the framework of this project, these study programs will be elaborated and a new international interdisciplinary "Smart Cities" specialization will be established. Using provided competence in the area of smart cities, the visibility and presence of the smart cities theme in the wide public will be enhanced. Beyond the specialization "Smart Cities" all possibilities for a joint degree study program will be evaluated.

Onwards the presentation of the network should be implemented by a Web-platform, which provides information and details to recent technological innovations and upcoming events. The platform presents the know-how of the project partners for the possibility of future cooperation and joint research proposals.

Beyond the idea of expert-forum, platform will address students and research-staff who are interested in the study possibilities at the universities of cooperation partners. From the project framework analysis 3 main objectives could be defined. The graphical representation of those can be found below.

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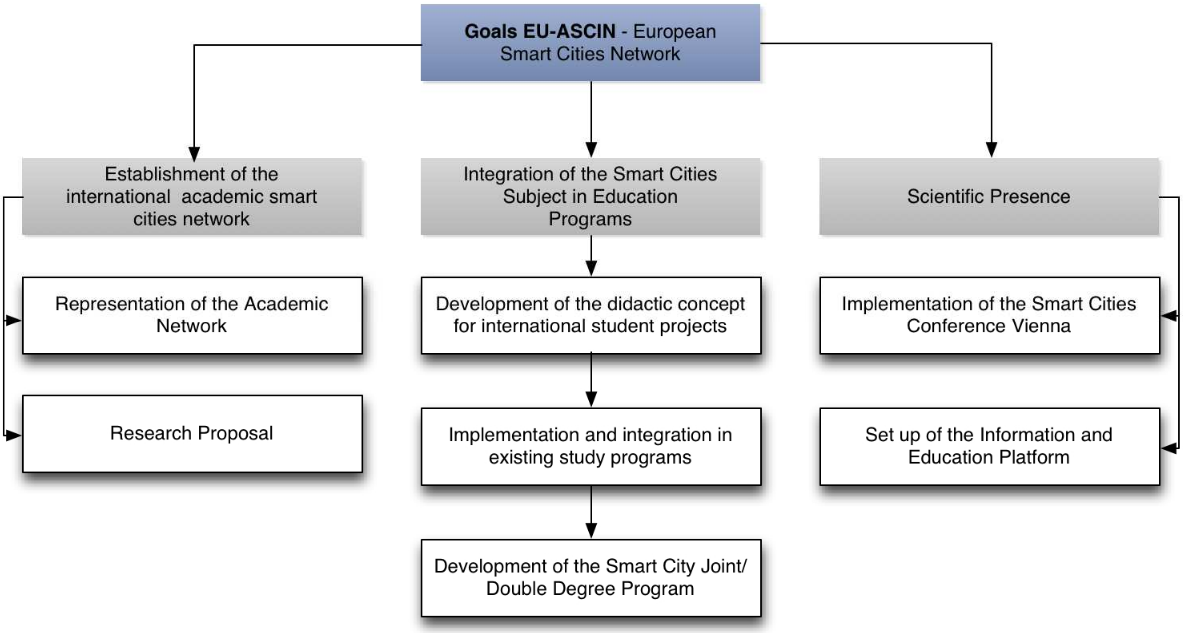

Fig. 2: EU-ASCIN project goals.

2.3.1 Establishment of the international academic smart cities network

The main goal of the project is the establishment of the academic smart cities network, resulting from the cooperation with the international universities in central Europe and Southeastern region. The network shall provide important contacts for the future project cooperation and joint degree programs.

2.3.2 Integration of the Smart Cities Subject in education programs

There is already successfully implemented cooperation with other academic institutions, which are manifested in several double degrees programs at the UAS Technikum Wien. Inter alia, these programs are European master`s of science in Intelligent Transport Systems in cooperation with the Linköping University and Czech Technical University and double degree program Information Systems Management in cooperation with Kharkov National University of Economics. Based on these long- standing experiences with multiple degrees programs an own smart cities study program can be developed. For this purpose the established cooperation with the project partners can be of particular use.

2.3.3 Scientific Presence

The two sub goals of this goal are: firstly, implementation of the Smart Cities Conference Vienna, which aims to establish the city of Vienna as international centre of competence for smart cities research and development; secondly, development of the Smart Cities information and education platform which should provide people interested in smart cities subject with relevant information, as technical innovation, legislative regulations, recent events, cooperation and possible funding opportunities for research projects. Educational platform offers a possibility to enhance the competence using the e-learning methods. Smart Cities Conference Vienna is the finale step of the EU-ASCIN project. UAS Technikum Wien and cooperation partners together with the municipal government of the city of Vienna will organise a scientific conference. The program with duration of one or several days will link the highlights from the scientific community and will represent in particular most significant projects in the economic environment of the city of Vienna. One of the important issues of the conference will be gender and diversity aspect. Inspired by the Intelligent Transport Systems (ITS) Congress in Vienna, 2012 Smart Cities Conference will emphasize “Women in Smart Cities” aspect and offer various possibilities for participation and meetings.

3 RELATED PROJECTS AND NETWORKS

3.1 The North See Region Programm 2007-2013

The North Sea Region Programme is a EU-level cooperation project involving Sweden, Denmark, Germany, the Nederland, the Flemish Region of Belgium, the UK and Norway. These countries are connected by the North Sea and share many of the common problems and challenges. The main objective of the cooperation is to share the know-how and experiences, to ensure higher quality of life, sustainable and balanced future in provided region.3 One of the projects implemented within the framework of the North See Region Programme is the Smart Cities project. The general purpose of the project is to interconnect the governments and academic partners, using ICT technology and e-services in particular. The project includes implementation of the Smart Cities Regional Academic Network, which is led by Edinburgh Napier University. The network partners include the Edinburgh Napier University, MEMORI and UAS Oldenburg, commercial and several associate partners from across the North See Region.4 The academic network plays supportive role in the project, by offering practical knowledge, implementing pilot projects, defining white papers and providing good practical methodologies. Academic partners work in close cooperation with the municipal governments to improve e-services, by implementing local IT-infrastructure, developing surveys and analytical tools.

3.2 RCE Vienna

Regional Centre of Expertise on Education for Sustainable Development Vienna is a network of existing academic organisations with the main objective to provide higher education level for sustainable development to local and regional communities. The project implements an interdisciplinary, informational and educational communication platform for promoting sustainable development concepts among the regional stakeholders.5 The relevant themes of the RCE Vienna are sustainable urban and regional development, smart cities themes and processes, climate change and sustainable entrepreneurship. Several projects in these areas are “Green Buildings Solutions”, “Eco-Mobility in the Austrian-Hungarian boarder region (EMAH)” and “Sustainability Challenge”. “Green Buildings Solutions” is a three-week summer-school program with the main theme of energy-efficient building, urban planning, passive house concepts and renewable energy sources. EMAH project looks into mobility behaviour of local residents in the Austro-Hungarian boarder region with the main goal to jointly develop eco-mobility concepts. “Sustainability Challenge” is an interdisciplinary study program with emphasis on sustainable and resilient development in the area of smart cities. Program includes lectures on e-governance, sociological and ecological aspects, climate change and sustainable urban planning.

3.3 SMART Community – Technology – City, TU Wien

Research centre for Energy and Environment at the Vienna University of Technology is a cross-faculty network, which deals with several smart cities sub-aspects. The network includes more than 20 lecturers and their assistants from more than eight faculties, which are organised in 19 working groups. Research fields of the SMART community include energy sustainable housing and infrastructure; sustainable and low-emission mobility; climate-neutral energy generation, storage and distribution; environmental monitoring and climate-change; efficient use of fissile resources; and sustainable technologies, products and production. SMART community also offers several lectures dealing with sub-aspects of smart cities, enterprise services, research projects implementation and know-how exchange. 6

4 UAS TECHNIKUM WIEN IN THE CONTEXT OF SMART CITIES

Smart cities concept introduces the cities of future, which are more sustainable, resilient, energy efficient, resident friendly and offer higher quality of life for all population groups. The numerous definitions of smart cities, consider at least the areas of Smart Mobility, Smart Environment, Smart Government, Smart Living, Smart Economy and Smart People.

UAS Technikum Wien intentionally delimits its scope of themes, and concentrates on 3 sub-aspects of smart cities, such as smart people, smart energy and smart mobility. The sub-aspect of smart people includes state-of-the-art education, active citizen participation in smart city concept and social awareness. UAS Technikum Wien identifies itself as a role model and forerunner for societal opinion, therby the aspect of smart people is the key aspect in implementation of smart cities concept.

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Smart mobility is the main research area of the bachelor's degree program Transport and Environment and master´s degree program Intelligent Transport Systems. Smart Energy is the field of employment of bachelor´s degree program Urban Renewable Energy Technologies and master´s degree program Renewable Urban Energy Systems.

Exisiting study programs each concentrates on own sub-area, unaware of possible synergies and cooperation possibilities. After introducing the area of smart cities in the scientific community and since the inception of the Smart City Vienna Initiative in 2011, UAS Technikum Wien is designated to set up the competence and offer networked and joint study course in smart cities.

As it can be seen from the related projects in 3. Related Projects And Networks, there is no particular study program in smart cities, each project offers own focus, either on energy or on mobility.

The main goal of the UAS Technikum Wien in this context is to fill the gap on the educational and research level, by introducing an integrative system approach, where smart mobility and smart energy are interconnected and expanded by the aspects of the ICT and urban planing.

EU-ASCIN project is the first scheduled step towards the hollistic integration of the smart cities theme in the educational program. Subsequently existing study programs should provide a well-founded basis to build on the smart cities competence.

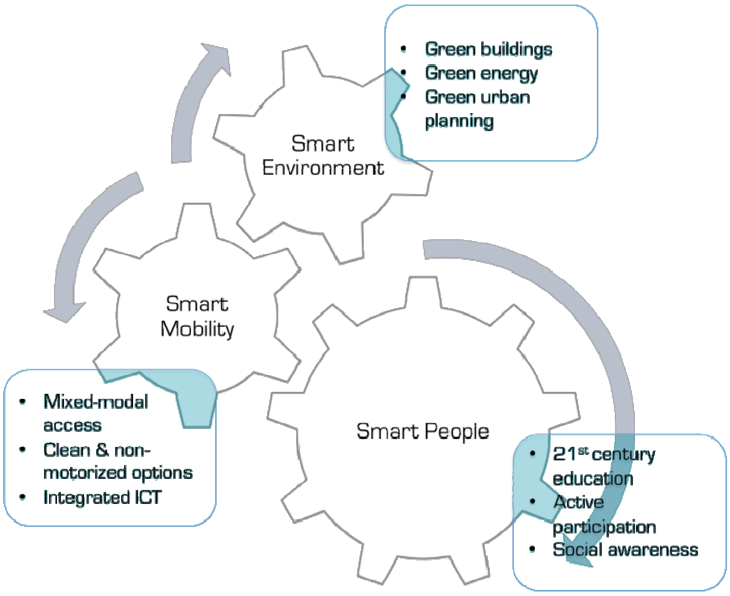

Fig. 3: EU-ASCIN topics

4.1 Smart Mobility

Smart Mobility is a sub-aspect of smart cities, which focuses on energy efficient, low-emission, safe, comfortable, economically efficient and accessible transportation modes. People take an active part in this concept by living the smart cities concept and choosing consciously "intelligent" solution. Definition of the smart mobility emphasizes in the first line optimized and intelligent use of the infrastructure, considering existing state of the art information and communication technologies. Main driver indicators of smart mobility according to Boyd Cohen are mixed-modal access, clean and non-motorized options and integrated ICT.7 Bachelor´s degree program at UAS Technikum Wien with duration of 6 semester focuses on telematics, traffic management, traffic information systems, multimodal transportation modes, environmental aspects of the traffic engineering, electro mobility, driver assistance systems and traffic simulation.

The number of student projects aim to implement the theoretical fundamentals in state of the art technical projects. Those projects include smartphone app development for traffic information, indoor navigation, multimodal ticketing, software development for traffic simulation, fleet management, and container management, methodical analysis of traffic survey, congestions and routing optimization.

The ambitions of this study program are to provide students with wide and well-founded basic knowledge, which can be deepened in following master´s degree program Intelligent Transport Systems.

By introducing the concept of Smart Cities, these two study programs will be enhanced and interconnected with renewable energy aspects, practical implementation of electro mobility concept and alternative propulsion types.

4.2 Smart Energy

Smart Energy is the core concept of smart cities, with the main objective to provide future smart city residents with climate-friendly, available and high quality living space and to support their needs according to the sustainable economy concepts. Smart energy includes energy- and resource-efficient concepts primarily based on renewable energy technology concepts. These concepts are using resilient resource systems and innovative approaches for strategic planning. The use of the ICT is an important part of smart energy concept. The area of smart energy covers wide thematic aspects as energy generation, energy-conscious buildings design, urban planning and smart grids. Boyd Cohen includes smart energy as main driver of smart environment sub-aspect.7

The Urban Renewable Energy Technologies bachelor's degree program offers a well-founded education with three topical focuses: renewable energy technologies, industrial-scale plants and buildings – energy – design. Students learn how to develop and set up the power supply systems of the future as well as how to dimension these systems and combine them into an integrated system to provide the world with the power it needs. The knowledge acquired during the bachelor´s degree can be enhanced by following up master´s degree program in Renewable Urban Energy Systems.

4.3 Future Study Programs

By using synergies of the both areas of smart mobility and smart energy, and by the expertise and well-founded technical competence, a new specialization in the area of smart cities becomes possible. In the first line it is a good chance to implement first cross-faculty study courses and subsequently joint research projects. Additionally, after successful cooperation of both faculties and using emerged network contacts from EU-ASCIN an own joint degree master´s program is also conceivable.

5 CURRENT STATUS OF THE PROJECT

The implementation of the EU-ASCIN project can be devided into 4 main parts: conception and planing stage; implementation phase with start-up projects; visibility and public work; and supervising project management. The subject of gender and diversity monitoring is an integrate part of all project phases.

Currently EU-ASCIN project is on the midway in the conception and planning phase, with workpackages 1 and 2 beeing completed. Within the workpackage 3 a workshop with project partners will be held, this workpackage is already planned and organized.

Independent from the project plan, the first steps towards information and communication platform are beeing made. A Web page of the project has been published, providing in the first line project key facts and additional information about project partners. The next step of the project determines detailed conception and further implementation of the platform, considering the input of the project partners from the workshop.

5.1 Conception and Planning

5.1.1 Work package (WP) 1

The project started in November 2013 with the conception and planing phase. Within the WP1 the current status of national and international activities in the research and development area of smart cities was evaluated. The main goals of the WP1 are on the one hand to define the positioning of the UAS Technikum Wien in the smart cities research context and to define the focus of possible research and study areas and on the other hand to provide the demand analysis of the job market in smart cities relevant areas.

The WP1 was implemented jointly by teams of smart mobility and smart energy each with their own focus. The result of the this workpackage is summarized in a report with the main focus on economic area of the city of Vienna.

According to this workpackage, UAS Technikum Wien is placing its own activities in the smart cities mainly in the thematic areas of urban energy technologies, environment, transportation systems and ICT. These areas are disignated to be enhanced and integrated in an own study focus.Within the reasearch work, the gaps in the existing smart cities academic projects and smart cities educational programs have been determined. The main gap emerged is the missing interconnection between the energy and mobility areas. EU-ASCIN aims to fill this gap by considering the isolated interconnection between energy, mobility and ICT technologies.

Furthermore, within the WP1 the decision was made to use existing endowed professorship position for carreer field research at the UAS Technikum Wien for the demand analysis of job market in smart cities area.The knowledge of the endowed professorship was already used in the preparation and design of several study programs. Many years of experience on this field should be used to consider the demands of professional market from begin on in smart cities study program design. Using the scientific methods and practical approach, a report considering job market analysis will be provided.

5.1.2 Work package (WP) 2

Existing smart cities networks were evaluated within the conception phase aiming to find possible synergies and potential partners. The objective of the WP2 is to consider the experiences of existing smart cities networks in EU-ASCIN project and to establish the interconnection to the future informational and educational platform.

Within the WP2 the cooperation partners of the EU-ASCIN project were designated. There already existing cooperation within the Energy and Transportation area with Austrian Institute of Technology and European Network of Danube Universities (Ulm). The result of this work package will be concentrated in an own report, providing overview over existing academic networks, their main objectives and methodical approach. Furthermore, report will provide recommendations concerning cooperation and synergy possibilities.

5.1.3 Further Steps

According to the project plan, the next phases after conception and planning are the implementation phase and public work. The future work packages and next steps can be found in the table below.

Phase	WP	Description	Expected Results
Conception and Planning Phase	WP1	Evaluation Smart Cities activities in research and development	Report containing research and development activities, including gender and diversity aspect and demand analysis of the job market
	WP2	Evaluation Smart Cities networks	Report containing existing networks in the area of smart cities
	WP3	Workshop with the project partners	Workshop report, gender and diversity review
	WP4	Initiate research cooperation with network partners	Research map
	WP5	Design and planning of study programs	Brief descriptions of study programs and concepts for student projects
	WP6	Design and planning of informational and educational platform	Concept paper
Implementation Phase	WP7	Develop study programs	Curriculum matrix and detailed content of teaching
	WP8	Implementing international student projects	An international student project is performed
	WP9	Implementing and shaping of informational and educational platform	Document content analysis, screen design, specification to hardware and software; Platform is online
	WP10	Prepare research proposal	Innovative project idea is selected; Call for submission is found; Research proposal is written;
Visibility and Public Work	WP11	Publication study programs	Study programs are online
	WP12	Release informational and educational platform	Platform is approved for network partners and the general public
	WP13	Smart Cities Conference Vienna	Conference theme is set, tender is finalized; conference platform is online; conference is organized and conference content is finalized;
Project Management	WP14	Gender and Diversity Monitoring	On-going review of gender and diversity management; an annual gender and diversity monitoring report is provided

Table 1: EU-ASCIN work packages

6 CONCLUSION

After evaluating the current smart cities activities and existing academic research status it can be concluded that a lot of projects are simply restricted to particular aspects of smart cities concept. It has been determined that there is a number of study programs at several universities which focus on selected sub-aspect of smart cities, such as telematics, energy management, renewable energy systems, traffic management, information and communication technology, solar technology, urban planing, etc.

As the motivation for EU-ASCIN project, it also has been observed that only a few joint projects exist, which are using synergies between individual sub-aspects, and no study program exist which provides interconected courses and hollistic knowledge in smart cities context.

UAS Technikum Wien is going to fill this gap by providing the first of its kind smart cities course with the possibility for an own study program, which considers gender and diversity aspects and is wholly disigned considering the requirements of the job market.

Finally UAS Technikum Wien will use developed competence in the smart cities areas to expand own fields of research and submit new projects.

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Externalities and Local Government Policy as Braking Factors of the Development of Water Supply Systems in the Russian Towns

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1 ABSTRACT

The article deals with the analysis in activity losses of water-supply systems in small and average towns of the Russian Federation, considering preconditions and factors of unproductive expenses. The research is made on the example of the LLC "Uralvodokanal" in Dobryanka in Perm Region – a typical representative of the town of the Russian Federation. Such settlements are characterized by having centralized engineering networks as well as high proportion of housing without modern conveniences. Noted problems are mainly acute in the country towns with the population of 10 - 50 thousand people.

The maintenance of the housing and urban (utility) services (HUS) operability comes first in Russia. There are strong reasons to that:

- high level of depreciation of the housing stock, urban infrastructure and fixed assets of the resource-supplying organizations (RSO);
- levels of HUS costs have dramatically increased, compared to the average wages in the Russian Federation;
- reduction tendencies development in the municipal budgets formation and decrease in opportunities of local governments to solve problems of housing and utility services;
- increase of social tension due to the objective growth of tariffs for housing and urban services.

As it is defined by the theory, negative externality effects appear in the conditions of property rights "washing out" and lack of economic feasibility of the transaction expenses connected with protection of these rights. The typical aspects of resource-supplying organizations (RSO) functioning are: shipping opportunities, law nihilism and management companies "cloning", deliberate bankruptcy of consumers, unauthorized inserts in resource transportation systems, etc. As a result all negative externalities find reflection in the increase of tariffs which leads to the decrease of service quality. Losses from externalities with the limit coefficients for tariffs growth set by federal authorities significantly reduce a share of productive costs. Low efficiency of regulatory base and poor performance of law-enforcement system not directed against unauthorized consumption, result in a steady increase of burden on conscientious consumers. Consequently, it leads to the growth of opportunism, reduction of a conscientious consumers share and inevitable destruction of infrastructure as a whole.

The main proposed directions to resolve this situation are:

- improvement of the regulatory base of housing and urban services;
- defining a measure of territory leaders responsibilities for infrastructure operability and formation of their participation mechanisms in regulation of managing companies and RSO;
- effective formation of infrastructure projects sources of financing in small country towns of the Russian Federation.

2 ABNORMAL EFFICIENCY

LLC "Uralvodokanal" was created in 2003 on the basis of assets of the Perm state district power station for operation of systems of water supply and water disposal of the city of Dobryanka by a group of individuals. The company experienced following problems which were defined as paramount:

- execution of license obligations;
- improvement of provided services quality;
- decrease in expenses for the production activity;
- objects operation reliability increase.

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From the moment of foundation of the enterprise all the necessary licensing documents to provide the complex solution of questions of water use, operation of subsoil and waste were received. To date all existing license obligations are strictly fulfilled in terms determined by license conditions. For the purpose of the quality improvement water intake from a surface source (the Tyusevsky reservoir) is almost stopped. 100% of water is taken from restored and newly drilled wells except for winter time. Liquid chlorine is excluded from technological process, contact clarifiers are modernized for the purpose of infectious diseases risks among the city population decrease.

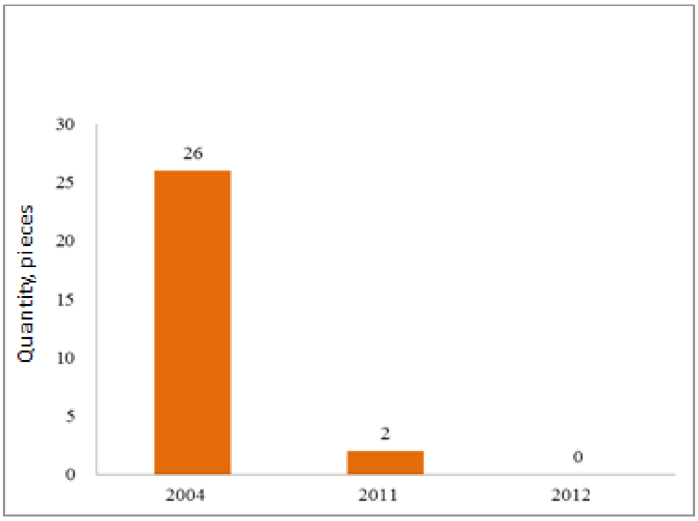

Fig.1 A number of non-standard tests in the water intake points and before distributive network entering

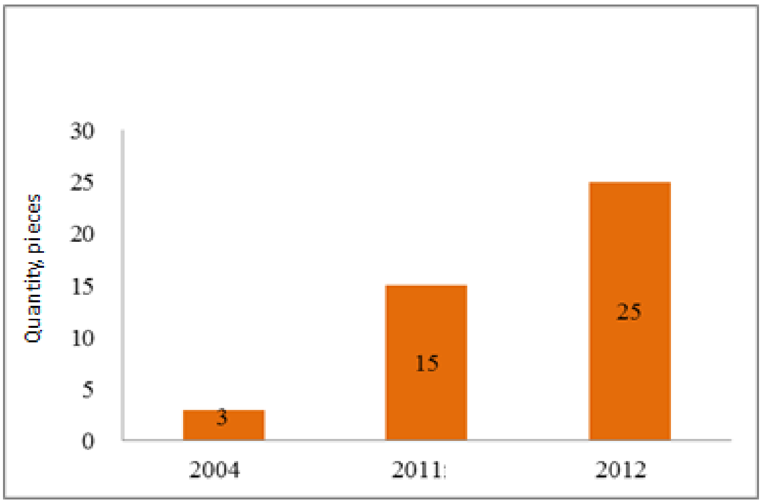

Fig.2. Using of artesian wells stock

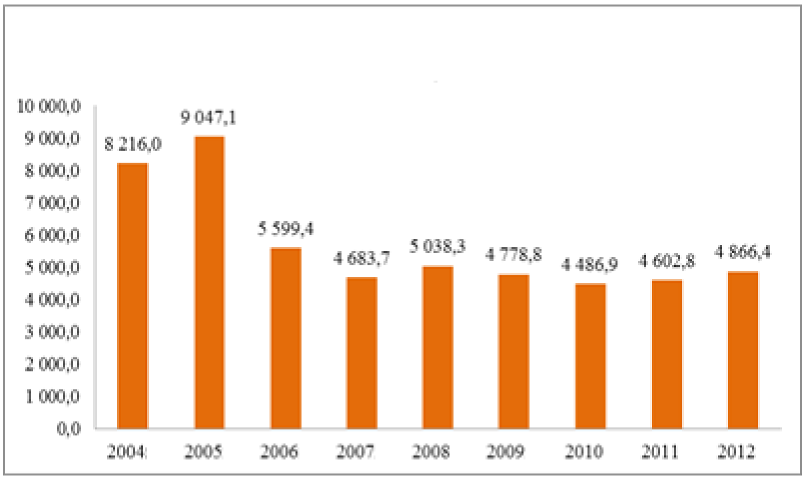

Fig.3. Dynamics of consumption of electric energy from 2004 to 2012, thousand KW

Starting From 2004 the capital investments in the amount of 119,0 million rubles ($3.6 mln) were made for ensuring reliability of functioning and decrease in production costs. Those actions allowed to achieve almost accident-free operation and to decrease significantly production expenses by 33,0 million rub per year (more than 30%). The main components of the reduction of the prime cost are as follows:

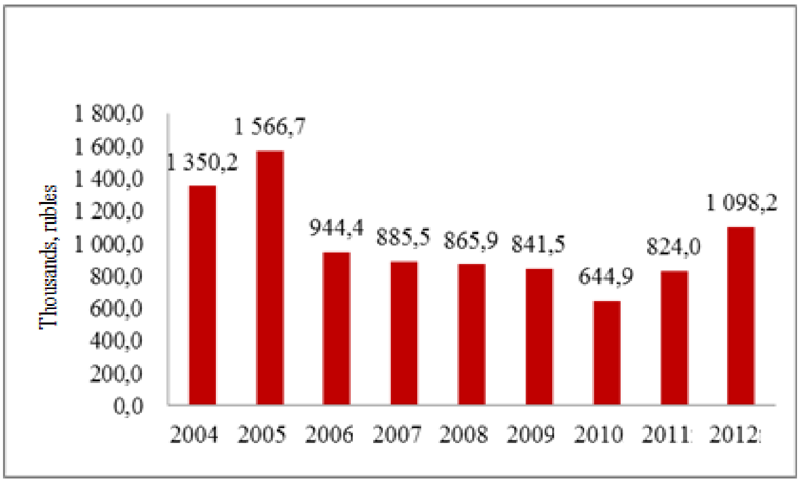

Fig.4.Expenses on chemical reagents

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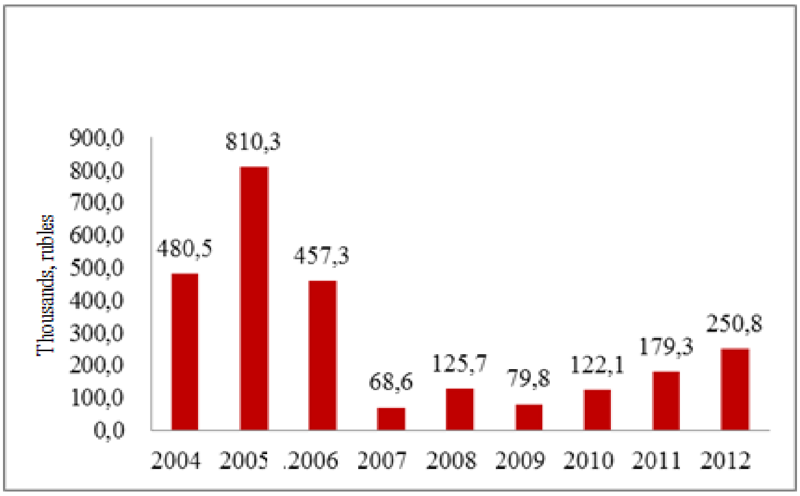

Fig.5.Payments for environmental pollution

However the reached expenses decrease didn't lead to the essential increase in an overall performance of the enterprise as a whole and didn't enhance the investments return for a number of reasons:

(1) The most notable factor is objective decrease in physical volumes of realization in water supply and water consumption (35,3% and 40,4% respectively from level of 2004). Thus total cost of services increased by 7,4%, and the revenue of realization – by 2,9% mostly due to the growth of tariffs. In aggregate growth of tariffs and calculations transfer via metering devices, and falling of physical outputs in the average Russian cities continue to support the trend of water utilities' services physical volumes reduction.

(2) The considerable part of the reached economy on expenses is withdrawn by federal natural monopolies due to the advancing growth of their tariffs rates:

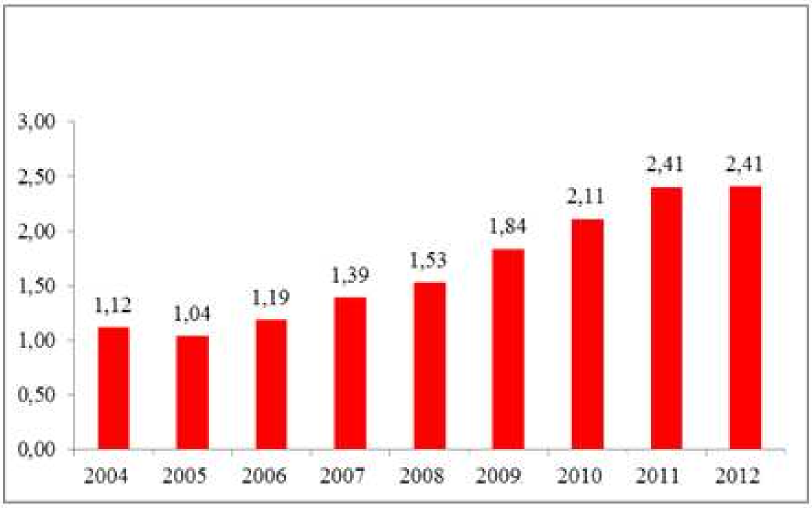

Fig.6. Average tariffs for electric energy, rubles/KW

(3) Important economic problem in the conditions of the Russian reality is represented by lack of support, understanding and active counteraction from bodies of local government. The professional price-rating analysis is rather an exception, than an obligatory element of municipalities work. Local government acts to lead pricing bodies (The regional power commission) in the direction of maximum decrease in tariffs to the detriment of system aiming for populist decisions operability proper maintenance, and ignoring moral ethical standards, thus breaking the principle of balance.

As a result each party seeks for achievement of marginal result instead of achievement of the higher quality of services. The situation is aggravated with restrictive practice of federal regulators, that are set annually without taking into account lifecycle of infrastructure projects.

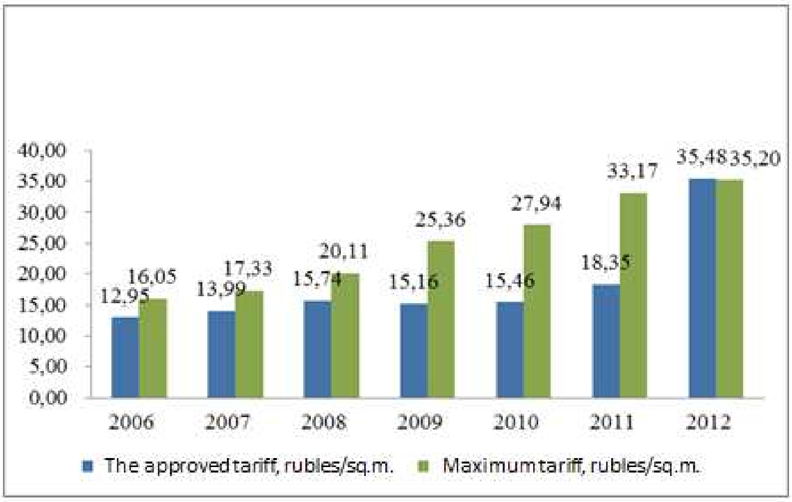

Fig.7. The comparative analysis of the actual growth of a tariff for water supply services with greatest possible

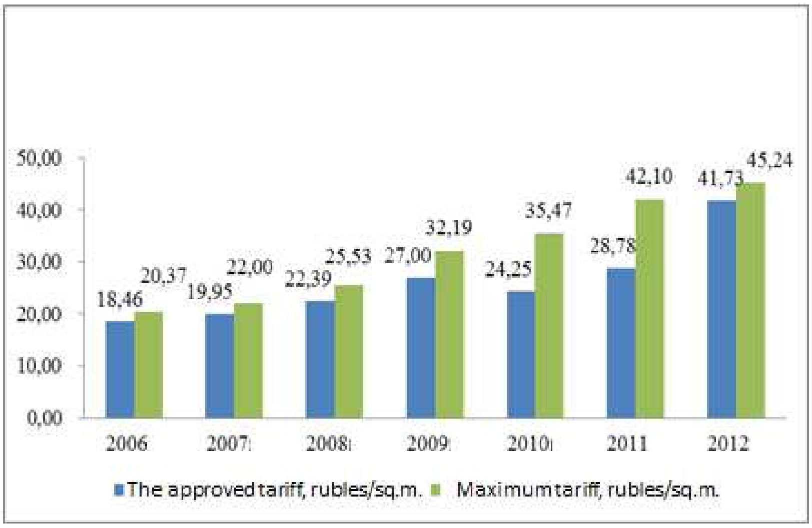

Fig.8. The comparative analysis of the actual growth of a tariff for water disposal services with greatest possible

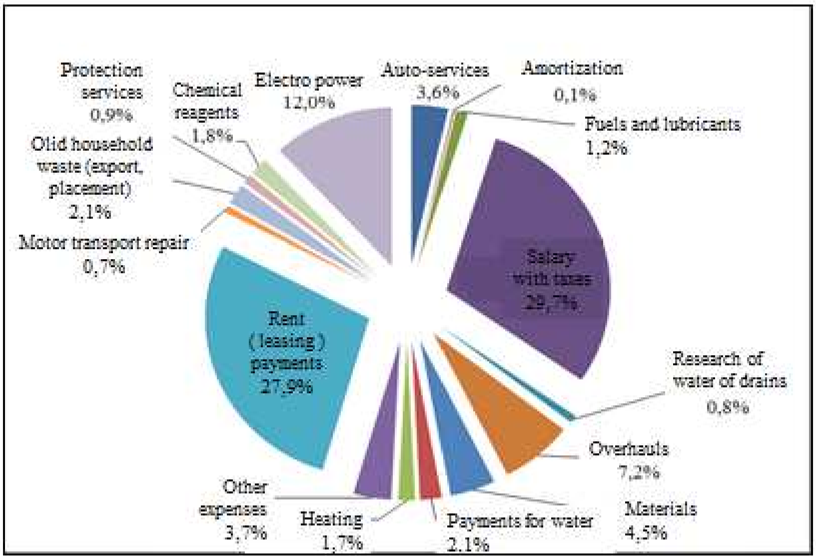

Fig.9. Expenses structure of "Uralvodokanal" for 2004 year

Structure changes of LLC "Uralvodokanal" expenses for the considered period are presented below:

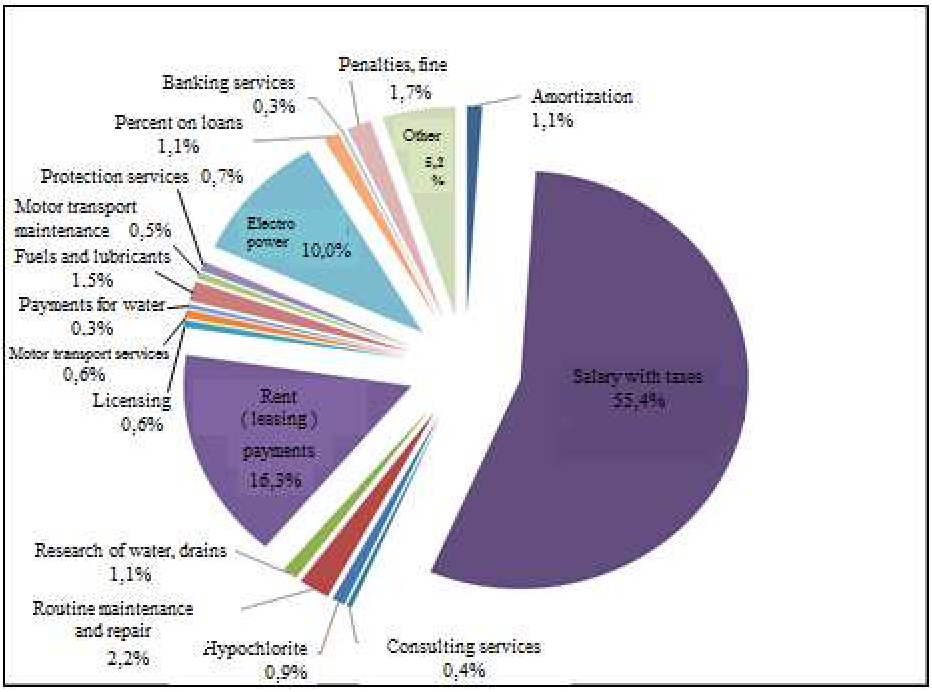

Fig.10. Structure of expenses of "Uralvodokanal" for 2012 year

It is well seen from the data above that expenses are compressed to a limit, internal reserves are almost depleted, the production program (tariff) does not provide funds for development of fixed assets. The number of examples when trusting to luck turns in a technogenic catastrophe, increases in a geometrical progression with time.

(4) Judicial proceedings held for the purpose of adjustment decisions unreasonably made by the pricing bodies take away a lot of effort, time and funds. More than 20 judicial proceedings took place with participation of LLC "Uralvodokanal " during the period since January, 2011 (about 75% of total amount – the claims connected with opportunistic behavior of consumers). However even absolutely advantageous

cases neither reduce the average number of the current assets in receivables, nor provide sufficient decrease in transaction expenses.

(5) Expenses connected with continuous pressure from law enforcement authorities are also significant. Local managers have formed the stereotype according to which the lack of financing can be compensated by an increase of pressure strengthening from the administrative and power block.

Based on the above it is clear that the private water utility has no alternative options of survival, except further decrease in expenses. Therefore, when internal opportunities are substantially exhausted, the only alternative is to work with outer effects, the majority of which has a negative influence.

As it is defined by the theory, negative externality effects appear in the conditions of property rights “washing out” and lack of economic feasibility of the transaction expenses connected with protection of these rights. The typical aspects of resource-supplying organizations (RSO) functioning are: shipping opportunities, law nihilism and management companies "cloning", deliberate bankruptcy of consumers, unauthorized inserts in resource transportation systems, etc. As a result all negative externalities find reflection in the increase of tariffs which leads to the decrease of service quality. Losses from externalities with the limit coefficients for tariffs growth set by federal authorities significantly reduce a share of productive costs. Low efficiency of regulatory base and poor performance of law-enforcement system not directed against unauthorized companies, result in a steady increase of burden on conscientious consumers. Consequently, it leads to the growth of opportunism, reduction of a conscientious consumers share and inevitable destruction of infrastructure as a whole.

The situation arising at operation of water folding columns (further in the text – WFC) in the private sector is classical for the water utilities working in small towns.

3 THE ANALYSIS OF LOSSES OF LLC "URALVODOKANAL" DURING THE WORK WITH WFC

To date the supply of drinking water to consumers in the economically weaker section residential districts "Komarovo" and "Zadobryanka" (further in the text – the private sector) is carried out in two ways:

- by connection to the water supply system directly in the house;
- by water supply through street WFC.

In the first case subscribers pay off with RSO – "Uralvodokanal" according to indications of water metering devices, the installation of which are obligatory for subscribers. In the second case the subscribers of the WFC pay off according to the rates of water consumption approved for this category of the consumers.

Ideally, the volume of water lifted by a water utility should be equal to the volume of water realized to consumers. In practice, the volume of water realized (paid by consumers) in the private sector is much less than the volume of water given to a water supply system (tabl. 1).

No.	Indicator	Unit of measure	Quantity
1	The volume of the lifted water	cubic meter	8 584,7
2	The volume of the realized (paid) water	cubic meter	3 490,7
3	Water losses, including:	cubic meter	5 094
3.1	The technological	cubic meter	502,0
3.2	Error of metering devices of water (further in the text- MDW)	cubic meter	482,0
3.3	Leaks through consolidations of network fittings	cubic meter	1 977,0
3.4	Losses at the expense of natural losses	cubic meter	107,0
3.5	Unauthorized (unpaid) analysis of water through WFC	cubic meter	2 026

Table 1: The analysis of average monthly indicators on water supply of the private sector in 2013 year.

As shown in the table above, water losses in the private sector (without modern conviences) make up 5 094,0 cubic meters or 59,3%, which brings up a question about economic efficiency of rendered services in water supply. The structure of water losses is presented in the chart.

The chart visually presents that the greatest specific weight – 39,77% is occupie unauthorized water consumption through WFC. The analysis made by company specialists the showed that unauthorized consumption of water includes:

- water consumption by the accidental consumers who don't have contracts for water supply (consumers come to WFC by cars, gain capacities and leave);
- water consumption by the constant consumers who consciously aren't signing contracts for water supply, proceeding from real or imaginary belief that water in WFC – is a national property for which it is not necessary to pay for, or considering free water supply as a compensation for the absence of other amenities;
- water consumption by the consumers having contracts for water supply at home through water supply systems with metering devices, but actively using WFC.

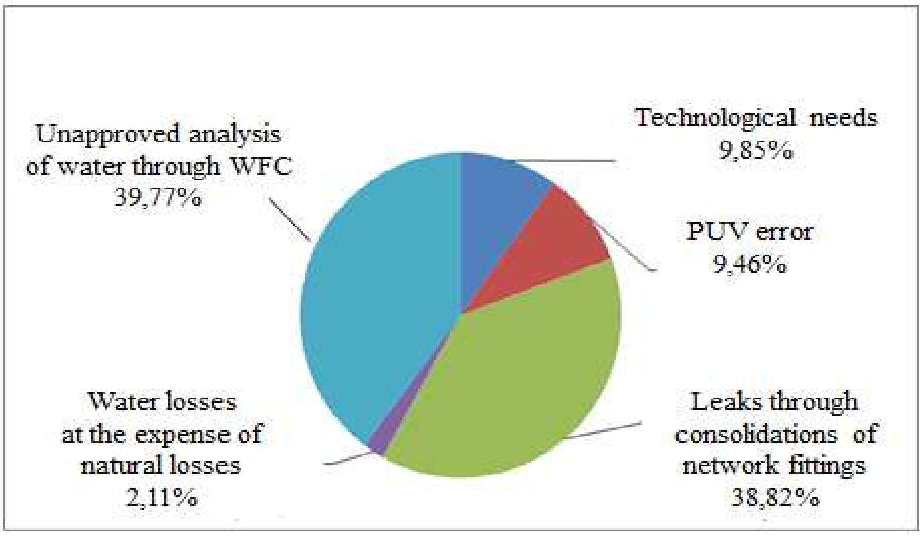

Fig.11. Structure of losses of water in uncomfortable part of the city of Dobryanka

Using the tariffs rates for 2013 year, it is easy to estimate losses of the water-supply organization in the private sector. Monthly LLC "Uralvodokanal" loses 180 735,12 rubles, including unauthorized consumption of water through WFC – 71 882,48 rubles or 862 589,76 rubles a year.

Besides losses, the water utility company should incur expenses on maintenance and elimination of emergencies on WFC, not relying on operation frequency and water consumption volumes.

Actions attributed to maintenance and technical repair which are carried out by a water utility company are as follows:

- replacement of fast-wearing-out materials WFC (rubber laying, collars);
- replacement of joints (water intakes);
- pumping of wells;
- warming WFC during the winter period.

Maintenance and heating costs were calculated for the one WFC for the purpose of the analysis and optimization which made 4 903,75 rubles and 2 452, 34 rubles respectively. For 2012 year 17 water pumps were repaired and 15 of them were warmed. Based on the data above, "Uralvodokanal's" annual operational expenses under this budget line made 120 148,85 rubles.

4 THE DECISION OF "A PROBLEM OF THE FREE RIDER" AT WFC OPERATION

Summarizing the above "Uralvodokanal" annually incurs losses from unauthorized consumption of water through WFC of 862 589,76 rubles and maintenance and warming costs of 120 148,85 rubles with WFC providing conscientious customers with drinking water according to the current legislation. Total expenses connected in operation of WFC are 982 738,61 rubles (about 1% of total amount of realization which significantly decreases the profitability which does not exceed 5%,) which, finally, finds reflection in the tariff rates for water supply.

The analysis shows that the established practice of subjective, most often populist decisions in forming tariffs practically leads to a lack of liquidity. The structure of expenses of "Uralvodokanal" eloquently testifies to it (see above). Therefore any insignificant options of economy of expenses, even at first sight, can't remain unnoticed.

The volume and structure of expenses for WFC operation convincingly show necessity of their reduction, the analysis prompts solutions for current situation.

The main alternative of operation of WFC remains installing a water supply system to subscribers in each house or apartment. Water supply system will allow:

- to stop unauthorized consumption of water through WFC;
- to avoid expenses for WFC maintenance;
- to organize the exact accounting of volumes of the realized water by installation of metric devices.

Nevertheless not all customers ideologically and financially ready to install a water supply system in the house or the apartment. Having possibilities of uncontrolled consumption of water, including temporary conduits (for example, made rubber hoses) many consumers do not support the offer, but also actively counteract against it. It is obvious that their financial benefit is received from pockets of other consumers, i.e. classical "the effect of the free rider" takes place.

The analysis shows that on condition of payment of the cost of materials (approximately 3.5 thousand rubles), and other expenses are gratuitous, the expense of a water utility is economically justified. The average cost of works on laying 25 meters of water supply system with installation of a well and a metering device makes 13 427,44 rubles. Today 197 contracts for rendering services of water supply through WFC are signed. The water utility company's expenses of water supply system laying will make up 2 645 205, 68 rubles counting all the consumers. The payback period of the project is estimated to be 2.7 years taking into account that the water utility will save 982 738, 61 a year in case of termination of operations of WFC.

However implementation of this economically obvious project demands to resolve two fundamental questions:

- to define a source of financing of works;
- to keep a component providing economic payback of the project in a tariff rate.

The question of the work financing is the most difficult. Sources of development financing or even preservation of system of water supply/water disposal in a good condition were and continue to remain almost not resolved issue. The practice of covering losses of municipal water utilities developed in the majority of regions is unacceptable for subjects with alternative forms of ownership like, for example, LLC "Uralvodokanal". The main sources of financing of "Uralvodokanal's" projects of development remain the money of the business firms which have been given out under guarantees of owners of fixed assets in the form of loans and financial rent. However efficiency of use of such financing remains below any criticism for two reasons:

- the price of a resource is 4-5 points higher than the bank;
- payments of percent on the loans obtained from the commercial organizations don't join in the production program also are repaid from profit of RSO which is almost zero at the moment.

A bank loan for "Uralvodokanal" is still unavailable because there are no financial institutions which accepts to credit socially focused business in Russia. This means a system mistrust of the banking system to the state pricing bodies – the Regional power commissions, and an impasse in development of state-private partnership in the sphere of housing and communal services.

A real step of creation of partnership in this sphere could become budgetary guarantees of the target credits for implementation of economically reasonable projects similar to an exception of WFC from the water supply system.

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5 CONCLUSION

To summarize, it is necessary to note that the considered problem has systematic character. In addition, the necessity of its solution is obvious to all, from the highest levels of power to private consumers. The main proposed directions to resolve this situation are:

- improvement of the regulatory base of housing and urban services;
- defining a measure of territory leaders responsibilities for infrastructure operability and formation of their participation mechanisms in regulation of managing companies and RSO;
- effective formation of infrastructure projects sources of financing in small country towns of the Russian Federation.

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🏆 *reviewed paper*

Games in Urban Planning – a Comparative Study

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1 ABSTRACT

The purpose of this paper is to show and discuss the results of a comparative study of games for urban planning. We provide an overview of the selected games available on the market. Because of the variety of offered games, we decided to group them in categories distinguishing among non-digital/traditional, digital and pervasive. The group of non-digital/traditional games includes some well-known, but also some recently developed games: Broken Cities, CLUG, Ginkgopolis, Masterplan, Neue Heimat, Pop-up Pest, Stadtspieler and The Harbour Game. In the category of digital games we considered: Anno, City One, Civilisation, Community PlanIt, Green Sight City, Minecraft/Block by block, Plasticity, Securing Sydney´s Urban Planning, SimCity and Surfing Global Change. The category of pervasive games included: Mogi, PacManhattan and REXplorer. We compared them according to the predefined criteria including participation, interaction, realistic visualization, learning effect and knowledge transfer. One of the positive aspects comprehended that there are some games used for integrating people in urban planning processes. The critical aspects included that there are many games focusing on urban planning issues, but only little were used for integrating people in active urban planning processes. We conclude our paper with a critical discussion of the results of our study and a reflection about further research on games for urban planning.

2 INTRODUCTION

The development and implementation of games in urban planning is an emerging research and application area. Games can show abstract and very specific planning processes in a playful way. Players can take on different roles in a game and act according to the unique requirements and rules of the game. For example, an environmental activist and a real estate investor can make different decisions due to their different roles in an urban planning process.

Research about games in urban planning (Abt 1972, Sanoff 2000, Borries; Böttger; Walz 2006, Lange 2007, Poplin 2011) discusses the use of games for attracting people to participate and learn about urban planning processes in a playful way. It can be seen as an advantage in which games can enable players to make decisions in an experimental, game-based environment (Sanoff 2000, page 76-79). Related to urban areas von Borries explains: "Spaces are realized in another way during playing in them. Not just simulation is in the front, also engagement and enthusiasm of the actor and so the examination of the gaming object – the city" (Borries; Böttger; Walz 2006, page 43).

In addition, games are also often criticized, because they predominantly implicate fun. These are the most common and popular games which have purely an amusement function. Furthermore, there are serious games, which include in addition to entertainment serious aspects. One of the first experts Clark C. Abt defines serious games as: "Games which achieve an explicit, cautious, educational function and whose major feature is not just entertainment. That does not mean games should not be enjoyable; they can be used to impart knowledge in a playful way" (Abt 1972, page 5 ff.). This leads us to an important question: Are there actually games, which can entertain people and simultaneously animate them to participate in applied planning processes as well as facilitate learning about the current process in a playful way? This question motivates us in our research.

The structure of this article is as follows: In Section 3 we review the different groups of games which are relevant for this paper. In Section 4 we explain the research methodology, and the evaluation and results of the comparative study. In the same section we critically discuss the results. Conclusions and ideas for further research are presented in Section 5.

3 SELECTED GROUPS OF GAMES FOCUSED ON CITIES

The game industry is multifaceted and the focus on cities is very popular. Some of them are serious and include realistic visualizations of the city or city district. A few games also enable knowledge transfer, which means that concrete information about a planning situation is given. Many of them just aim to entertain the

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player. In this paper we distinguish among three categories of games: non-digital/traditional, digital and pervasive games. This three groups cover most of all games. This games can be serious or just used for entertainment. Non-digital/traditional games can be played without using electronic means or computers. This can be board- and card games like "CLUG", which is an applied education game. The player learns about influence and relationships of urban growth. Recently, digital games, which use computers and electronic devices, come to the fore in urban planning (Poplin 2012, page 198). PC-games like SimCity are very famous. In this game, the player has to create a successful working city. The third category includes pervasive games, which got popular since the invention of internet and its fusion with GPS-capable mobile telephones. In these games, the borders between virtual and physical almost disappear. According to Montola: "The family of pervasive games is diverse, including individual games ranging from simple single-player mobile phone games to artistically and politically ambitious mixed reality events" (Montola 2009, page 7). Recent technology allows completely new playing areas which are used for example by geocaching in the game MOGI.

3.1 Non-digital/traditional games: board- and card games

This group includes well known, but also recently developed games. The selection covers the description of the following games: Broken Cities, CLUG, Ginkgopolis, Masterplan, Neue Heimat, Pop-up Pest, Stadtspieler and The Harbour Game.

Broken Cities: is a competitive city building game published in 2011. At the beginning of this role-play, the user has to choose whether he wants to be a polluting profit chasing landlord or a green-minded real estate mogul. It is placed in an abstract real world. The player can see the consequences of his decisions in real-time. The interaction consists of dealing with implications of other players decisions irrespective of how their own team behaves (Suarez; de Suarez; Juhola 2011).

CLUG (Community Land Use Game): 1965 developed by Allan G. Feldt as a game for education. It is based on a board with 144 squares representing lots of land. The transport is operated on the streets. A port, a terminal and a supply center are included in the game. One player acts as a moderator and takes the part of an instructor. He works as a neutral visitor and defines the rules of the game, keeps the rules observation, gets the transport fee and can also announce unexpected catastrophes. The use of this game is to show the player essential relationships, which determine the urban growth (Diekmann; Leppert 1978, page 51-58).

Ginkgopolis: entered the market in 2012 as a strategy card game. The player represents an urban planner. The activity is composed of designing, developing and controlling a city. It offers high interaction because all players are permanently involved in the game by overbuilding and replacing each other. To reach the goal, the player has to collect points of success via planning, urbanizing and building (Z-Man Games 2014).

Masterplan: was generated in 2011 as a tactical game for two persons. The board game shows a masterplan and the included figures are houses, parks and towers. The game process provides the possibility to construct a city on the masterplan. The goal of this game is to build houses as close as possible to the parks and towers to get the most winning points (Lach; Rapp 2013).

Neue Heimat: was also published in 2011 and deals with urban topics and actors like a mayor, real estate investor, speculator, special permit or local recreation area. The gaming process allows real estate speculation. New plans of land development, new deals in credits as well as new buildings can arise. Interaction runs through the whole game because there are no waiting times for each player. There is no "next to you", all players are permanent in the game with buying something at an auction (Zoch 2013).

Pop-up Pest: was presented as educational game in 2012. This game was especially made for children, which live in Budapest, Hungary. According to their wishes, they could design the city and make fictive urban plans. The lying on the floor game board is 25 m2 and shows the map of Pest (part of Budapest). Pest includes touristic attractions as well as a deprived area with urban deficiencies. The children who played the game, live in this part of Budapest and should express their needs and wishes in their environment via Pop-up Pest. There were several missions to fulfill. Urban interventions were symbolized by building blocks, which are divided into: environment, transportation and culture. Interaction took place by acting together, collaborating with other players, helping each other, working in a community and discussing about urban planning issues. The player took on different roles during the game. The purpose of Pop-up Pest was to support children in learning about their environment as well as understanding possible changes in urban spaces (Tóth; Poplin 2013).

Stadtspieler: was published in 2003 in Leipzig, Germany. Since then it has been often used in civic participation processes in urban and regional development. The game bases on a board which can be adapted of particular situations (Fig. 1). The attendant city can be built with putty by the players during the game. The purpose of the game is to create a high quality living environment. To reach this goal permanent role-play is intended. Communication is crucial and the players can develop a common level of language over the game. Interaction turns out to be informing, creating, communicating, controlling, analyzing and evaluating. This game makes the complexity of planning processes practical (Ullrich; Pohl 2005, page 38-40).

Figure 1: Stadtspieler event with TRENDBÜRO Hamburg 2011(Photo: Felix Borkenau) and the game board. www.stadtspieler.com

The Harbour Game: was developed in 2003 as a mixed reality game. It aims to promote the development of the harbor in Aarhus, Denmark. The port is built on a large game board. The players can discuss possible problems and ideas, inform others about the development and share texts and photos. There are two playing alternatives: An expert-mode with complex rules and detailed information and an public-mode with simple rules and abstract problems. In planning processes people mostly are integrated after a plan has been finished. The purpose of the game is to change the existing procedures in urban planning and integrate people earlier in the process. (Lossing; Nielsen; Lykke-Olsen; Delman 2007, page 388).

3.2 Digital games: PC-games

First games for computers were researched and designed at universities. With an emerging distribution of personal computers and gambling machines (later consoles), PC-games became popular also among the citizens (Lange 2007, page 16 - 19). Today, the technical progress makes games in fictive 3D-visualizations possible. The player can get a feeling of being directly in the virtual world. By now the industry of PC-games is a mass market and serves various games for different user groups. We considered games, which deal with urban planning aspects and selected the following: Anno, City One, Civilisation, Community PlanIt, Green Sight City, Minecraft/Block by block, Plasticity, Securing Sydney´s Urban Planning, SimCity and Surfing Global Change.

Anno: was developed as one player game in 1998 with the aim to simulate economic systems. First the player can colonize an island, build a city and satisfy the inhabitants' needs. With rising requirements also the missions, that the player has to fulfill, grow up and the steps of civilization become more complex. There are diversified interactions for reaching the main goal: create a prospering city. Many computerized rivals complicate the defense and conquest of the players´ island. All characters in the game are male, which can be considered critically, especially for those who might want to choose a female character.

City One: entered the market in 2010 and was created as a serious game by IBM. The base of this simulation game is the reality; there are more than 100 real world scenarios included in the game. It was developed for special users like city planners and government agencies. The main player´s activity is to convert a city through technologies that save water, reduce traffic congestions or by choosing alternative energy sources. Players learn how to balance the city' interests including finances, environment and sociology. The purpose of the game is to create a green environment with a limited budget. The user can communicate (or interact) with other players or IBM experts (IBM 2014).

Civilisation: was designed in 1991 as a global strategy PC-game. It is the player´s job to lead a nation from the Neolithic to the present age, up to colonization of a new planet. The purpose of the game is to assemble

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an own empire which is bigger, more productive and more progressive than the competitor's one. The aim of this game is to get money and force. Social and ecological aspects grow up in the latest versions. In the meantime interaction is given by diplomatic relations and negotiations with other civilisations (Fischer 2013).

Community PlanIt: is an online game platform and part of the research project "Engagement Game Lab" founded at the Emerson College in Boston. This game was produced as a local participation game. The function of the game is to impart joy for planning in a community and additionally to communicate knowledge about the city and community living in the city. Its purpose is to optimize the communication between all stakeholders as well as to share information and involve communities in planning processes. The users can learn about the impact of games, social community planning processes and local participation. Each game can be adapted to particular planning processes in a commune. It is available via facebook and Twitter. First the player has to complete different missions, assist in a planning process, and win money. The players interact, share their stories and show their ideas. They also communicate, discuss and make new connections with other players. The earned money can be pledged to a local project, and the player can make real immediate impact. The purpose of this game is to make better places by the community because the answers and annotations will be used by the planners (Engagement Game Lab 2013).

Green Sight City: is a social game which was published by the Daimler-Benz group in 2011. The player can reconstruct an existing city into an ecological one. The economic system can be boosted without getting a gridlock and without additional pollution of the environment. The purpose of the game is to rebuild a common city into an ecologic operating city. Interactions are affected thru other facebook-gamers in replacement, help and giving hints. The aim of this game is to impart knowledge about eco-friendly mobility, renewable energy as well as innovative technologies (Neymeyer 2011).

Minecraft: entered the market for single- and multiplayer games in 2011. The player can release recourses in an imaginary world and converts it by using objects needed for building and defending houses. Besides the only action is to fight against computer-based monsters. At first sight this game is not directly connected with urban issues. But since 2013 it is used in real life to get real convertible results. This "Block by block" called game (Fig. 2) is a partner project between Minecraft, UN-Habitat and UN-Agency. It is used for young residents of problematical areas to take part in planning processes. It started in Nairobi, where people could create urban areas with the help of blocks. The purpose of the game is to redesign 300 public places till 2016 (Persson; Bergensten 2011/ Westerberg 2013).

Figure 2: Block by block Playground Undugu. Westerberg 2013.

Plasticity: was used as project for urban planning from 2004 to 2006. It was a multiplayer PC-game with the focus on the city of Bradford. In the first step the players could change the lake´s water level. After that they could implement collaborative strategies for urban planning. Interactions could happen between game designers and urban planners and were based on dialogues. One of the purposes of Plasticity was to enable the residents to experiment playfully and explore their own urban environment. They also could learn collaboration and that they are not able to change their city by themselves. They also could participate in a mutual exchange of suggestions and planning acts (Fuchs 2007, page 370).

Securing Sydney´s Urban Planning: is the latest developed (2013) computer simulation. It is based on an interactive replication of Sydney´s central business district (CBD). The player can act as the brain of the game; he can measure security problems related to public and private places in the CBD, design and redesign the buildings, etc. This game also offers unforseen events like floods, explosions, emergencies as well as varying weather patterns. It is made for urban planners, architects and developers and is available via facebook and Twitter. Also the exchange between players and experts works via social media. The purpose of the game is to develop the capacity of Sydney´s CBD and to change the way of thinking about the use of space (Strachan 2013).

SimCity: the first version appeared on the market in 1989. Several novel versions have been developed since then. The game plays in a virtual world. The player is in the role of the major and has to build up a city from zero. Avatars, called "the sims", live in the storyline and act like instructors. The factors of influence are broaden to crime, environment, traffic flow, education, infrastructure and missions. The purpose of SimCity is to create a prosper city. The use of waking people´s interest of geographical information software is visible. But there is also criticism, for example social aspects are lacking (Devisch 2011, page 26-30).

Surfing Global Change: was designed in 2003 for education as a role game. The player can learn to understand the contents; he can write about and reflects upon his own attitudes, ponder aspects of topics and has the chance to win chips. He gets to know with bargaining of complex consensus. Users of this game can be apprenticed urban planners, architects or civil engineers. In the fore is communication with each other. The use of the game is learning how to bargain in order to reach a solution for the problem. The user can learn about social processes in situations of negotiations (Handler; Trattnigg 2011).

3.3 Pervasive games: games in urban environment

Pervasive games are also engaged in topics of cities. New technologies open the possibilities to explore urban areas. The reason why urban games are sold successfully and became mainstream trend, is for example the affordability of GPS technology as well as the social integration via internet (Bitz 2010, page 3). We decided to present three games, which act in urban environment: Mogi, PacManhattan and REXplorer.

Mogi: was invented as a multiplayer, location-based role-playing-game in 2000. It was used for geocaching on the streets of Japan. The course of action consists of choosing geocachers from a list and entering coordinates of the geocache into the GPS device. The player can use his GPS device to assist others in finding the hidden geocache. After finding it, he can sign the logbook and return it to its original location. At the end the player can share his stories and photos with other players. They feel united because they can work in teams on common missions. This game combines offline and online activities. The purpose of this game is to explore new ways of interaction (Joffe 2007, page 224).

PacManhattan: is one of the most popular video games published as Pac-Man in the USA in 1980. The playground is originally based on a labyrinth which was adopted in Manhattan in 2004. The labyrinth was changed into a map of the city. This adoption aimed to establish a connection between the virtual and the real world. The game consists of controlling a little yellow figure called Pac-Man in the labyrinth. His challenge is to eat a specified amount of "dots" to get points and reach the next level. He is followed by four ghosts. The purpose of the game is to stay alive and collect points as long as possible. In practice, a player wears a Pac-Man-Suit, ranges the area around the Washington Square Park and collects dots along the streets. Four more players are wearing ghost suits and try to catch Pac-Man. They can communicate via mobile device and internet (Lantz 2004; Müller-Lütken 2012).

REXplorer: is a pervasive game for tourists published in 2007. It enables mobile guided tours through the city of Regensburg in Germany. It is made for tourists, especially for younger people, to show them the history and culture in a playful way. The story is based on secret mystic symbols written on a gravestone. These symbols are connected with transcendental activities in Regensburg. To research this connection, fictive scientists designed an interactive mobile phone (Fig. 3). They can interact in front of significant buildings. The player gets answers to different questions via this phone. He is guided through the whole city. At the end he can create a souvenir-blog, where he can see and share his experiences of the day. Also a map of his walk is shown on the mobile device (Ballagas; Walz 2007, page 366).

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Figure 3: REXplorer map and technological equipment. Ballagas; Walz 2007, page 367.

4 COMPARATIVE STUDY

The aim of our paper is to compare different games according to the predefined criteria. These criteria include participation, interaction, realistic visualization, learning effect and knowledge transfer. In our study we compared twenty-two games shortly described in Section 3. We selected the most popular games as well as some of the recently developed ones. We informed about the use and the publicity and we showed diversified contents as much as possible. We took extracts of the categories non-digital/traditional, digital and pervasive games. First we matched the games inside their three groups and showed the connection between games and criteria. For example we compared inside one group how interaction in each game is given, which methods are used and if there is social media involved. Then we evaluated which one implies all criteria. At the end we presented the results of comparing with positive aspects and critiques.

4.1 Criteria for comparison

We focus on participation, interaction, realistic visualization, learning effect and knowledge transfer in our research. “Participation” means that interested people and residents take part in planning processes in concrete places with the help of the game. In our definition the game relates to a practical situation or a planning project. The user´s requests and needs can be included in the planning process and its implementation. A direct link between the game and the development plan can be established within the game environment. “Interaction” consists of talking, writing or discussing with each other. This can happen among the users or in a discussion with experts. They are able to communicate and/or even to compare their notes. The results of their interaction can be exchanged via social media, for example facebook or Twitter. “Realistic visualization” supposes that the story of the game plays in a real, existing city. This city can just be the base of a fictive storyline. But it can also include a real planning process in this urban area. This depends on the particular situation. “Learning effect” is given when players find out something about correlation and interdependency in the planning structure or learn about the city. They can get to know about extensive planning systems by playing the game. They can also argue with other positions and learn about different perceptions. This criterion means common learning effects. In contrast to learning effect, “knowledge transfer” communicates facts and figures about a real planning situation or a practical city. Then concrete information is indispensable in the game. Contents are always linked to the real-world knowledge related to the current projects and places in the city. The more criteria a game exhibits, the merrier it fits to our research question. If there are actually games, which can entertain people and simultaneously animate them to participate in authentic planning processes as well as facilitate learning about the current process in a playful way?

4.2 Results of the comparison

We compared the games inside the groups of board- and card games, PC-games and games in urban environment. To represent all games according to the criteria clearly, we made some graphs (figure 4, 5 and 6). The colored fields show the games which are analyzed. The criteria are arranged on the x-axis. It is shown which game includes which criterion. The size of the colored fields is irrelevant, it adapts according to the number of games. In this way it can directly be shown which criterion includes lots of games and which less. We present the quantity of each field.

4.2.1 Comparing board- and card games

The eight described board- and card games have similarities and differences. Participation was used in four games: Broken Cities, Pop-up Pest, Stadtspieler and The Harbour Game. All games include interaction. Communication was in the fore. In all games player interacted with other users or experts. As shown in Figure 4, realistic visualization was implemented in only three games: Pop-up Pest, Stadtspieler and The Harbour Game. Stadtspieler can be adapted to every planning situation; it inserted realistic visualization as well as participation. Including Broken Cities and CLUG as an official game for education, these five games offer real knowledge transfer and learning effects. People got to know about the complexity of urban planning processes in general. How to discuss and behave as well as what to respect in this process. The Harbour Game gave a lof of information about the needs of Aarhus and the importance of the harbour. Residents could inform them and according to this, they could add their needs and show their ideas. Pop-up Pest was the only game especially made for supporting children in learning about urban planning issues. Ginkgopolis, Masterplan and Neue Heimat are primary tactical games with more entertainment aspects than education. Ginkgopolis and Neue Heimat enable only interaction. We could outline that only three games had realistic visualization: Pop- up Pest, Stadtspieler and The Harbour Game. Four imparted participation and six of eight games had learning effects. Interaction was enabled in all games.

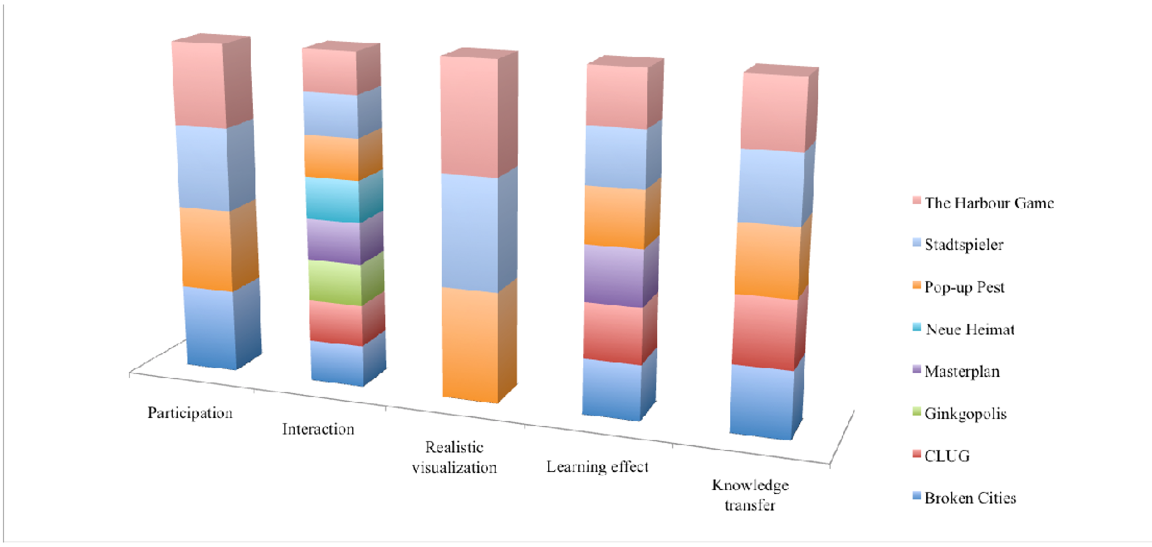

Figure 4: Board- and card games and their criteria.

4.2.2 Comparing PC-games

Only Block by block, Community PlanIt and Securing Sydney´s Urban planning imparted participation. People could take part in the authentic process and their ideas influenced the implementation. Communes continued processing with the outcome of the game. Interaction was all over given. Online games made an exchange with social networks like facebook or Twitter very easy. Thereby the possibility for communication grew and networks could increase. Many games included discussions with experts. It was demonstrative that Minecraft covered just the criterion interaction, but the game which resulted from it (Block by block) covered all criteria. In the field of PC-games it became apparent, that there were many games which focus on entertainment. We could present also some games which had realistic visualization of the real-world cities (Fig.5). These games had real knowledge impact and learning effects. Anno, Civilisation and SimCity are very popular games, but they serve primary entertainment. The player just experienced about little realistic connection in urban planning systems. The learning effect as well as the use for participation function was very low in this three games. Altogether eight games had learning effects and seven games offered knowledge transfer.

4.2.3 Comparing games in urban environment

Participation was completely missing because all games acted in the city, but not in relation to planning processes (Fig. 6). All three games had placement in real-world cities as well as using the urban area as a board in common. The player could move in physical, real-space and was dependent on interactions. Communication and common exchange was essential for the players of the game. This could be enabled via

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networked technology or inside a group. The basis was the reference to the real world. Mogi enables players to learn interacting with geographical information and getting along with maps in the environment. REXplorer is the only game, which conveys real knowledge about a real-world city. The player is guided through the city along important buildings and places of interests. He could learn about the history in a playful way. The characteristics of the game REXplorer were in contrast to the features of PacManhattan. The main challenge was just catching Pac-Man and collecting dots. This game had just an entertaining function and did not involve any education.

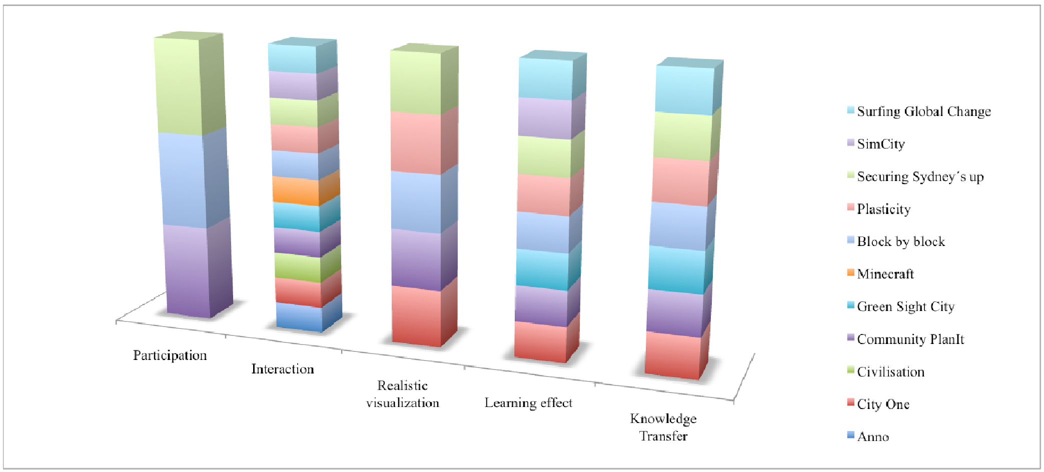

Figure 5: PC-games and their criteria.

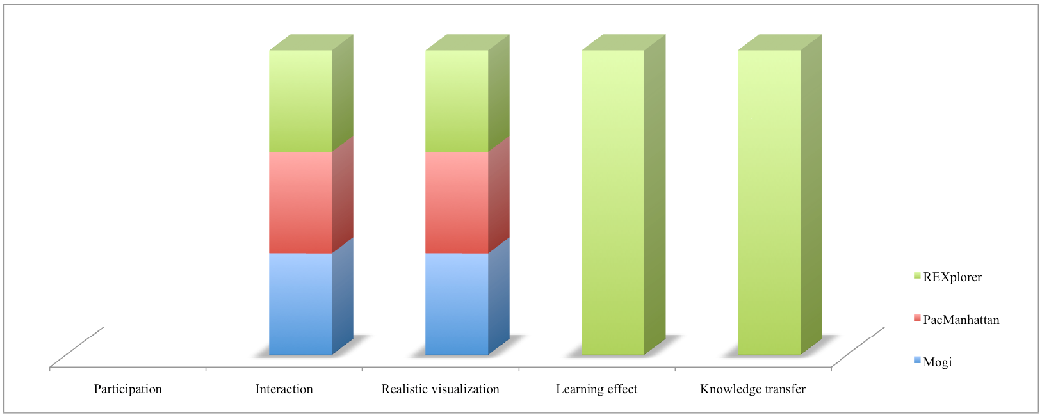

Figure 6: Games in urban environment and their criteria.

4.3 Discussion

Even though we analyzed many games, we just found five games (Block by block, Community PlanIt, Pop-up Pest, Stadtspieler and The Harbour Game) that match our research question: Are there actually games which can entertain people and simultaneously animate them to participate in applied planning processes as well as to learn about the current process in a playful way? These five games implemented all predefined criteria and were developed with the purpose to support urban planning processes. Pop-up Pest focuses even children in learning about their environment and understanding changes in urban areas. These games might have a crucial impact in current planning processes. They are exemplified and transferable for other projects.

Surfing global change was developed as educational game. It focuses on learning effects and interaction but without any realistic visualization. The entertainment function in this game is low.

Actually games in urban environment included only few of our criteria; this group did not satisfy our research question. All three games could entertain people, but they were not used for participation in real-world planning processes. These games arose in the recent years due to the novel technological possibilities. We could not find games enabling participation in this group. The selected list is limited and some novel games might be on the market, which include the possibility to participate in urban planning processes.

We can conclude that we found five of twenty-two games, which entertain people and simultaneously animate them to participate in real-world planning processes in a playful way. Block by block, Community

PlanIt, Pop-up Pest, Stadtspieler and The Harbour Game are our current examples for games that combine participation, interaction, realistic visualization, learning effect and knowledge transfer.

Positive aspects:	**Critiques:**
Some games were on practice in urban planning. → 5	Participation (7 games) and realistic visualization (11 games) is low. → Less than half of all games.
All games are designed for interactions and possible learning effects are high.	Especially games in urban environment don´t offer more than just entertainment.
Although a game like Minecraft seems to be unfitting to urban issues first, a successful game for real planning processes could be developed.	There are lots of games with urban planning issues but they are not sufficiently are used for integrating people in real-world planning processes.
Only some games enable pure entertainment (8 of 22).	
The applied games could already show successful results. → For example Block by block got ideas for redesigning public places by players, which are used for further planning.	

Table 1 summarizes the positive aspects and critique of the analysed games.

5 CONCLUSIONS

Games for urban planning can show planning processes in a playful way and they can facilitate participation and interaction. In Section 2 we stressed that games are often criticized because of their only focus on an amusement function. We tested twenty-two games and five of them complied with our criteria: participation, interaction, realistic visualization, learning effect and knowledge transfer. Only eight of twenty-two games implicated just fun. We can conclude that although there are entertaining games, we also found several serious ones.

In this article we concentrated on finding games that satisfy our criteria. This turned out to be a complex task. The games industry offers a mass on commercial games which focus urban planning aspects. During our research we found many games in which a player had to create a prospering city, similar to SimCity. Getting detailed information about these games was complicated. We were always sent to the official game homepage, where information were just visible with a registration. Unknown games as well as board- and cardgames were hard to find besides the mass of popular ones. If games were used in communes, they were often hidden. It was difficult to get serious information about games that focus urban planning processes.

We reflected our predefined criteria and one of them is “interaction”, which consists of talking, writing or discussing with each other. We focused on the relationship between users among each other. According to Salen and Zimmerman, interaction can also be the interactivity between the game and the player. They mention: “The relationship between the player´s choice and the system´s response is one way to characterize the depth and quality of interaction” (Salen; Zimmerman 2004, page 57 ff.). There are several definitions of interaction, but the connection between action and outcome as well as many forms in which interaction can come through the game, is very interesting too. In our former research we will add other levels of interactivity to our criteria.

The practice of using and implementing games in urban planning can help people to find out what they really need in their urban environment. Block by block is a good example for a game that enables non-experts to upgrade space in a slum area via a PC-game. This game can be transferred to other situations. For example if a public place has to be redesigned, users could place important objects like street furniture in the virtual place. They could see costs, planning documents as well as administrative barriers. They could get to know arising circumstances in a concrete project.

PC-games enable simulations of realistic scenarios in an easy way. Board games can be produced faster than PC-games, but they require a higher imagination. At this time ideas with focus on planning processes could not be implemented in the environment. Upcoming technological innovations will make those games possible. We can imagine a game for example, in which users could play geocaching with real street furniture and objects for public spaces. They could play together in groups, catch important elements and place them for example on a real market place. People could create a concept for this place and show their

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needs. The groups could be divided into topics like “green”, “furniture” or “lightning”. One benefit could be, that players see directly their results and discuss in the environment which is the content of the planning process. Those games require a higher effort than a PC-simulation does. But here residents could connect new technologies with play, discussion and participation in the real world.

The games industry has a rapid development. New games will be evolved soon and this comparative study is a kind of snap-shot. We hold that rapid development has also potential for designing more games that motivate people to participate in real processes. We are especially interested in designing a pervasive game that participate people in planning processes. In our research we found only one game (Pop-up Pest) that was specifically made for children. We will create a game, that especially invites marginal groups to participate. We would like to cooperate with a commune and develop a game that motivates concerned migrants for example.

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reviewed paper

Global Competition needs Smart Solutions, Urban Design Elements on City Branding

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1 ABSTRACT

Globalization is one of the most important issues that changes cities. Global competition makes cities to need a range of solutions in order to be different from opponents and attract more economical investments. Branding is a customary topic for economics but globalization, attracting more investments and tourists to cities caused the topic an emerging subject for urban design and planning. Contemporary researches on integrated sustainable city can be turned into reality with city branding approaches. One of the fundamental decisions of urban studies approaches is to manage urban and spatial planning according to the urban design elements on city branding and identity of place. City branding is a smart solution for urban development, creation of jobs and providing a greater place to live and work.

Advertisement and communication technologies could have a key effect on city branding. Mobile apps and websites can be used to deliver city branding goals and a lot of cities used ICT as a key policy to present their brand. But urban design elements on city branding should be represented in these activities in order to express the unique brand of the city and the elements are not the same in different cities. These elements should be identified and appraised in the cities rather than relying on stereotypical responses to a commercial order.

This study considers key urban design disciplines and previous attitudes on city branding to offer a framework for urban design elements on city branding. This concept introduces the elements in main approaches and dimensions. In order to introduce urban design elements on city branding, this study uses a laboratory experiment that happened during Fourth International Conference on Urban and Extra Urban Studies 2013, Amsterdam, The Netherlands and concluded fourteen urban design elements for Amsterdam brand.

2 GLOBALIZATION AND URBAN STUDIES

The idea of the city branding was a subject of economics; but in last decade, the importance of space political economy grows gradually and researchers also have paid attention to this topic as an urban issue. Cities do not need gentrification solutions and the role of urban design should not be overlooked because urban design projects have a dominant effect on city's future economy (Cuthbert 2005, 56). Increasing investment and marketing constraints have addressed a new interest in local differences to create particular image of the city for new target groups and stakeholders. One of the urban planners and administrators tasks is to facilitate people interaction with the environment and new developments of the city according to the context of the city, rather than relying on the stereotyped responses and methods (Erickson and Roberts 1997, 35-37).

Erickson and Roberts have suggested that civic spaces are frequently bound to commercial leisure and retail industries. Yet many local government authorities encounter competition with large out-of town shopping centers. City authorities would like to market the town center as a more interesting alternative than the shopping mall. If they do not appraise their unique urban identity, branding activities will lead to places as indistinguishable as the branches of chain stores in cities (Ibid, 35). Marketing and urban studies are some of the impressive items in city branding. Growing global competition on absorbing financial and human sources have maximized the interest of city managers (Simmonds and Hack 2000, 271). Banalscapes are the outcome of branding process without urban design approaches on city identity in public space, so the lack of urban design analyses in branding may loss urban identities and local differences (Munoz 2010, 78).

Contemporary changes in cities economical approaches from industrial to post-industrial have highlighted urban regeneration. For example, over 5000 transactions shows that from 2000 to 2006, at least 10.000.000 square meters of industrial land has been disposed of by companies in 96 locations throughout the Netherlands. By the end of 2006, about 75 % of these locations were redeveloped (Figure 1). This is surprising in a small country like the Netherlands with few available development areas and the sites were often located in central urban areas (Havermans, Meulenbroek and Smeets 2008, 7-8).

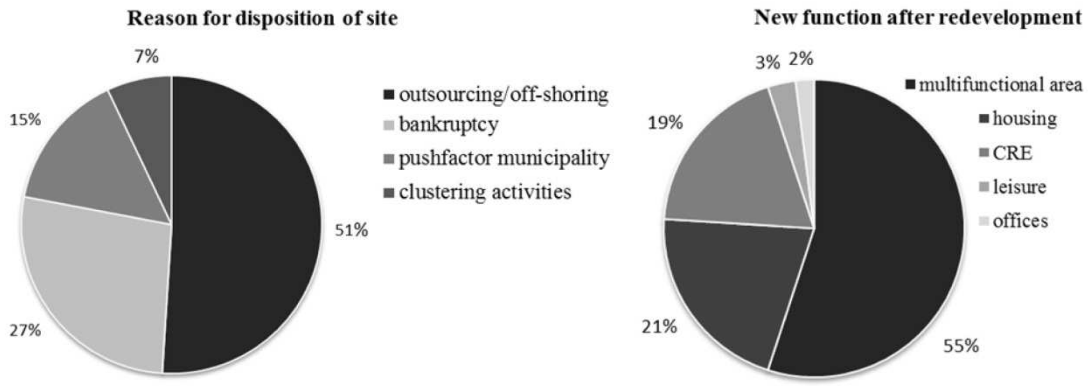

Fig. 1: Reasons for disposition industrial sites in the Netherlands and new functions after redevelopment. Source: Haverman, Meulenbroek and Smeets 2008, 8.

A minority of urban designers and planners have exposed to this topic recently. Many discussions in this topic have been issued by economists and they have emphasized that interdisciplinary approaches should become more prevalent in city branding (Dennie 2010, 4). Marketing specialists have done considerable effort in city marketing and many examples of these activities are available. They point out that a city is not a product and cannot be treated as products (Kavaratzis and Ashworth 2005, 507). Due to the complex urban issues in city branding the necessity of an interdisciplinary group for city branding is crucial. Thus marketing experts can work more closely with urban designers to determine the process of city branding.

Using websites and mobile apps are common to exhibit branding elements. Nowadays, almost all city branding campaigns have at least a website and provide a range of mobile apps, such as, tourist information mobile applications, to express the unique elements of the city. Based on the needs of target groups a range of ICT products for cities can be offered. These are smart tools should express the brand of city and appraise the unique elements of city. Urban designers and planners can distinct both unique visual and verbal means of city in all scales of the urban socio-spatial continuum and can represent them for the other experts, like as websites and mobile apps producers. The purpose of this study is to represent a conceptual framework of city branding elements in terms of urban design approaches to clarify them for all experts, which are a part of promoting city branding, including ICT experts. This paper explore the literature review of city branding and strategies of the topic, moreover, key urban design approaches on the topic will issue. Finally urban design elements on city branding are introduced and a laboratory experiment in Amsterdam is used in order to introduce an example for the mentioned elements.

2.1 Literature Review

In 1960s and the idea of place marketing emerged by Kotler and Levy. O'Leary and Iredal were the first authors introduced marketing as a challenging issue for the future and described that as " designed to create favorable dispositions and behavior toward geographic locations" (Zenker, Eggers and Farsky 2013, 134). A brand is something more than an identification name and the image of places cannot change by logos or advertisement easily (Kavaratzis and Ashworth 2005, 508). A brand is the collection of physical, psychological and social attitudes that are related to a product (Simones and Dibb 2001, 218-19). Besides, visual and aesthetic commendation of the urban landscape may lead to dispositions the residents' relationship with the place (Govers and Go 2009, 256-57).

Place marketing can be considered as a range with two borders. First one is describing urban capabilities and unique identity for target groups, and the second one is selling the place like a product and emphasis on advertisement and avoid the ugly backs of the place that may create a schizophrenic inspiration to place (Ericson and Roberts 1997, 53-58). Place marketing often misunderstands as place selling. Place marketing highlights an economic matter and the increasing of social functions to forms a major goal. It is a customer-orientated approach, which should consider existing and potential "customers" of the city; yet place selling concentrates solely on the promotional aspects of marketing. Place selling disregards the true aims and range of place marketing and branding (Zenker 2011, 41).

City branding theory is in the initiative stages of the accomplishment. This is expected that the global competition and contemporary economical necessities cause cities to enhance their unique brand in order to achieve urban development and regeneration goals (Dinnie 2010, 7). Branding is a deliberate process of boosting the symbolic value of a production or service in comparison with the other commentators (Zenker and Beckmann 2013, 7). A simple definition for place branding is applying product branding for places; yet places are more complex than products and a logo or new slogan cannot create a new identity for places (Kavaratzis and Ashworth 2005, 508). Place marketing and place branding are used instead of each other occasionally. Place marketing and place branding are used instead of each other occasionally. In fact place marketing concentrate on advertisement but place branding engaged to promote place identity and image (Pergelova and Angulo Ruiz 2011, 2).

In recent years, losing local identity issues and the target groups' image of the city are known as branding, although marketing was used frequently in the early years of 90s. A city can strengthen the uniqueness of its images by place branding. Branding can help the target groups to distinguish the city from its competitors and introduce a decent destination for investors, tourists or other stakeholders so target groups should be considered as an important section in literature review.

2.2 Target Groups

A variety of authors introduced residents, visitors, and investors as the main target groups in the process of city branding. Residents have a higher priority and visitors and investors are in the later priorities because the majority of strategies and policies, such as economic, cultural and formal, are designated to increase the quality of life for city residents. All of these groups have different perceptions and demands from the places, for example, tourists are looking for great shopping and cultural activities and financial investors are interested in economic; therefore city customers will not be interested in a dot on the map and they need a decent place for their intended purposes (Zenker and Braun 2010, 2).

Target groups in branding practice are much more complex. Visitors can be divided into business and leisure time tourists (Zenker and Beckmann 2013, 7). Professional visitors can be categorized as archaeologists and architects; besides, residents can be separated into current residents (internal group) and potential residents (external group). Within these groups, target groups may be specifically introduced, such as students or creative classes (Florida 2002, 67-79). These two target groups show a different knowledge structure that is based on different levels of experience (Figure 2). External target groups represent more common and stereotyped associations, whereas internal target groups possess a heterogeneous place brand perception (Zenker and Beckmann 2013, 8).

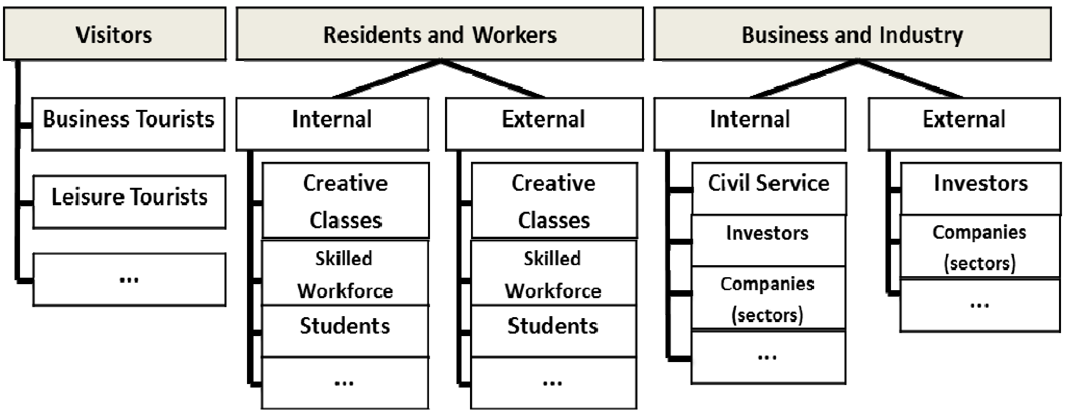

Fig. 2: Target groups in city branding. Source: Author

3 A FRAMEWORK FOR URBAN DESIGN ELEMENTS ON CITY BRANDING

Urban design can be defined as the multi-disciplinary activity of shaping and managing urban environments. It is interested in both the process of this shaping and the spaces it helps shape. Combining technical, social, and expressive concerns, urban designers use both visual and verbal means of communication, and engage in all scales of the urban socio-spatial continuum (Madanipour 1997, 22). Urban design has influenced by various interdisciplinary factors based on new challenges, such as economical necessities and marketing (Dinnie 2010, 7). In spite of the fact that lots of marketing authors have issued different essential elements

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on the topic, urban designers, as professionals who are noticing urban qualities, did not express urban design elements of the topic. Urban design is highly sensitive in identifying and appraising of the city identity. Urban designers and planners can make a professional interaction with municipal authorities to represent implementation strategies and policies as supplementary planning guidance according to the statutory plans. This is a batch process with marketing experts and the other stakeholders.

Dimension of brand evaluation method issued by Zenker is a decent way to measure the current situation and target picture of branding elements. This evaluation may be considered for all identity base elements; moreover, Asset and Brand Strength method can be helpful due to the fact that elements can be compered each other by possible maximum points. This study has presented Three-dimensional city branding elements scoring model based on the combination of above methods to evaluate brand elements (Figure 3). Each element scored from -5 to +5 points in three dimensions and the summation of the element's points determines the current situation or target picture total point. X-axis corresponds to points of uniqueness, Y-axis related to the positive and negative effects of the element and Z-axis evaluate the strength and weakness points of the element base on the questionnaire outputs. The questionnaire should be prepared comprehensively to measure brand elements in terms of responder opinion for current situation and target picture in three axes. Current situation is the present image of element and target picture illustrates the responder expectations of element for the future as showed in figure 4.

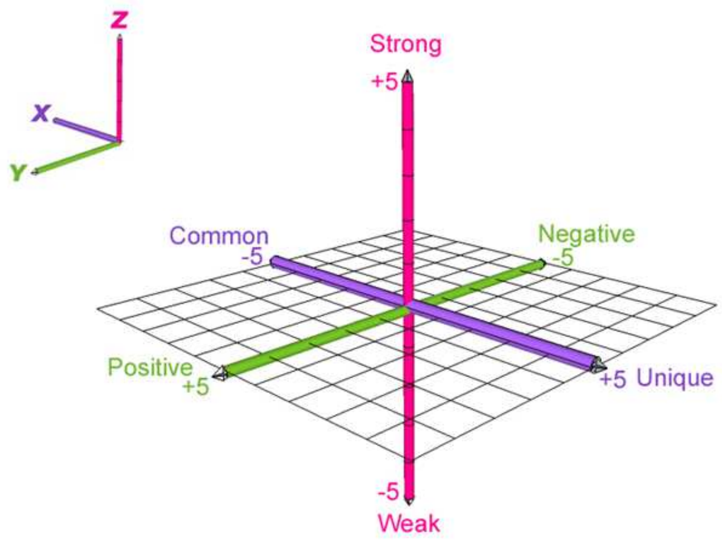


Fig. 3: Three-dimensional city branding elements scoringmodel. Source: Author

This paper considers spatial, visual, physical and public realm organizations as the key urban design disciplines (Zekavat, 2002, 30-32). This study uses previous attitudes on city branding and urban design diciplines to offer a framework which explore urban design elements on city branding. This concept introduces city branding elements in approaches and dimentions. The focus of this paper is on identity appraisal approach and the other approaches may be considered in later researches.

Urban design elements on city branding is a framework for apprising unique identity elements in urban areas. This framework offers 26 elements in 3 dimensions for identity appraisal approach that helps to categories the elements in urban areas in order to strength cities' differences. Besides, Urban design elements on city branding contains an evaluation model for identified features. Using this framework can address some weaknesses of branding campaigns due to the fact that usually they do not express a distinct process for exploring unique elements of urban areas.

The goals of this framework can be issue as follow:

- Promoting tourism economy
- Boosting social pride among residents
- Upgrading the global position of the city
- Promoting livability in urban areas

- Apprising the difference and unique identity of the city for target groups

Identity appraisal approach is the first main groups that signify urban design elements on city branding. These are introduced in ecological, social and artificial environments as three dimentions of this approach. The second approach is implementation, which indicate factors and mechanisms of the implementation process. Fundraising, backup infrastructure, participation themes are different dimentions of implementation approach. And the third one explain the supplementary approach that happened during branding process by monitoring and advertisement (Figure 4). Three-dimensional city branding elements scoring model is an evaluation model for prioritising the strength of every branding elements and features. Positioning in current situation and target picture exhibit the most important elements among 26 identity appraisal elements and features. Besides, positioning represent some of the elements which earned zero points. These elements and features are considered as not applicable branding elements in the city. So the elements will be different in different cities. This framework clarify branding elements for all experts, which are a part of promoting city branding, including ICT experts in order to relay on the unique elements of the city rather than relying on stereotypical responses to a commercial order.

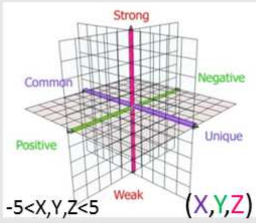
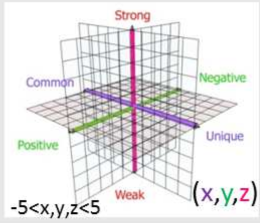
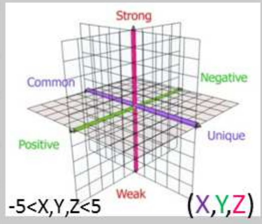
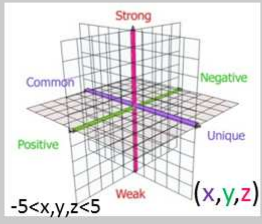
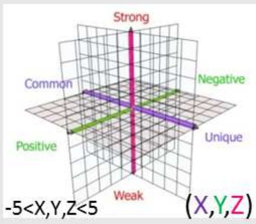
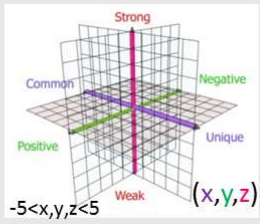
Approaches	Dimensions	Positioning / Elements and Features	Current situation	Points	Target picture	Points
Identity appraisal	Ecological environment	Natural features		X + Y + Z		x + y + z
		Weather				
		Natural Landscape				
	Social environment	Walkability		X + Y + Z		x + y + z
		Urban Spaces				
		Bikability				
		Events				
		Food				
		Public transportation				
		Art festivals				
		Tourist attractions				
		Civic buildings				
		Mixed-uses				
		Formal- informal activities				
		Urban landscaping				
		Religion				
	Artificial environment	Iconic buildings		X + Y + Z		x + y + z
		Activity Nodes				
		Spatial order				
		Tall buildings				
		Urban landscaping				
		Mixed-uses				
		City silhouette				
		Urban fabric				
		Night scape (lighting)				
		Public art				
Implementation	Fundraising					
	Backup infrastructure					
	Participatory approach					
Supplementary	Monitoring					
	Advertisement					

Fig. 4: Urban design elements on city branding. Source: Author

3.1 Empirical Study

In 2003, the city of Amsterdam have started a branding campaign to strength the position of Amsterdam as a major cultural center has been threatened by a growing competition from other cities both within and outside The Netherlands. They established a picture of priorities and opportunities for the current situation and target picture, representing the sixteen dimensions in the form of a spider's-web (Figure 5).The spider's-web provided the city necessaries to work on. Living conditions in the city, for example, Liveable City and Residential City need considerable improvement (Kavaratzis, 2008).

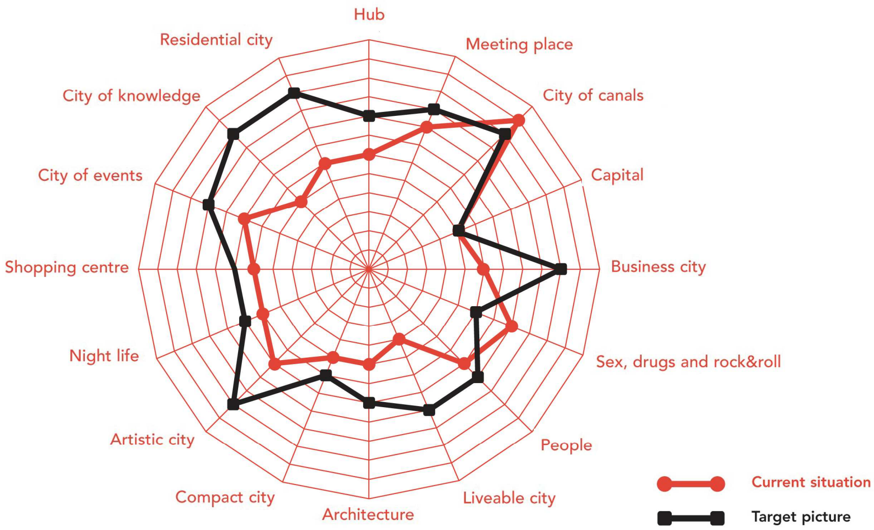


Fig. 6: Proposal Amsterdam brand dimensions in the form of a spider's-web.Source: City of Amsterdam 2003,17.

In spite of the fact that Amsterdam authorities have chosen a strategy that addresses, or intends to address, the needs not only of the tourism sector, a wider base of urban elements and target groups in the selection of these dimensions should be considered with caution for two reasons. First, all cities are obviously versatile and most of dimensions are not unique to Amsterdam. Secondly the process of choosing the specific dimensions shows clear signs of a top-down approach and there is no framework for priorities and introducing these dimensions.

There is perhaps a question arising from these points of criticism. Could cities have chosen an urban design based strategy or a stronger theatrical framework to introduce unique identity elements of the city? This is related to the wider question of how to apply or evaluate the efficacy of branding elements in cities? In order to conclude urban design elements on city branding for a city in practice, this study uses a laboratory experiment with urban studies researchers' in Spaces and Flows: International Conference on Urban and Extra Urban Studies, Amsterdam, The Netherlands, as participants in the questionnaire.

Identity appraisal elements of Amsterdam were derived from 20 participants using qualitative in-depth interviews and the laddering technique, the participants average age was 29.2 years (SD=2.59), 34 per cent were male. Despite its merits, the present study features two main limitations. First, do in-depth interviews with 20 participants reveal all the relevant associations of the identity elements of Amsterdam brand? Second, all of the participants did not live in Amsterdam and they could not express nonphysical elements of the city brand well and they are small target group of city branding. Despite this limitation, Amsterdam is one of the well-known cities for architects, urban designers and planners so they have enough information to evaluate the current situation and target picture of the city and all of participants have the opportunity of visiting the city before the conference.

The empirical study has signified fourteen urban design elements applicable for Amsterdam brand. Three-dimensional city branding elements scoring model shows that social elements are dominant elements for the research target group. Canal architecture, semicircular spatial organization of the city center and Rijksmuseum, have taken the most points in current situation (E1,2,3,...,n) and target picture positioning (e1,2,3,...,n) (Figure 6). This study shows that social environment identity elements have a dominant effect on urban design elements of Amsterdam brand and it emphasizes the importance of apprising nonphysical identity elements in city branding. The focus of this paper is on identity appraisal approach and it is evident that, implementation and supplementary approaches should be considered for different target groups in later researches to achieve all urban design elements of Amsterdam brand.

Some of the concluded elements may be considered as negative elements for the image of the city in terms of target group points of view, for example in this study participants reduced the importance of the Red-Light district as an identity element for Amsterdam in target picture (the element score 7) in comparison with current situation (the element score 9). Besides, some elements may be contained more than one feature, like as iconic building that covers 4 features in Urban design elements on city branding for Amsterdam..

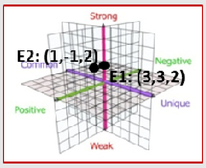
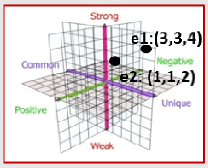
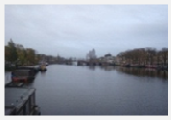
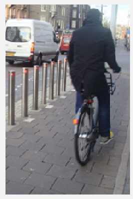
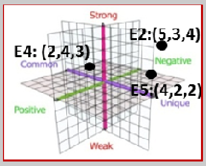
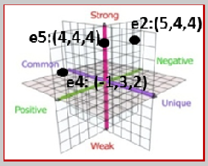
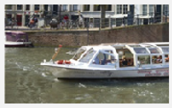
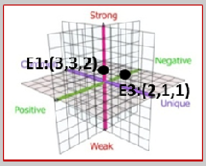
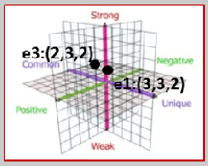
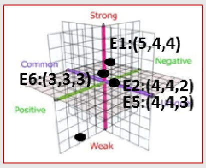
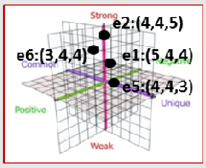
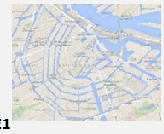
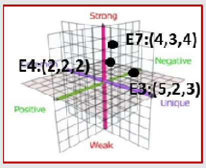
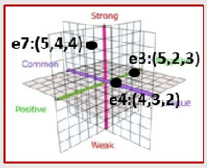
Approach	Dimensions	Positioning / Elements	Current situation	Points	Target picture	Points	Examples
Identity appraisal	Ecological environment	Natural features (**City of Water**) **E1**		8		10	 E1
		Weather (**Cloudy weather**) **E2**		2		4	
		~~Natural Landscape~~		0		0	
	Social environment	Walkability		0		0	 E1
		~~Urban Spaces~~		0		0	
		Bikability (**Bickability**) **E1**		8		10	
		~~Events~~		0		0	
		~~Food~~		0		0	
		Public transportation (**Canal Transportation**) **E2**		12		13	 E2
		~~Art festivals~~		0		0	
		~~Tourist attractions~~		0		0	
		~~Civic buildings~~		0		0	
		Mixed-uses (**Shopping streets**) **E3/**		4		7	 E4
		Formal- informal activities (**Red light District**) **E4**		9		7	
		Urban landscaping (**City of Flower**) **E5**		8		12	
		~~Religion~~		0		0	
	Artificial environment	Iconic buildings (**Canal Architecture**) **E1/ (Rijksmuseum) E2/ (City of Bridges) E3/ (Modern Architecture in District of Zuid) E4**		9/10/11/6		13/13/10/9	 E1
		~~Activity Nodes~~		0		0	
		Spatial order (**Semicircular Spatial Organization of the City Center**) **E5**		11		11	 E2
		Tall buildings (**City of Tower Clocks**) **E6**		9		11	
		Urban landscaping		0		0	
		~~Mixed uses~~		0		0	
		City silhouette		0		0	 E4
		~~Urban fabric~~		13		13	
		Night scape (lighting)/ (**Night Life**) **E7**		11		13	
		~~Public art~~		0		0	

Fig. 6: Urban design elements on city branding for Amsterdam. Source: Author

According to the above chart, urban design elements on city branding for Amsterdam are concluded respectively as follow table. These elements have been prioritized in current situation and target picture (Figure 7). Moreover, the elements can be used to provide urban development policies and principals in an urban design guideline on city branding for Amsterdam. It would be the subject of an urban design and planning project that will pursuit the proposed framework goals.

Positioning / Current situation	Scores (out of 15)
Canal Architecture	13
Canal Transportation	12
Semicircular Spatial Organization of the City Center	11
Night Life	11
City of Bridges	11
Rijksmuseum	10
City of Tower Clocks	9
Red light District	9
City of Water	8
Bickability	8
City of Flower	8
Modern Architecture in District of Zuid	6
Shopping streets	4
Cloudy weather	2

Positioning / Target picture	Scores (out of 15)
Canal Transportation	13
Night Life	13
Canal Architecture	13
Rijksmuseum	13
City of Tower Clocks	13
City of Flower	12
Semicircular Spatial Organization of the City Center	11
City of Water	10
Bickability	10
City of Bridges	10
Modern Architecture in District of Zuid	9
Shopping streets	7
Cloudy weather	4
Red light District	4

Fig. 7: Urban design elements on city branding priorities for Amsterdam. Source: Author

4 CONCLUSION

Data collection, data analysis, making solution and evaluation are dominant stages in urban design process (Shirvani 1985, 111) and urban design elements on city branding are very helpful to represent the unique brand of a city in urban development process. This study introduces a conceptual framework of city branding elements in terms of urban design approaches to clarify them for all experts, which are a part of promoting city branding, including ICT experts in order to relay on the unique elements of the city rather than relying on stereotypical responses to a commercial order.

This study offered a framework to represent urban design elements on city branding and signifies that a range of ecological, social and artificial dimentiones must be considered in city branding. Moreover, three-dimensional city branding elements scoring model is a way for positioning current situation and target picture of the elements in target groups' point of views. The focus of this paper is on identity appraisal approach and it is evident that implementation and supplementary approaches should be considered for different target groups in later researches to represent all urban elements on a city brand.

To manage future urban development, an urban design and planning guidance on city branding may be a valuable document that explores branding principals for cities. Urban design and planning guidance on city branding can be considered as an official document for cities and municipality can supervise urban development according to the guidance principals, policies and guidelines. It would be the subject of further urban design and planning researches, in addition, urban authorities have to consider advertisement and monitoring during the long term city branding process. Urban design elements on city branding described in this paper is the beginning of a comprehensive study, the purpose of which will be to contribute to the realization of the city branding both theoretically and empirically.

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Identifikation von Kriterien für den smarten Einsatz von Elektrobussen in den Netzen des ÖPNV

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1 ABSTRACT

In Deutschland werden in den kommenden Jahren die Busflotten der öffentlichen Personennahverkehrsbetriebe vor allem zur Reduzierung der Umweltbelastungen (Schadstoffe, Lärm) sukzessive elektrifiziert. Ein zentrales Problem, das die breitere Nutzung der Elektromobilität im öffentlichen Personennahverkehr (ÖPNV) stark behindert, ist die Frage der Klimatisierung batterieelektrisch angetriebener Busse. Im Rahmen des Projektes „CO_2-neutrale Klimatisierungstechnologie für Elektrobusse“ werden die unmittelbar praxisbezogenen Grundlagen für eine lokal CO_2-freie Elektrobus-Klimatisierung auf der Basis der Sorptionstechnik geschaffen, ohne dabei die sehr beschränkten Traktionsenergievorräte des Fahrzeugs einsetzen zu müssen. Das Projekt wird durch Mittel der Exzellenzinitiative des Bundes und der Länder gefördert und von vier Instituten der RWTH Aachen University durchgeführt.

Das Institut für Stadtbauwesen und Stadtverkehr als eines der vier Institute, beschäftigt sich dabei mit der Frage der Einsatzpotentiale von Elektrobussen in den Netzen des ÖPNV. Um eine intelligente und nachhaltige Umstellung für Verkehrsbetriebe und Kommunen zu ermöglichen, ist zu überprüfen, welche Linien- und Netzstrukturen sich für den Einsatz von Elektrobussen besonders eignen. Zudem ist zu klären, wie diese optimiert werden können, um einen smarten Einsatz von Elektrobussen zu ermöglichen. Im Rahmen dieser Überlegungen werden Kriterien entwickelt, die dabei helfen zu entscheiden, welche Strukturen sich unter welchen geographischen und weiteren infrastrukturellen Randbedingungen für einen elektrifizierten Betrieb eignen. Die Kriterien zur Bestimmung der Einsatzpotentiale kommen von den vier Partnern des Projektes und werden unter Berücksichtigung technischer Grenzen, betrieblicher und verkehrlicher Rahmenbedingungen und der Gestaltbarkeit der Netze entwickelt. Die Kriterien bilden die Grundlage für einen multikriteriellen Ansatz, der die verschiedenen Möglichkeiten hinsichtlich einer Vereinbarkeit der Kriterien aufzeigt.

Bei der Gestaltung eines ÖPNV-Netzes spielt bei klassischer Antriebstechnik der Busse mit Verbrennungsmotoren vorrangig die Siedlungsstruktur, also die Verteilung und Dichte der bebauten und bewohnten Fläche eines Raumes, sowie die gewünschte Art der Erschließung eine Rolle. Verfügbare Energiemengen und Nachlademöglichkeiten brauchen bislang bei der Strukturierung der Netze nicht berücksichtigt zu werden. Die technischen Restriktionen beim Einsatz von Elektrobussen begrenzen jedoch die realisierbaren Netzstrukturen, wodurch ein Spannungsfeld von Nutzerakzeptanz und technischer Notwendigkeit entsteht. (ITMC et al., 2013)

Die Stadt der Zukunft wird aufgrund der Verknappung der Ressourcen ohne fossile Energieträger auskommen müssen. Die Elektrifizierung der Busse stellt demnach eine nachhaltige Strategie dar, welche darüber hinaus dazu beiträgt, die Umweltbelastungen zu reduzieren und die Lebensqualität der Bevölkerung zu verbessern. Gerade der ÖPNV hat im Hinblick auf die Elektrifizierung große Chancen, da durch den vorgegebenen Linienweg der Energiebedarf ziemlich genau abgeschätzt werden kann. (Soffel, Schwärzel, 2013)

Dieses Paper gibt einen Überblick über die im ersten Schritt des multikriteriellen Ansatzes entwickelten Kriterien aus Sicht des ÖPNV. Die Kriterien sind allgemein gültig und bilden die Grundlage für die Entwicklung des Ansatzes unter der Berücksichtigung weiterer Kriterien wie z. B. aus den Bereichen Material oder elektrische Netze.

2 PLANUNG IM ÖPNV

Der Planungsprozess im ÖPNV orientiert sich an dem Bedarf von Personen. Dazu gehören Aspekte wie die Erschließung, die Mindestversorgung oder auch die Nachfrage von Personen nach dem ÖPNV. Während in Städten vor allem die Nachfrage entscheidend ist, rücken in ländlichen Regionen dagegen Aspekte wie Mindesterreichbarkeiten oder eine Mindestversorgung in den Vordergrung. Um die in der Bedarfsplanung

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ermittelten Anforderungen bedienen zu können, ist das Angebot im ÖPNV entsprechend auszulegen. Die Planung kann dabei in Angebots- und Betriebsplanung unterteilt werden (vgl. Abb. 1).

Die Angebotsplanung umfasst die Netz-, Linien- und Fahrzeitplanung. In der Netzplanung wird zunächst das Streckennetz des ÖPNV bestimmt. Anschließend wird in der Linienplanung der Verlauf der einzelnen Linien festgelegt. Das Ziel bei der Linienplanung ist ein hoher Direktfahreranteil, d.h. ein hoher Anteil Reisender, die im untersuchten System nicht umsteigen müssen. Durch die Fahrzeitplanung werden anschließend die Abfahrtszeiten sowie die Taktfrequenzen festgelegt. Das Ergebnis der Fahrzeitplanung ist der fertige Fahrplan.

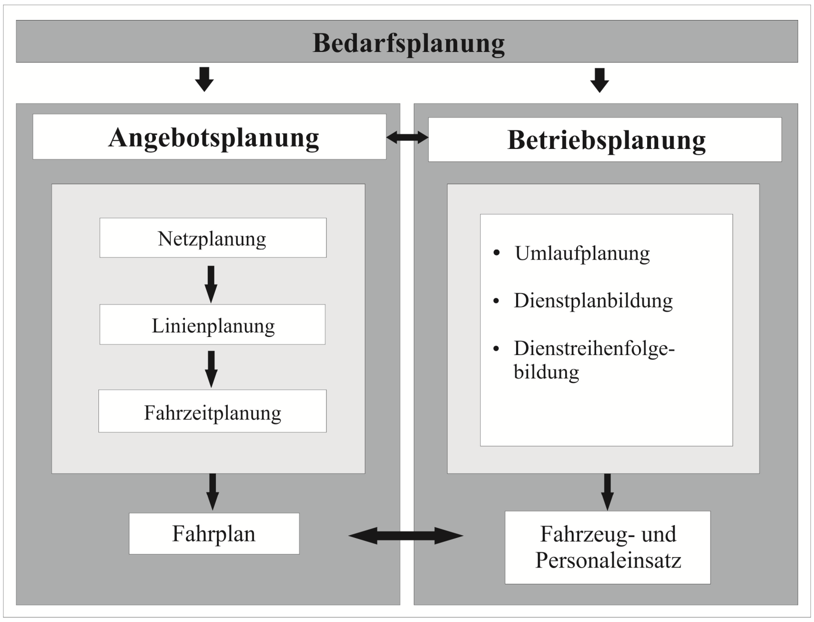

Abb. 1: Planungsprozess im ÖPNV (Quelle: eigene Darstellung ISB)

Der Einsatz von Elektrobussen würde bereits bei der Angebotsplanung zu Wechselwirkungen führen. So müssten bei der Planung z. B. Ladeorte berücksichtigt werden, die zu einer Veränderung des Linienverlaufs führen könnten. Gibt es einen zentralen Ladeort oder sollte ein Laden an jeder Endhaltestelle möglich sein? Und in wieweit hat die Ladezeit einen Einfluss auf den Fahrplan? Könnten sich durch die Ladung oder den Wechsel der Batterie auch die Reisezeiten für die Fahrgäste verändern? Dies sind nur einige Wechselwirkungen die durch den Einsatz von Elektrobussen im ÖPNV entstehen und bereits im Planungsprozess berücksichtigt werden sollten.

Die Betriebsplanung beinhaltet die Umlaufplanung, die Dienstplanbildung sowie die Dienstreihenfolgebildung. In der Umlaufplanung wird der Einsatz der Fahrzeuge festgelegt, wobei eine effiziente Ausführung des Fahrplans angestrebt wird. Es werden räumlich und zeitlich passende Fahrten hintereinander gelegt und zu einem Umlauf verbunden. Durch die Festlegung der Umlaufzeiten ergeben sich am Ende der Route Lücken, welche als Wendezeiten bezeichnet werden. Die Wendezeiten dienen dazu, Verspätungen aufzufangen und gesetzlich vorgeschriebene Pausenzeiten für den Fahrer zu ermöglichen. Am Ende der Umlaufplanung ist der Laufweg für jedes Fahrzeug festgelegt. Dieser beinhaltet dann alle Stillstände, Betriebs- und Nutzfahrten.

Die Dienstplanbildung und die Dienstreihenfolgebildung legen im Anschluss an die Umlaufplanung fest, wie das Personal optimal eingesetzt wird. In der Dienstplanung erfolgt eine Zuordnung von Diensten zu den Mitarbeitern. Eine große Herausforderung bei der Dienstplanung ist die Berücksichtigung von Randbedingungen wie Pausenregelungen, Ruhe- oder Dienstzeiten. Diese ergeben sich aus unterschiedlichen Regelwerken, wie dem Arbeitszeitgesetz, der Fahrpersonalverordnung (FPersV), EU-Verordnungen, Tarifverträgen oder Betriebsvereinbarungen. Diese Planungen werden oft auch vor der Umlaufplanung durchgeführt, da die hohen Personalkosten bei einer wirtschaftlichen Betrachtung in der Regel den maßgebenden Fall darstellen. Die Zuordnung konkreter Fahrzeuge und Fahrer zum Fahr- und Dienstplan, wird als Disposition bezeichnet und erfolgt nach der Planung.

Auch die Betriebsplanung würde durch den Einsatz von Elektrobussen beeinflusst. So kommt z. B. die Frage auf, ob ein Elektrobus auf dem vorgegebenen Linienweg überhaupt in der Lage ist das Fahrgastaufkommen aufzunehmen und somit die Beförderungsnachfrage befriedigen kann. Oder ob vielleicht der Takt verdichtet werden müsste oder ein größeres Fahrzeug gewählt werden sollte?

Die Planung im ÖPNV erfolgt unter Berücksichtigung verschiedener Kriterien, die sich aus den Anforderungen der Nutzer, der Betreiber und der Allgemeinheit an das ÖPNV-Angebot ergeben (Kirchhoff et al., 1999). In Abbildung 2 sind die von der Forschungsgesellschaft für Straßen- und Verkehrswesen (FGSV) erarbeiteten Kriterien dargestellt. Die Kriterien werden in Kriterien mit Raumbezug und Kriterien mit Qualitätsbezug unterteilt. Die raumbezogenen Kriterien beziehen sich auf den Bedienungsraum und dessen Struktur. Bei den qualitätsbezogenen Kriterien steht dagegen die Qualität der Beförderung aus Sicht des Fahrgastes im Vordergrund.

Die Kriterien mit Raumbezug berücksichtigen die Anbindung der Gemeinden an das Liniennetz und unterstützen bei der Erstellung des ÖPNV-Fahrtenangebots. Für die Qualität der Beförderung ist es wichtig, dass der Fahrgast das gewünschte Fahrtziel schnell erreichen kann. Neben der Beförderungsgeschwindigkeit ist aber auch die Beförderungsqualität in den Fahrzeugen wichtig. In diesem Zusammenhang ist der Besetzungsgrad der Busse ein wichtiger Indikator.

Da die Attraktivität des ÖPNV-Angebots und die Kosten dieses Angbots sich gegenseitig beeinflussen, ist es wichtig, einen sinnvollen Kompromiss zu finden.

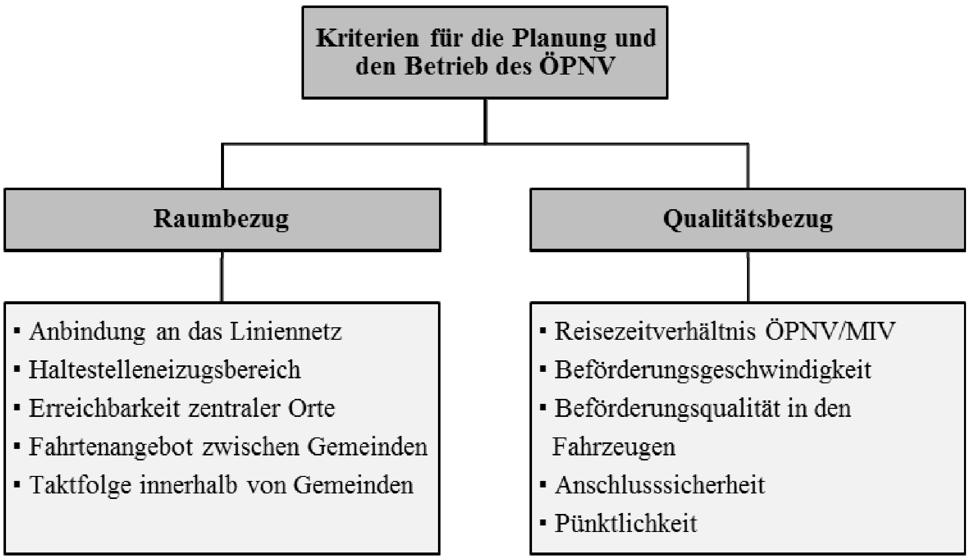

Abb. 2: Kriterien für die Planung und den Betrieb des ÖPNV (Quelle: eigene Darstellung May, in Anlehnung an FGSV 2010)

Durch den Einsatz von Elektrobussen in den Netzen des ÖPNV entsteht ein Wechselspiel zwischen den in Abbildung 2 aufgeführten Kriterien und den Kriterien, die sich durch die wesentlichen Randbedingungen und Anforderungen der Elektrobusse ergeben. Im nächsten Abschnitt werden die Randbedingungen und Anforderungen erläutert, sowie die im Rahmen des Projektes entwickelten Kriterien vorgestellt.

3 ANFORDERUNGEN UND GRENZEN ELEKTRISCH BETRIEBENER BUSSE

Linienbusse im ÖPNV eignen sich besonders gut für eine Elektrifizierung. Sie sind in ihrem Betrieb verhältnismäßig gut planbar, wodurch sie sich entsprechend deutlich wirtschaftlicher nutzen lassen als etwa individuell genutzte Elektro-Pkw. Der Linienverlauf der Busse ist vorgegeben, was die Abschätzung des täglichen Energiebedarfs recht präzise ermöglicht. Darüber hinaus kann der Abschreibungsanteil der derzeit noch teuren Batterien an den Betriebskosten auf ein vertretbares Maß gedrückt werden. (ITMC et al., 2013)

Durch die Elektrifizierung der Busse werden Umweltbelastungen wie der Schadstoffausstoß und Lärmemissionen reduziert. Bei einem verstärkten Einsatz von Elektrobussen ist jedoch aufgrund der technischen Restriktionen und der dadurch auferlegten Begrenzung realisierbarer Netzstrukturen ein Spannungsfeld von technischer Notwendigkeit und Nutzerakzeptanz zu erwarten. Ein Nachladen energetischer Ressourcen, was zurzeit über einen Betriebstag hinweg nicht vermieden werden kann, führt zu einer geringeren Transportgeschwindigkeit. Große Batteriekapazitäten, die eine höhere Reichweite ermöglichen würden, sind dagegen ökonomisch (Kosten, Bauraum, Nettotransportgewicht) nicht vertretbar.

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Der Energieverbrauch der Elektrobusse setzt sich aus dem Traktionsenergieverbrauch und den traktionsfremden Energieverbräuchen zusammen. Der Traktionsenergieverbrauch der Busse ist von verschiedenen Faktoren abhängig. Das Fahrzeug hat bei der Bewegung den Fahrwiderstand zu überwinden, welcher wiederum von der Größe des Busses, der Geschwindigkeit oder z. B. auch der Topographie abhängig ist. Zu den traktionsfremden Energieverbräuchen zählen z. B. der Verbrauch für die Klimatisierung der Busse oder die benötigte Energie für pneumatische Systeme (Türen, Kneeling). (Sinhuber et al., 2012)

Um den Einsatz von Elektrobussen in den Netzen des ÖPNV realsieren zu können, ist auch die städtebauliche Integration der Ladeinfrastruktur erforderlich. Dafür ist zunächst zu klären, ob bei den Fahrzeugen ein Austausch oder ein Laden der Batterie erfolgen soll (vgl. Abb. 3). Für den Austausch der Batterie sind zusätzlich zur vorhandenen Infrastruktur Batteriewechselstationen zu errichten, was z. B. zentral am Depot erfolgen könnte.

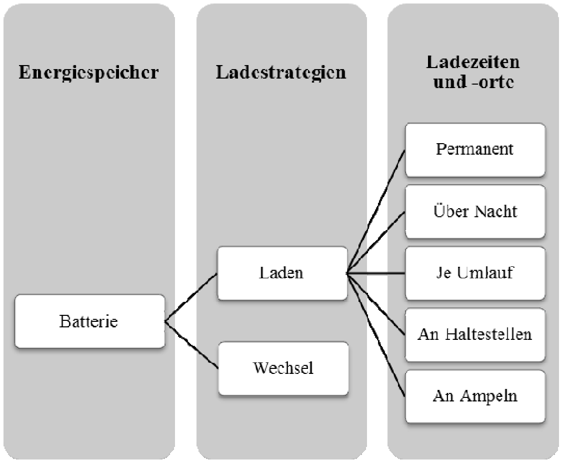

Abb. 3: Mögliche Ladezeiten und -orte (Quelle: eigene Darstellung May)

Für das Laden der Batterie stehen induktive und konduktive Systeme zur Wahl. Beim induktiven Laden wird die Batterie durch eine Spule im Boden der Fahrbahn berührungslos geladen. Dies könnte z. B. an Haltestellen, Ampeln oder auch im Depot erfolgen. Diese Art des Ladens bedarf allerdings einer aufwendigen und teuren Ladeinfrastruktur. Dies hätte jedoch den Vorteil, dass sie sich nahezu unsichtbar in das Stadtbild integrieren würde. Beim konduktiven Laden erfolgt die Energieübertragung an einer Ladestation. Dies könnte über eine Kabelverbindung oder mithilfe von Oberleitungen erfolgen. Das konduktive Laden würde jedoch durch die erforderlichen Ladesäulen optisch in das Stadtbild eingreifen.

Bei der Platzierung der Ladestationen sind zudem einige Randbedingungen zu beachten. Wo kann wie lange geladen werden, ohne dass der ÖPNV an Attraktivität für seine Kunden verliert, zugleich aber auch der Energiebedarf für die gewünschte Reichweite gesichert ist? Informatiker aus Hongkong haben sich mit der optimalen räumlichen Verteilung von Ladestationen für Elektroautos beschäftigt (Lam, Leung, Chu, 2013). Einige dieser Randbedingungen können auch auf den Einsatz von Elektrobussen übertragen werden. So muss ein voll geladener Bus mit der Strommenge in der Lage sein, eine andere Ladestation erreichen zu können. Idealerweise sollte dies ohne ein Abweichen vom Linienweg möglich sein. Der Abstand zwischen den Ladestationen darf daher nicht über der Reichweite des Elektrobusses liegen. Eine weitere Randbedingung ergibt sich aus der begrenzten Kapazität der Ladestation. Die lokale Nachfrage an dieser Station sollte befriedigt werden können, ohne den Linienverkehr einschränken zu müssen. Darüber hinaus sollten insgesamt so viele Ladestationen vorhanden sein, dass der gesamte E-Bus-Betrieb im Stadtgebiet abgedeckt werden kann. Eine optimale Verteilung ist dabei wichtig, da zu viele Ladestationen, die ineffizient genutzt werden, ökonomisch nicht sinnvoll sind.

4 KRITERIEN FÜR DEN EINSATZ VON ELEKTROBUSSEN

Im Rahmen des Forschungsprojektes „CO_2-neutrale Klimatisierungstechnologie für Elektrobusse“ wird ein multikriterieller Ansatz entwickelt der die Widersprüche zwischen nachfragebedingten und elektrooptimalen Netzstrukturen analysiert. Die Herausforderung besteht darin, die unterschiedlichen Anforderungen, die sich durch den Einsatz von Elektrobussen im Netz des ÖPNV ergeben, gegeneinander abzuwägen. Durch den multikriteriellen Ansatz sollen verschiedene Möglichkeiten hinsichtlich einer Vereinbarkeit der unterschiedlichen Kriterien aufzeigt werden.

Bei der Planung des ÖPNV werden bei einem Einsatz von Elektrobussen aufgrund von technischen Grenzen, betrieblicher und verkehrlicher Rahmenbedingungen und der Gestaltbarkeit der Netze, neben den Kriterien aus Abbildung 2, weitere Kriterien zu beachten sein. Die Kriterien werden von den vier Partnern des Projektes interdisziplinär entwickelt und berücksichtigen Randbedingungen und Anforderungen die sich durch den Einsatz von Elektrobussen im Linienbetrieb mit der neuen Klimatisierungstechnologie ergeben. Die multikriterielle Analyse erfordert somit eine Abwägung zwischen betrieblichen, ökologischen, fahrzeugtechnischen und infrastrukturellen Aspekten (vgl. Tab.1).

Betriebsablauf	**Fahrzeugtechnik**	**Ökologie**	**Infrastruktur**
Linienlänge Wendezeit Fahrgastnachfrage	Geschwindigkeit Rekuperations-potential	Lärmbelastung Schadstoff-emissionen	Integration der Ladeinfrastruktur Netzinfrastruktur

Tabelle 1: Kriterien für den Einsatz von Elektrobussen (Quelle: eigene Darstellung May)

Der Einsatz von Elektrobussen im ÖPNV wird zu einer Veränderung in der Angebots- und Betriebsplanung führen. Um den Elektrobus optimal einzubeziehen ist es wichtig, dass der Linientyp und die Netzstruktur den Einsatz ermöglichen ohne dabei die Attraktivität des ÖPNV-Angebots zu beeinflussen. Der Bereich Betriebsablauf beinhaltet daher Kriterien, die aus betrieblicher Sicht den Einsatz von Elektrobussen begünstigen. Bedeutende Unterschiede zum Dieselbus liegen in der begrenzten Reichweite und dem erforderlichen Laden oder Wechseln der Batterie. Für den Betrieb mit Elektrobussen sind solche Linien geeignet, die ein entsprechendes Betriebskonzept durch ihre geographischen und organisatorischen Eigenschaften unterstützen.

Des Weiteren sollen die Vorteile des Elektrobusses bestmöglich genutzt werden, da so Resscourcen eingespart und der Nutzen gesteigert werden können. Die Kriterien aus dem Bereich Fahrzeugtechnik berücksichtigen den zu erwartenden Energieverbrauch der Fahrzeuge. Durch die Kriterien aus dem Bereich Ökologie soll die Umweltentlastung Beachtung finden, die durch den Einsatz der Elektrobusse entsteht. Da ein Elektrobus bei dem momentanen Strommix nur lokal CO_2-frei ist, bietet sich der Einsatz von Elektrobussen auf einer Linie an, bei der die größte Anzahl durch Schadstoffe betroffener Anwohner entlastet werden kann.

Der Bereich Infrastruktur behandelt die Problematik der Ladeorte und Ladestrategien, die sich durch den Einsatz von Elektrobussen ergibt.

4.1 Betriebliche Kriterien

Die betrieblichen Kriterien setzen sich zusammen aus der Linienlänge, der Wendezeit sowie der Fahrgastnachfrage. Die Informationen für diese Kriterien können zum Teil direkt aus dem Fahrplan abgelesen werden.

4.1.1 Linienlänge

Durch die begrenzten Energievorräte eines Elektrobusses ist die Reichweite der Fahrzeuge beschränkt. Die Linienlänge hat einen Einfluss auf die mitzuführende Energiemenge des Elektrobusses, die notwendige Ladeleistung an den Ladestationen sowie die Batteriekapazität im Bus. Bei langen Linien sind die Batterie sowie die Ladeleistung deutlich größer zu dimensionieren als bei kurzen.

4.1.2 Wendezeit

Bei einem optimalen Fahrplan sollte die Wendezeit möglichst gering sein, da in dieser Zeit keine Verkehrsleistung erbracht wird. Dies spiegelt sich auch im Fahrplanwirkungsgrad wieder. Der Fahrplanwirkungsgrad dient in der Betriebsplanung als Qualitätsindikator für den erstellten Fahrplan, indem er den Anteil der Beförderungszeit an der Umlaufzeit ausweist. (Köhler, 2001)

Wenn die Wendezeit jedoch für das Nachladen eines Elektrobusses benötigt werden kann, ist eine aus betrieblichen Gründen schon vorhandene, lange Wendezeit besonders günstig. Für das Nachladen der Busse

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kann jedoch nicht die gesamte Wendezeit genutzt werden. Je nach Ladetechnologie ist ein mehr oder weniger langer Initialisierungsprozess notwendig. Zudem sollte auch weiterhin ein Puffer eingeplant sein, um Verspätungen auffangen zu können. Verlängerte Wendezeiten können auch bei der Personaldisposition genutzt werden. Die Standzeiten der Busse können mit den Pausenzeiten des Fahrpersonals kombiniert werden, sodass weniger Fahrerwechsel nötig sind. Demnach eigenen sich Linien mit einer schon vorhandenen langen Wendezeit besonders gut für den Einsatz eines Elektrobusses.

4.1.3 Fahrgastnachfrage

Wenn der Elektrobus in die bestehenden Strukturen des ÖPNV integriert werden soll, sollte der einzusetzende Bus in der Lage sein, dass Fahrgastaufkommen der bisherigen Linie aufzunehmen. Die Größe des Busses ist demnach so zu wählen, dass genügend Plätze vorhanden sind, um die derzeitige Nachfrage auf dieser Linie befördern zu können. Dabei sollte die Beförderungsqualität in den Fahrzeugen beachtet werden. Der Verband Deutscher Verkehrsunternehmen (VDV) empfiehlt im ÖPNV einen Besetzungsgrad von 65% als Mittelwert über die Spitzenstunde nicht zu überschreiten (VDV, 2001). Der Besetzungsgrad ist der Quotient aus der Zahl der Fahrgäste und der Zahl der Plätze (Sitz- und Stehplätze) je Richtung.

Wenn der bisherige Fahrplan der Linie beibehalten werden soll, ist die Größe und Anzahl der einzusetzenden Elektrobusse dementsprechend auszuwählen. Anderenfalls sollte der Fahrplan der Linie hinsichtlich Takt und Umlaufzeit angepasst werden.

4.2 Fahrzeugtechnische Kriterien

Die fahrzeugtechnischen Kriterien setzen sich zusammen aus der Geschwindigkeit und dem Rekuperationspotential.

4.2.1 Geschwindigkeit

Gerade der ÖPNV eignet sich durch die geringen Durchschnittsgeschwindigkeiten besonders gut für den Einsatz von Elektrobussen, da diese in der Regel für einen geringen Geschwindigkeitsbereich ausgelegt sind. Der Einsatz eines Elektrobusses bietet sich auf den Strecken an, bei denen ein Dieselbus besonders ineffizient ist. Dies ist gerade im langsamen Geschwindigkeitsbereich der Fall. Denn dort arbeitet der Dieselbus im niedrigen Teillastbereich. (VDV, 1999)

Die Fahrplangeschwindigkeit ergibt sich aus der Division der Fahrplankilometer mit der Fahrplanzeit, und kann als erster Anhaltspunkt für die durchschnittliche Geschwindigkeit auf einer Linie dienen. Sollte diese durchschnittliche Geschwindigkeit die Höchstgeschwindigkeit des Elektrobusses übersteigen, ist ein Einsatz des Fahrzeugs auf dieser Linie nicht möglich.

4.2.2 Rekuperationspotential

Elektrobusse können dank eines regenerativen Bremssystems auch Energie zurückgewinnen. Die zurückgewonnene Energie kann in der Batterie gespeichert und erneut verwendet werden. Die Energierückgewinnung wird aktiviert, sobald der Fahrer den Fuß vom Gaspedal nimmt. Linienwege, auf denen viel Energie zurückgewonnen werden kann, bieten sich daher besonders für den Einsatz von Elektrobussen an.

4.3 Ökologische Kriterien

Die ökologischen Kriterien umfassen die Kriterien Lärmbelastung und Schadstoffemissionen. Elektrofahrzeuge gelten als besonders umweltfreundlich. Die von ihnen ausgehenden Belastungen sowohl durch Schadstoffe als auch durch Lärm sind deutlich geringer als die eines Dieselbusses.

4.3.1 Lärmbelastung

Im städtischen Umfeld gilt vor allem der Straßenverkehr als Hauptverursacher des Lärms (UBA, 2011). Während man den Güterverkehr zeitlich und räumlich leiten kann, ist dies im ÖPNV keine Option. Da ein Elektrobus durch den nahezu geräuschlosen Motor deutlich weniger Lärm verursacht als ein Bus mit Verbrennungsmotor, würde der Einsatz von Elektrobussen gerade in dicht besiedelten Bereichen zu einer spürbaren Reduzierung der Lärmbelastung beitragen. Bei höheren Geschwindigkeiten verursacht ein

Elektrobus jedoch ebenso Roll- und Windgeräusche wie ein konventioneller Bus. Daher würde der Unterschied gerade bei geringen Geschwindigkeiten deutlich.

Je dichter der Bereich um den Linienverlauf herum besiedelt ist, umso höher würde der Nutzen durch eine Umstellung auf Elektrobusse ausfallen. Die Elektromobilität könnte auf dieser Linie somit zu einer beträchtlichen Entlastung im Bereich des Lärms führen.

4.3.2 Schadstoffemissionen

Durch den Einsatz von Elektrobussen kann der Schadstoffausstoß im Vergleich zu Dieselbussen reduziert werden. Jedoch lässt er sich derzeit noch nicht vollständig vermeiden. Ein elektrisch betriebener Bus stößt beim Fahrvorgang zwar kein Kohlenstoffdioxid (CO_2) aus, jedoch kann der Strom, der zur Ladung der Fahrzeuge benötigt wird, mit Emissionen behaftet sein. Das Treibhausgas CO_2, welches beim Verbrennen fossiler Entergieträger entsteht, wirkt sich auf das Klima aus und ist mitverantwortlich für den Treibhauseffekt (Dykhoff, Souren, 2007). Die elektrische Energie zum Laden der Batterien muss demnach als Zwischenprodukt gesehen werden, bei dem als Primärenenergieträger vor allem fossile Brennstoffe in Großkraftwerken zum Einsatz kommen. Bei dem derzeitigen Strommix in Deutschland fährt ein Fahrzeug mit Elektroantrieb somit nicht wirklich schadstoffärmer als mit Verbrennungsmotor (Öko-Institut, ISOE, 2011). Damit die Umstellung der Busse auf Elektroantriebe auch zum Klimaschutz beitragen kann und die CO_2-Emissionen dauerhaft gesenkt werden können, müsste der Energiebedarf auf erneuerbare Weise gedeckt werden. Der schnelle Ausbau erneuerbarer Energien ist dafür unumgänglich.

Die Umstellung auf Elektrobusse und die Verlagerung des Emissionsortes aus dem Ballungsraum trägt momentan somit noch nicht zum Klimaschutz bei, sehr wohl aber zum Gesundheitsschutz der Bevölkerung, da neben dem klimaschädlichen CO_2-Ausstoß, ein Teil der Schadstoffe, wie z. B. Stickoxide, Schwefeloxide oder Partikel auch gesundheitsschädigend wirken (FGSV, 1998). Die Schädigung des menschlichen Organismus kann sich z. B. in emissionsbedingten Atemwegserkrankungen, Augenreizungen oder auch Herz-Kreislauf-Störungen äußern. Demnach sind nicht nur die globalen Emissionen von Bedeutung, sondern auch die lokale Verteilung der Schadstoffe. Die Feinstaubbelastung kann durch den Einsatz von Elektrobussen stark reduziert werden, da elektrische Motoren im Betrieb keine Partikel ausstoßen und demnach Feinstaub nur durch den Reifen- und Straßenabrieb entsteht. Dies würde die Kommunen dabei unterstützen die geforderten Grenzwerte einzuhalten.

Da Elektrobusse lokal nahezu emissionsfrei sind, ist der Nutzen eines Elektrobusses folglich besonders groß, wenn der Bus innerhalb von dicht besiedelten Gebieten fährt und somit dort zu einer Reduzierung der Schadstoffbelastungen führt. Durch eine genaue Analyse des genutzten Strommixes könnte zudem eine Aussage über den Beitrag zum Klimaschutz getroffen werden.

4.4 Infrastrukturelle Kriterien

Zu den infrastrukturellen Kriterien zählen die Integration der Ladeinfrastruktur sowie die Netzinfrastruktur. Zum einen muss die Ladeinfrastruktur am Ladeort städtebaulich eingebunden werden können. Zum anderen sollte die Netzinfrastruktur ein Laden an diesem Ort auch ermöglichen.

4.4.1 Integration der Ladeinfrastruktur

Um je nach Ladestrategie ein Nachladen der Busse oder einen Wechsel der Batterie ermöglichen zu können, sollte die Errichtung der benötigten Ladeinfrastruktur an dieser Linie bzw. in der Stadt auch möglich sein. Für den Wechsel der Batterie werden Wechselstationen benötigt, welche eine relativ große Fläche in Anspruch nehmen. Für das Laden der Batterie des Elektrobusses wird eine Ladestation benötigt. Da die ortsfeste Ladestation in räumlicher Nähe zum Bus sein muss, sollte am Ladeort für den Bus ein garantierter Stellpaltz vorhanden sein. Gerade in der Innenstadt behindern Lieferverkehre oder Falschparker häufig die Haltestellen der Busse. Solche Störungen sind im Umland, bei geringerem Parkdruck tendenziell seltener zu erwarten.

Der mögliche Ladeort des Busses sollte demnach eine ausreichende Fläche aufweisen, um eine Lade- bzw. Wechselstation errichten zu können. Bei der Wahl des Ladeortes könnte auch untersucht werden inwieweit eine Nutzung der Ladeinfrastruktur durch andere Nutzergruppen wie z. B. Lieferverkehre möglich wäre.

4.4.2 Netzinfrastruktur

Bei der Auswahl der Ladestrategie und der Errichtung von Lade- oder Wechselstationen ist eine Analyse der bestehenden Netzinfrastruktur erforderlich. Mögliche Ladeorte sollten über eine ausreichend vorhandene Stromnetzinfrastruktur verfügen, um das Laden der Batterie ermöglichen zu können. Sollte die vorhandene Infrastruktur nicht ausreichend sein, ist zu überprüfen, ob der Ausbau möglich ist, und ob er an diesem Ort auch als sinnvoll erachtet wird.

Darüber hinaus sollte auch überprüft werden, wie sich ein Aufladen vieler Elektrobusse in Spitzenlastzeiten auf die Stromnetze auswirkt, und ob größere Beschränkungen auftreten könnten. Durch ein intelligentes Lademanagement könnte dem entgegengewirkt werden. Eine weitere Herausforderung stellt die Kopplung der Elektrobusse an erneuerbare Energien dar. Wenn die Anbindungspotentiale des Ladeortes an das Stromnetz besonders hoch sind, bietet sich der Einsatz eines Elektrobusses auf dieser Linie an.

5 FAZIT UND AUSBLICK

Der Einsatz von Elektrobussen wird im Vergleich zur Dieseltechnologie zu Einschränkungen im Hinblick auf eine deutlich geringere Reichweite, höhere Anschaffungskosten und Mindeststandzeiten bedingt durch die Aufladung oder den Austausch der Batterien führen. Dies wird zu einem Wechselspiel zwischen nachfragebedingten und elektrooptimalen Netzstrukturen führen. Um diese Herausforderungen bestmöglich zu meistern, ist die Entwicklung geeigneter Linien- und Netztypen für den Einsatz von Elektrobussen unbedingt erforderlich. Im Vergleich zum herkömmlichen Antrieb wird beim Einsatz von Elektrobussen ein geringerer Schadstoffausstoß, geringere Lärmemissionen sowie ein geringerer Energieverbrauch erwartet.

Im Rahmen des durch die Mittel der Exzellenzinitiative des Bundes und der Länder geförderten Projektes „CO_2-neutrale Klimatisierungstechnologie für Elektrobusse“ sind Kriterien entwickelt worden, die die Grundlage für einen multikriteriellen Ansatz bilden der die verschiedenen Möglichkeiten hinsichtlich einer Vereinbarkeit der Kriterien aufzeigt. Die entwickelten Kriterien stellen dabei keine Endlösung dar. Es ist ein ergebnisoffener Prozess, der das Wechselspiel der Kriterien aufzeigen und als Hilfestellung dienen soll.

Im Laufe des Projektes werden die Kriterien, aufgrund der neuen Klimatisierungstechnologie, durch weitere Kriterien zu ergänzen sein. So kann bei dem Klimakonzept z. B. eine Nebelwolke entstehen, die städtebaulich berücksichtigt werden muss. Auch ein Wasseranschluss, nahegelegene Abwärmequellen und ein Anschluss an das Fernwärmenetz könnten für das Klimakonzept relevant sein und einen Einfluss auf mögliche Ladeorte nehmen.

Der multikriterielle Ansatz bildet die Grundlage für die Ableitung elektrooptimaler Netz- und Linientypen, die neue Anforderungen berücksichtigen und somit den Einsatz von Elektrobussen begünstigen. Durch den Einsatz von Elektrobussen können lokal emissionsfreie und nachhaltigere Mobilitätskonzepte unterstützt werden. Der effiziente Einsatz von Elektrobussen trägt demnach zum Umweltschutz bei und steigert die Lebensqualität in den Innenstädten, wodurch ein positiver Beitrag zum Themenfeld Verkehr und Mobilität auf dem Weg zu einer Smart City geleistet werden kann.

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Identifying Cultural Ecosystem Services of Urban Green Infrastructure – Report about a Pilot Project undertaken in Lower Austria

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1 ABSTRACT

Access to adequate environmental amenities is fundamental for the sustainability and quality of human life, requiring a better understanding of ecological patterns and processes in the places most people call home. As more people will live in cities than in rural environments, this means that the daily interaction with nature for most people will come from their everyday urban places, including urban green infrastructure. The Lower Austrian "Wohnbauforschung" has funded our pilot project in Laa an der Thaya to investigate ecosystem services of urban green infrastructure. This article focuses on our identification of cultural ecosystem services.

In itself, green infrastructure represents a compendium of ideals, seeking to improve human well-being and living conditions. Included in those ideals are the concepts of ecosystem services, restoration of natural habitats, improving biodiversity, human well-being and adaptation to climate change. One of the most important challenges of the 21st century is to sustain the functions of ecosystems and to support ecosystem services for those issues. Urban green infrastructure is intrinsically a heterogeneous landscape of micro-infrastructure networks set in a culturally-determined ecosystem. Sustaining and co-ordinating the multiple benefits from an urban network of neighbourhood green infrastructure will require an integrated landscape framework, a coherent approach to governance and collaborative adaptive management. Urban green infrastructure is considered more and more as a strong sustainable tool in adressing those challenges1. A paradigm shift at multi-scalar levels requires an urban green infrastructure strategy that integrates some of the fundamental concerns of urban citizens in their everyday lives. These include quiet places for contemplation and restoration of their health and well-being, environmental security, and the cultivation and culture of food. In these everyday gestures can the relationship between people and nature be restored.

The value of ecosystem services in the form of urban green infrastructure has become increasingly recognised in the policy agenda (Carpenter et al., 2009), supported by a growing number of studies on their benefits and costs. But the gap to implementation remains to be bridged over. As the ecosystem services of green infrastructure are still not well recognised in Austrian municipal councils, we initiated a place-based approach to the perception of green infrastructure and climate change in Laa an der Thaya. This pilot project aims on the one hand to enhance the understanding of ecosystem service benefits of green infrastructure and on the other to strengthen the potential for the implementation of green. Urban green infrastructure included all public spaces, urban forests and parks. We considered green infrastructure as a network integrating a broad range of quality green places, designed and managed to enhance the character of place, while providing multiple benefits of ecosystem services. Our investigations at selected places represent a place-based scale where it is possible for humans to perceive and understand effects of climate change, as well as the benefits of urban green infrastructure. Within this approach the perceived cultural ecosystem services of the stakeholders were incorporated with a survey of existing ecosystem services (CO_2 storage, rainwater management and urban heat island effects) to estimate the benefits from green infrastructure. This would lead to the intitial development of modules to implement and enhance the urban green infrastructure in Laa.

To overcome the barriers to implement green infrastructure an integrated approach has been developed together with a core stakeholder group. The "cultural services"2 were investigated in a public participation process, the Moved Planning Process or "MPP" (Rottenbacher 2009), in conjunction with a SWOT analysis to strengthen reflection and appreciation of the natural benefits of urban green infrastructure systems. In a

[1] see European Calls (e.g. FP7-ENV-2013- Urban biodiversity and green infrastructure) and policies (e.g. European Commission, D. G. Environment (2012). Science for Environment Policy. In-depth report on “The Multifunctionality of Green Infrastructure”. http://ec.europa.eu/environment/nature/ecosystems/docs/Green_Infrastructure.pdf

[2] "*Cultural services are primarily regarded as the ‘environmental settings, locations or situations that give rise to changes in the physical or mental states of people, and whose character are fundamentally dependent on living processes’. Over millennia these environmental settings have been co-produced by the constant interactions between humans and nature"* (Church et al., 2011; Haines-Young and Potschin, 2013; in: CICES going local).

dialogue about cultural ecosystem services and the multiple benefits of green infrastructure we defined together "special " areas, i.e. areas that are of a particular value, eg. for recreation, as meeting places, but also available places wherein green infrastructure can be implemented.

2 DEFINITIONS

2.1 Urban Green Infrastructure

Green infrastructure is defined as an interconnected network of green space that conserves natural ecosystem values and functions to provide associated benefits to human populations. "The underlying principle of Green Infrastructure is that the same area of land can frequently offer multiple benefits. By enhancing Green Infrastructure, valuable landscape features can be maintained or created, which are not only valuable for biodiversity but also contribute to the delivery of ecosystem services such as the provision of clean water, productive soil, attractive recreational areas as well as climate change mitigation and adaptation. In addition, Green Infrastructure can sometimes be a cost-effective alternative or be complementary to grey infrastructure and intensive land use change." (31.7.12: http://ec.europa.eu/environment/nature/ecosystems)

Different studies and reports present a variety of definitions of green infrastructure. These definitions differ in their emphasis on the various components, features and characteristics of green infrastructure. Some definitions stress the importance of biodiversity conservation, through the role in connecting ecological networks and contributing to landscape scale conservation. Others focus on the functionality of green infrastructure and stress its importance in providing ecosystem services, comparing its role to man made infrastructure such as engineered drainage systems and flood defences. In other context, the emphasis is on the benefits of green infrastructure to communities in enhancing the built environment and providing a resource for recreation, supporting human health and improving quality of life.

Urban green infrastructure is primarily set within a human ecosystem that is defined by gradients of “nature”, and its 'domesticated' ecosystem functions, services and biodiversity. This matrix represents the relationship between humans and nature whose cultural landscape is a unique signature of ecosystem services. Furthermore, humans privilege certain green infrastructure forms and processes over others, to maximise benefits possibly at the expense of ecosystem functions and intrinsic values. In negotiating a framework to recognise the potential for socio-cultural adaptations, we require a dialogue to explore the relationship between people and their urban nature. This is to reach a more durable stewardship of natural processes that would manage trade-offs among ecosystem services. The green infrastructure paradigm in urban areas requires the restoration of natural processes and functions to a meaningful degree, relative to the location, type and scale of the problem (Convention on Biodiversity, 2000). Urban green infrastructure can neither be a “return to the wild” nor the dissembling objection that nature is simply a cultural artefact. Instead urban green infrastructure should provide a significant restoration of natural processes to a meaningful performance of urban ecosystem services starting with a dialogue about their cultural ecosystem services.

2.2 Ecosystem services

Ecosystem Services ("ESS") derive from ecological processes or functions that are essential for human wellbeing and have a value to individuals or society at large. The terms ecosystem function and ecosystem service have been used interchangeably, creating confusion that still exists. Ecosystem function is defined as the "capacity or capability of the ecosystem to do something that is potentially useful to people" (Costanza et al., 1997). The capacity to deliver a service exists independently of whether anyone wants that service. This capacity becomes a service when benefits can be identified. “Put simply using ecosystem-based approaches means working with nature for human well-being."[3]

[3] In May 2011, the European Commission adopted the Biodiversity Strategy which aims to halt the loss of biodiversity in the EU by 2020. Target 2 of this Strategy states that "by 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15% of degraded ecosystems. To achieve this target three closely related actions are foreseen:

- Improve knowledge of ecosystems and their services in the EU (Action 5)
- Development of a Green infrastructure Strategy (Action 6)
- Ensure no net loss of biodiversity and ecosystem services (Action 7)"

We consider that the sustainable use of ecosystem services, delivered in the form of urban green infrastructure, is a cost-effective solution in mitigating the anthropogenic impacts of urban regions.

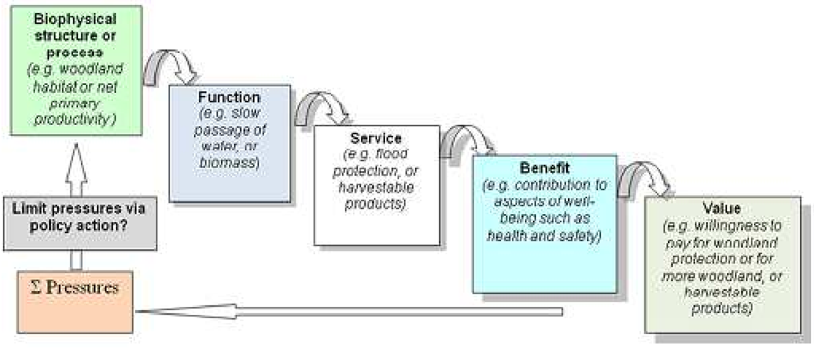

Fig.1 The ecosystem service cascade model, showing the relationship between biophysical structures and processes, functions, services, and benefits as well as values for human well-being (Potschin and Haines-Young, 2011)

2.2.1 Valuing ecosystem services of urban green infrastructure

For an integrated cultural ecosystem services approach it is particularly important to assess local knowledge and place-based values in conjunction with biophysical parameters associated with the range of ecosystem services available. In urban centres, where humans with their cultural diversity are an integral ecosystem component, such services are indispensable to the quality of urban life. However these services have been the most impacted from degradation.

Integrating cultural ecosystem services into decision making and planning processes incorporates different societal concepts of world views, meanings and attachment to place and include values associated with place. The concept of values (natural character values of green infrastructure and character values of place e.g. identification and attachment) describes the process of evaluation by which people and their communities attach importance or significance to a natural process or natural resource within their neighbourhood or locality. Character values of place are defined by place quality parameters (design analysis) and by the attachment to place. The dynamic relationship between the biophysical and cultural worlds play a role in facilitating place making[4] and place meaning.[5] People come to identify with nature and place within an integrated process. Personal knowledge about place derived from experiences is incorporated into the cultural framework dealing with social relationships, circumstances, patterns and other codes of conduct. These structures and social realities are reconstructed, confirmed and extended with everyday experiences with place. Simultaneously the modalities of perception orientate individual feelings, emotions and thinking patterns. The capacities for environmental concern in the context of place making lie in how we perceive, feel, discover and invent place, and how we integrate our concern into to everyday actions.

There have been investigations concerning the role of cultural values, meanings and place attachment (Höppner et.al.2008), how they determine self-efficacy and outcome-efficacy in place-based participation processes. This then can be further developed to an ongoing adaptation of actions necessary to implement and maintain green infrastructure. These feedbacks can reduce policy resistance as it requires us to see how our actions feed back to shape our environment (Sterman 2008). Adaptive management provides a useful and widely applicable approach:

- can be applied at different scales (regional, national and local) and benefits can be realised over short and long term time periods;
- may be more cost-effective than measures based on hard infrastructure and engineering;
- can integrate local traditions and cultural values.

The TEEB synthesis report (2010) identified aspects of cultural ecosystem services (e.g. spiritual values) as non-use values that are not associated with actual use but stem from people’s knowledge that nature exists

[4] The concept of place making describes the process how the values are manifested in ongoing behavior, engagement and maintenance of place.

[5] Meaning of places represents various phenomena of emotional relationships to places (positive and negative). The range reaches from concepts of rootedness, of belonging, protection, appropriation, the sense of possession and control over a place, of comfort, to humans´experiences with nature and wilderness.

(‘existence value’) or because they wish it to exist for future generations (‘bequest value’) or for others in present generations (‘altruist value’). Generally these are important values and are rarely valued in monetary terms.

2.2.2 Frameworks for classifications- from MA to CICES

As there are a diversity of approaches and multiple classifications, comparisons of assessments are difficult. Often used classification systems are the Millenium Assessment (2005) ("MA") and Common International Classification for Ecosystem Services (2012) ("CICES"). According to the complexity of the topic and the different ideals staying behind it seems reasonable to integrate these classification models within holistic planning frameworks and adaptive management.

A need was recognized to design a "common base" of approach that enables comparison between ESS assessments at different places (Haines-Young and Potschin, 2009). This approach should be specific enough to relate to the several context, while remaining relevant to a multitude of objectives for which frameworks and adaptive implementations can be developed (Nahlik et al., 2011).

CICES in comparison to MA refers to the final outputs from ecosystems. Following common usage in the ESS literature, the classification recognises these outputs to be provisioning, regulating and maintenance, and cultural services, but it does not cover "supporting services" used in the MA. As the supporting services are only indirectly consumed or used, they are treated as part of the underlying structures and processes that characterise ecosystems. CICES was initiated by the European Environment Agency (EEA) and is coordinated by the University of Nottingham (Haines-Young and Potschin[6]). One of the advantages of the CICES approach is that it allows adjustment to local conditions.

The latest CICES classification for cultural ecosystem services was applied to focus areas in Laa using a participation and negotiation process, while integrating the benefits of regulating services.

2.2.3 Cultural Ecosystem Services

All cultural service classes in CICES refer to a bio-physical setting that can provide cultural services. Direct benefits we can derive from cultural services are:

- recreation – physical, social, spiritual and mental well-being;
- nature exploration, contemplation;
- living in an attractive and healthy environment;
- nature education;
- motoric and creative development for children;
- ongoing cognitive recreation, reflection and development (not in CICES).

Benefits for wellbeing are mentioned in the last column of CICES. There also benefits like the satisfaction and mental well-being from outdoor work are mentioned.

Our Investigation in Laa focused on regulating and cutural services.

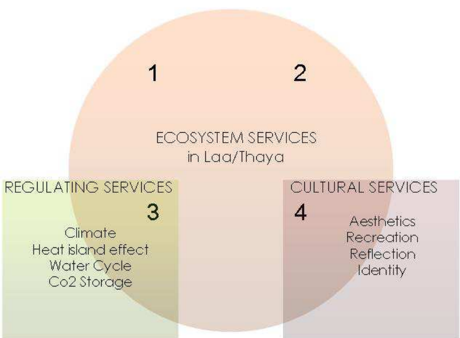

Fig.2 Focus of work /Regulating- and Cultural Ecosystem Services

[6] Haines-Young and Potschin are mainly responsible for adaptations of the CICES classifications.

For surveying cultural services we combined the recent classification of CICES-Be[7] (Turkelboom et al. 2013) with insights from environmental studies about human health and well-being in the context of urban green infrastructure and the Moved Planning Process (MPP). Our goal was to enhance the classification, as well as to develop an implementation and management framework, using the dynamics of the community to express their identification with the cultural ecosystem services. We also assessed degraded or missing services in order to identify opportunities for additional green infrastructure.

The relationships between nature, environmental changes and human health are complex because they often can be perceived and experienced indirectly, displaced in space and time. Human health ultimately depends on ecosystem benefits, which are essential for a productive livelihood. The diversity of interactions between climate change, changing conditions for urban vegetation as well as health and well-being is not yet integrated in planning frameworks. Longer hotter summers can cause an increase of greenhouse gases, health effects due to the heat, an increase in energy costs due to the increased demand for air conditioning and a deterioration of the conditions of urban vegetation.

Well-being in residential environments is based on a continuum of available identification and fields for expressions and activities, each dependent on contact with green places in their seasonal rhythms. Well-being also identifies several components for a good life, such as freedom and choice, health, good social relations and personal safety.

Research results about the relationship human-nature suggest that parks and other natural environments play a crucial role in human health and well-being as humans also have psychological, emotional and spiritual needs (Wilson 1984, Frumkin 2001, Wilson 2001). An interesting overview about research and assessment methods on nature experience, cognitive function and mental health is given by Bratman, Hamilton and Daily (2012), who differenciate which elements of the natural environment may have impacts on cognitive function and mental health and what may be the most effective type, duration, and frequency of contact. Nature contact can happen in various forms:

- Stay in a park can reduce stress, the experience of green spaces support recreation and relaxation, stress reduction and mental health.
- Natural environments also have a restorative function. Ulrich (1984) for example, examined that hospital patients with views of trees and nature in front of their windows experience faster healing;

Chiesura (2003) has shown that natural environments with vegetation and water cause relaxation - using this natural elements for calming in urban areas is increasing - as stress is a growing aspect of daily life in towns.

In addition to aesthetic, cognitive, and health benefits, natural features can also bring social benefits, such as a diverse use of open space, which can increase social integration and interaction among neighbors. For example, national and international initiatives for urban community gardening that provide a cogent means to strengthen integration of immigrant communities.[8]

3 STRATEGY

Collaborative adaptive management provides a strategic approach to realise the potential of sustainable ecosystem services in mitigating the impacts from urban settlements and development.

3.1 Collaborative Adaptive Management CAM

The collaborative adaptive management approach is an implementation framework for urban green infrastructure that facilitates and enhances community participation, collaboration, monitoring, natural character assessments, best practice guidelines, conflict resolution and negotiation with policy impediments. It represents a flexible platform for citizen science and support for communities of practice. Adaptive management is a paradigm that assumes urban green infrastructure policies and actions are not static, but are adjusted based on learning from actions affecting ecosystem functions and services. A collaborative adaptive management approach incorporates and links knowledge and credible science with the experience and values of stakeholders for more effective management decision making.

[7] CICES-Be (Belgium) is a recent development of the CICES framework that provided a more refined categorisation of cultural services that was more amenable to our project in Laa.
[8] see research results on https://communitygarden.org/resources/research/, from 3.3.2014.

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According to Sterman (2008), complexity in a world (i.e. ecosystem) that is dynamic, evolving and

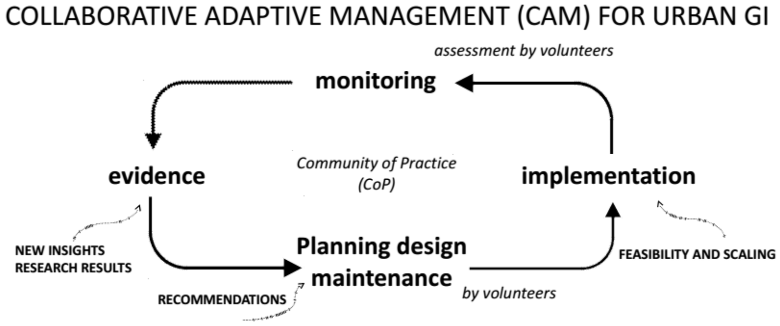

Fig.3 CAM Collaborative Adaptive Management to integrate learning and acting

interconnected reduces our ability to discover the impacts of interventions. This hinders the implementation of policies on the basis of evidence.[9] Even when strong evidence is available, common mental models and judgemental bias lead to erroneous but self-confirming inferences:

overconfidence in our judgments (underestimating uncertainty);

wishful thinking (assessing desired outcomes as more likely than undesired outcomes);

confirmation bias (seeking evidence consistent with our preconceptions).

There is a tendency to think in short, causal chains, assuming each effect has a single cause. Ignoring or not recognising feedbacks in policy design can lead to policy resistance. Given the inherent ecological and social uncertainty in complex urban decision making, adaptive management recognises that it is not always possible, a priori, to identify the "best" management alternative. Therefore, an experimental approach is warranted, and learning about the system becomes a deliberate goal. In the Laa project we try to increase public knowledge by initiating an iterative learning process or 'spiral' through the reflection of cultural ecosystem services. This then will be embedded in a collaborative adaptive management program.

3.2 Communities of Practice

The concept of communities of practice ("CoP") is based on social learning theories and practices to address complex systems and challenging environmental issues. There is a dynamic connection between identity and practice. Developing a practice requires the formation of a community whose members can engage with one another. They deal with shared interests as well as with the group dynamic of shared practice, and the effects of belonging to the group through the way they engage in action with one another and relate to one another. The challenge is to foster CoP development with existing neighbouhood groups in Laa.

In this sense, the formation of a community of practice is also the negotiation of identities:

- Identity as negotiated experience. We define who we are by the ways we experience ourselves through participation.
- Identity as community membership. We define who we are by the familiar and the unfamiliar.
- Identity as a learning trajectory. We define who we are by where we have been and where we are going.
- Identity as a relation between the local and the global. We define who we are by negotiating local ways of belonging to broader constellations and of manifesting broader discourses (Wenger 2010).

We investigated methods of stakeholder and community participation using the Moved Planning Process (MPP) combined with targeted focus group interviews, along with participatory mapping of community and place character values. These initiatives are designed to link local perceptions of place to environmental values, providing an important contribution of local knowledge. Similarly the aim is to raise awareness of the

[9] "Creating a healthy, sustainable future requires a fundamental shift in the way we generate, learn from, and act on evidence about the delayed and distal effects of our technologies, policies, and institutions. Deep change in mental models arises when evidence not only alters our decisions within the context of existing frames, but also feeds back to alter our mental models. An iterative learning process in which we replace a reductionist, narrow, short-run, static view of the world with a holistic, broad, long-term, dynamic view, reinventing our policies and institutions accordingly." (Sterman 2008).

green infrastructure policy, as well as opportunities for implementation and innovation. These investigation methods also provide insights into attachment to place in conjunction with green infrastructure functions, spatial structures and services. The place- and people-based approach is used to directly investigate local knowledge and local perceptions of individuals and groups, collecting and sharing narratives. Based on the concept that places can retain a position of significance for individuals because they are repositories of personalised memories and centres of everyday routines, we assume they are distinguished by the uniqueness of personal place attachments. At the same time, collective sentiments too can accord meaning to place. Social places are similarly textured by layers of everyday meanings and representations of narratives. When personalised and collectivised meanings intersect, place meanings are augmented, by:

- Developing place meanings as a successor of inventive interplays between time and setting, varying with individuals and the conditions in which they find themselves, as well as with groups of individuals.
- Identifying places through their character and personality that distinguish them from other places. People identify with a place, to feel a sense of belonging and attachment to it (Manzo 2005).

Each community develops its practice by sharing and developing the knowledge of the participants. Elements of a practice include its repertoire of tools, methods and stories as well as activities related to learning and innovation (Wenger 2010).

The MPP also supported the dynamics of existing neighbourhood groups. Walking as a group was undertaken at selected sites to help express emotional relationships (attachment to place), to use the dynamic of mutual experiencing of meanings within the group. We walked together through the places and conducted different place/nature experience questionnaires. As imagination and understanding emerge from our embodied experiences, the walk of the group, the bodily movement and interaction integrate recurring patterns of perception and develop new ones (Rottenbacher 2009). The coexistence of shared grasping and deciphering contain already prearrangements about the shared "lebensraum", and can lead to monitoring and maintaining activities.

The results were developed into insights about:

Invisible Parameters of Place Values	Visible Parameters of Place Values
(investigated by questionaires, narratives, MPP) Place identity Sense of place/spiritual places Place attachment of individuals Community attachment	(investigated by questionaires, narratives, MPP) Architectural Analysis of Place Natural Character of Place

Tab.1 Differentiation of visible and invisible parameters of place values

4 INVESTIGATION IN LAA

To reach the public on several levels we started with a press conference and developed a TV video about ecosystem services in Laa, writing as well in the local newspapers and starting to work together with the town renewal initiative. There we built a core stakeholder group consisting of interested parties from the public and employees of the municipality.

The following steps were:

- We investigated cultural ecosystem services together with affected people, integrated perceptions and defined shared values together with the core stakeholder group.
- We related our expert knowledge with the everyday knowledge of the neighborhood groups during the assessments and reviewed it together with the core stakeholder group.
- We developed modules for implementaions according to the different local built qualities and the existing impediments with neighborhood groups.

4.1 Investigation of cultural ecosystem services together with stakeholders

Based on the mentioned SWOT analysis and the resulting values attached to it the interview guide was developed, which was reflected together with the neigboorhood groups in the selected areas. This reflection

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included an inventory of the ecosystem services as well as perceptions of natural processes and functions and how climate change in the cultural city landscape is currently observable. The questions in the interview guide dealt for example with: the accessibility of the amenities, the security, sustainable available services, how often those amenities are used, who else uses them, how are qualities of natural services experienced (also questions about noise, temperature, smell, dust), where are degraded services and about social and cultural qualities. Spiritual places were investigated as personal or shared "Kraftplätze" beside religiously occupied places.

The interview guide was presented to the neighborhood groups, where the individual participants were asked to move around the place for experiencing place and answering the questions. Afterwards, all were invited to walk together to show each other mutually their perceptions and meanings. In a further evaluation process the results and surveys by experts have been merged. Natural character values were attached by the core stakeholder group and external experts according to together predefined criteria and selected indicators.

Selected place	Green Infrastructure and Natural Character	Existence	Health/Well-Being	Security	Social Relations	Meaning Of Place
	Sealed/degraded environment plaster-sealing-pot plants plaster and water-bound areas as well as minimal greenery (grass, annuals) also use of perennials + natives trees along streets parks urban forests	good air good drinking water good food free of noise free of light	physical health mental /spiritual health	differentiation: personal security accessibility amenity sustainability facilities	definition of different qualities for meeting places, retreat places, gardening maintenance, places together	differentiation of: historical meanings, aesthetic valuation naming of places and narratives

Tab.2 Example for classification of place character values

4.2 Merging expert knowledge with local knowledge

The concept that expert knowledge has to be merged with the everyday knowledge of the residents to develop sustainable local solutions, takes into account how people identify with place and nature. To support the CAM and CoP strategy this identification process is crucial for an ongoing stewardship. Personal knowledge of the place is derived from perceptions and experiences and incorporated in the given cultural framework and the social relations and rules. These social realities of the communities can be reconstructed, be confirmed or rejected and expanded. The capacity for expansion, e.g. a paradigm shift to use urban green infrastructure, lie in how we attach meanings to the places that constitute our identities (Manzo 2005).

Main meanings and character values that could be agreed to are:

Many public green areas in Laa bring the countryside into the city and are easily accessible from almost all population groups, such as the green belt along the "Mühlbach"- the "jungle" (also spiritual place), and "Thaya Park", the "Schubert and Schiller Park", the Castle Square, Church Park, the paths through the "Wehr"gardens, and the place at the tower (also spiritual place), these generate identity and character, bring the landscape into the city, provide a good connection for recreation and cause cooling and a pleasant microclimate. The city is trying to close a green belt around new settlement areas and to achieve an attractive corridor throughout those areas which was attached a high value.

As degraded areas mainly the commercial centres, big sealed parking areas, some new dwelling areas were identified as "non" places, with nearly no character and natural character values.

In Laa several initiatives started feeding into the CAM and CoP concept, like planting communities for trees, tree sponsorships, neighborhood groups planting and maintaining street amenity beds, swales and rainwater storing ponds in the commercial area, and initiatives of schools.

4.3 Participatory mapping and identifying places to implement green infrastructure

The identified place character values were related to the map of Laa to support the process of building the CAM as an ongoing implementation framework:

Fig. 4: Place character values

Based on this map we developed place-related proposals for interventions in accordance with the requirements of the various sites.

Fig. 5: Example for proposed implementations according to previously investigated place values

5 CONCLUSION AND OUTLOOK

An integrated cultural ecosystem services approach experiences several challenges in reflecting place-based values together with stakeholders. The process of evaluation by which single individuals and communities attach importance to a cultural service and natural process can create a dynamic impulse for groups to immediately seek to enhance the amenity of places. These measures have to be embedded in a planning framework that considers costs and time for implementation to maintain the community momentum.

A further decision criteria will be the calculation of existing ecosystem services (CO_2 storage, rainwater management and urban heat island effects). A number of factors have been identified so far, which can support or hinder a successful implementation of urban green infrastructure in Laa an der Thaya.

Impeding factors:

- One major barrier is the differing priorities and points of view amongst stakeholders and the resultant competing interests and fears. For example the groundwater level in some areas still changes quite unpredictably, therefore the implementation of rainwater management modules will be difficult. Though there are enough data uncertainties in performance and cost still are strong. Further "trust building" activities are needed.

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- A guideline to select techniques and support the policy goal of the council is missing, this will be developed and negotiated with the council and further experts.
- Fragmented responsibilities and the lack of integrated management will not be resolved yet, as it is only possible to work on the level of the council, one main impediment we experienced was the lack of coordination of the energy and water infrastructure- e.g. often the hole street was used for the infrastructure and no place could be identified for planting trees.
- Lack of funding and effective market incentives- in Laa neighborhood groups started to organise events for collecting money for green infrastructure implementations.
- Practitioners and authorities require a demonstration of successful implementation in their own communities before they are willing to adopt any of the ecosystem service tools available.

Enabling Factors:

- Special meanings, relationships play a strong role in valuing cultural ecosystem services benefits as well as certain groups and individuals overtook a dynamic role in communicating and acting.

At the moment Laa has about 80 volunteers planting and maintaining public places.

6 ACKNOWLEDGEMENT

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reviewed paper

In the Public Eye: Toward the Electronic Transparency of Planning Process

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1 ABSTRACT

The numerous technological possibilities have significantly improved the performances of contemporary planning. The open access to information and continuous upgrading of data bases have certainly raised the level of interaction between planners/professionals and public audience/users, leading to a better understanding of sensitive urban mechanisms, anticipated development options and available spatial resources. The digitization of planning process has also become an important issue in developing countries, especially related to problems of public participation and visibility of information.

Similar problems were detected in Serbia, causing delayed implementation of plans, but also blurring investment possibilities. However, during the last decade a number of planning institutions have been using web platforms to present different planning documents to the public, facilitating communication with different groups of users and providing valuable information about planned transformations.

The paper discusses a relationship between contemporary cities, their digital skeleton and planning trends, focusing on the expected and achieved transparency of planning process. The case of Serbia is emphasized, considering the possibilities of digitization in the field of planning/urban development. The selected examples (Pozarevac, Belgrade and Zrenjanin) will be presented, the main elements of the applied e-networking will be analyzed and the possible obstacles in a process of upgrading will be identified.

2 INTRODUCTION

The city of the 21st century has gradually become an open system shaped by the increasing significance of technology and information. The role of planners is changing and adjusting to new trends, shifting the focus to innovative methods, techniques, strategies and procedures. The upgraded complexity of planning has become a necessity of/for further urban development which should provide better understanding of fast-changing urban processes, efficiently tackle the problems of multiplying urban realities and facilitate preferred inter- and multi-modal nature of urban spaces.

The existing technology, with its various applications and implications, is frequently labeled as an important element of urban culture. Reflecting its power on all levels and scales, technology pervades cities, stimulates interaction between urban space, urban society and innovations, and opens numerous perspectives and possibilities. However, urban socio-technical change could face problems of obduracy/inflexibility, which might reflect in urban development. Hommels (2005) identifies three different conceptions dealing with this problem - concept of frames, embeddedness and persistent traditions.

The concept of frames could be found in urban planning and design and applied to situations in which both users and planning/technology experts are restricted by the rigid ways of thinking and interacting. The concept of embeddedness emphasizes the importance of interlinked social and technical elements, clarifies heterogeneous nature of a city and its networks and considers technological inflexibility of urban systems or their elements. The concept of persistent traditions is focused on structural, cultural and symbolic factors influencing the inflexibility of urban structure and its technological background.

Technology also provdes new tools which might help citizens to find information, connect with others (groups, communities, experts, administrative bodies etc.) and to participate in planning process transcending traditional spatial, social or economic boundaries. Simultaneously, technology increases efficiency but often decreases opportunities for socializing and making contacts. Changing the traditional dynamic and the rhythm of everyday life it also affects space organization and emerging typologies in many ways.

3 CONNECTING THE PLANNING REALMS

The link between cities and advanced technology has generated numerous alterations in our perception of urban surrounding, processes, groups and individuals. Digital and physical worlds have become intertwined, allowing mutual recognition and more-less synchronized functioning of both multiplying communities and challenging identities. The way we communicate also defines urban planning and design. Consequently, the performances of the current technological realm guide our actions in physical space, as well as within numerous analogue and digital networks.

3.1 Public participation

The real effects of public participation in the process of urban planning have often been questioned both by numerous authors and the public. According to Fung (2006), by applying a synchronized participation of citizens and government in the planning process it could be possible to achieve three democratic values - legitimacy, effectiveness, and justice. However, the problems related to the involvement of representatives of all citizens, relevant inputs and ability of citizens to join the process are still present and mostly unsolved. Still, the active public participation, which includes more responsibilities for the planning outcome and implementation, has also been recognized as a precondition of sustainable urban development.

It is important to notice that we can identify several groups of participants in the process of decision making, but they rarely represent all interested parties. In general, these groups are determined by their role in planning process, as well as by their potentials, resources, knowledge and level of influence. Therefore, we can distinguish three main categories - the professionals (in charge for the proposal of the plan), the decision makers (local government and city authorities) and the public (which has to be well informed, highly motivated and trained to act and contribute to the process).

The theory and practice of participation has evolved since 1969 and the famous Arnstein's essay "A Ladder of Citizen Participation". In general, a contemporary political theory has distinguished two modes of decision making - aggregative and deliberative (Cohen, 1989; Gutmann and Thompson, 1996). Simultaneously, the practitioners have developed many methods and techniques in order to recruit participants (e.g. random selection - Fishkin, 1995), to facilitate meetings and to design entire participation processes adjusted to possible (and inevitable) civil disputes, regulatory challenges and law making (Connor, 1988; Creighton, 2005).

The trend of public participation also affected the methodology of planning process. Instead of experts and urban administrators who were traditionally in charge of creating urban plans, the contemporary comprehensive planning includes and supports an extensive involvement of citizens and nongovernmental stakeholders (Brody et al., 2003). Consequently, a number of participatory techniques has been created and used, ranging from interactive workshops and meetings to Internet websites (Creighton, 2005).

In general, there are five basic types of engagement which aim to inform, consult, involve, collaborate and empower participants.

The main objectives of these engagements are:

- providing objective information to stakeholders which could be used for building skills and knowledge of the community;
- obtaining feedback from the community on various analysis, options and decisions which can be used for future policies and plans;
- ensuring understanding and consideration of public concerns and aspirations;
- working with a community in order to cover every aspect of the decision, develop alternatives and identify preferred positions;
- ensuring power (and shared responsibility) of the public in the final decision-making.

Although the direct public participation could be manifested on all levels of governing, it is evident that the highest efficiency could be achieved on local and regional level. The citizens could be involved in the process of various analysis, stimulation, conceptualization, implementation and evaluation of decisions, especially those related to environmental issues, public services (education, public health etc.), economic and social development. However, there is always a noticeable tension between citizens and experts, which is the result of an imbalance of resources and knowledge of these two groups. Therefore, it is necessary to provide a high level of decentralization, local control and direct participation, maintaining the fragile equilibrium.

3.2 Wired, viral or virtual?

Beside traditional modes of participation, the advanced technology has introduced benefits of e-participation which is supposed to provide cyber-democracy and enable creation and functioning of virtual democratic communities. The created inter and intra urban e-networks have also influenced a new perception of public spaces, which provide and support interaction within and across urban communities, but via digital interfaces and tools. These on-line meeting places could be seen as an improvement of the level of democratic participation, but frequently they could be used as another tool of political manipulation or a testing ground for anticipated changes. Although declaratively open and transparent, the digital realm of contemporary cyberspace has its own system(s) of control and boundaries, which often has a boomerang effect both on users and the system's security.

In order to follow recent patterns of 24/7 accessibility we have to be continuously linked and interactive. Consequently, e-networking represents a new supporting system and social glue that saturates all areas of our lives. Producing new and redefining existing urban processes and relationships, electronic web has upgraded urban tissue with superimposed digital realm. Introducing a completely different set of values, opportunities and social constructions, digital infrastructure has directly or indirectly guided latest urban transformations in order to create a perfect (efficient) setting for further increase of electronic interconnections.

Mitchell (2000) described cities of the 21st century as systems of interlinked, interacting, silicon- and software-saturated smart, attentive, and responsive places. And indeed they have become complex interfaces affecting a new logic behind urban restructuring - on spatial, functional and social level. However, it is evident that digital nodes of gathering, interaction and intellectual exchange cannot completely replace physical ones, although they certainly provide easier flow of information and ideas, representing an additional connector between public and professionals (planners, architects, urban designers) and an efficient tool for social and economic integration. However, in order to work properly, all these access points should provide 'both freedom of access and freedom of expression' (Mitchell, 2000). Sometimes, the availability of different options could direct users towards like-minded participants in the process, which might cause creation of homogenized groups and disable favorable discussions and debates originating from different perspectives.

The relationship between technology and community, although frequently emphasized as a necessity which leads to a better accessibility, transparency and democratization, actually represents an insufficiently defined and simplified field of interaction, in which participants usually act as passive consumers of information, instead of being their active producers (Schon et al., 1999). However, in order to reach a higher level of participation, especially in the planning process, it is essential to extend the role of technology, activating its communicative potential, instead of using it as an advanced data base.

4 PRACTICE AND LEARN

Although Serbia ratified the Aarhus convention (1998), which is supposed to grant the public rights regarding access to information, public participation and access to justice concerning environmental issues, some of the most important principles of this convention are not included into the latest Law of building and construction. This law, as well as its predecessors, only guarantees the planning procedure which requires the public presentation of spatial/urban plans, but not the actual participation in the conceptual phase of the plan. After the public display, all comments, questions and remarks are sent to the team in charge of the proposal, which is obliged to react and respond to them. However, even in this limited participation, a number of problems have been detected:

- the structure of public meetings is too rigid and controlled by the authorities which moderate them;
- the presentation of the plan (its language and elements) are not adjusted to non-expert participants;
- meetings are usually organized during working hours, which excludes some of possible participants from the process;
- meetings/public presentations are usually organized in the municipal building, which might not be accessible to all interested parties (due to financial limitations or available time);

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- some meetings could be obstructed by small, but aggressive groups of citizens;
- majority of citizens is not aware of the fact that they could participate in the planning process, or they do not know how to obtain that right.

Evidently, the Serbian model of public participation does not provide training for active participation in the conceptual phase of the plan or decision-making. Instead, the public is only informed about the proposal, allowing the possibility for reaction and comments.

According to Serbian practice and laws, cities and municipalities are obliged to create spatial and master plans for their territories, which are re-evaluated every five years. Master plan of a city, representing a strategic document, should provide guidelines for anticipated land use and public investments. Since the document does not include actions which tackle the level of individual property, citizens are usually not motivated to participate in the planning process which does not maximize their personal benefit (Djukic, Milovanovic, 2003). However, there are some examples which represent a certain improvement, especially in the field of public participation based on electronic accessibility.

4.1 Working together: the city of Pozarevac

During the last decade, Pozarevac adopted several urban plans and the new Master plan 2025, was created by the team of the Faculty of Architecture, University of Belgrade. Methodological framework was based on a planning paradigm which used variables generated by the prevailing condition of general social and economic uncertainty. During the conceptual phase a data base was established, a catalog of existing sites/locations was created, as well as an atlas of their potentials. The structure of the catalog could be directly used for an interactive map, enabling faster access to information related to current and planned land use, identified condition of urban infrastructure and possibilities for further implementation of the plan. This kind of application would certainly facilitate general e-accessibility providing a higher transparency of anticipated transformations.

The concept of the Master plan was supported by an extensive participation of citizens and the outcome of this phase was included in a program for the Master plan (Ralevic, 2006). It is interesting to notice that the Serbian legislative does not formally recognize the importance of public participation in this phase. Instead, it is considered to be an important element of the next phase, suggesting a necessity of public meeting(s) before its official confirmation by the City Assembly.

During the planning process related to the Master plan of Pozarevac, citizens were asked to express their views and ideas related to the identity and value of urban spaces and ambiances. The survey with closed-ended questions was conducted, along with a series of systematically reviewed meeting minutes ('meeting-in-a box'), thematic panels with local experts and brainstorming, which included relevant maps and photos. This methodology engaged lay stakeholders i.e. the unpaid citizens with a deep interest in some public concern, willing to be involved and to represent those with similar interests. Simultaneously, many associations, NGOs, professional associations, but also public officials and representatives, took part in these meetings and discussions. The conclusions resulted from three separate rounds and were structured around three complex topics - (1) land use, urban land rent, heritage and value; (2) green, tourist and sport activities and facilities; (3) traffic and land equipment. The result of this process also emphasized some special concerns about a typology of housing and density, public services in local communities, new parks and green areas, lack of parking lots, connections with antique Roman city Viminacium, as well as a problem of neighboring rural areas.

Since February 2012, the city of Pozarevac is using a specific e-service, as a possible channel of communication between city government and citizens. During the last two years the service detected 56 questions addressing the city authorities. About one third of them is related to communal issues, but some of the questions might be solved by revising the existing documents and implementing new measures. It is also interesting to notice that some questions overlap with conclusions generated from meetings which followed the process of master planning - from those underlining the traffic problems (available parking space, quality of street pavement, signalization), inadequate infrastructure, street furniture, accessibility for all groups of users, to legal issues and environmental conditions.

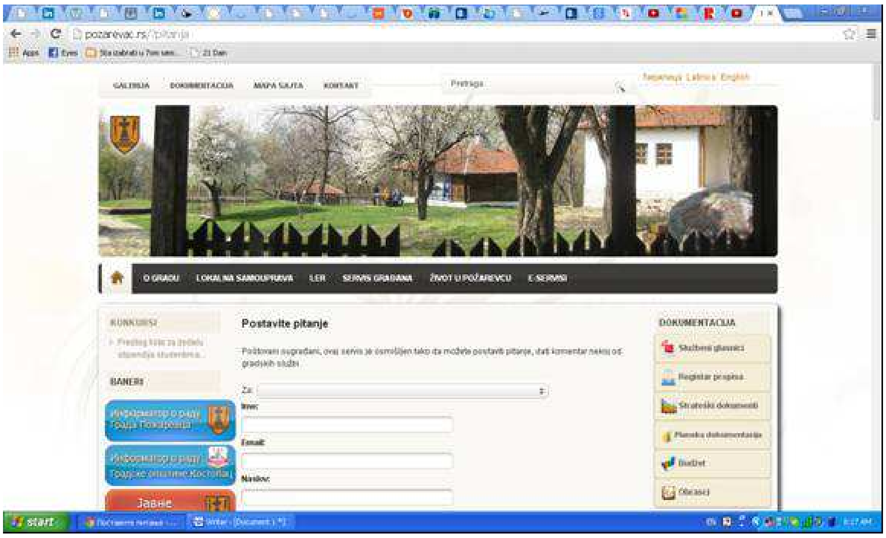

Fig.1: City of Pozarevac - official web-presentation: section for questions, as a channel for communication between local government and citizens.

4.2 Improving accessibility: the city of Belgrade

During the preparation of the Master plan of Belgrade in 2003, public participation was also included into the first phase of the process. The conceptual phase used the method of 'random participation', targeting all interested parties. Several hundreds of Belgrade citizens communicated with a special team in charge for the preparation of Master plan, using various media - from phone calls, to emails. After the completion of the second phase (and before the official approval of the plan), citizens also participated in the public meeting which gave them a detail insight into the document. Although majority of citizens were mostly interested in small-scale interventions i.e. a level of their own lot or building, approximately one-fifth of the present citizens was interested in the problems of public good, giving a number of useful ideas and suggestions related to crucial urban issues - green network, urban infrastructure, main bridges, articulation of river banks, protection of certain areas and buildings, quality of the environment.

Fig. 2: Town Planning Institute of Belgrade, web-site: frequently asked questions related to different aspects/problems of urban development (e.g. planned activities and capacities, procedures, public presentations of plans etc.)

Following this practice, the Town Planning Institute, as the leading planning institution of Belgrade, has posted all planning document related to the development of Belgrade and enabled an interactive approach to the documents produced during the last six years. The Institute has also opened a special e-service oriented towards citizens, intensifying the communication between the users of urban space and experts of the Institute. The majority of questions has been related to the process of implementation of approved plans, as well as to other areas of spatial development and transformation, on all levels and scales.

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4.3 Increasing efficiency: the city of Zrenjanin

The city of Zrenjanin has also established a mode of e-government. The web-site of the city administration includes a section related to planning documents containing all levels if plans - from the Regional and Master plan, to the plans of general and detail regulation of urban zones. The documents (textual files and drawings) could be downloaded from the site by all interested parties. The site also incorporates two interesting services - 'The office of quick responses' and 'System 48'. The first one provides information about urban sites/locations, including the data about potentials and limitations of a particular building lot, defined by the planning documents. The 'System 48' is used for communal problems, which could be reported by phone, text messages or Internet. It interlinks services of all public institutions founded by the city of Zrenjanin, enabling efficient response to identified urban problems and demands of citizens, as well as facilitating their solution. The system is active non-stop and within 48 hours all users receive a status report about the activities related to the problem.

Fig. 3: City of Zrenjanin, web-presentation: 'System 48' - a user-friendly service of e-government, which enables interaction between citizens and all institution founded by the city.

The web-site of the city administration has another user-friendly option, which enables citizens to check the status of their documents (to be issued or applied for). However, this e-platform does not provide information about the content of user's requirements, remarks and comments (in contrast to the platform in Pozarevac), or the insight into frequently asked questions (which is possible in the case of Belgrade).

5 CONCLUSION

The contemporary technology enables improvement of traditional methods of public participation during the planning process. However, its success still depends on numerous elements which should increase the motivation of citizens to participate in planning activities, provide necessary information about detected problems and actions which might have spatial consequences and train citizens to formulate and express their opinions and suggestions in all phases of the process.

The best results could be achieved when participation represents an inseparable part of all phases of the process - from conceptualization, decision-making to implementation. The electronic transparency of planning is preferred because it increases the accessibility of information, provides different possibilities for training and education of the public, and ensures continuous and interactive participation. However, in spite of numerous advantages, it cannot be used as a substitute for other, more traditional techniques, but just as a complementary tool which might increase efficiency of interaction.

Although Serbia still has to increase the significance and influence of public participating, as well as its electronic support, it is noticeable that some positive changes have occurred since 2000. However, they are mostly related to the final part of the planning process or post-planning activities, when electronic transparency represents an option for gathering information and communicating with urban services and institutions. Therefore, it is necessary to further develop integrative potential of e-platforms for participation, provide a stronger political support, increase scope and intensity of use, as well as a level of inclusion. The organization and structure of services also influence the overall results and efficiency, but they mostly depend on implemented tools, financial support and continuity of application.

6 ACKNOWLEDGEMENT

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reviewed paper

Influence of Transport on Urban and Rural Development in Bosnia and Herzegovina

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1 ABSTRACT

In this paper a possible influence of transport on urban and rural development in Bosnia and Herzegovina is being discussed. In Bosnia and Herzegovina, like in other former socialist countries of Europe, urban and rural development had a different importance in the past fifty years. Influence of transport on the future orientation of transport network and traffic courses in Bosnia and Herzegovina and on its geographic-traffic position is being evaluated. Overall economic development of Bosnia and Herzegovina in the past ten years has been marked by several important events, which reflected intensely in its transport as well as regional development. Inheritance that the country of Bosnia and Herzegovina bears from the former country will be a stumbling block for many years in its future rural and traffic development. This is the most evident in the area of orientation of transport network and business relations, as well as in instruments by which economic position of transport is regulated.

Construction of new and extension and reconstruction of the existing roads in Bosnia and Herzegovina is an assumption that rural development of economy and population will be strongly affected by transport. It is also important to emphasize that the future economic growth of industrial production and the population growth, as well as development of demand for transport services will have a permanent growth by means of the future more developed transport. A bigger use of Bosnian transit routes by other countries will also have an influence on rural development considering the fact that international transport has been growing more rapidly in the world than local transport in the past decade. Transport system has a big importance in economic and social development of Bosnia and Herzegovina. First of all, it enables availability of all areas thus affecting the rural development.

2 INTRODUCTION

In this paper, a possible classification of roads and influence of transport on urban and rural development in Bosnia and Herzegovina is discussed. Influence of transport on the future orientation of road network and traffic flows in Bosnia and Herzegovina and on its geographic-traffic position is evaluated. Construction of new, expansion and reconstruction of existing roads in urban and rural settlements of Bosnia and Herzegovina are also discussed. Transport will contribute to a faster regional development of economic activities and population in rural settlements. It is also important to emphasize that the future economic growth of domestic industrial production and population growth, as well as development of demand for transport services, will have a permanent growth with the future development of road network. Influence on development of road network will have also an increased use of Bosnian major highways from other countries, considering the fact that international transport has been growing faster in the world in the past decade than domestic one. On such concept of transport network, a new economic development in urban and rural settlements of Bosnia and Herzegovina should be based (Malić, (1998: 89-96).

This is most evident in the field of directiveness of transport network and business relations, as well as in instruments by which the economic position of transport was regulated. Road transport has had an increasingly important role lately in the system of communications between urban and rural settlements in Bosnia and Herzegovina, which gives a new image of regional development in the space. With inclusion into development flows of the European Union, a possibility for a faster economic development is being opened, particularly through valorization of some comparative advantages of Bosnia and Herzegovina. For example, we are highlithing the possibilities of modern economic development in urban and rural settlements that are offered by traffic-geographic position of Bosnia and Herzegovina,.(Nurković, R.2007: 7-19).

3 TRAFFIC NETWORK IN BOSNIA AND HERZEGOVINA

Generally observed, and within the limits of the European Union, traffic network in Bosnia and Herzegovina is underdeveloped. In 2010, lines of communication constructed from 1945 to 1991 were mainly used.

Network of regional and local roads have been increasing from year to year, however, the quality of asphalt layer and the increased motorisation affected its fast ruination. Total length of traffic arteries was 21.846 km, of which 11.425 km were highways, and 10.421 km were the other roads (Fig. 1). Railway lines were insufficient as well. Total length of railways in Bosnia and Herzegovina at the end of 2010 was 1.000 km. (www.bosnaihercegovina.biz).

In the same period, construction of the A1 Motorway, which is part of the Pan-European Corridor Vc was planned. The motorway will be built by extending the M5 motorway, up to the M17 motorway, wherefrom the motorway will go in a different direction. The A1 Motorway will pass through the following settlements (north-south direction): border of Bosnia and Herzegovina with Republic of Croatia, Donji Svilaj-Modriča-Doboj-Zenica-Kakanj-Visoko-Jošanica-Sarajevo-Jablanica-Mostar-Border with Croatia , Gabela. The A2 motorway is also planned and is going to pass through the following places (southeast-nortwest direction): border with Serbia, Hum-Foča-Goražde-Sarajevo- Zenica-Travnik-Jajce-Ključ-Bosanski Petrovac-Bihać-Border of Bosnia and Herzegovina with Croatia, Izačić. Parralel to the mentioned corridor, construction of the Vc Railway corridor has also been planned, which will with a larger section follow the motorway direction on the corridor. It will be an important connection with Hungary (rest of Europe), Croatia and Bosnia and Herzegovina. It will connect Bosnia and Herzegovina with Croatia at port of Ploce, which is very important, not only for Bosnia and Herzegovina, but also for Croatia.

Fig. 1: Traffic network in Bosnia and Herzegovina. Autors: Drešković, N., Nurković, R. (2014.)

Road transportation of Bosnia and Herzegovina is differentiated as it is in other neighbouring countries. There are differences between the branches recovering faster from the war damages and those that still do not serve their purpose. Despite the difficulties and a poor, inherited structure, road transportation has largely started to expand, while the railway transport is still without the expansion and is carried out with a few capacities. In the period from 1992 to 1995, road and railway network were destroyed around 35%, and the bridges around 40%. By time, most of the road and railway transport on main lines has been renewed. According to 2003 data, there were about 22.400 km of roads of which 75 km were motorways. Main roads are Bosanski Šamac-Doboj-Sarajevo–Mostar- Metković; Gradiška-Banja Luka–Jajce–Bugojno-Jablanica and Donji Vakuf-Jajce-Travnik-Sarajevo. Regarding the railway transport Bosnia and Herzegovina has 1.031 km of railway lines, of which 795 km are electrified. By mid 2003, Bosnia and Herzegovina was the only country of Souteast Europe that did not have a single kilometer of modern motorway, and by 2007, about 45 kilometers of motorway were built. Today, lines of communication in Bosnia and Herzegovina, including the capital Sarajevo, are among the worse roads in Europe. They are obsolete, poorly maintained and dilapidated, as the experts of the European Union, who thoroughly analysed them in 2005, claim. (Table 1 and Chart 1).

Category	L (km)	L(%)
Major asphalt	3149, 88	25,87
Regional	820,65	6,74
Local asphalt	3676,94	30,20
Major macadam	237,30	1,95
Local macadam	4288,79	35,23
Total	12173,56	35,23

Table 1: Length of road communications in Bosnia and Herzegovina. Source: The Agency for Statistcs of Bosnia and Herzegovina, 2014

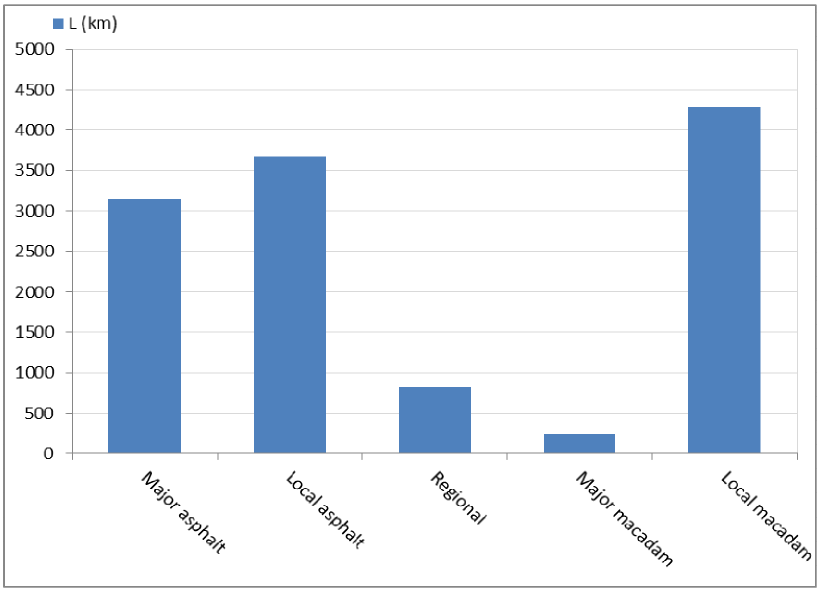

Chart 1: Length of road communications in Bosnia and Herzegovina.

While analyzing the length of road communications by regions in Bosnia and Herzegovina, a disproportion is noticeable, which additionaly highligths the differences in economic development as well. The region of Tuzla has the densest road network (about 40 km/100 km2) while the poorest region regarding road communications is the region of Banja Luka with about 25 km/100 km2. Regarding the length of road communications the region of Sarajevo takes the first place and is followed by Mostar, Banja Luka, Tuzla, etc. Since 1992, economic strukture has undergone significant changes in city of Sarajevo. The fundamental characteristic of these changes is a reduction in volume of production or a complete closing down the large economic systems. Industrial lines are mostly neglected and are insuffiently used. In addition, they stll represent a strong traffic infrastructure that may be used for other purposes, as requirred by contemporary economic development, such as establishment and construction of industrial and duty-free zones, freight terminals and large shopping centres. In the following period, railway transport will have a big importance in development of intermodal intersection of Sarajevo, and also in development of traffic in the area of Canton of Sarajevo, respectively of metropolitan area of the city. In 2010, the highest speed of passenger trains in Bosnia and Hercegovina was 70 km/h, while for freight trains it was 60 km/h.

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4 TRAFFIC CONNECTIONS IN URBAN AND RURAL SETTLEMENTS OF BOSNIA AND HERZEGOVINA

Traffic connections caused a radial expansion of socio-economic transformation process of urban settlements affected by travelling possibilities (Šimunović, I. (2007: 112-126). Migrations to suburban settlements may go from rural settlements of the surroundings or other areas, but also from the home city. When urban population share is analysed in total number of population of Bosnia and Herzegovina, it is concluded that it is a poorly urbanised country. It belongs to a group of the European countries with the lowest share of urban population, which does not exceed 50% of total national population. At the end of the 20th century, Bosnia and Herzegovina was in industrial phase of development, at which active population share in secondary activities was dominant and still increasing, but the active population share in other activities was also high. So, the share of active population in primary activities, of more than 30%, is still high. In this direction, a dominance of the number and the share of rural population over the urban population should be observed. For rural development in Bosnia and Herzegovina, traffic has a big importance. Considering its poorer arrangement in rural areas, the transport of goods and services is carried out with difficulties in most of rural areas. The improved traffic network brings closer rural settlements to a main source of politics, economy and society in Bosnia and Herzegovina (Dammers, E. i Keiner, M. 2006:12-13).

One of the main factors that affect urban sprawl of urban settlements in Bosnia and Herzegovina is the traffic. Sarajevo is a centre of road traffic in Bosnia and Herzegovina. Seven main roads connect the city with other parts of the country: M-5 motorway in the north, in direction of Travnik, Banja Luka and Bihać, M-17 toward Zenica and Doboj and M-18 toward Tuzla, M-5 in the east toward Višegrad and Goražde, M-19 toward Zvornik. M-18 goes southward through Foča to Dubrovnik, and M-17 westward to Mostar. The planned European motorway, Corridor Vc, will pass near Sarajevo connecting it to Budapest in the north, and Ploče in the south. So, the model consists of the central place, regional gathering places, main lines of communication connecting the gathering places and the main centre, as well as the lines of communication connecting the places of living and gathering places. (Nurković, R. 2007: 24)

Thus, town municipalities with population density of over 90 km/100 km2 distinguish themselves, unlike the peripheral municipalities. Density of categorised network of the Sarajevo Canton is 68.4 km/100 km2 that is substantially higher compared to the average of Bosnia and Herzegovina, which is 40.8 km/100 km2. Density of road network of the Canton of Sarajevo is higher than the density in the Tuzla Canton, which is 52.7 km/km2, the Central Bosnia Canton with 42,3 km/km2 and the Una-Sana Canton with 28.9 km/km2. Road network length in the Sarajevo Canton is also bigger than all road networks of other regions in Bosnia and Herzegovina. In 2005, total length of all roads was 2.941.77 km. The peripheral municipality of Ilijaš has the longest road network of 568.22 km inside the region, while the central municipalities of Stari Grad and Novo Sarajevo are left behind. (Nurković, R. 2007:24) (Table 2 and Fig. 2)

Community	**Major asphalt**	**Regional**	**Local asphalt / Canton**	**Lokal community**	**Major asphalt**	**Total**
Centar	7,34	0	44,71	26,7	88,7	167,45
Hadžići	25,99	18,68	33,64	58,44	388,94	525,69
Ilidža	14,59	15,62	43,59	62,45	297,01	433,26
Ilijaš	33,77	12,07	18,36	44,34	459,68	568,22
Novi Grad	12,26	0	54,88	26,03	200,75	293,92
Novo Sarajevo	8,73	0,64	29,71	13,48	54,5	107,06
Stari Grad	4,53	7,88	32,23	10,48	147,48	202,60
Trnovo	5,81	25,79	52,26	59,08	281,31	424,25
Vogošća	23,88	2,42	7,01	35,52	150,49	219,32
Total	136,9	83,10	316,39	336,52	2.068,86	2.941,77

Table 2: Length of road communications in Kanton Sarajevo in km, 2007. Source: Study of traffic Canton Sarajevo, Sarajevo, 2007.

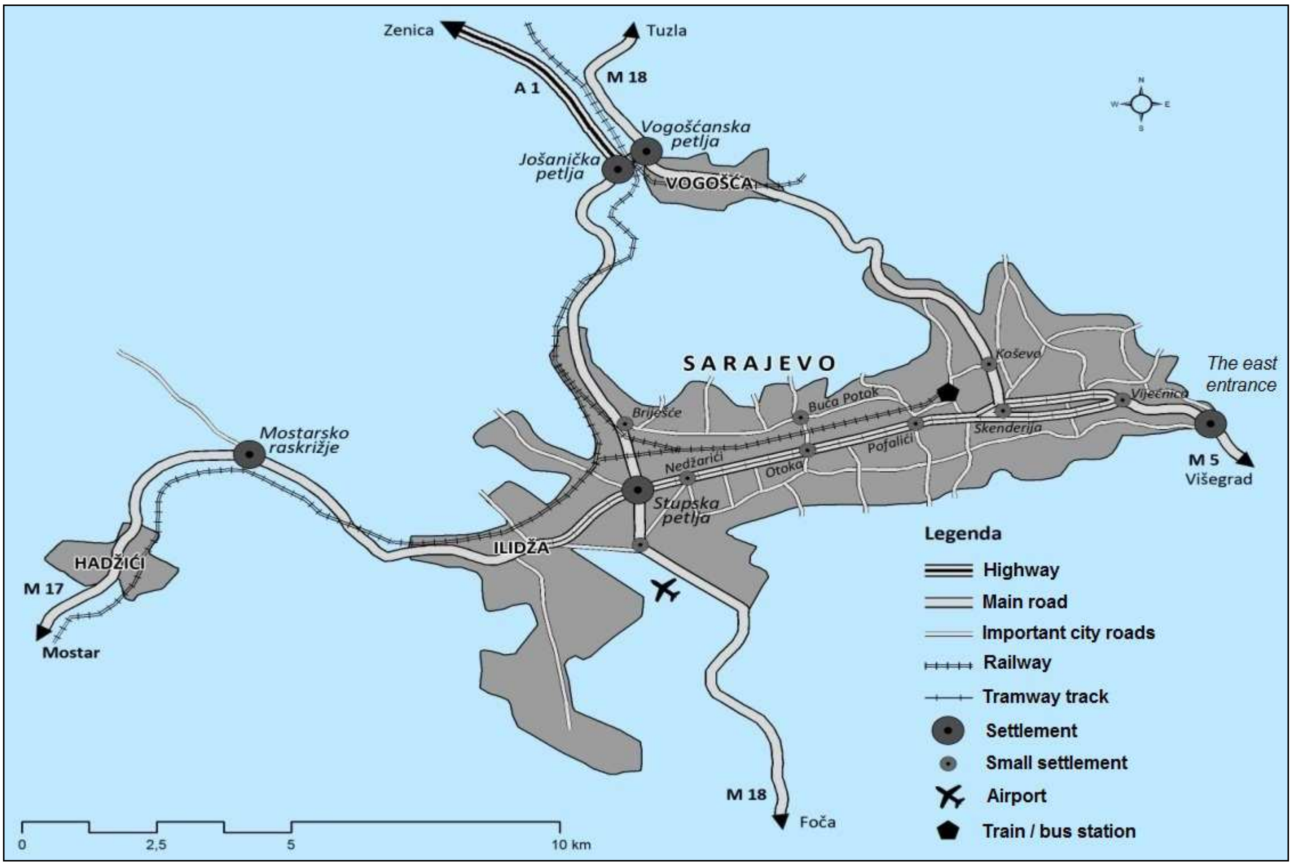

Fig 2: Traffic network in city Sarajeva, 2010. Source: Nurković, R. And Dešković, N. (2010). Study of traffic Canton Sarajevo, Sarajevo,2007.

Rural areas of Bosnia and Herzegovina, which are difficult to access, are facing serious problems in relation to a poor socio-economic sustainability and population density. With regard to several important trends in agriculture and rural areas in Europe, along with some relevant challenges and prospects for future, it is a common phenomenon that the role of agriculture in rural areas is drastically falling. Certain rural areas in Bosnia and Herzegovina have very bad traffic accessibility and are subject to decrease in numbers of the older population and rural population, in general (Bryceson & Howe, 1992:14).

Development of traffic system enables an increased mobility of rural population, not only inside the rural area, but also in direction of urban area. Process of daily migrations in Bosnia and Herzegovina from rural areas toward work places in urban environments, requires good road connections and a developed network of bus lines of suburban transport. With analyzing the role of transport in rural development of Bosnia and Herzegovina, it is clear that except for the passenger traffic, with a permanent increase in physical volume of production, cargo traffic has also increased in Bosnia and Herzegovina. The intensive increase in number of jobs in industry affected the decrease in total number of rural population and the increase in number of employed people in traffic, threreby affecting the increase of share in total GDP of Bosnia and Herzegovina. (The Agency for Statistcs of Bosnia and Herzegovina, 2013).

At the end of the 20th and at the beginning of the 21 century, traffic development in Bosnia and Herzegovina has increasingly enabled, not only functioning of basic activities, but also the development of rural tourism, respectively using free time of urban inhabitants. For planners, the urbanization result, i.e.the fact that the biggest growth had the settlements of size between 2.000 to 10.000 inhabitants, and that the biggest demographic growth realised the settlements in the group between 50.000 and 100.000 inhabitants, were particularly significant. On the Map 2, spatial arrangement of settlements having more than 2.000 inhabitants, respectively 10.000 inhabitants, with a new road infrastructure and directions of concentration of population and activities, are seen. A very rapid urbnisation development in Bosnia and Herzegovina in a relativelly short period, in relation to the European standars, caused that urbanisation has demographic features, respectively quantitative characteristics, to a great extent. Certain sociological researches indicate that in such rapid quantitative changes of city sizes, one should seek also a considerable inflexibility of immigrated population to urban conditions, intolerance and aggressivity (Sabandar, 2007: 201-209).

If Bosnia and Herzegovina is observed as a whole, it can be noticed that a network of urban centers is made of, except Sarajevo as the state centre, regional centres among which according to development of functions of cities, tradition, urbanity and size of gravitation-functional area are distinguished: Mostar, Banja Luka, Tuzla, Zenica, Doboj and Bihać. In addition to these centres, there is around ten subregional centres, which are within the framework of functional-gravitation areas the bearers of development of single functions of higher rank. Urban areas of Bosnia and Herzegovina will be integrated into the urban network of Europe (Euro-regions) through regional cooperation, by forming the network of urban centres and with development of multimodal transport corridors (Nurković and Drešković, N., 2013).

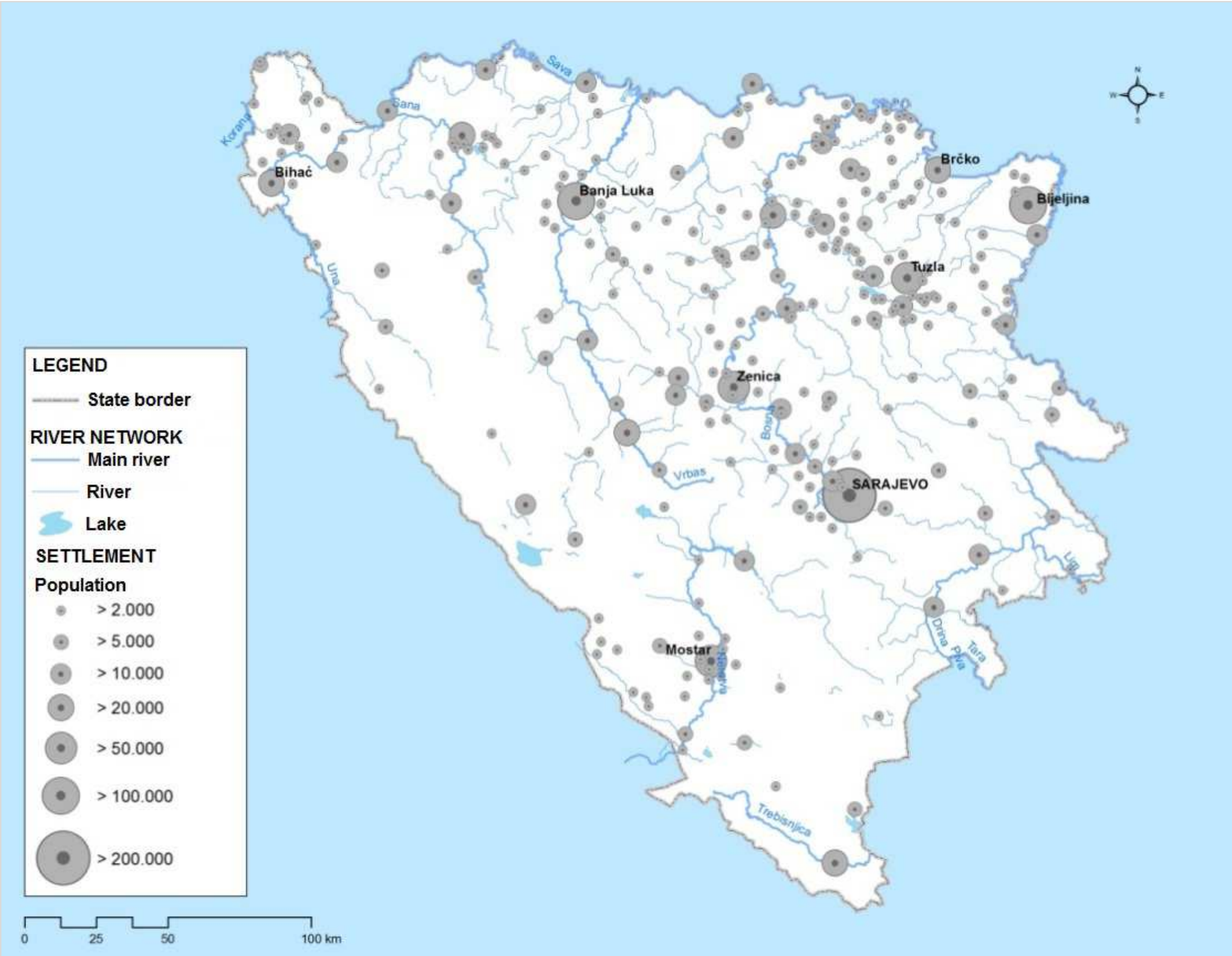

Fig. 3: Spatial arrangement of settlements in Bosnia and Herzegovina bigger than 2.000 inhabitants, 1991-2010. Authors: Drešković, N., Nurković, R. (2014.)

5 CONCLUSION

Bosnia and Herzegovina on its way of transition and inclusion into the European and world's integrations, among other must rehabilitate its road network as soon as possible, not only inside the larger urban settlements but also between the rural settlements and the neighbouring countries. Unfortunatelly, unfavourable political circumstances and a complete division of the area of Bosnia and Herzegovina considerably deteriorates the processes that are in progress, and by which the efforts are made toward a fast inclusion of the state into contemporary European and world' s economic flows. The obsolete and war-damaged traffic network does not give enough hope that a new regional development of Bosnia and Herzegovina will soon get nearer, not only to surrounding countries, but also to member countries of the European Union. The huge domestic administrative apparatus and insufficient entry of foreign capital into Bosnia and Herzegovina is an additional problem that needs to be solved as soon as possible as the European Unions expands faster than expected. Old road and other communications leading through Bosnia and Herzegovina will be avoided by both those coming from the East and the West. Our neighbours will certainly know how to use it, and the European Union is going to be our first neighbour, but with the door closed, until the state improves in accordance with the European principles, and economic and other standards.

Changes in transport are mainly imposed, so they are rather exogenous than endogenous, taking into consideration the role of two modern countries during their development. Regional transport system has been introduced without consideration of its potential synergy with local transport system. Rural population enjoys bigger economic possibilities, but the life gets more complex. There is no clear answer to a question 'to which level the improvements in transport contribute to rural economy'. The fact that the improvements in transport can even increase the differences in information, transaction costs and market imperfections due to disfunctional institutions, leads to a conclusion that the improvements in transport, although being able of promoting economic growth, can also increase rural differences and conflicts.

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Information-Analytical System for Managing Cities of Perm Region Spatial Development

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1 ABSTRACT

To date, the practice of urban planning and design in Russia is based on the principles of the Soviet planned economy, while the current economic conditions require new approaches.

Perm National Research Polytechnic University together with JSC «PROGNOZ», with the financial support of the Perm Region Government during the year of 2013 is developing an integrated spatial development IT-model, which allows the bringing together of socio-economic statistics, real estate state cadastre data, mathematical, statistical and adaptive methods library integrated with GIS under one platform.

The main purpose of the system is the improvement of validity of decisions taken in different urban planning types, design improvements of Land Use and Development Regulations and prioritization of the municipal budget allocation.

Decision support system is based on the Prognoz Platform (PP) - a next-generation BI platform for building high-tech business applications on a turnkey basis. PP allows to visualize and analyze operational data model and forecast processes. It has its own data warehouse designer which helps to build full-featured industrial BI systems based on the Prognoz Platform. PP Integration with the state information system for urban planning allows consideration of established local and federal law requirements for the quality of the urban environment, the prevailing land use and capabilities of municipal budgets.

Model is to be used for the following tasks:

- Analysis of the effects of the changes in the administrative-territorial division of the region;
- Optimization of social facilities, taking into account standards of security, transport availability, etc. on the territory;
- Analysis of the current and future needs of transport infrastructure development, resource security of the region;
- Justification of the area choice for investment projects, etc.

In the first phase the analogs of software that are used to solve problems of this kind, were identified.

In the second phase of the model development typology and classification of simulation objects were studied, a list of necessary calculation and performance indicators/indicative indexes were determined, an algorithm providing integration with GIS and a prototype system were created. Prototype testing was conducted for the following tasks:

- Optimization of social facilities, taking into account federal regulations and budgetary constraints: selection of the site for the construction of a new school in the city;
- Justification of the energy infrastructure development scenario by combining mining settlements of Kizelovskoe and Gremyachinskoe municipal districts of Perm Region;
- Land Use Plan development for new residential area in New Lyady, Perm
- The next step of the analysis implies specifically housing and social infrastructure development challenges arising at the local government level, for the solution of which it is expedient to use the created model.

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2 URBAN PLANNING PROBLEMS IN RUSSIA, OBJECTIVES AND TASKS

To date, the practice of urban planning and design in Russia signifacantly differs from other market economy countries, thus is based on the principles of the Soviet planned economy, while the current economic conditions require new approaches.

Due to resource limitations municipalities cannot provide required amount of experimental research for the development and accessement of variable scenarios of socio-economic development, thus cannot define priorities in construction financing of objects of social, transportation and engeneering infrastructure.

At present there are no practical technologies that allow the improvement of validity of spatial planning and decreasing the amount ineffective budget expenditure associated with implementation of urban planning policies.

Implementation of Western urban planning technologies seems to be impossible due to condition of Russian urban planning system, which is still undergoing the formation stage ,whereas, the development of cities goes either spontaneously or according to short term planning.

The complexity of spatial planning of any urban objects lies, primarily, in variability of settlement typologies and the necessity of large amount of input data processing (from climate and geographical to political) and decisions, taken at different levels of administrative management.

The research objective is the decision support system development based on a complex model of spatial development, containing general socia-analytical statistics, federal real estate state cadastre data, mathematical, statistical and adaptive methods library integrated with GIS considering established by the legislation level of availability of different types of services, opportunities municipal budgets, prevailing urban conditions.

3 GENERAL CHARACTERISTICS OF TASKS SOLVED WITH THE IT-MODEL OF INFORMATION-ANALYTICSL SYSTEM

The decision support system is based on the IT-model of spatial development. It allows the bringing together of socio-economic statistics, real estate state cadastre data, mathematical, statistical and adaptive methods library integrated with GIS - under one platform. The model allows consideration of established local and federal law requirements for the quality of the urban environment, the prevailing land use and capabilities of municipal budgets.

Model is to be used for the following tasks:

- Analysis of the effects of the changes in the administrative-territorial division of the region;
- Optimization of social facilities, taking into account standards of security, transport availability, etc. on the territory;
- Analysis of the current and future needs of transport infrastructure development, resource security of the region;
- Justification of the area choice for investment projects, etc

4 OVERVIEW OF THE EXISTING ANALOGS

In the first phase the analogs of software that are used to solve problems of this kind based on following criteria were identified:

- Conducting research of spatial data possibility;
- Availability of tools of geospace modelling;
- Data visualization (presentation of data in user-friendly format);
- The completeness of the sofware (does not need instalation of or plug-ins primary or secondary programs);
- Users accessibility (possibility to download the software without conducting any additional commitments or agreements).

Name	Developer	Operation system	Access	Purpose	Defining feautures
ArcGIS	Esri http://www.esri.com/	Linux, Windows, Unix, iOS, Android, Windows Phone	Limited (платные versions)	Create, visualize, manage, analyze spatial data	Has a special application for the PC, mobile phone; Visualizes large volumes of geo-referenced statistical information; Maps of all scales: from the plans of plots to world map; Toolkit for analyzing spatial information
Agstats	Dr. Kevin McGarigal - University of Massachusetts http://www.umass.edu/landeco/ research/fragstats/ fragstats.html	Windows	Free	Landscape metrics for different types of models	The ability to use the characteristics such as the area, density, physical parameters
Erpy Grouper	RiSE group (@gmail:rise.group.eafit), Dr. Juan C. Duque and Boris Dev http://www.rise-group.org/section/ Software/clusterPy/	Linux, MAC OS, Windows	Free	Spatial clasterization	A collection of algorithms, combined in groups for regions
Eodaspace	GeoDa Center for Geospatial analysis and Computation https://geodacenter.asu.edu /software	MAC OS, Windows	Free	Spatial econometrics	Spatial models built using GMM, IV and spatial HAC
Google earth	Google http://earth.google.com/	Linux, MAC OS, Windows	Free/ 400$ extended version	3D visualization	Has a special application for the PC, mobile phone; Automatically updates the data through the Internet; Contains current and historical maps; You can create a small visual elements correlated with internet
Grass	GRASS Development Team http://grass.osgeo.org/	Linux, MAC OS, Windows	Free	Environment visualization	Extensive set of tools for GIS raster and vector data, SQL, visualization
Legacy GeoDa	GeoDa Center http://geodacenter.asu.edu/ geodasum	Windows	Free	Analysis of spatial data	Visualization, ESDA, contains territorial regression; interactive exploratory analysis, the basic spatial possibilities of recourse
PySAL	GeoDa Center http://www.pysal.org/	Linux, MAC OS, Windows	Free	Analysis of spatial data	Modules for computational geometry, spatial weights, mobility and spatial econometrics
Quantum GIS	QGIS Development Team http://www.qgis.org/	Linux, MAC OS, Windows	Free	Environment visualization	Has broad functionality, additional plugin capability, includes elements of geoprocessing
R-Analysis of Spatial Data	Roger Bivand http://cran.r-project.org/ view=Spatial	Linux, MAC OS, Windows	Free	Analysis of spatial data	Integration of spatial data: classification, processing, reading and writing spatial data, graphical representation, environmental analysis, spatial regression
SAGA	Institute of Geography at the University of Hamburg, Germany http://www.saga-gis.org/en/index.html	Windows, Linux	Free	GIS, space analysis	Surface analysis, geostatistics, terrain analysis, hydrology modeling, various TIN tools

Table 1: The results of software analogs analysis.

One of the defining criteria was the presence of functional of geospace modelling. Basic characteristics of analyzed software are summarized in Table 1.

There were 12 systems analyzed, most suitable for a variety of analytical tasks of spatial planning are – ArcGIS, SAGA, PySAL, providng special tools to meet the challenges of spatial planning.

The algorithm and prototype of the model based on the research conducted was created.

5 KEY PARAMETERS AND TARGET FUNCTIONS OF THE MODEL

In the second phase of the model development typology and classification of simulation objects were studied, that allowed to determine a list of necessary calculation and performance indicative indexes of providing favouribe living conditions on different territories. The existing standards are analyzed for the provision of social services by the example of the Perm edge areas to determine necessity of establishment of certain restrictions. The main theoretical approaches to modeling spatial location problem of social facilities, the objective functions and the basic relations used in the analysis of urban development in the Russian Federation have been outlined in the research work of A.V. Golovin [4].

Set of key parameters for the prediction of target functions that characterize urban planning situation and used for the verification of the model include:

The number and size of households (people), the number of students and preschool (% of population), estimated housing security, FAR (the ratio of floor space to land area), a planning factor (the ratio of the living area to the total area), the ratio of land development, % , water consumption (liter/person a day), stories of buildings.

These parameters are determined using the specific indicators to be defined by the plan of the municipality, Land Use and Development Regulations or SP 42-13330. 2011 "Urban Planning. Planning and construction of urban and rural settlements", or set on the basis of demographic and urban research.

The target functions which are determined by the calculation formulas for the forecast period (years) include: the predicted increase in population, students and preschool, required land area of residential development, community facilities, water and energy consumption, the need for new development in public transport and projected level of motorization, forecast maximum area of commercial real estate and other parameters of the territory.

This information is included in the attribute information of model geodatabase.

6 ALGORITHM AND PROTOTYPE OF THE MODEL

The main components of IT-model as the basis of i decision support system of strategic decision-making in the field of spatial planning are three major subsystems: 1) data storage, 2) tools for working with maps and 3) modeling and forecasting tool. For this purpose they are integrated on a single platform.

Data repository must contain:

- Socio-economic statistics,
- Forecasts for the development of territories,
- Information system for urban planning,
- Legal and regulatory framework of urban planning,
- Other sources of data used in the practice of urban planning.

Tools for working with the maps will be borrowed from the geographic information systems considered in the table above.

Prognoz Platform is used as a tool for modeling and forecasting. It is a next-generation BI platform for building high-tech business applications on a turnkey basis. Prognoz Platform supports the development of software solutions on the desktop, web, and mobile devices for visualization and online analytical processing (or OLAP), reporting, and modeling and forecasting of business processes.

Application of Prognoz Platform and its analytical tools will help to find solutions of multiobjective optimization problems of spatial distribution of various objects (housing, civil, industrial etc.) in urban areas and analyze long-term scenarios for the development of cities.

The logic of the system taking into account selected components and the use of this system to solve practical problems is presented in Figure 1.

Modeling and forecasting tool is designed to make data researches, create different econometric models and analytical calculations implementation based on them. The possibility of visual design models and algorithms of arbitrary complexity, a rich library of mathematical and statistical techniques (more than 300 units.) as well as automatic generation of reports with the analysis results, are its main advantages.

Modeling and forecasting tool is widely used in the development of economic and mathematical models in many countries and regions, including USA, Brazil, China, Kazakhstan, Russia.

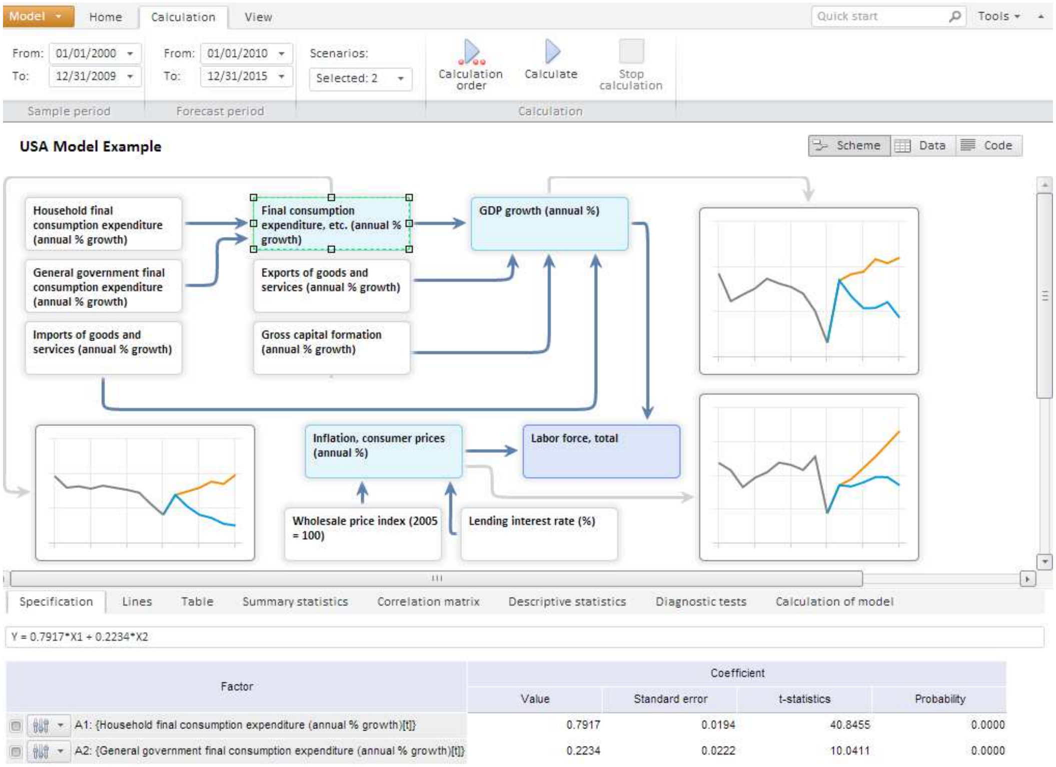

Figure 1. Example of the USA macro model implemented using PrognozPlatform - modeling and forecasting tool.

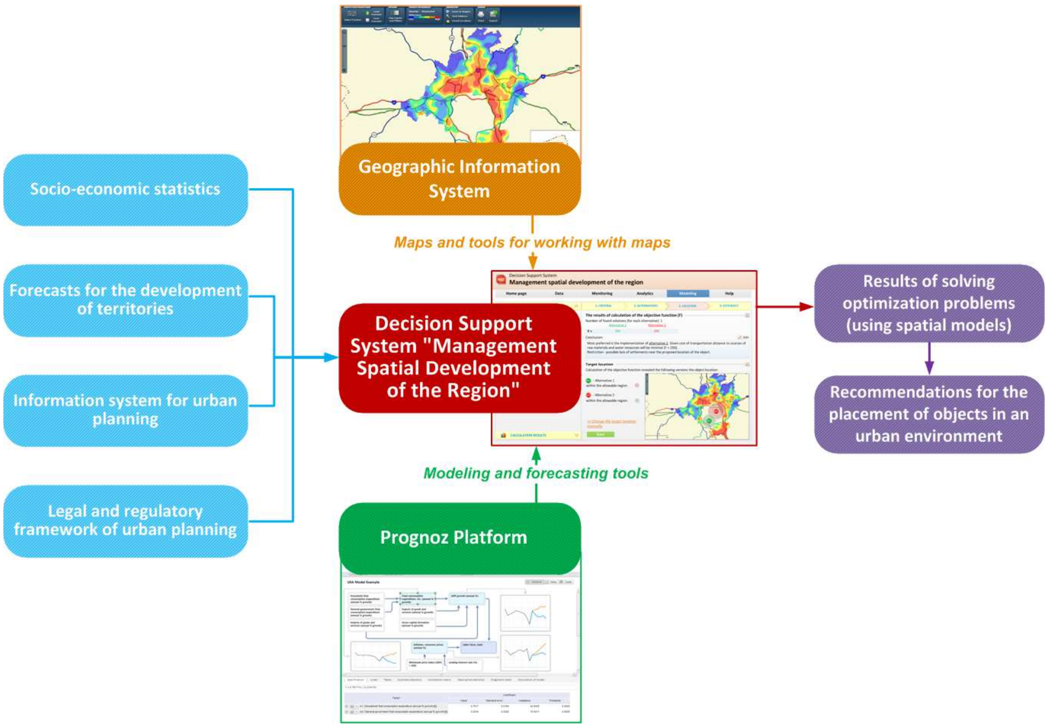

Figure 2. IT-model structure.

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7 PRACTICAL RESULTS

The following problems in developing the model using its prototype were solved:

- Location optimization of social facilities subject to federal regulations and budgetary constraints: selection of the plot for the construction of a new school in the city;
- Land Use Plan in the development / utilization of new residential development area of Lyady Perm.

Demo application on Figure 3 shows a prototype model for the solution of plot choice.

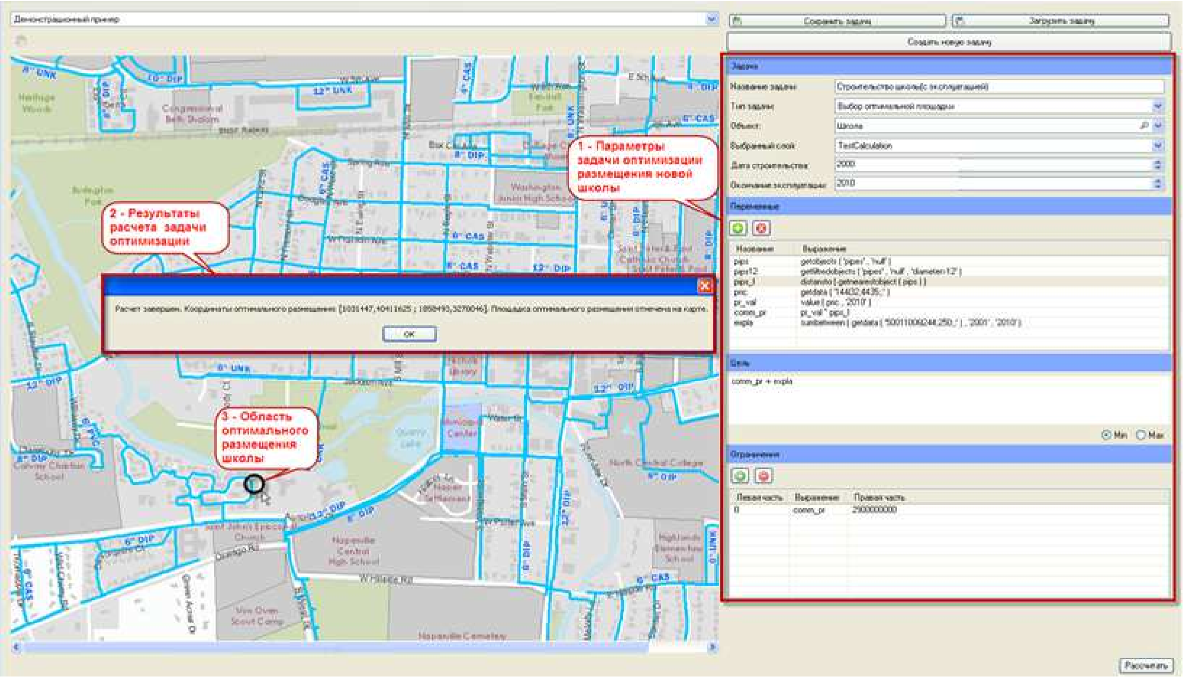

Figure 3. The task of Social objects location optimization interface.

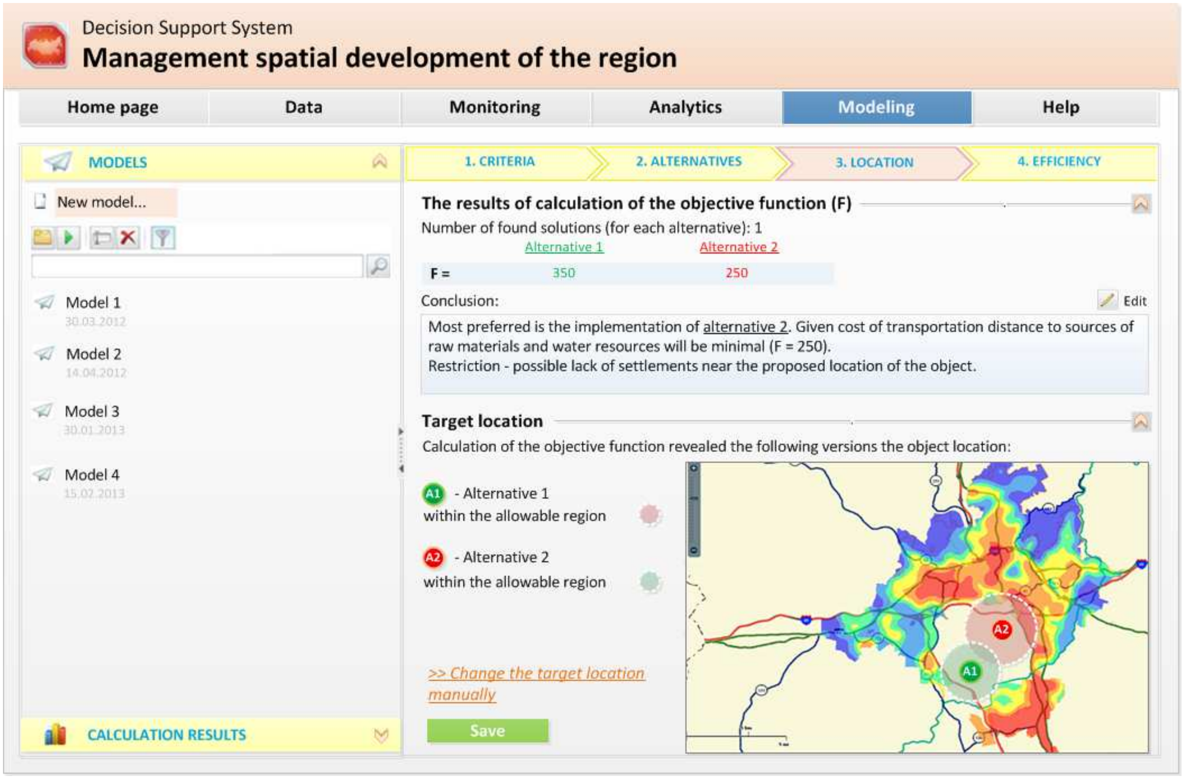

Figure 4: The interface of startegy development of Novye Liady.

To date OAO PROTON, one of the largest enterprises of the aero-space sphere, implements the Program of Territory Cluster Development «Technopolis Novyi Zvezdnyi», which is based on the expansion of production by 3,000 new jobs.

The inplementation plans of the interprise is directly dependent on solving the problem of housing new employees, development of transportation and engineering infrastructure of the New Lyady District in Perm.

Calculations conducted using the prototype model show that New Lyady have sufficient land resources to accommodate new residential buildings within existing existing boundaries and the additional land outside the existing boundaries, is not required. During the first stage of production up 2016 (opening up to 600 jobs) the existing social infrastructure (kindergartens, schools) is sufficient. The reconstruction of the school building and enlargement of its capacity will not be required until the the year 2020. Budget expenditures for the first stage of development until 2016 should be directed to the reconstruction of utilities and road Perm – New Lyady reconstruction.

8 CONCLUSION

The first stage of system development is finished:

- basic optimization algorithms developed;
- a software tool that allows the system to use analytical and GIS spatial data simultaneously developed;
- socio-economic statistics and state real estate cadastre data repository formed.

The next step of the analysis assumes specific development challenges of housing and social infrastructure arising at the local government level; testing the model in the development of land use regulations and development and prioritization in the municipal budget allocation.

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reviewed paper

Institutional Framework of Brownfield Regeneration in Serbia

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1 ABSTRACT

The general objective of this study is to present the existing institutional framework of brownfield regeneration in Serbia. However, as the research proceeds on the assumption that successful brownfield regeneration requires the active cooperation of different sectors and disciplines, there are several specific research objectives. Firstly, it is important to elucidate the nature of cooperation between the sectors at the same level, but also between different levels of spatial development. Furthermore, it is interesting to examine if there are specific institutions solely responsible for brownfield regeneration. Thus, the focus of the analysis will be directed to the institutional representatives (at different levels of spatial development) − their roles, responsibilities and limitations regarding the problem of brownfield regeneration. Also, documents relating to brownfield regeneration − laws, strategies, plans, concepts and spatial development programmes will be clarified. Proposed analytical strategy will shed light on the degree of integration between different sectors, disciplines and institutions within the same organisational level, tending to determine the extent of the so-called horizontal collaboration. In addition, the analysis elucidates the vertical collaboration between relevant institutions at national, regional and local level. Furthermore, it provides insight into the position of expert agencies within a certain institutional context. Finally, the analysis clarifies the character (formal or informal) of institutional collaboration. Such an extensive analysis of existing institutional framework of brownfield regeneration in Serbia provides guidelines for its improvement in the context of smarth urban growth.

2 BROWNFIELDS IN SERBIA

During socio-economic transition to market economy system, which currently exists in Serbia, the issue of brownfield regeneration has been unjustifiably neglected. The basic problem lies in fact that the term brownfield has been recently defined. Actually, before the adoption of the Spatial Development Strategy of the Republic of Serbia (RASP, 2009) in the year 2009, where the brownfield site was defined as: ”(…) land which was previously built and used, but in the meantime, due to financial or other economic reasons became abandoned”, there was no clear definition regarding the mentioned locations. Hence, the term is empirically known to the experts in Serbia, but its use in the plans is still pending. In the Belgrade Master Plan - 2021 (Belgrade Gazette, No. 27/03) there is no requirement for the brownfield revitalization. Due to the lack of a unified brownfield site cadastre on the national level, the precise data about the total area of brownfields are unknown. According to the recent data provided by Serbian Investment and Export Promotion Agency - SIEPA (2011), the brownfield area in Serbia occupies approximately 3000 hectares.

2.1 Institutional Framework for Brownfield Regeneration

The Serbian institutional structure for brownfield regeneration is not clearly defined. This comes out from the political, societal, and economic transition which is still in progress. The main challenges in Serbian socio-political context relates to the bankruptcies of many state-owned companies and privatization of the better ones. Nevertheless, the number of firms is still fully or partially owned by the Serbian state. The restitution of nationalized properties is in the process, but not finished. The question of the ownership of the land which is recognized as brownfield is the main barrier to the successful regeneration of these sites. However, the major participants among public sector concerned with brownfields are: Ministry of Regional Development, Privatization Agency, Serbian Investment and Export Promotion Agency (SIEPA), Ministry of Environment, Mining and Spatial Planning, Republic Agency for Spatial Planning, as well as the local authorities (Danilovic and Damjanovic, 2011; Peric, 2009). Brief overview of their roles and responsibilities is shown in the Table 1.

Institution	Functions and Responsibilities
Ministry of Regional	• Its role is the promotion of domestic production, export, and foreign direct

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Development	investment. • Facilitation in restructuring of the large business entities toward international market requirements is always prepared by this institution. • The ministry is responsible for the implementation of Integrated Pre-accession Assistance Programme (IPA) which includes specific measures aimed at brownfield redevelopment.
Privatization Agency	• It has the main role in regard with brownfields which appear as a result of former state-owned enterprises bankruptcy. • It manages and sells shares and interests in accordance with the Law on Privatization (Official Gazette, No. 123/07). • Its role is to train a number of bankruptcy trustees who will be able to realize the procedure within a reasonable time or the court settlement of creditors which would suspend the bankruptcy process.
Serbian Investment and Export Promotion Agency (SIEPA)	• It is the state agency responsible for the promotion of investment opportunities as well as for the help to foreign investors when starting business in Serbia. • The agency provides the service of brownfield sites locating, assistance in administrative procedures at all levels, as well as mediation with the relevant institutions both at national and local level. • It also coordinates direct investment for brownfield projects in the manufacturing sector, services sector, those involved in international trade and strategic projects in tourism, in a way of giving grants.1
Ministry of Environment, Mining and Spatial Planning	• Its role is to identify, coordinate and develop the goals of environmental policy in order to achieve sustainable development. • The important role within this ministry has the Environment Protection Agency which formulated several reports regarding soil contamination.
Republic Agency for Spatial Planning	• It is the state agency responsible for preparing, coordinating and monitoring the development of all the spatial plans in Serbia. • This institution also provides technical assistance for the preparation of planning documents within local governments. • The crucial role of the agency in brownfield regeneration process is to bind the state authorities with the experts from the both academy and research institutes. • The agency also prepared the most important documents with regard to the topic of brownfield regeneration: The Spatial Development Strategy of the Republic of Serbia from 2009 to 2020 (in 2009) and The Spatial Plan of the Republic of Serbia from 2010 to 2020 (in 2010).
Local authorities	

Table 1: Institutional framework for brownfields in Serbia (Source: Prepared by authors)

The specificity of local authorities in Sebia should be noted here. Namely, Serbian local authorities often lack accurate information about the percentage of building land in the category of brownfield sites within the whole territory of the municipality (Gligorijevic et al., 2007). According to the same source, the municipalities do not realize that in most cases the private investors withdraw investment because of the increased risks and costs. As Begovic points out, Serbian local governments do not have a vision of development, in terms of understanding the brownfield regeneration as a process that brings long-term profit. Specifically, the property tax is considered the main source of revenue that should be provided even if the activity that takes place in the municipality area has more negative (environmental, social) than positive (financial) effects (Begovic, 2002). Therefore, in Serbia there are no examples of turning the industry

[1] Grants are awarded in the amount of 2.000 to 10.000 euro per new job created, for a period of three years (SIEPA, 2011).

complex into the green park, which can lead to a greater investor interest, the price increases of the surrounding buildings, and the new jobs, i.e. to new revenue for the municipality.

2.2 Legal Regulations for Brownfield Regeneration

In contrast to the previous case studies, the topic of brownfield regeneration has been recently recognized in Serbian spatial planning and development documents. The breakpoint was the adoption of official term for brownfield site in 2009 within the Spatial Development Strategy of the Republic of Serbia from 2009 to 2020 (SDSRS) (RASP, 2009). Until that period of time, planning documents operated with the notion of urban renewal instead of the explicit definition of brownfield site (Vujovic and Petrovic, 2007). Also, brownfield regeneration was a part of several documents mainly based on the topic of environment protection and soil contamination. Thus, the Environmental Protection Law (Official Gazette, No. 135/04) defines the principle of the „polluter pays" concerning the cleaning-up costs, i.e. costs incurred with regard to contamination of environment as well as the remediation of damages to it. Regional Development Strategy for Serbia from 2007 to 2012 (Official Gazette, No. 21/07) indirectly indicates brownfield regeneration through introducing „clean technologies" in the devastated industrial clusters. Planning and Construction Law (Official Gazette, No. 72/09, 24/11) does not provide the answer about brownfield issue in a sustainable way. The tendency of introducing new urban functions in central city areas exists, but the way how to achieve that without a threat for public interest is still unclear.

Since 2009 the topic of brownfield regeneration became visible in main spatial planning documents. Namely, SDSRS from 2009 to 2020 (RASP, 2009, p. 45) set the "strict control of irrational spreading of building zones and greater involvement in brownfield regeneration" as one of the main spatial development priorities. Also, the scenario of sustainable spatial development means the displacement of industrial locations from the central areas (RASP, 2009, p. 48), and brownfield regeneration is seen as one of the instruments to achieve reformed and transparent system and land-use policy (RASP, 2009, p. 90). The same document recommends the brownfield site as a mechanism for regional and local identity preservation (RASP, 2009, p. 119). The most important part of this document deals with the possible guidelines for brownfield regeneration in Serbian context. Some of them are:

- Public sector must be responsible for the brownfield site remediation;
- The role of local governance is of crucial importance - it has to collaborate with public, private, and civil sector;
- Responsible plan implementation is a base for successful brownfield regeneration;
- Companies bankruptcy and their privatization as a instrument in dealing with brownfields;
- Public-private partnerships as a balance between different interests;
- Education and public promotion of brownfield regeneration should obtain a system support.

Besides everything aforementioned, the Law on the Spatial Plan of the Republic of Serbia from 2010 to 2020 (Official Gazette, No. 88/10) emphasizes the importance of brownfield regeneration as a means to better utilization of Serbia territorial capital (Official Gazette, No. 88/10, p. 47). The same document proposes the regeneration of unused military sites and objects as one of the several possible types of brownfield sites (Official Gazette, No. 88/10, p.120). The main strategic priorities to be achieved by 2014 within this document are:

- Brownfield cadastre with evaluation on the national level, which leads to efficient site revitalization;
- Establishment of institution (national level) in charge of brownfield regeneration.

3 CONCLUDING REMARKS

Based on previous brief overview of institutional and legal framework of brownfield regeneration in Serbia, some conclusions can be drived. Namely, the following remarks concern three aspects of brownfield regeneration, such as: institutional collaboration, position of expert agency, and institutional support to collaboration of various sectors.

Institutional collaboration. Although collaboration among institutions responsible for regional development is prescribed by law (Official Gazette, No. 88/10), in the practice of brownfield regeneration the extent of institutional collaboration depends on the various planning levels. At national level, cooperation between several sectors in order to create development documents is not effective, which stems from the unclear responsibilities of different sectors in a given process. However, the national body which tends to achieve a higher degree of horizontal collaboration is the Republic Agency for Spatial Planning (RASP), which acts as a mediator between the national government (ministries) and experts (as representatives of academia, and research institutes). At national level, the role of intermediary is also devoted to the Agency for Foreign Investments and Export Promotion (SIEPA). It provides assistance in administrative procedures at all levels, as well as in mediation with relevant institutions - national and local. On the other hand, there is no effective cooperation and exchange of experiences among different local governments. There is a distinct need for municipalities which already developed brownfield regeneration policies (e.g. Niš, Subotica) to share their experiences with other municipalities that have a low level of understanding of the brownfield regeneration effects (SKGO, 2011). The networking of activities as well as promoting of brownfield activation contribute to the improvement of abilities, skills, and motivation of employees in the public sector.

Vertical institutional collaboration is not developed to its full potential due to the absence of regional level of administration (Stojkov, 2012). Thus, in Serbia, despite the legal prescriptive (Official Gazette, No. 129/07), local authorities or their associations do not participate in the preparation of regulations related to sustainable land use as one of the priorities of municipal development.

Position of expert agency. At national level, RASP deals with the preparation of strategies and spatial development plans in accordance with the policies of sustainable land use. However, these documents are general in their nature, so Serbia lacks professional expertise in the field of brownfield regeneration (Bojovic, 2010). This is primarily seen in the absence of the National Agency for brownfield regeneration, and lack of cooperation with expert agencies at international level. In addition to this, the lack of a national strategy of brownfield regeneration is obvious, which is caused by missing the basic documents important to the success of such a process – brownfield cadastre and unique database of brownfield sites.

At local level, there is also a lack of brownfield related topics within strategic and planning documents of local government. Assuming of brownfield regeneration as a priority of local spatial development is sporadic and does not occur as the initiative of municipal representatives. The reason for this is the inadequate local professional capacity for the different aspects of brownfield regeneration, which should seek for the ability of an efficient decision-making, transparency of information, skills of mediation and facilitation, etc.

Institutional support to collaboration of various sectors. Law on Spatial Plan of the Republic of Serbia from 2010 to 2020 (Official Gazette, No. 88/10) clearly stipulates not only cooperation between various institutions responsible for the given area, but it also supports the cooperation of various sectors, primarily public and private one. However, in planning practice of brownfield regeneration there are two inconsistencies. On the one hand, a small number of local authorities do not assume public-private partnership as a form of cooperation that contributes to the brownfield regeneration effectiveness. On the other hand, when a public-private partnership is recognized as a mechanism for brownfield regeneration, there is often unequal cooperation between private sector – which has a great financial power, and public sector – which is characterized by inadequate professional power and the inability to control the whole process of brownfield regeneration.

Besides institutional collaboration, the Spatial Plan of the Republic of Serbia from 2010 to 2020 (Official Gazette, No. 88/10) proposes the development of informal forms of cooperation in decision-making process, particularly emphasizing the collaboration with civil sector. However, non-institutional instruments to stimulate brownfield regeneration do not exist. Thus, the inactivity of civil society in defining the objectives to be achieved by brownfield regeneration indicates a non-transparent policy formulation in a given domain.

Thus, the general conclusion is that Serbia took first steps towards understanding the problem of brownfield regeneration. This is primarily related to new planning instruments (plans and strategies) which treats the mentioned concept. It is also important that these documents emphasize the institutional responsibility for formulating the ways for the sustainable land use which means not only institutional collaboration, but also the collaboration of different sectors. However, current (unsatisfactory) state of brownfield regeneration in Serbia is caused, on the one hand, by the lack of appropriate measures serving for implementation of policies defined at national level. On the other, there is a certain lack of understanding the need to change approach to contemporary urban problems. In addition, inadequate treatment of brownfield regeneration is conditioned by non-education of experts in accordance with current planning paradigms, as well as unregulated cooperation between various sectors within brownfield regeneration process.

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reviewed paper

Integration of Emotional Behavioural Layer "EmoBeL" in City Planning

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1 ABSTRACT

The link between the built environment as a geometrical dimension with the human behaviour and emotional aspects in recent planning research field has got a growing interest in the field of city planning. The emotional dimension in particular has become an essential part in city planning field where the emotional relation and the degree of emotional response are structuring spaces followed by behaviours and can therefore be relevant for human interactive in urban spaces. The theoretical, empirical, and practical work in this field has generally aimed to enhance the quality of life through the creation of new layers for our cities considering these behaioural and emotional aspects.

This paper is an analytical part of a research work on the micro level of city planning focusing on the growing importance of computing and mobile technologies. It creates a linkage between cities, people and technologies through integrating quantitative limits and qualitative criteria. It investigates a new layer presenting the citizens' behaviours and emotions "EmoBeL", which could be added to the geometrical layer and create a city analysis to improve decision making process as well as physical planning in our cities, which is the main goal of planners, developers and even politicians.

2 INTRODUCTION

In the field of city planning, there has been a considerable attention to connect the geometrical dimension of mapping for the built environment with the citizens' behavioural and emotional aspects. The theoretical, empirical and practical work in this field has generally aimed at the goal of life quality enhancement (Handy et al., 2002). Otherwise, nowadays the physical city is covered with an increasing number of digital information through several social and telecommunication networks on handheld devices with global positioning and navigation systems. These rich sets of information are of increasing importance for researchers in the city planning field that open the possibility to a wide range of future applications and services, which are the subject of intensified research efforts (Kloeckl et al., 2011; Robinson, et al., 2012).

Over the past decades, computing, social media and mobile technologies have become integral parts of our social lives and work practices, as well as shaping the way we make sense of our cultures and engage us as citizens (Marcus et al., 2011). This is not only transforming how we study, design and manage cities but opens up new possibilities for researches and new approaches that give decision makers and researchers access to more qualitative and quantitative data about cities and their dynamics (Kloeckl et al., 2011).

The objective of this research is how to find a way for better understanding of our cities by initiating a new approach of merging the behavioural and the emotional dimensions as the most recent planning layers with the geometrical one as a base. This is an ongoing leading work of a new classification called "EmoBeL" analysis that depends on all the theories of emotions and a number of tested smart phone applications.

3 STATE OF RESEARCH

This work is an induction analysis research to end up with a new analysis approach in city planning. This approach will consider the integration of geometrical dimension of mapping with an Emotional Behavioural Layer "EmoBeL" for more experiencing of our cities, Fig.1. This integration is getting more reliable with the help of various techniques such as Global Positioning System (GPS) for collecting data through citizens' movements in cities. Otherwise, might use in the future more technological tools, devices and programs such as SMART bands, biometric sensor measuring, Galvanic Skin and other recording data devices that is eliminated by this research for present (Nold, 2009; Zeile et al., 2009; Rania et al., 2011; Taha et al., 2012; Bergner et al., 2013).

To tackle previously mentioned analysis method there are several considerable steps: a literature review illustrating the cognitive mapping dimensions in city planning; geometrical, behavioural, and emotional dimensions as well as the proposed "EmoBeL" analysis approach with the theoretical base relation.

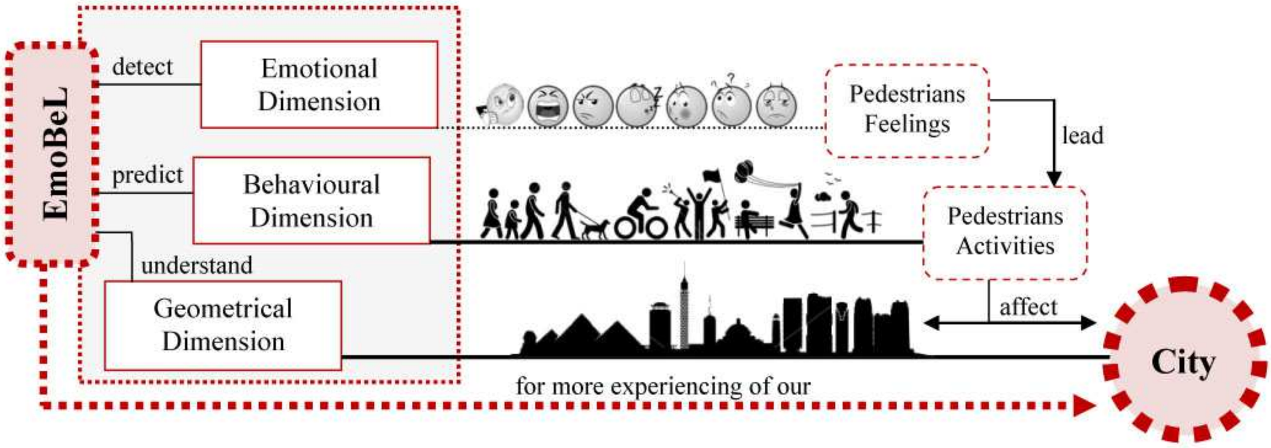

Fig. 1: The state of research for the EmoBeL analysis approach.

4 COGNITIVE MAPPING DIMENSIONS

The conventional cognitive mapping dimensions are usually the geometrical dimension one and the behavioural layer. Regarding the geometrical part, there are a variety of terms that have been used by city planners when referring to the built environment in recent city planning mapping process. Although these terms often seem changeable, the distinctions among them are important. According to urban planning theories and practices, "Urban design" usually refers to the design of the city and the physical elements within it. This includes both their arrangement and their appearance. In addition to, it is concerned with the function and appeal of public spaces. While, "Land use" typically refers to the distribution of activities across space, including the location and density of different activities, where activities are grouped into relatively categories, such as residential, commercial, industrial and others (Handy et al., 2002). All these terms exemplified our conventional approach of mapping in geometrical level of city planning.

By considering the problem of city mobility nowadays and the growing interest of pedestrians' behaviours in urban spaces, there is an increasing interest in determining the behavioural layer. Robinson (2012) argued on how people currently make decisions concerning their daily travel plans and how their in situ decision-making might be improved by streamer conditions and any other information deemed relevant by that individual.

According to Reeve (2009) there have been perennial questions regarding the behavioural layer:

1) What causes behaviour? And why do people do what they do? 2) Why does behaviour vary in its intensity? Why does a person behave one way in a particular situation at one time yet behave in a different way at another time? What are the motivational differences among individuals and how do such differences arise? 3) By answering previous questions a new one arises about how can we predict and expect peoples' behaviours in urban spaces?

Depending on previous studies on the behavioural layer it has been identified and discussed that all citizens' behaviours should be that way depending on the stress as one of the key motivators in the emotional layer in experiencing the city (Zeile et al., 2009; Rania et al., 2011; Taha et al., 2012; Bergner et al., 2013).

5 EMOTIONAL DIMENSION OF MAPPING IN CITY PLANNING

Various methodologies have been tested and developed for detecting emotions in urban spaces. One of the most promising approaches through emotional maps is the Christian Nold maps of cities where he mapped peoples' emotional geography instead of mapping their physical layout. He invented a technique called biomapping where participants walk the area connected to a system that measures galvanic skin response, a measure of the electrical resistance of the skin, which is known to give a rating of arousal and stress (Nold et al., 2008). His maps described an area in terms of how stressful it is, and so far, he mapped Greenwich in London, San Francisco, Stockport and the sensory experiences of Newham.

5.1 Emotion within city planning

A major problem in the field of emotion is the wide range of definitions that have been proposed for a long time. James (1884) illustrated that our mental way of thinking and mental perception of some fact excites the mental affection and that what called emotion and gives rise to the bodily expression. Kleinginna Jr & Kleinginna (1981) identified ninety two definitions and nine skeptical statements that were compiled from a variety of sources in the literature of emotion drawn mainly from psychological dictionaries and well-known texts on emotion, motivation, physiological psychology and introductory psychology. While Gartner (2012) mentioned the emotion as one of the psychological processes such as: perception, cognition, memory, emotion, behaviour, and physiology that devices and sensors can experience.

That meets Reeve (2009) where emotions are one type of motive power, which energizes and directs behaviour. Emotions are feeling states with physiological, cognitive and behavioural components. Emotions are usually intense and short-lived. According to that the bodily changes which behaviour follow directly the perception of the exciting fact and our feeling of the same changes as they occur is the emotion (James, 1884). On the other hand, moods are more pervasive and can last for longer period of time (Kleinginna Jr & Kleinginna, 1981).

By this work it has been considered to the explanation of Reeve (2009) that has been proposed the word emotion as a complex set of interactions among subjective and objective factors, mediated by neural-hormonal systems, as shown in Fig.2, which can:

(1) give rise to affective experiences such as feelings of arousal, pleasure/displeasure;

(2) generate cognitive processes such as emotionally relevant perceptual effects, appraisals, labeling processes;

(3) activate widespread physiological adjustments to the arousing conditions; and

(4) lead to behaviour that is often, but not always, expressive, goal-directed and adaptive.

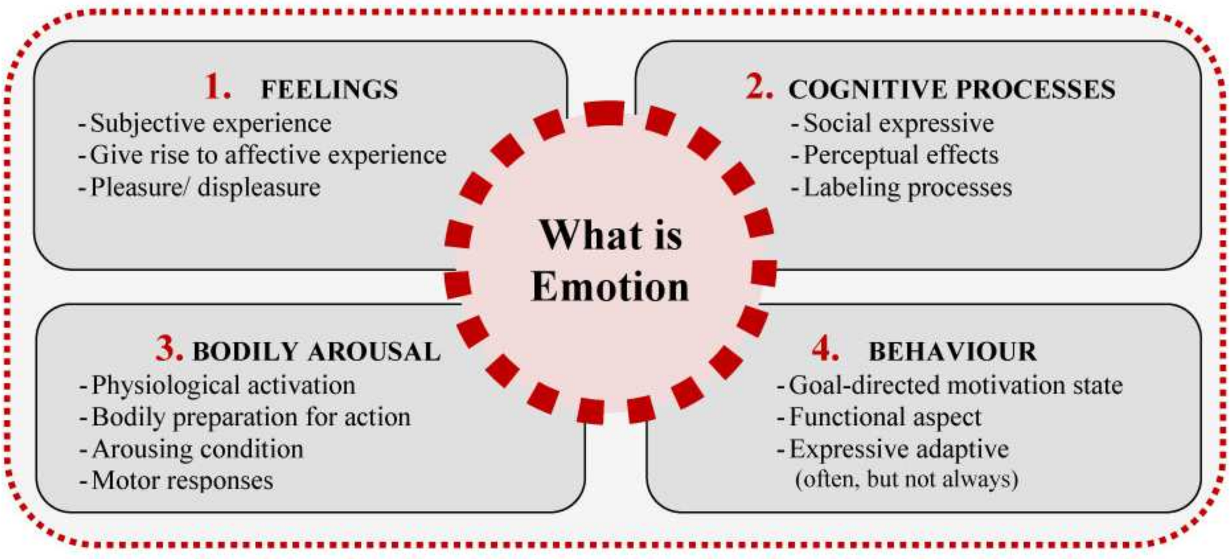

Fig. 2: The four components of emotion definition. Source: after Reeve, 2009.

5.2 Emotion Classifications and Theories

Different emotional expressions and states have been identified in the context of detecting emotions. Plutchik's multidimensional model and his wheel of emotions (1962, 1980) addressed basic emotions, their dimensions and how those can be arranged into hierarchies around prototypes as shown in Fig.3 (a,b). This was and still the best known perspective of emotion and its structural model. Plutchik postulated eight primary emotions, which all other emotions are derived from (Andersen & Guerrero, 1997). His wheel of emotion was well classified because it filtered the emotions types and intensity in eight different colors with four degrees of strength.

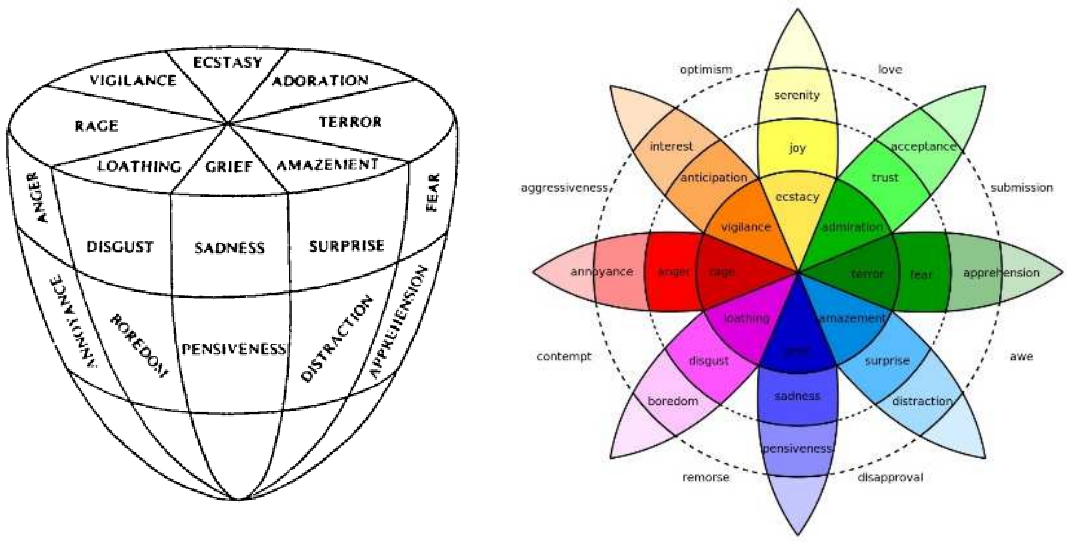

Fig.3: (a,b) Plutchik's three- dimensional emotion cone and his wheel of emotions 1962,1980. (Source: Andersen & Guerrero, 1997)

Gartner (2012) categorized emotions to anger, sadness, happiness, cheerfulness, neutral, joy, boredom, fear, annoyance and disgust. While Nummenmaa et al. (2013) added surprise, anxiety, love, depression, contempt, pride, shame and envy. Otherwise, there are much more researches in this field that enables communities to track and act on their feelings about their local environment. The most common emotions recognized are the standard emotions: anger, happiness, sadness, fear, disgust, surprise, anxiety, and interest (Klettner et al., 2011). However, people are more likely to have mixed emotions than pure forms of any single emotion.

According to that the research expect this inclusion of a subjective layer will bring benefits to different disciplines regarding city planning, architecture and decision making depending on the next four theories of emotion that Reeve (2009) summarized them as shown in Fig.4 to:

1) The James-Lange Theory of Emotion (1834-1900): where it has been suggested that bodily changes are the results of emotion.

2) The Cannon-Bard Theory of Emotion (1898-1977): where the physical changes and emotional experiences happen at the same time.

3) The Two-Factor Theory of Emotion: that proposed emotion as a result of the interaction between physiological arousal and the cognitive label we attach to.

4) The Cognitive-Mediational Theory of Emotion: that classified emotions in two ways: pleasant or unpleasant, and how much arousal is present. It is mostly concerned with the interpretation of the environment and work on how it affects a pedestrian.

This last theory of emotion, as shown in Fig.5, has been proven to be the most "accurate" one. While its way of classification has been used nowadays through several handheld and telecommunication devices by smart-phones to detect pedestrians’ emotions through cities (James, 1884; Titchener, 1914; Ecedents, 2001; Reeve, 2009).

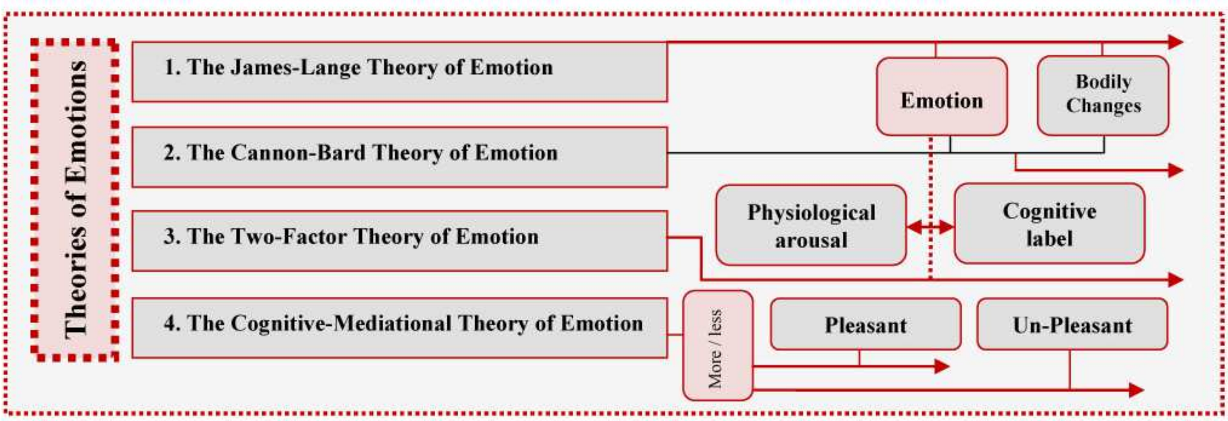

Fig.4: A schematic diagram illustrates the four theories of emotions.

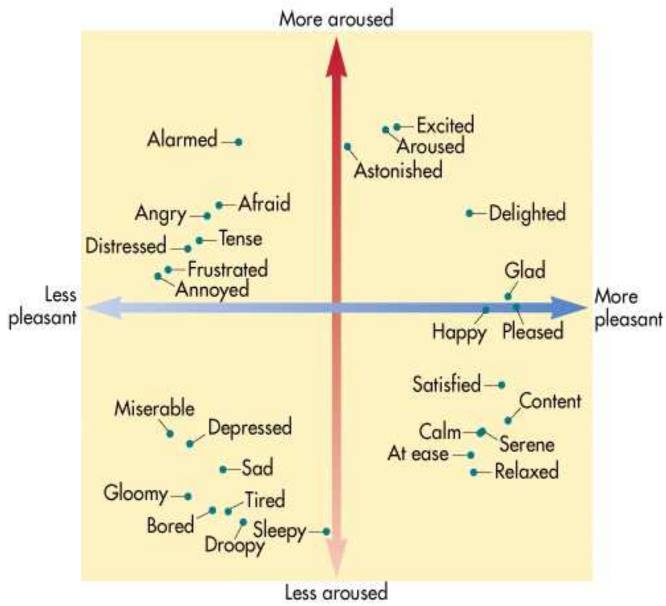

Fig.5: The Cognitive-Mediational Theory of Emotion (Source: Reeve, 2009

5.3 Emotional Applications in City Planning

There are several applications that benefit from smart phones using numerous methodologies for citizens' emotional detection and behavioural monitor. There are many projects about this development of hand held technologies for behavioural interventions that address several problems regarding cities quality of life. This research is using the advantages of two promising applications. One of them is the Emomap application that gathers qualitative data about peoples' affective experiences in urban spaces for building a subjective layer to modify the route calculation in pedestrian navigation systems (Klettner et al., 2011). This application focuses on testing the hereby developed methods and algorithms by collecting pedestrians' feelings in their surrounding spaces for the hypothesis that the inclusion of emotional data can improve user satisfaction (Gartner & Ortag, 2011). As shown in Fig.6, users submit their feelings through a number of indicators positively or negatively about the degree of feeling comfort, calm, diverse, safe, and appealing. These emotions then are sent to the system that automatically uploads the average feelings into a geometrical map. These indicators then have been re- classified by our research and added into the EmoBeL analysis method.

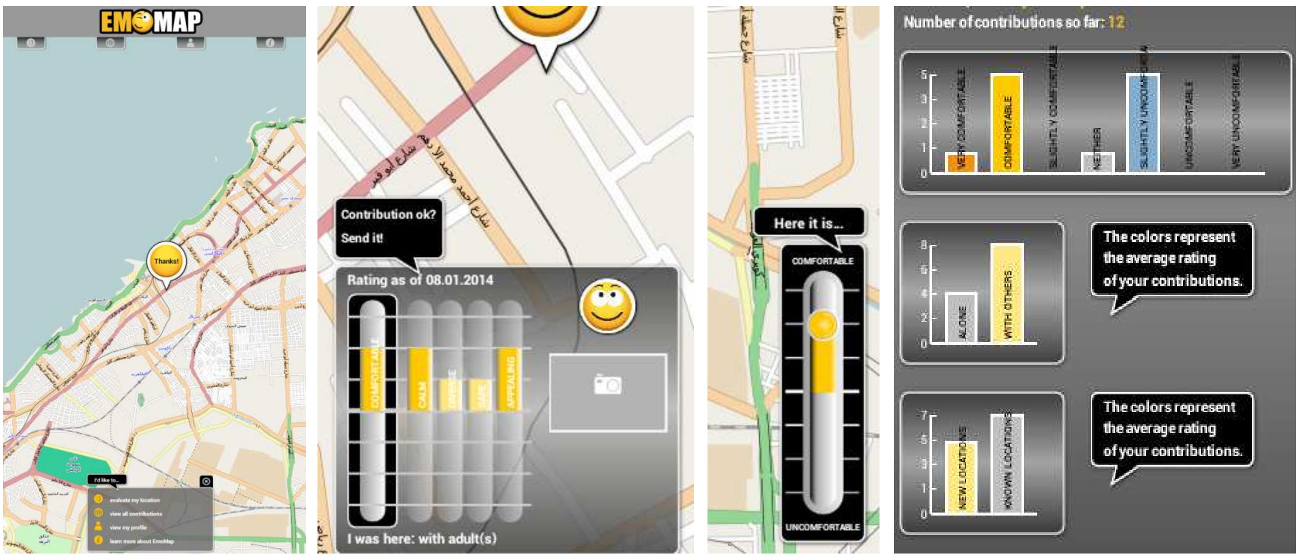

Fig.6: Measuring the citizens' emotions by Emomap application where users identify their feelings about the surrounding spaces. (Source: Klettner et al., 2011)

Another application that has been used is the Emotion Sense application that combines systematically gathered data from a wide range of sensors with the user's own report about their feelings, which is entered

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through a system designed by psychologists. Based on their response, the phone then conducts a brief survey to clarify their emotional state (Lathia, et al., 2013). As shown in Fig.7, the users are asked to mark how they feel using an on-screen matrix called an “emotion grid” based on the previous mentioned theories of emotions. Users have been asked ten questions about the degree of feeling calm, anxious, angry, alert, enthusiastic, sad, lonely, relaxed, their companionship, their activities, and their daily social life.

These parameters furthermore have been added into the EmoBeL analysis method. With further modification, this type of mobile phone technology could be a very accurate means of tracking the factors influencing people's emotions, but until now, these technologies have been designed for sensing information from single users or small groups.

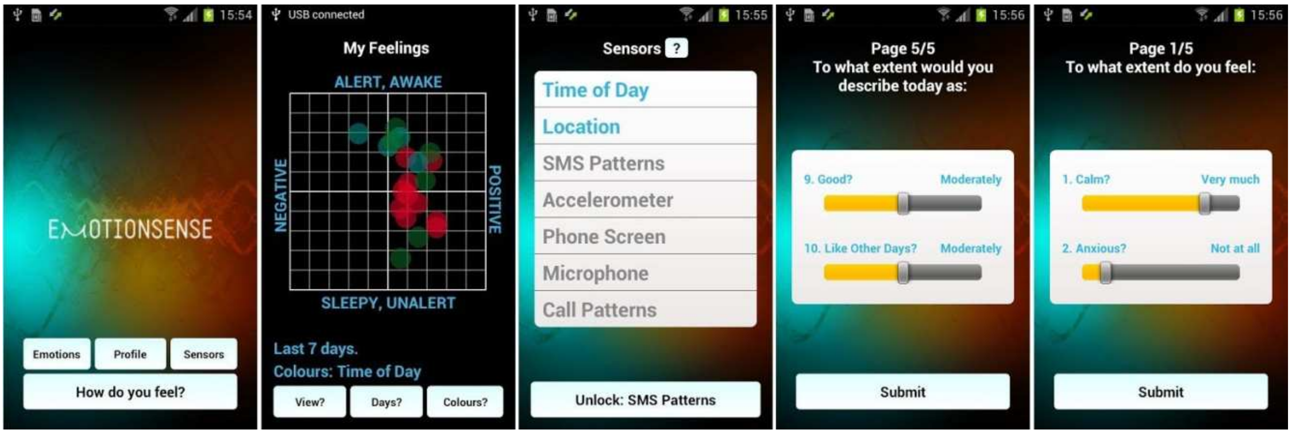

Fig.7: Measuring the citizens' emotions by Emotion Sense application. (Source: Lathia, et al., 2013)

6 EMOBEL FOR CITIES

This is an ongoing research of work leading to a new classification called “EmoBeL” analysis. This analysis depends on the theories of emotions particularly the Cognitive Mediational Theory as mentioned before as well as some of the most recent smart-phone applications for measuring how citizens feel in their environment such as Emomap app that depends on the GPS system (Klettner et al., 2011) and the other more psychological one, Emotion Sense application (Lathia et al., 2013).

The research proposes that citizen‘s emotions would be sorted into two main categories: Positive and Negative emotions as shown in Fig.8 (left). The positive emotions are at the upper side while the negative emotions are located at the lower side. Each part has been classified into four main zones differentiated in colors and ranged chromatically according to the emotion intensity depending on the emotions’ colors of Plutchik emotions wheel. By that we got eight primary zones of emotions consists of twenty seven positive and twenty seven negative emotions that have selected from all the theories of emotions and the tested smart phone applications as shown in Fig.8 (right).

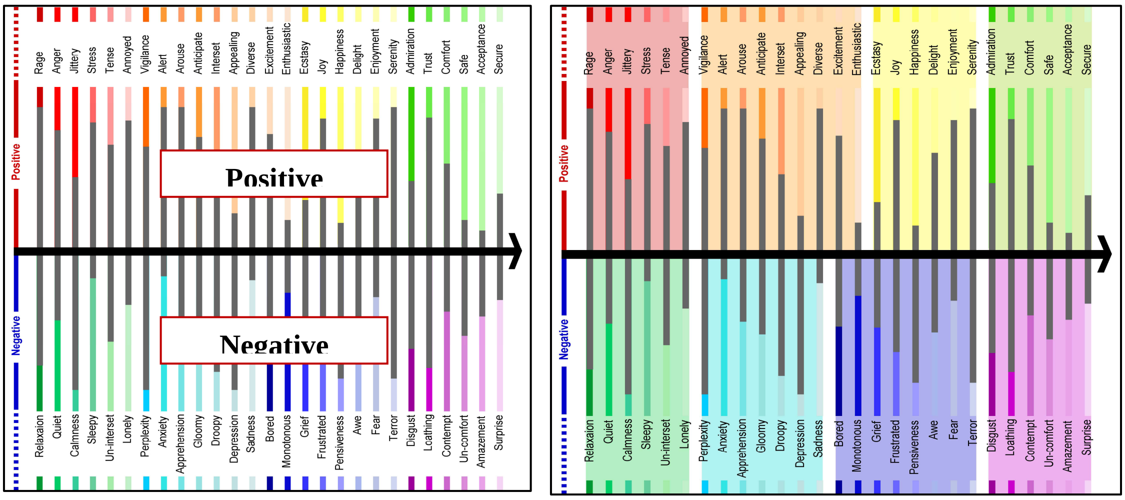

Fig.8: The EmoBeL graph classification of emotion (left) and the EmoBeL graph zoning of emotion (right).

This part of work is a new proposed approach that would be helpful for city planning field. This proposed work that shown in Fig.9 is an induction analysis of pedestrians' behaviours through urban spaces depending on the analyzed part of the emotional layer on EmoBeL analysis methodology.

For example, the red zone represents the feelings of rage, anger, stress and annoyed where city planners would expect that pedestrians in this zone might behave in a nervous way and walking with a high speed causing accidents. Otherwise, the yellow zone represents the happiness emotions with raising expectation of interest from pedestrians and that might cause a better environment for shopping and a highly use of spaces and activities. Feeling safe and comfort through the upper green zone might expect highly motivated activities such as cycling. On the other hand, the cyan zone corresponds to the feelings of depression and sadness causing negative responses on the urban activities. Getting into the blue zone means getting bored and feeling monotonous through spaces and this should get more effort to re-join pedestrians within the urban activities. In this zone also the feelings of fear and terror should get more concerns from city planners or it will turn to be defects areas within the city. The magenta zone reflects the un-comfort emotions that could be affected by the urban fabric and features and this would change the behaviour in the surrounding spaces.

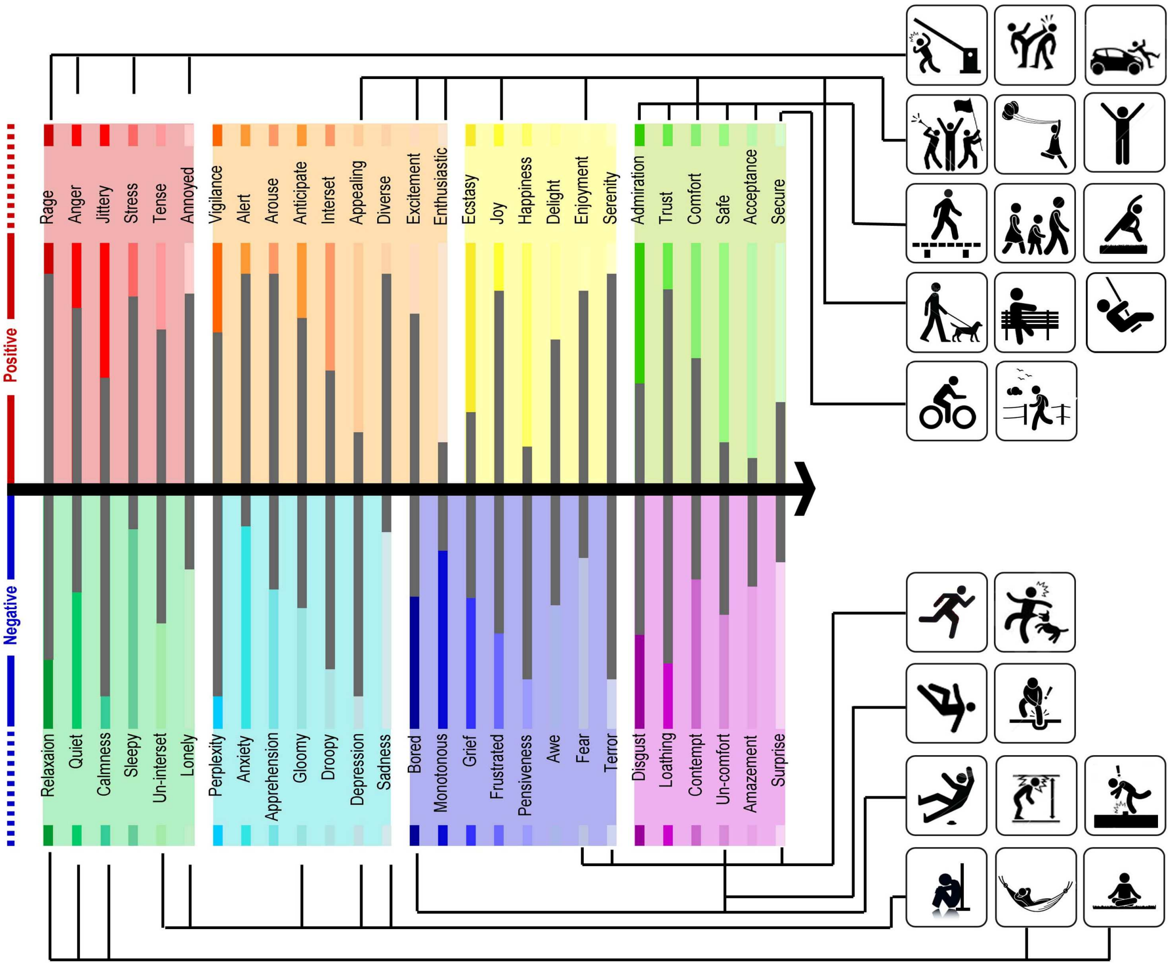

Fig.9: The EmoBeL analysis approach of emotions and its' expectations of behaviours.

7 EMOBEL MAP

Applying the previously mentioned analysis approach on part of Alexandria city map causes a prospective EmoBeL map as shown in Fig.10. This is just a visionary output analysis for the old town of the city. According to that the research proposed a new transparent and colored layer. This new layer depends on the EmoBeL analysis approach as a legend where it could be recognized that the city will get into the proposed colored zones. For instance, the yellow parts of the city are along the sea front of the Eastern Harbor of Alexandria where pedestrians feel joy and happiness walking along the beaches (refer to Taha et al., 2012). Under the red zones there are highly traffic arteries where pedestrians suppose to feel anger and annoyed

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with more polluted environment. The blue zone gives indicators for the feelings of bored and fear so as to give more attention for these areas in the city.

This part of work is still in progress with a promising effort for more reliable work with the help of a number of participants for site experience of Alexandria city.

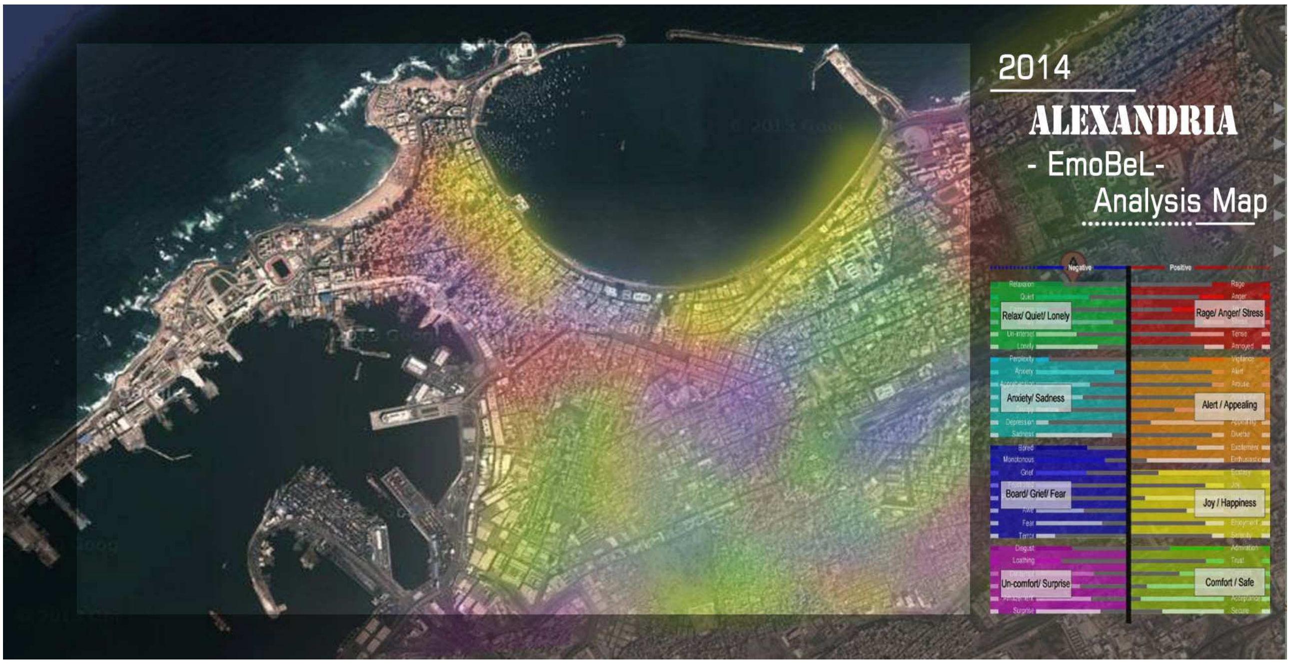

Fig.10: A prospective map of Alexandria city after applying the EmoBeL analysis approach.

8 RESEARCH POTENTIAL

This work is just a new start point on a micro scale level of research that could give more potential to decision makers in other disciplines by analyzing such maps and connecting them with the expectations activities for better understanding of our cities. This pilot study also threw up some interesting suggestions about how circumstances may affect our emotional condition, but still lakes a certain qualitative data collection that might be a stage forward.

9 CONCLUSION AND ONGOING WORK

Such research could be more supportive to decision making process in cities if it includes indicators and parameters to improve urban living conditions by answering the following questions: how do people perceive their environment? How people react on surrounding impacts either positively or negatively? How is it possible to collect all of the citizens' impressions in a centralized way; and how could these impressions be visualized in mapping process?

This work contributes to better understanding of the opportunities and challenges provided by a proposed EmoBeL analysis approach that could followed up with more tools and programs to bring benefits to different disciplines regarding city planning, architecture and decision making in cities.

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reviewed paper

It's Not Big, It's Large: Mapping and Characterizing Urban Landscapes of a Different Magnitude based on EO Data

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1 ABSTRACT

The United Nation's *"World Urbanization Prospects"* numeralise a migration process of a huge dimension – from rural to urban areas. While in 1975 only 37.7% of the world's global population were urban dwellers, in 1990 already 43.0% and today little over 50% of all earth-dwellers are living in urban areas. For the year 2050 the expected number is even 67.2% (UN, 2011). This recent and prospective urbanization trend leads to new spatial dimensions of urban landscapes.

One new trend is the spatial evolution of once polynuclei urban areas to so-called *'mega-regions'*. Because in literature clear definitions for the term *'mega-region'* are missing or at least fuzzy and only qualitative we aim to derive quantitative physical spatial characteristics possibly defining mega-regions. For this purpose we use multi-temporal and multi-source satellite data to classify urbanized areas for an exemplary mega-region – the Hong Kong-Shenzhen-Guangzhou mega-region in Southern China – for the years 1975, 1990, 2000 and 2011. Furthermore, we suggest a set of spatial features potentially characteristic for the evolution of mega-regions. In particular we apply a multitude of spatial metrics at a defined spatial unit for the entire mega-region. The result is a novel spatial approach to capture, measure and analyze new dimensions and shapes of urban landscapes.

2 INTRODUCTION

What is the shape of cities and how does it evolve? The traditional concept of the urban fabric – the 'city' in a broader sense – is defined as dense center surrounded by a more or less complex halo of lower-rise buildings and suburbs. However, the dramatic urbanization now under way constitutes one of the epochal transformations in human history. As a consequence of the before mentioned transformation process the overcoming process of spatial urbanization creates different types of settlement and respective landscape patterns. Thus spatial landscape configurations are not big anymore, they are large. Today the dynamic process of urbanization leads to a conglomeration of multi-nuclei patterns where a center is not obvious.

While spatial growth and expansion of urban areas and landscapes has long been studied at the local scale, the effects and change processes of urban expansion beyond a regional scale are virtually unknown. Especially as new dimensions and types of settlements and respective large-area urban landscape patterns are evolving. New concepts such as *mega-regions*, *urban corridors* and *city-regions* are suggested to capture the new nature of urban landscapes (UN-Habitat, 2008). It is particular characteristic for these new spatial units that they are emerging in various parts of the world, turning into spatial units that are territorially and functionally bound by economic, political, socio-cultural, and ecological systems (UN-Habitat, 2008). However, our understanding of urbanization at these scales is primarily based on United Nations population figures, but these statistics do not provide information on the distribution, pattern and evolution of the built environment (Zhang & Seto, 2011).

We use remote sensing data and techniques to provide a physical perspective on the evolving settlement patterns. Clear advantages in using remote sensing methods are the capacity for consistent mapping and periodic monitoring of large urban agglomerations such as mega-cities or mega-regions at various scales. In the following study we choose data from the Landsat programme which is an obvious and cost-effective choice as the data are freely available from USGS. Using this series of sensors allows to monitor spatial urbanization since the mid-1970s. For extending the time series we additionally opted for radar data. We use data from the radar satellites TerraSAR-X (TSX) and TanDEM-X (TDX) to delineate urbanized from non-urbanized areas (Esch et al., 2012; Taubenböck et al., 2012).

For our study we focus on the following research question by the use of large area, multi-temporal remote sensing data: Can we find specific spatial parameters which characterize the spatial configuration of a mega-region and which allow for an empirical definition of spatial mega-region attributes?

To find a systematic answer for the above mentioned research question we apply the following workflow schematically illustrated in Fig. 1. The headlines represent the structure of the paper. The study is basically oriented on the work published in Taubenböck et al. (2014).

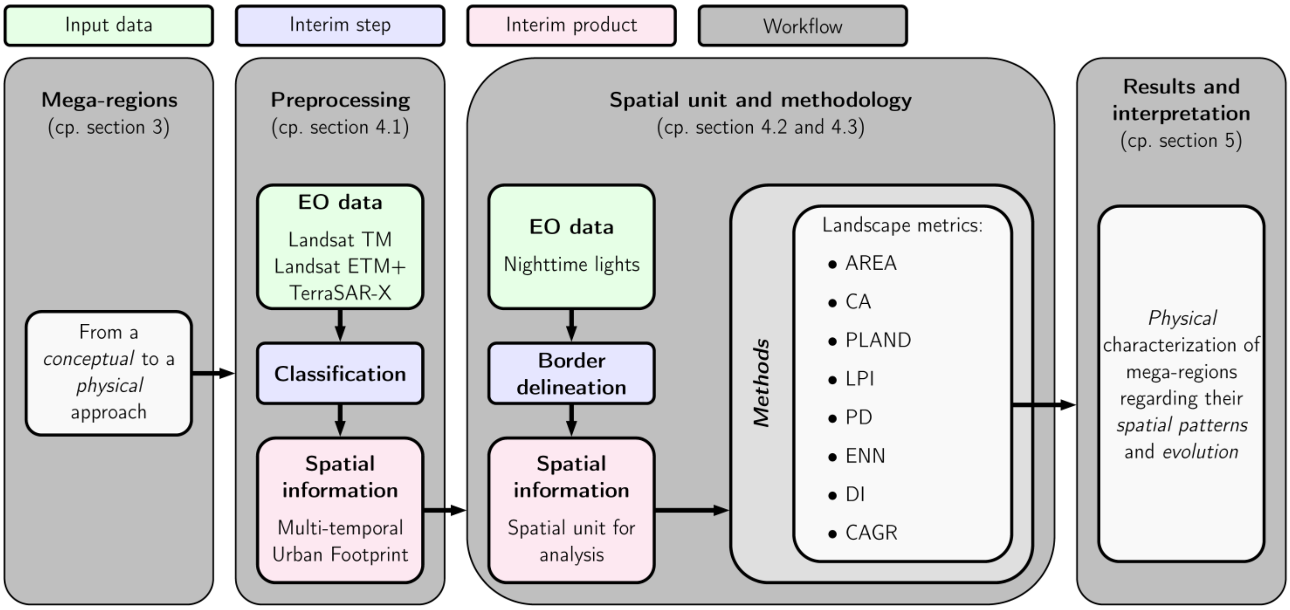

Fig. 1: Schematic overview of the workflow from a conceptual definition to the physical characterization of a mega-region.

3 THE CONCEPT OF MEGA-REGIONS AND THEIR PHYSICAL ATTRIBUTES

In literature there are many attempts to conceptualize the above mentioned new dimensions and types of settlement. In 2008 Florida et al. (2008) as well as the UN-Habitat (2008) suggested a new concept using the before mentioned term *mega-region* to capture the new nature of urban landscapes.

Mega-regions form a spatial unit territorially and functionally bound by several emerging city areas that result from the convergence growth (e.g. shared infrastructure systems) and spatial spread of geographically linked metropolitan areas and other agglomerations (Atlanta Regional Commission, 2008; Florida et al., 2008; UN-Habitat, 2008, Taubenböck et al., 2014). Further characteristics of mega-regions are the polycentric urban clustering surrounded by hinterlands with low densities regarding their settlement elements as well as the population growth which exceeds the growth of the overall population of the nations in which they are located (Florida, 2008).

Suggested examples of mega-regions in literature are the Hong Kong-Shenzhen-Guangzhou mega-region in China (home to approximately 120 million people), Nagoya-Osaka-Kyoto-Kobe in Japan (about 60 million), Philadelphia-Baltimore-Washington (named Bos-Wash) in USA (about 54 million) or Rio de Janeiro-Sao Paulo with about 43 million (Florida et al., 2008; UN-Habitat, 2008) among many others.

All of the above introduced concepts have the following properties:

(1) They classify the above introduced concept of a mega-region solely on a descriptive and qualitative level.

(2) An universal theory on their definition, location, evolution, spatial extent and delineation does not exist.

(3) Common approaches to delineate mega-regions are based on subjective perception of people or descriptive assumptions regarding land use and respective functional parameters. Nevertheless, respective resilient data sets on land use, commuting or socio-economy are very inconsistent across the globe or only available for case studies if available at all.

The central concern of this study is to overcome the qualitative stage of the conceptual definitions of mega-regions by classifying and characterizing the spatial pattern of the settlements and their evolution over time. Therefore we identify physical characteristics from the qualitative descriptions of mega-regions mentioned in the cited literature (after Taubenböck et al., 2014):

(1) The dimension of the area: several cities which are distributed over a large area beyond the dimensions of mega-cities form a mega-region;

(2) Poly-nuclei settlement pattern: cities which are formerly independent are at the mega-region stage physically linked to each other;

(3) Dynamics of urbanization: The urban growth dynamics exceed other regions or cities within the country.

4 METHODS

4.1 Classification method

We apply a backdating chronological workflow to optimize the outcome of the monitoring of spatial urbanization based on multi-sensoral EO data sets. Therefore, the classification aiming at delineating ‘urbanized’ from ‘non-urbanized’ areas starts with the latest data set, the TDX data from 2011, having the highest geometric resolution. For the TDX classification we classify VHR SAR images using a pixel-based approach. The result is a binary mask delineating ‘urbanized’ from ‘non-urbanized’ areas, a so called ‘urban footprint’ classification (Taubenböck et al., 2012; Esch et al., 2012).

For our backdating chronological workflow we use the urban footprint classification derived from TDX data from the year 2011 to support the classification of urban areas for the year 2000. The lower geometric resolution of the Landsat data as well as the related problem of mixed pixels makes it necessary to integrate the urban footprint classification from the year 2011 into our classification approach. With it we aim at reducing the possible areas for classifying urban areas in the scene of the 2000 time step to the particular spatial extension. Thus, we classify urbanized areas in the Landsat data only if the later time step confirms an urban location (Taubenböck et al., 2012). The classification of the Landsat scenes is based on an object-oriented hierarchical classification procedure, which has been elaborated by Abelen et al. (2011).

4.2 Spatial unit and methods

The spatial compositions of urban landscapes depend very much on the scale of observation. Therefore analysis and interpretation of landscape patterns are highly sensitive to the areas of interest as well as to the spatial and thematic scales. With respect to the available binary urban footprint classifications and the availability in multi-temporal resolution, we approach the spatial configuration and evolution of the mega-region in a self-defined spatial scale.

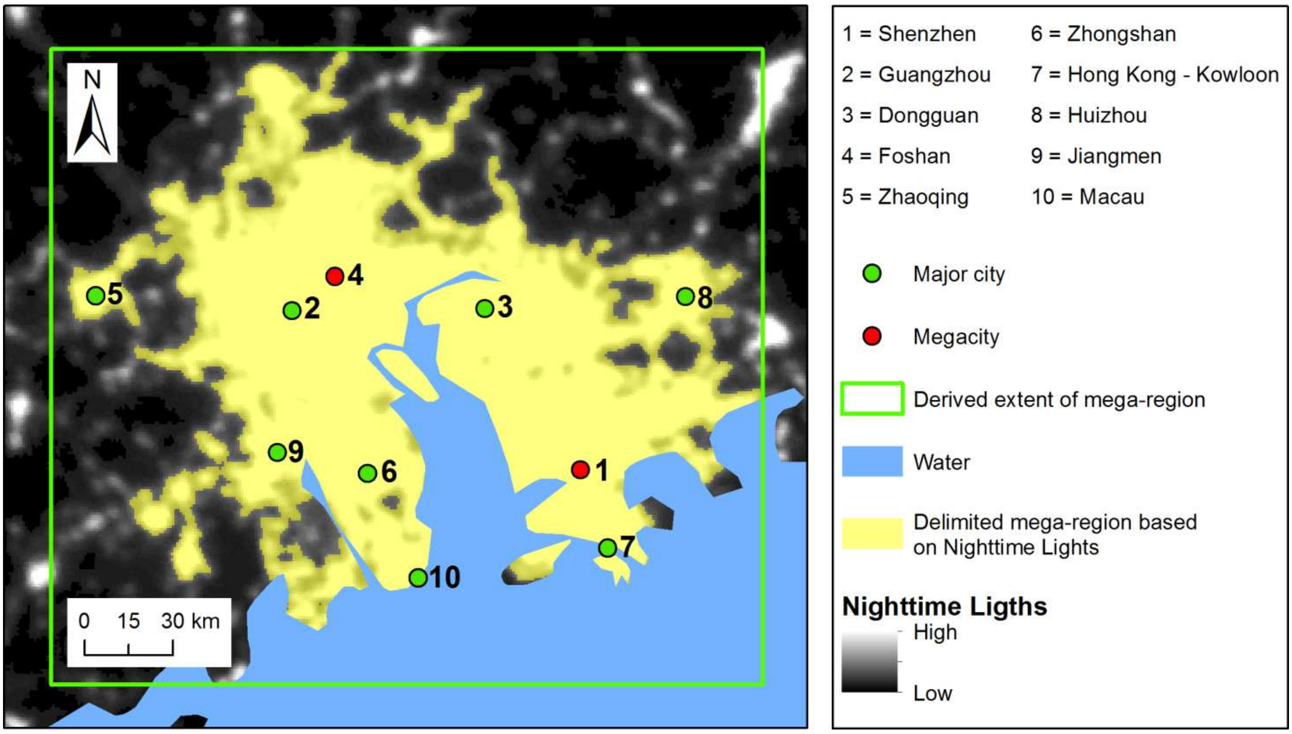

Fig. 2: Spatial delineation of the mega-region Hong Kong-Shenzhen-Guangzhou: The entire mega-region which contains 10 individual major cities of which two are mega-cities.

We use nighttime lights provided by the Defence Meteorological Satellite Program (DMSP-OLS) for a straightforward dissimilarity contrast split segmentation algorithm to differentiate between areas of light

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emission and dark areas as the light reflection inherits information on human activity (Fig. 2, NOAA, 2013, Taubenböck et al., 2014). Based on this we define a circumjacent rectangle drawn around the main body of coalescent areas of intense light emission to delineate the mega-region area (Fig. 2). We assume that the so extracted region inherits the spatial unit defining the area of interest for the entire mega-region (Taubenböck et al., 2014).

4.3 Spatial metrics for urban landscape analysis

Concerning two-dimensional urban patterns not even two spatial configurations across the globe are identical. However, it is a challenge to capture the complex patterns in a quantitative way. This is imporant for an objective identification of typical spatial features defining conceptual approaches such as mega-regions. For objective comparison beyond subjective visual inspection of the complex settlement pattern. We apply and develop spatial metrics at the defined spatial unit.

In the following we introduce the *Compound Annual Growth Rate* as well as *landscape metrics*.

4.3.1 Compound Annual Growth Rate (CAGR)

With the *Compound Annual Growth Rate* (CAGR) we aim at measuring the dynamics of spatial urban growth dependent on different time intervals (see equation 1). The CAGR is defined as annual growth rate of the considered measurement – in our case the change in urban extent between time step t_0 (i.e. 1975 in our case) and t – which can be related to different spatial units A (Taubenböck et al., 2014). Due to the approximate decadal availability of urban footprint classifications the spatial growth is interpolated per year.

$$CAGR(t_0, t) = \frac{A(t)}{A(t_0)}^{\frac{1}{N}} - 1 \qquad \text{(without unit)} \qquad (1)$$

4.3.2 Landscape metrics

One central goal of this study is to analyze the spatial landscape configuration using selected spatial metrics. These metrics have been introduced as quantitative measures of landscape configuration derived from digital analysis of thematic categorical maps showing spatial heterogeneity at specific scales and resolutions (McGarigal et al., 2002; McGarigal & Marks, 1995).

With the urban area as one thematic class of interest and with our main intention to identify typical features of the spatial urban landscape, we select complementary class-level-metrics to highlight landscape composition and landscape configuration from different points of view with respect to the class 'urban' (Riitters et al., 1995; Turner et al., 2001). We include in our analysis selected landscape metrics for the categories '*area and edge metrics*' and '*aggregation metrics*' (see table 1, McGarigal et al., 2012). We select landscape metrics based on particular hypotheses with respect to spatial changes as a consequence of urban growth processes.

Among the area and edge metrics we use the *Class Area* (CA) as a measure for the absolute urban area to define the dimension of the particular urbanized area.

The *Largest Patch Index* (LPI) gives the proportion of the total area occupied by the largest patch with respect to the entire landscape area A (Luck & Wu, 2002). It is a measure to define a metric, the *Modified Largest Patch Index* (MLPI), which also gives the proportion of the total area occupied by the largest patch with respect to the entire area of the class 'urban' (see equation 3). This metric is independent from the entire landscape area A and thus reveals the dominance of the main urban patch relative to the urbanized areas within the entire landscape (Taubenböck et al., 2014).

Among the '*aggregation metrics*' we apply the *Patch Density* (PD), which is the number of urban patches per area, as a measure of discrete urban areas in the landscape. Patch density is expected to increase during periods of rapid urban nuclei development, but may decrease if urban areas expand and merge into a continuous urban fabric (McGarigal et al., 2002; Seto & Fragkias, 2005).

For a quantitative measure on the relative location of the patches to each other we calculate two nearest neighbor metrics within the group of aggregation metrics: We calculate the *Mean Nearest Neighbor Distance* (ENN_MN). High values indicate isolation of patches, while low values indicate clustering of patches. Furthermore, the *Nearest Neighbor Coefficient of Variation* (ENN_CV) for patch distances measures relative variability around the mean of ENN (McGarigal & Marks, 1995). Thus, regularity or irregularity of the spatial patch composition can be indicated.

Beyond this, we use a *Dispersion Index* (DI) which is based on a combination of two above mentioned spatial metrics presented in Taubenböck et al. (2014): *Number of Patches* (NP) and the *Modified Largest Patch Index* (MLPI). The mathematical details are shown in equation 2 and 3.

$$NP = n_i \qquad (2)$$

with n_i equals the absolute number of patches of class *i*.

$$MLPI = \frac{\max_{j=1}^{n} a_{ij}}{CA} \cdot (100) \qquad \text{(in percent)} \qquad (3)$$

The spatial dispersion index is defined as a function of NP and MLPI; we assume that in a two-dimensional feature space spanned by both parameters – NP and MLPI – an urban landscape with the complete urban area CA (class area) represented in one single coalescent urban patch is an idealistic representation of a monocentric, compact landscape; this is represented in one urban patch and thus a MLPI of 100%. If the complete urban area CA is represented by the maximum possible number of non-coalescent individual patches the landscape would be idealistically dispers.

Both parameters are weighted equally and are normalized to $NP_{norm.}$ and $MLPI_{norm.}$ while building ratios between NP respectively MLPI and CA. For that CA is first converted from hectares to pixels depending on the raster pixel size. The mathematical details for $NP_{norm.}$ and $MLPI_{norm.}$ are shown in euqations 4 and 5:

$$NP_{norm.} = \frac{NP-1}{CA-1} \cdot 100 \qquad \text{(in percent)} \qquad (4)$$

$$MLPI_{norm.} = \frac{MLPI-\frac{1}{CA}}{100-\frac{1}{CA}} \cdot 100 \qquad \text{(in percent)} \qquad (5)$$

All landscapes classified can be absolutely related within this two-dimensional feature space spanned by the parameters *Normalized Number of Patches* ($NP_{norm.}$) and the *Normalized Modified Largest Patch Index* ($MLPI_{norm.}$).

$$DI = \frac{NP_{norm.}+(100-MLPI_{norm.})}{2} \qquad \text{(without unit)} \qquad (6)$$

If the DI approaches 0, then the pattern is compact with a low number of patches ($NP_{norm.}$) and the largest patch ($MLPI_{norm.}$) is integrating almost the entire urban landscape. This specific landscape can be interpreted as spatially monocentric. If the DI values approach 100 the number of patches is high and the dominance of the largest patch is very low, thus we are close to an idealistically, spatially dispersed landscape.

5 RESULTS

5.1 The mega-region Hong Kong-Shenzhen-Guangzhou

For testing the spatial approach and identifying spatial features which might be characteristic to define and classify an area as mega-region, we selected the *Hong Kong-Shenzhen-Guangzhou* area as representative case. This region is located in in the province of Guangdong on the South-East Chinese coast near to the piedmont and coastal plain physiographic regions, declining from the mountain areas in the north to sea level at the confluence of the Pearl River in the south (Yu & Ng, 2007).

Today two mega-cities – the provincial capital Guangzhou with 10.84 million inhabitants in 2011 and the economic hub Shenzhen (10.63 million in 2011) – are the dominating urban agglomerations (see Fig. 2); beside these two mega-cities several other large cities such as Dongguan, Foshan, Huizhou, Zhongshan, Jiangmen and Zhaoqing as well as two special administrative regions – Hong Kong and Macau – form a vast, polynuclei region with several dynamic extra-large cities and big cities of different sizes and types.

Population statistics assess that within the mega-region Hong Kong-Shenzhen-Guangzhou 120 million people are living (Oizumi, 2011). However, the population statistics mentioned above do not provide knowledge on the current physical processes.

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5.2 Spatial characteristics of a mega-region

In Fig. 3 the multi-temporal classification result for the entire mega-region Hong Kong-Shenzhen-Guangzhou is illustrated and shows us a very large and complex urban settlement pattern. It is characteristic that the city landscape stretches far beyond individual city limits to a more or less coalescent polynuclei pattern spanning roughly an area of 250 km times 220 km (Taubenböck et al., 2014). The multi-temporal classification pictures the highly dynamic process of spatial urbanization since the 1970s.

Subject	Metric	Formula	Units	Range
Area and edge metrics	AREA	$AREA = a_{ij}\left(\frac{1}{10000}\right)$	hectares	$AREA > 0$
	CA	$CA = \sum_{j=1}^{n} a_{ij}\left(\frac{1}{10000}\right)$	hectares	$CA > 0$
	PLAND	$PLAND = \frac{\sum_{j=1}^{n} a_{ij}}{A} \cdot (100)$	percent	$0 < LPI \leq 100$
	Largest Patch Index (LPI)	$LPI = \frac{\max_{j=1}^{n} a_{ij}}{A} \cdot (100)$	percent	$0 < PLAND \leq 100$
Aggregation metrics	Patch Density (PD)	$PD = \frac{n_i}{A} \cdot (10000) \cdot (100)$	Number per 100 hectares	$PD > 0$
	Euclidean Nearest-Neighbor Distance (ENN)	$ENN = h_{ij}$	meters	$ENN > 0$
Custom metrics	Dispersion Index (DI)	$DI = \frac{NP_{norm.} + (100 - MLPI_{norm.})}{2}$	percent	$0 \leq DI \leq 100$
Other metrics	CAGR	$CAGR(t_0, t) = \left(\frac{A(t)}{A(t_0)}\right)^{\frac{1}{N}} - 1$	none	$CAGR \geq 0$

Table 1: Mathematical details of the used spatial metrics for landscape quantification where aij ist the area (m²) of patch j of class i, A is the total landscape area in m² and hij is the distance (m) from patch ij to the nearest neighboring patch of the same type (class) based on patch edge-to-edge distance, computed from cell center to cell center.

It is characteristic for the time step of 1975 that individual more or less concentric city patterns with significant distances to the next larger city shaped the urban landscape. In between large and low dense rural areas separated the cities, thus a spatial connectivity was not given. This has altered significantly. Today a massive spatial urban sprawl shaping a more or less coalescent, highly complex, very large urban landscape. While in the 1970s each city can be considered spatially as a center in its own right, the pattern with today's large urban extensions and their almost totally merged shapes create a transformed, now coalescent multi-nuclei urban landscape (Taubenböck et al., 2014).

Based on the change detection we aim at quantitatively measuring the spatial urban configuration of the developing patterns for an empirical definition of possibly characteristic spatial mega-region attributes.

In general the CAGR (see equation 1) reveals very high spatial urban growth dynamics at mega-region level, with the highest dynamics in the 1990s of over 9 % (see figure 4 (left)). With respect to other studies, the mega-region grows spatially with higher dynamics (up to more than 13 times its spatial extent with respect to 1975; figure 4 (right)) than e.g. mega-cities. Indeed, in China even mega-cities such as Beijing (7 times) or Shanghai (6 times) spatially grow less dynamic, indirectly confirming the statement in chapter 3, that mega-regions grow considerably faster than other parts of the nation (Taubenböck et al., 2014 & 2014b).

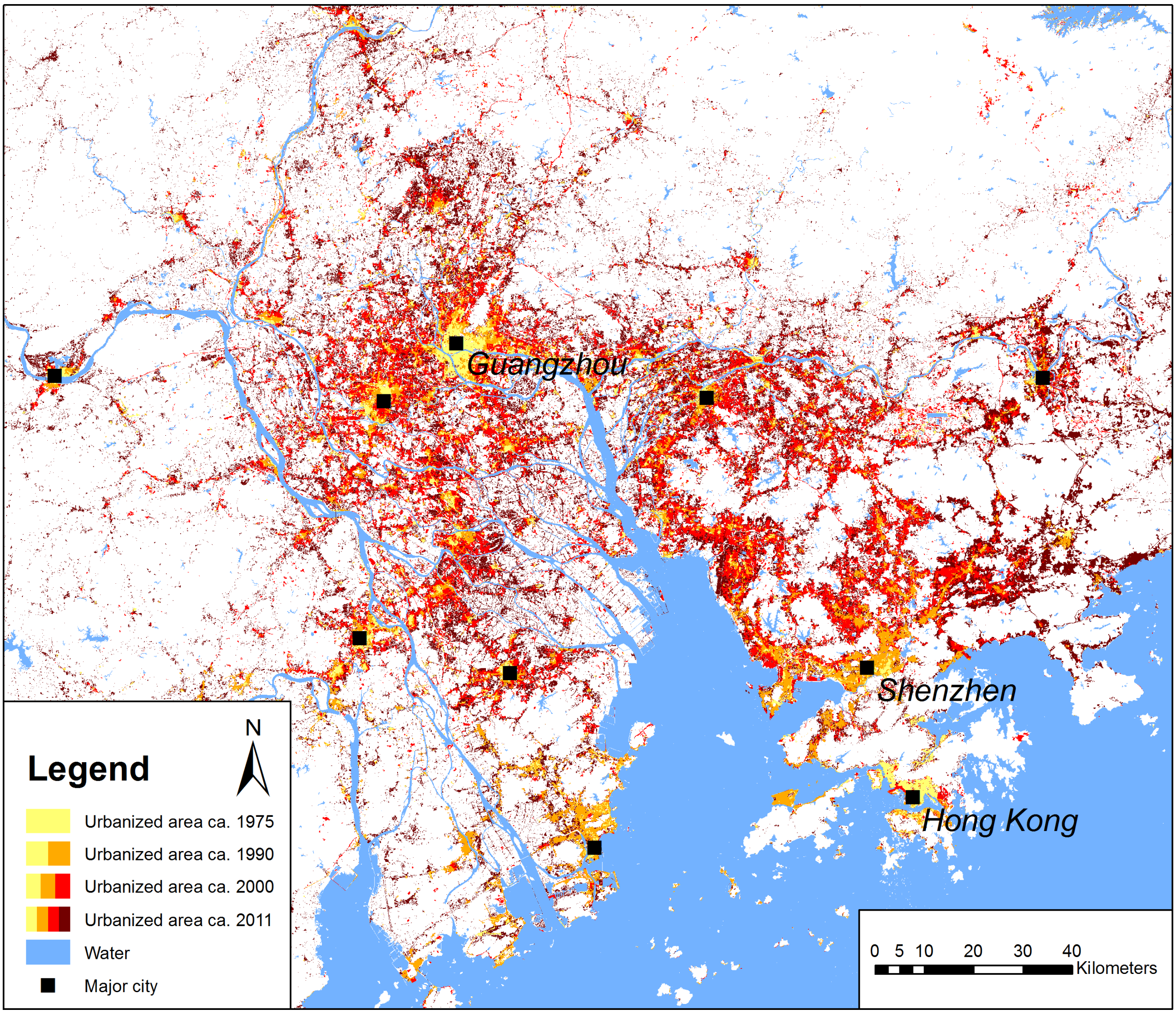

Fig. 3: Spatial development of the mega-region Hong Kong-Shenzhen-Guangzhou mapped from multi-temporal EO-data since the 1970s.

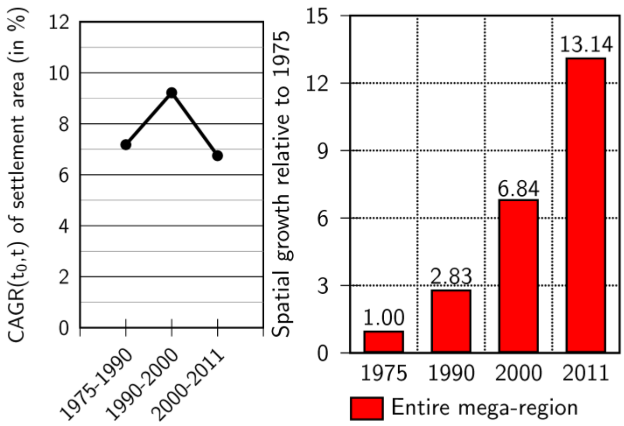

Fig. 4: Compound Annual Growth Rate (CAGR) of settlement area concerning the defined spatial extent of the mega-region (left) and the spatial growth of settlement areas for the entire mega-region relative to the urban footprint area in 1975 (right) (after Taubenböck et al., 2014).

Regarding the spatial configuration of the urban landscape we observe an continuously increasing LPI with a massive increase in the last decade (see figure 5 (left)). In general the values of LPI are low, when compared to other studies focusing on individual cities. This can be seen as a logical consequence as we deal with a multi-nuclei urban landscape. However, if the LPI calculated only on the urban footprint area (MLPI), the values of the MLPI show that coalescent processes reveal a relative dominance of a large patch (this can be

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traced back to the coalescing growth in the Guangzhou-Foshan area, where two neighbouring large cities developing a spatial focal point in the area) (see figure 3). Fig. 5 shows us that the value of the MLPI decreases from 1975 to 1990, what can be interpreted as beginning urban sprawl.

As a logical consequence of spatial urban growth combined with urban sprawl processes the PD is rising over all four time steps (see figure 5 (second from the left)). In particular, the immense increase between the years 2000 and 2011 can be lead back to intensive sprawling processes. At the same time we observe a decreasing mean nearest neighbor distance (ENN_MN) of urban patches hinting especially at densification processes of settlements in formerly low dense, spatially clearly separated areas between cities (see figure 5 (second from the right)). On the contrary the coefficient of variation of the Euclidean mean nearest neighbor distance (ENN_CV) rises permanently since 1990 as a consequence of densification process in a sprawling urban area (see figure 5 (right)).

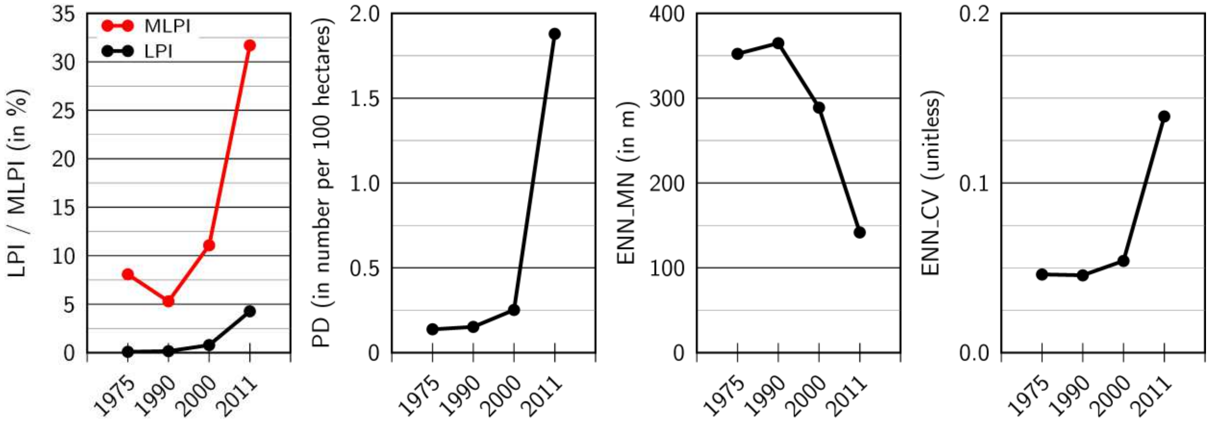

Fig. 5: Temporal development of LPI, MLPI, PD, ENN_MN and ENN_CV for the entire mega-region (after Taubenböck et al., 2014).

The dispersion index (DI) for the mega-region stays relatively constant for the years 1975 until 2000 (46.6; 47.6; 44.6) although spatial growth rates were enourmous (see figure 6). Accordingly, compaction and thus spatial weight of the largest patch within the mega-region basically balances splinter development. Since 2000 the DI shows a significant reduction (34.8) proofing a coalescent process to a multi-nuclei mega-region. Similarily, the behaviors of the city and the hinterland patterns reveal a tendency towards a more compact pattern.

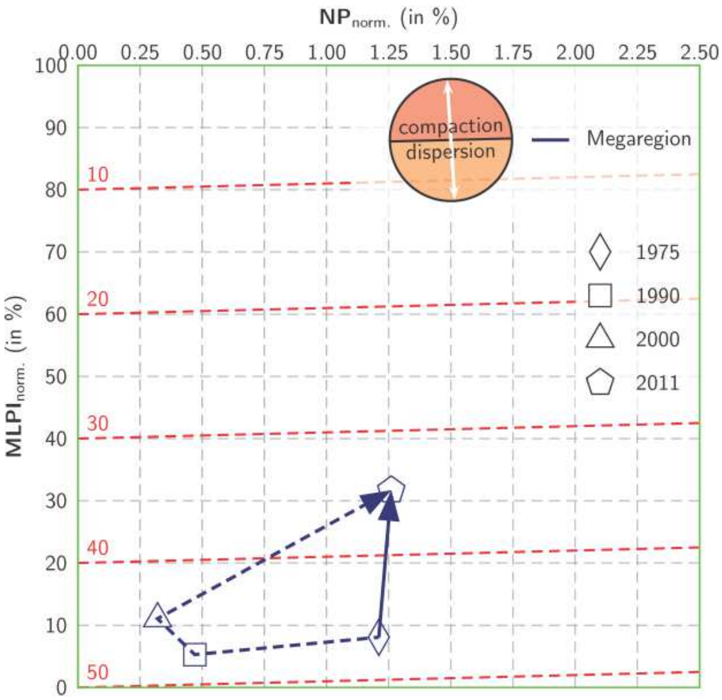

Fig. 6: The Dispersion Index (DI) as a function of NPnorm. and MLPInorm..

In Fig. 6 the y-axis as well as the x-axis are calculated relatively; this means that the Number of Patches (NP) as well as the Largest Patch Index (MLPI) are normalized spanning from 0 to 100 ($NP_{norm.}$ and $MLPI_{norm.}$) according to equations 4 and 5. The change of a pattern over time toward the lower right corner (this means an increasing number of patches and a decreasing size of the largest patch) within the two-dimensional diagram indicates a rising grade of spatial dispersion. The development of DI values vice versa toward the upper left corner in Fig. 6 indicates a more compact pattern (Taubenböck et al., 2014).

6 MAIN FINDINGS, DISCUSSION AND CONCLUSIONS

The main findings of this study refer to the research questions stated in chapter 2: Can we find specific spatial parameters which characterize the spatial configuration of a mega-region and which allow for an empirical definition of spatial mega-region attributes?

It is characteristic for our dynamically urbanizing world that new types of massive settlement types are evolving. The concept of mega-regions tries to capture this aspect by describing a large polynuclei coalescent urban area defined and bound by different systems – economic, transport, trade, settlements, political, etc.

We used multi-source remote sensing data for a consistent large area mapping and generated urban footprints for four time steps, namely 1975, 1990, 2000 and 2011. A major advantage of the applied multi-sensoral approach for long-time spatial monitoring consists in the consistently high classification accuracies between 80 and 90% (Taubenböck et al., 2012); however, it has to be mentioned that sensor changes as well as different physical aspects and geometric resolutions between Landsat and TSX/TDX data might, to a certrain degree, influence the pattern analysis.

By this spatial concept we characterize *spatial configurations of a mega-region*, which has been suggested in literature. With our suggested approach we introduced spatial features allowing for a possible *empirical definition of spatial mega-region attributes*.

In general the results confirm the identified physical characteristics from the qualitative descriptions of mega-regions from the cited literature. We observe the mega-region as an urban landscape growing far beyond an individual center. Thus, it is impossible to identify the borders between city, suburb, exurb or townscape. The dimension of the entire urban area is far beyond individual cities or respective mega-cities. Also the spatial dynamics are immense (13.14 times its spatial extent since 1975) and overcome the growth rates of mega-cities in China such as Beijing or Shanghai.

In general, we measure increasing values of the LPI and MLPI for the analyzed region. Although PD and therefore indirectly NP is increasing over time the coincidental and more intensive increase of MLPI results in a decreasing DI. This means the entire region is developing towards spatial compactness. Because of the slight but steady increase of PD we also identify a decreasing ENN_MN as well as a rising ENN_CV revealing trends of urban sprawl.

This study suggests physical parameters to define the abstract concept of mega-regions. As this approach has only been tested on one example – the Hong Kong-Shenzhen-Guangzhou mega-region in China – comparative studies to other mega-regions are critical to prove that the main findings are de facto characteristic for these large urban landscapes or if the special orographic, economic, transport, etc. situation has a higher influence on the resulting urban pattern. Beyond this, a complementary analysis of different systems such as trade or transport within the respective mega-region is of crucial importance to find a broader picture on the spatial delineation of mega-regions. Earth observation has to take its share in providing a larger data base for systematic urban analysis.

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Lampertheim effizient – Herausforderungen für Mittelstädte im Rahmen der Smart-City-Debatte

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1 EINLEITUNG

Der „Smart City"-Begriff ist nicht abschließend definiert, wird aber regelmäßig mit den Kriterien Nachhaltigkeit, Innovation sowie Optimierung von Infrastrukturen und Dienstleitungen durch die Nutzung von Informations- und Kommunikationstechnologien verknüpft (vgl. Saringer-Bory et al. 2012, Hollands 2008). Seit den verstärkten Bemühungen CO_2-Emissionen durch die Nutzung regenerativer Energien und die Steigerung der Energieeffizienz zu reduzieren, werden dementsprechende Maßnahmen häufig ebenfalls als „smart" klassifiziert. Es stellt sich die Frage, welche Potenziale und Schwierigkeiten kleinere Mittelstädte haben, sich in dieser Hinsicht zu smarten Städten zu entwickeln. Das Forschungsprojekt „Modellstadt25+/Lampertheim effizient" untersucht in der 32.000 Einwohner-Stadt Lampertheim in Hessen (Deutschland), wie auf Quartiers- und gesamtstädtischer Ebene Energie eingespart und die Energieeffizienz gesteigert werden kann. In dem vorliegenden Paper wird erläutert, welche typischen „Smart City"-Komponenten dabei zum Einsatz kommen und welche Hürden zu überwinden sind.

2 HINTERGRUND

Die Deutsche Bundesregierung hat sich bis 2020 das Ziel gesetzt, den CO_2-Ausstoß um 40 % im Vergleich zum Jahr 1990 zu senken (vgl. Bund 2007). Um dieses ehrgeizige Ziel zu erreichen, wurde die Förderung von Maßnahmen zur Energieeinsparung und Energieeffizienzsteigerung sowie zum Ausbau regenerativer Energien in zahlreichen nationalen Programmen festgelegt, bspw. im Energiekonzept oder dem Nationalen Aktionsplan Energieeffizienz (vgl. Bund 2010; BMWi 2011).

Dem Gebäudesektor kommt derzeit ein Anteil von ca. 40 % am Endenergieverbrauch Deutschlands zu (vgl. BMWi 2013). Er stellt somit eine wesentliche Komponente dar, die bei der Effizienzsteigerung und Energieverbrauchssenkung zu betrachten ist. Die Höhe des gebäudebezogenen Energieverbrauchs wird sowohl durch die Gebäudehülle und -technik beeinflusst, als auch durch das individuelle Verhalten der Gebäudenutzer. Das Projekt „Modellstadt 25+/Lampertheim effizient" analysiert diese drei Faktoren gemeinsam und leitet daraus energetische Optimierungspotenziale auf Ebene des Quartiers und auf gesamtstädtischer Ebene ab. Wie kann die Stadt Lampertheim als kleine Mittelstadt es schaffen, dass sie sich über die Bestandsaufnahme und Aktivierung von Energieeinsparpotenzialen zu einer smarten Stadt entwickelt?

3 „SMART CITY"-POTENZIALE UND HERAUSFORDERUNGEN VON KLEINEN MITTELSTÄDTEN

Als Erstes stellt sich die Frage nach einer Definition von kleinen Mittelstädten. Da in Deutschland zahlreiche landesspezifische Gemeindegrößen und -gliederungen existieren und die Bundesländer städtische Hierarchiestufen unterschiedlich vergeben, ist die Operationalisierung des Mittelstadt-Begriffs sehr schwierig (vgl. BBSR 2012: 11). Insgesamt sind Erscheinungsbild, Funktion, Lebensverhältnisse, Bedeutung für die regionale Versorgung und die individuellen Herausforderungen von kleinen Mittelstädten sehr vielfältig (vgl. BBSR 2012: 11f.), so dass Baumgart/Rüdiger (2010: 190) feststellen: „Die Mittelstadt gibt es nicht."

Im vorliegenden Fall wurde aus pragmatischen Gründen zunächst nur die Einwohnerzahl als Abgrenzungskriterium herangezogen, so dass die projektinterne Kategorie „Kleine Mittelstädte" alle deutschen Städte zwischen 25.000 und 50.000 Einwohner beinhaltet. Besondere Herausforderungen für Mittelstädte ergeben sich oftmals aus der schwierigen finanziellen Situation, in der sie sich befinden. So können Städte und Gemeinden in der Größenklasse zwischen 20.000 und 50.000 Einwohnern, zu 50% ihre Aufwendungen und Ausgaben für 2011 und 2012 nicht decken (vgl. kfw-Bankengruppe/difu 2013: 18). Im

Vergleich mit anderen städtischen Größenklassen fällt jedoch auf, dass größere Städte mit über 50.000 Einwohnern noch schlechter abschneiden (vgl. kfw-Bankengruppe/difu 2013: 18).

Neben der Einwohnerzahl sind stadtstrukturelle und akteursbezogene Strukturen in Mittelstädten i.d.R. überschaubarer als in Großstädten, weshalb die Dienstwege zwischen den verschiedenen Akteuren kürzer sind - „man kennt sich“, es existieren mehr persönliche Kontakte, die Aushandlungsprozesse über komplexe Problemlagen innerhalb der Stadtentwicklung positiv unterstützen können. Was auf der einen Seite fördernd wirkt, stellt sich auf der anderen Seite jedoch als Problem dar: So ist die Bearbeitung von aktuellen Themenfeldern, wie Energiewende oder Agenda-21-Prozessen stark abhängig vom „Verständnis und der Ausgestaltung des (Verwaltungs-)Fachpersonals“ (Baumgart 2004: 8). Die geringere Personalausstattung von kleinen Mittelstädten und die tendenziell eher übergreifenden, weniger ausdifferenzierten Arbeitsaufgaben der einzelnen Mitarbeiter können die Beschäftigung mit solchen zusätzlichen/„on-top“-Themen – die zugleich eine intensive Einarbeitung in die jeweilige Thematik erfordern - in kleineren Verwaltungen erschweren.

Ebenfalls eher problematisch stellt sich die Datenlage in kleinen Mittelstädten dar. Es existieren beispielsweise für nur ca. ein Drittel der deutschen kleinen Mittelstädte kostenlose Schrägluftbilder in Google-Maps oder Bing. Außerdem befinden sich die ALKIS-Daten auf einem unterschiedlich detaillierten Stand, so dass Methoden, die für spezielle Mittelstädte entwickelt wurden, oftmals aus Gründen der geringen und oftmals sehr unterschiedlichen Datenverfügbarkeit in weiteren Mittelstädten nicht oder nur bedingt zum Einsatz kommen können. Insbesondere die Daten zum Gebäudebestand wie Baualtersklassen, Gebäudehöhen und Wohnfläche oder der Sanierungsstand, liegen nicht flächendeckend vor, geschweige denn in digitalen Datenbanken und im GIS räumlich verortet. Allerdings stellen diese Daten eine unabdingbare Voraussetzung für ein kommunales Energiemonitoring dar. Doch hier sind nicht alleine die Städte gefragt, sondern auch weitere Akteursgruppen, wie Wohnungsgenossenschaften und Energieversorgungsunternehmen, die den Kommunen ihre Datengrundlagen zur Verfügung stellen könnten. Vor diesem Hintergrund weist Voigt ausdrücklich darauf hin, wie wichtig Daten zur Wärme- und Stromversorgung von privaten Haushalten auf Ebene des Quartiers und auf gesamtstädtischer Ebene sind, um den Umbau des Energiesystems zu meistern, zeigt aber auch die Problematik auf, die mit einer derartig umfangreichen Datenbeschaffung einhergeht (vgl. Voigt 2013: 51f.).

Nichtsdestotrotz weisen kleine Mittelstädte insbesondere aufgrund ihrer Überschaubarkeit große Potenziale auf, um sich zu „smarten“ Städten zu entwickeln. So erfahren bspw. besondere „Aktionen“ und Wettbewerbe zu bestimmten Themen innerhalb von kleinen Mittelstädten eine höhere Aufmerksamkeit, da sie eine höhere Außeralltäglichkeit aufweisen, als das bei Großstädten der Fall ist. Auch im Bereich der Dienstleistungen können Mittelstädte Vorteile nutzen: Beratungsangebote können spezifischer an die örtlichen Gegebenheiten angepasst werden, z. B. durch Energieberater, die sich mit der Gebäudetypologie vor Ort besonders gut auskennen. Und auch Projekte im Infrastrukturbereich können in kleineren Gemeinden von der weniger komplexen Akteursstruktur profitieren: Da die Optimierung der Energieinfrastruktur auf Quartiers- und gesamtstädtischer Ebene weniger zu versorgende Objekte umfasst, kann bspw. die Umsetzung von Nahwärmenetzen unter Umständen unkomplizierter erfolgen.

Schlussendlich zeigen andere Projekte, wie „Elektromobilität im Stauferland - Integriert in Stadtentwicklung und Klimaschutz“ in den Mittelzentren Göppingen und Schwäbisch Gmünd, dass innovative smarte Themen, wie die Integration von E-Mobilität innerhalb der Stadtentwicklung von Städten in mittlerer Größenordnung angegangen werden können. Hier wird ganz demonstrativ aufgezeigt, welche Herausforderungen aber auch Chancen E-Mobilität für Mittelstädte darstellen kann (vgl. Webseite EMiS 2014) und „dass Elektromobilität auch in Städten dieser Größe eine wichtige Zukunftstechnologie darstellt und dass Kommunen, die sich bereits heute mit dieser Technologie auseinandersetzen, einen Mehrwert für die Bürgerinnen und Bürger schaffen können.“ (Webseite EMiS 2013).

4 FORSCHUNGSPROJEKT „MODELLSTADT25+/LAMPERTHEIM EFFIZIENT“

Das EnEff:Stadt-Projekt „Modellstadt25+/Lampertheim effizient: Innovative Konzepte zur Realisierung von Energieeffizienzpotenzialen in Mittelstädten“ (Laufzeit: 2012-2015) wird vom deutschen Bundesministerium für Wirtschaft und Energie (BMWi) im Rahmen des 6. Energieforschungsprogramms „Innovation und neue Energietechnologien“ gefördert. Auftragnehmer sind das Institut für Hochspannungstechnik und das Institut für Stadtbauwesen und Stadtverkehr (ISB) der RWTH Aachen University sowie die Stadt Lampertheim und die EnergyEffizienz GmbH.

Ziel des Projektes ist es, eine ganzheitliche Methodik zur Untersuchung von Stadtquartieren zu entwickeln, die Investitionsentscheidungen zunächst für Wohngebäude – und in einem weiteren Schritt für Gewerbe, Handel und Dienstleistungen - auf Basis von energetischen Optimierungspotenzialen ableitet. Das computergestützte Tool soll in der Lage sein, technologieunabhängig optimale Maßnahmenpakete zu bündeln, die eine möglichst effiziente Versorgung mit Strom und Wärme ermöglichen (vgl. Krengel et al. 2014). Hierbei werden nicht nur gebäudebezogene (z. B. energetische Sanierung der Gebäudehülle), sondern auch quartiers- bzw. infrastrukturbezogene (z. B. Nahwärmenetze oder BHKW) Maßnahmen miteinander kombiniert. In das Modell fließen neben technischen, wirtschaftlichen und ökologischen Kriterien ebenfalls das energiebezogene Nutzerverhalten ein (vgl. Krengel et al. 2014). Ziel des Tools ist es, möglichst mittels weniger Eingabeparameter - insbesondere für Mittelstädte - belastbare Ergebnisse zu energetischen Optimierungspotenzialen auf Quartiersebene zu produzieren.

5 VORBEREITENDE ANALYSE

Im Rahmen der Modellentwicklung wurde eine vorbereitende Analyse durchgeführt, wofür zunächst umfangreiche Daten zusammengetragen, aufgearbeitet und räumlich verortet wurden. Insbesondere die heterogenen Datenquellen, datenschutzrechtliche Bestimmungen des Energieversorgungsunternehmens und der Stadt Lampertheim sowie gebäudebezogene Daten in ausreichender Qualität auf Quartiersebene und gesamtstädtischer Ebene zu ermitteln, waren große Herausforderungen. So mussten beispielsweise zahlreiche Bauakten in Papierform aus dem städtischen Archiv hinzugezogen werden, um das exakte Baualter einzelner Gebäude bestimmen zu können. Es wurde insgesamt festgestellt, dass viele Daten (noch) nicht digitalisiert vorliegen - eine Realität, der sich viele kleinere Mittelstädte stellen müssen, aber Grundvoraussetzung für eine smarte Stadt! Für komplexe Fragestellungen, die vor dem Hintergrund der Energiewende entstehen können, sind jedoch umfangreiche Datenbestände erforderlich, um die derzeitige Situation in Städten analysieren und zukunftsfähige Prognosen und Modelle erstellen zu können (vgl. Webseite Eneff-Stadt o.J.).

Die literaturbasierte Analyse zum Thema Nutzerverhalten kommt zu dem Ergebnis, dass der Heizenergieverbrauch privater Haushalte zwar maßgeblich durch den energetischen Zustand des Gebäudes bestimmt wird; der Einfluss des Nutzers auf den Heizenergieverbrauch ist jedoch sehr hoch und kann zu Verbrauchsänderungen von ± 50% führen (vgl. IWU 2003: 50; Abbildung 1). Weeber et al. 2010 sehen sogar das Heiz- und Lüftungsverhalten der Nutzer als relevanteste Stellgröße zur Aktivierung von Einsparpotenzialen an (vgl. Weeber et al. 2010: 860). Demnach sollten technische Maßnahmen zur Steigerung der Energieeffizienz an Gebäudehülle und -technik stets mit Aufklärungs- und Informationskampagnen für die Verbraucher gekoppelt werden, um den (Wärme-)Energieverbrauch tatsächlich zu reduzieren.

Weitere Forschungsvorhaben zum Einfluss des Nutzerverhaltens auf den Energieverbrauch setzen sich mit Rebound-Effekten auseinander (vgl. Santarius 2012). Damit wird das Phänomen beschrieben, dass die durch die Effizienzsteigerung erzielten Einsparungen geschmälert oder sogar aufgehoben werden, da bspw. das Wissen um den niedrigeren Verbrauch zugleich dazu verleiten kann, Geräte wie Heizungen, etc. öfter und länger zu nutzen. Bezogen auf die Raumwärmenutzung können die direkten Rebound-Effekte 10 bis 30 Prozent erreichen (vgl. Webseite Umweltbundesamt 2013).

Andere Studien untersuchen den Zusammenhang zwischen Energieverbrauch und Lebensstilzugehörigkeit: Bohunovsky et al. (2011) haben empirisch überprüft, wie der Energieverbrauch von österreichischen Haushalten mit der Zugehörigkeit zu unterschiedlichen Lebensstilen zusammenhängt und haben daraufhin verschiedene Energieverbrauchsstile abgeleitet. Sie kommen zu dem Ergebnis, dass zwar je nach Milieu/Lebensstil unterschiedliche Energienutzungsmuster existieren, jedoch „dass sich Energieeffizienz und Nutzungsverhalten über die Gruppen in Summe aufheben“ (Bohunovsky et al. 2011: 38) und der Gesamtenergiebedarf pro Person in der Summe in allen Lebensstil-Gruppen gleich ist. Begründet wird dies damit, dass „Haushalte, die Energie sehr effizient nutzen (energieeffiziente Geräte, gute Dämmung des Wohngebäudes) diese Einsparungen durch vermehrte Nutzung (mehr Geräte, größere Wohnflächen) bzw. ein intensiveres Mobilitätsverhalten (Fahrten mit dem Auto, Flüge) kompensieren“ (Bohunovsky et al. 2011: 38), so dass auch hier Rebound-Effekte nachgewiesen werden konnten.

Eine im Auftrag des UBA durchgeführte Studie trifft u. a. Aussagen zur Investitionsbereitschaft von Nutzern für klimaverträgliche Produkte bzw. klimabewusste Verhaltensweisen und kategorisiert die Nutzer ebenfalls nach unterschiedlichen Lebensstilgruppen unter Verwendung der Sinus-Milieus (vgl. UBA 2009). Hier werden - ähnlich zur österreichischen Untersuchung große Unterschiede - sowohl hinsichtlich des umweltbewussten Verhaltens als auch des Umweltbewusstseins - zwischen den einzelnen Lebensstilgruppen festgestellt. So sind untere soziale Schichten geprägt von einem starken Desinteresse an klimabezogenen Themen und weisen dementsprechende Verhaltensweisen auf, was auch im Zusammenhang mit dem geringem Einkommen dieser Milieus gesehen wird (vgl. UBA 2009: 29f.). Zudem werden explizit vier Lebensstilgruppen (Etablierte, Postmaterielle, Moderne Performer, Bürgerliche Mitte) genannt, die sich besonders umweltbewusst verhalten und vorgeschlagen, diese als Multiplikatoren für umwelt- bzw. klimabewusste Verhaltensweisen zu nutzen (vgl. UBA 2009: 9). Zugleich wird darauf hingewiesen, dass ein hohes Umweltbewusstsein nicht mit einem umweltgerechten Verhalten einhergehen muss und umgekehrt (vgl. UBA 2009: 9).

Als Ergebnis der vorbereitenden Analyse ist festzuhalten, dass zwar Studien existieren, die aus einer sozialwissenschaftlichen Perspektive heraus, versuchen besonders sparsames bzw. verschwenderisches Energieverbrauchsverhalten bestimmten Personengruppen zuzuordnen, dass diese Untersuchungen allerdings vornehmlich die Ursachen, Motivation und die Einstellungen von Verbrauchern, die dazu führen Energie einzusparen oder zu verschwenden in den Blick nehmen (vgl. Peters et al. 2012, Bohunovsky et al. 2011). Es bestehen jedoch weiterhin Forschungslücken bei der Quantifizierung des tatsächlichen Energieverbrauchs der befragten Nutzer (vgl. Peters et al. 2012) und bei der genaueren Untersuchung des Zusammenhangs zwischen der Altersstruktur der Nutzer, dem Verbrauchsverhalten und dem Heizenergieverbrauch (vgl. Krengel et al. 2014). Dies ist jedoch von hohem Interesse und bedarf daher einer empirischen Überprüfung. Denn über diesen Zusammenhang könnten über die Einwohnerstruktur eines Quartiers Rückschlüsse auf das Verbrauchsverhalten gezogen werden (vgl. Krengel et al. 2014).

Da Daten zum Nutzerverhalten bezogen auf den Heizenergie- und Stromverbrauch weder in der Literatur noch in Lampertheim selbst in der erforderlichen Datenqualität vorliegen, wurde im Sommer 2013 eine umfangreiche Haushaltsbefragung in Lampertheim durchgeführt. Auf dieser empirischen Datengrundlage werden die Nutzer als „kalkulierbare“ Verbraucher betrachtet, die nach ihren verschiedenen Verbräuchen, aber auch nach ihrer Bereitschaft - beispielsweise in die energetische Ertüchtigung eines Gebäudes - zu investieren, differenziert werden sollen.

Ziel ist es, eine Nutzerklassifizierung zu entwickeln, um diese in einem weiteren Schritt in das zu entwickelnde Rechenmodell zu integrieren. Dies wurde bei bestehenden Berechnungstools zur Ermittlung des Energiebedarfes auf Gebäudeebene als Komponente bislang noch nicht/oder kaum berücksichtigt.

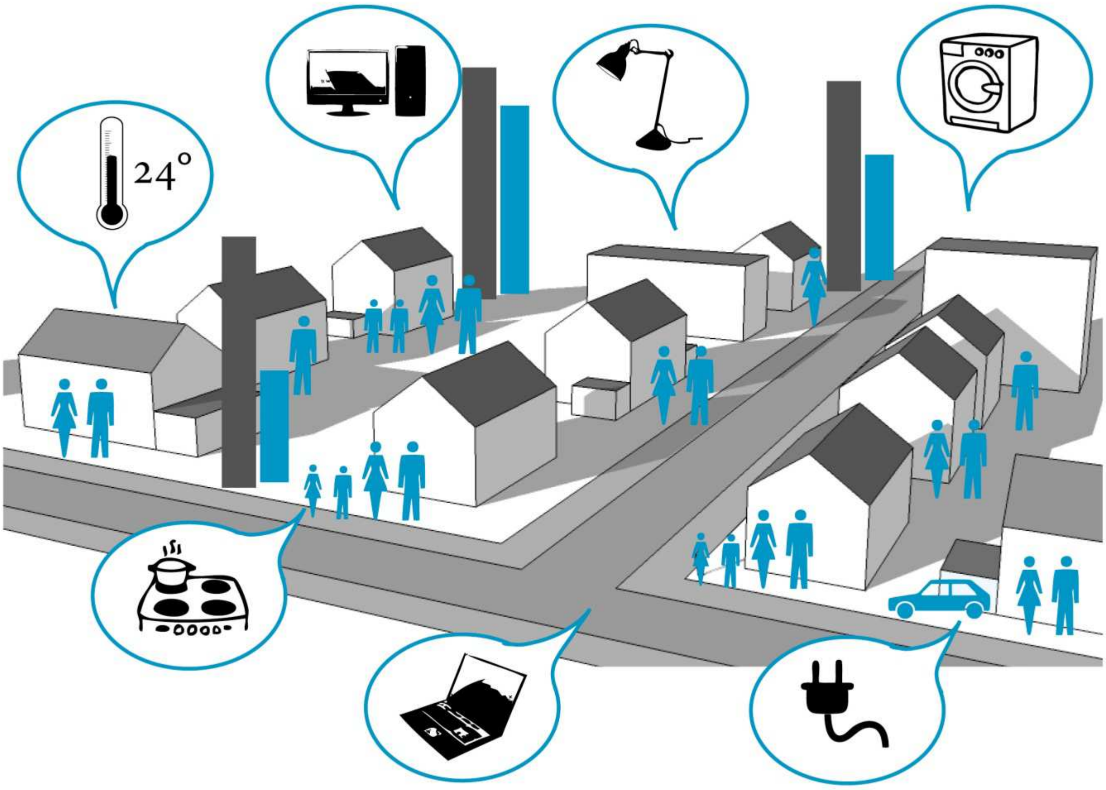

Abbildung 1: Nutzerverhalten im Quartier (Quelle: C. Dietrich, ISB).

6 HAUSHALTSBEFRAGUNG ALS DATENGRUNDLAGE

Im Rahmen der Haushaltsbefragung wurden rund 7.000 Fragebögen versendet, sie richtete sich an alle Lampertheimer ab 18 Jahren. Insgesamt haben ca. 1.000 Bürgerinnen und Bürger der Stadt Lampertheim den Fragebogen zurückgeschickt, der Rücklauf umfasste Personen aller Altersklassen.

Ziel der Befragung war es, vertiefte Kenntnisse über das Energieverbrauchsverhalten, das Investitionsverhalten und den Zusammenhang zwischen dem Energieverbrauch und sozioökonomischen Merkmalen der Befragten zu erlangen. Somit wurden im achtseitigen Fragebogen Einstellung zum Energiesparen, die Investitionsbereitschaft in Anlagen zur Nutzung erneuerbarer Energien oder in energetische Gebäudesanierung, Verbrauchsverhalten (z. B. Lüftungsdauer, Zimmertemperatur etc.), Angaben zur Person und weitere Aspekte zur Gebäudehülle und Gebäudetechnik abgefragt. Auf Basis dieser Datengrundlage können zudem der aktuelle und künftige Energieverbrauch in Lampertheim und zukünftige Investitionen besser abgeschätzt werden. Langfristiges Ziel soll es sein, diese Erkenntnisse auf andere kleine Mittelstädte zu übertragen.

7 ABLEITUNG VON NUTZERTYPOLOGIEN

Um eine Nutzertypologie für private Haushalte abzuleiten, wurden die Nutzer generell in zwei Kategorien – private Haushalte sowie Gewerbe, Handel und Dienstleistungen (GHD) unterteilt. Die Steuerungsmöglichkeiten der Stadtentwicklung beschränken sich überwiegend auf den Bereich der privaten Haushalte; verallgemeinernde Aussagen zu den Bereichen GHD können aufgrund ihrer sehr individuellen Einspar- und Optimierungspotenziale, seitens der Stadtentwicklung nicht/oder kaum getroffen werden (vgl. BMVBS 2012: 16). Sie sind dennoch Teil nachfolgender Arbeiten, werden aber in diesem Paper nicht behandelt. Vor diesem Hintergrund ist bei der Modellierung von Stadtquartieren zu berücksichtigen, welche Nutzungen vorwiegend im jeweiligen Quartier verortet sind oder ob sich beispielsweise neben der Wohnnutzung noch gewerbliche Nutzungen in den unteren Etagen der Gebäude befinden (z. B. in der Innenstadt).

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8 NUTZERKLASSEN PRIVATER HAUSHALTE – ZENTRALE STELLGRÖßEN

Aus vorangegangenen Analysen geht hervor, dass zu den wichtigen, das Energieverbrauchsverhalten beeinflussenden Faktoren in privaten Haushalten die Haushaltsgröße/Haushaltsstruktur, die Altersstruktur der Haushalte, das Haushaltseinkommen und die Eigentumsverhältnisse (Mieter/Eigentümer) zählen.

Die Größe der Haushalte stellt die zentrale Einflussgröße auf den Stromenergieverbrauch dar, da mit steigender Anzahl von Personen in einem Haushalt der Strombedarf zunimmt (vgl. EnergieAgentur NRW 2011: 5, 8); dies konnte ebenfalls bei der Auswertung der Haushaltsbefragung bestätigt werden. Jedoch steigt der Stromenergieverbrauch nicht proportional zur Anzahl der Personen im Haushalt: So haben beispielsweise Singlehaushalte in Relation gesehen einen sehr viel höheren Stromverbrauch als Zwei-Personen-Haushalte (vgl. EnergieAgentur NRW 2011: 5, 8). Außerdem zeigt sich, dass die Verbrauchspofile (prozentuale Verbrauchsanteile je Verbrauchsbereich) je nach Haushaltsgröße eine andere Ausprägung aufweisen (vgl. EnergieAgentur NRW 2011: 7f.). Das ist aber für die Nutzerklassifizierung privater Haushalte unerheblich, da es um den Gesamtenergieverbrauch der Haushalte geht. Zudem spielt die Haushaltsgröße nur indirekt eine Rolle im Zusammenhang mit dem Heizenergieverbrauch, da größere Haushalte in der Regel größere Wohneinheiten bewohnen.

Des Weiteren ist die Einbeziehung der Alters- und Einkommensstruktur sowie der Eigentumsverhältnisse im Rahmen der Nutzerklassifizierung wichtig: Beispielsweise kann angenommen werden, dass bei älteren Personen oder Personen mit geringerem Einkommen häufig eine geringere Investitionsbereitschaft hinsichtlich energetischer Maßnahmen am Gebäude oder energieeffizienter Produkte vorhanden ist und dass selbstbewohnende Eigentümer eher zu Investitionen im Rahmen einer energetischen Gebäudeertüchtigung geneigt sind (vgl. Lorenz-Hennig 2010; UBA 2009: 31).

Haushalte in Ein- und Zweifamilienhäusern mit einem höheren Einkommen weisen einen auf die Fläche bezogenen niedrigeren Heizenergieverbrauch auf, als Haushalte mit einem niedrigeren Einkommen (vgl. Frauenhofer Instituts für Systemtechnik und Innovation u. a. 2004: 63); begründet wird dies damit, dass Personen mit einem höheren Einkommen Gebäude bewohnen, die sich in einem besseren energetischen Zustand (jüngeres Baualter, bessere Ausstattung) befinden, als Personen mit niedrigerem Einkommen.

Hinsichtlich des Wärmekomfortverhaltens wird oftmals angenommen, dass ältere Menschen einen höheren Wärmekomfortbedarf aufweisen, als jüngere und damit einen höheren Heizenergieverbrauch haben. Ein statistischer Beleg für ein solches Verhalten älterer Personen existiert allerdings bislang nicht. Auch existiert eine gegenläufige Annahmen, die davon ausgeht, dass das Milieu der „Traditionsverwurzelten" - zu dem ein großer Anteil der Generation 65+ zählt und das 14% der Gesamtbevölkerung in Deutschland ausmacht - eine ausgeprägte Sparsamkeitsorientierung aufweist und durch seine sparsame Verhaltensweise eher zu Energieeinsparungen beiträgt (vgl. UBA 2009: 18; 30f.).

Aus Auswertung der Haushaltsbefragung in Lampertheim kann bisher abgeleitet werden, dass ein statistisch signifikanter Zusammenhang zwischen Alter der Befragten und dem spezifischen Heizwärmeverbrauch ($kWh/m^2/a$) existiert: So haben ältere Befragte einen tendenziell höheren Heizenergieverbrauch pro m^2 und Jahr als jüngere Befragungsteilnehmer (vgl. Abbildung 2). Dies muss jedoch nicht zwangsläufig mit dem Wohnkomfortverhalten zu erklären sein; die Erklärung für diesen Zusammenhang kann auch darin begründet liegen, dass ältere Personen tendenziell eher in älteren Gebäuden leben und/oder dass ältere Personen sich länger und öfter zu Hause aufhalten.

Die im Projekt zu entwickelnden Nutzertypen oder Nutzerklassen privater Haushalte sollen sich in ihrem Energieverbrauchsverhalten möglichst stark voneinander unterscheiden und gleichzeitig innerhalb ihrer Gruppe eine möglichst geringe Varianz aufweisen. Da Strom- und Heizkostenzähler, zumeist haushalts- bzw. wohneinheitenbezogene Daten bereitstellen, ist es sinnvoll eine Nutzertypologie auf Haushaltsebene zu entwickeln. Somit handelt es sich nicht um den einzelnen Nutzer als Individuum der untersucht wird, sondern um eine Klassierung von Nutzern.

Die unterschiedlichen Klassen werden so eingeteilt, dass sie sich z. B. im Energieverbrauch stark voneinander unterscheiden, so dass es eine Einteilung nach „Vielverbrauchern", „durchschnittlichen Energieverbrauchern" und „Energiesparern" angestrebt wird.

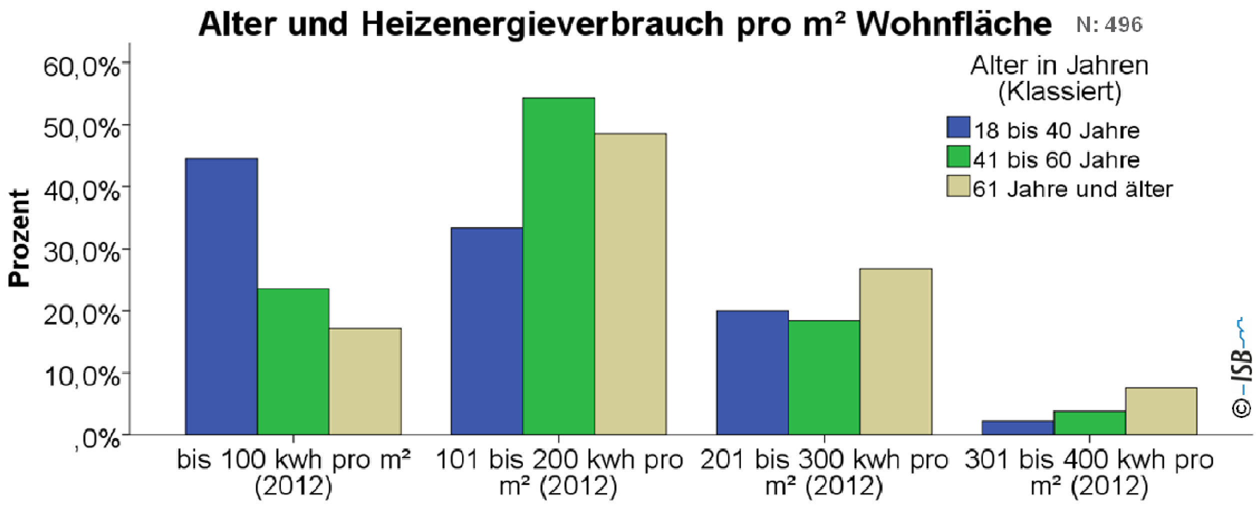

Abbildung 2: Alter und Heizenergieverbrauch pro m² Wohnfläche in der Haushaltsbefragung Lampertheim 2013 (Quelle: C. Dietrich, ISB).

9 AUSBLICK

Die bereits begonnene Auswertung der Haushaltsbefragung und die darauf basierende Nutzerklassifizierung werden weiter geführt. Die Nutzerklassen sollen in Form von metrischen Daten in das Modell integriert und/oder als Übersichtskarten auf Quartierseben dargestellt werden. Daraus sollen u. a. Rückschlüsse auf das zukünftige Investitionsverhalten in Erneuerbare Energien, energetische Ertüchtigung des Wohngebäudes etc. ermöglicht werden. Zudem ist eine zweite Nutzertypologie im Bereich Gewerbe, Handel und Dienstleistung geplant; hierfür steht die weitere Datenbeschaffung noch bevor. Insgesamt wird ein verstärktes Augenmerk darauf gelegt, dass die Nutzertypologie auf andere Mittelstädte übertragbar und die Nutzerklassen mit möglichst wenig Aufwand ermittelbar sind.

10 SCHLUSSFOLGERUNG

Mittelstädte haben durchaus ein großes Potenzial sich als Smart City zu behaupten. Die Ergebnisse der Umfrage haben z. B. gezeigt, dass in der Mittelstadt Lampertheim smarte Bürgerinnen und Bürger leben. Denn die Befragten haben nicht nur ein großes Interesse an Themen wie Energieeinsparung, Energieeffizienz und erneuerbare Energien, sondern sie handeln auch smart: 93 Prozent der Befragten achten eigenen Angaben zufolge beim Kauf von Haushaltsgeräten auf die Energieeffizienzklasse. 76 Prozent verhalten sich energiesparend, wo immer es geht. Zudem ist es einer deutlichen Mehrheit der Befragten wichtig, dass ihr Strom aus erneuerbaren Energien gewonnen wird. Außerdem hat die überschaubare Stadt- und Verwaltungsstruktur dazu geführt, schnell mit allen relevanten Akteuren in Kontakt zu treten und Absprachen treffen zu können.

Mit dem Rechenmodell wird insbesondere Mittelstädten ein einfach zu handhabendes computergestütztes Tool zur Optimierung der Energieeffizienz zur Verfügung stehen. Durch eine Zusammenschau von möglichen energetischen Optimierungspotenzialen auf gesamtstädtischer und auf Quartiersebene stehen Mittelstädten Wege offen, um noch smarter zu werden und die Energiewende zu meistern. Letztendlich hängt die Smartheit einer Stadt jedoch ganz entscheidend von der Beteiligung der Bürgerinnen und Bürger vor Ort ab, da diese die Energiewende und auch die damit verbundenen Kosten stemmen müssen.

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🏆 *reviewed paper*

Land Acquisition Policy in India: An effictive Inclusive Planning or Exclusive Planning Policy?

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1 ABSTRACT

India is a developing country and it requires fast space quality infrastructure development, which is the need of current times. For any development, land is required and the land belongs to the people. Government is acquiring land for “Public Purpose”. Government of India (GoI) has substantially increased its focus towards infrastructure development, over the last few decades which lead to economic growth of the country.

A preliminary assessment of Five Year Plan (FYP) of Planning Commission suggests that investment in infrastructure during the Twelfth Plan (2012-17) would need to be of the order of about Rs. 4099240 crore (US $ 1025 billion) to achieve a share of 9.95% as a proportion of Gross Domestic Product (GDP). This would have to be a key priority area in the Twelfth Plan in order to sustain and support the targeted growth. Based on the Eleventh Five Year Plan (2007-12), the Planning Commission has assessed the investment in infrastructure is Rs. 2054205 crore. The investment in infrastructure was likely to rise from 5.15% of GDP during the Tenth Plan to about 7.55% during the Eleventh Plan, as against a target of 7.60%. This consti¬tutes a significant shift in favour of investment in infrastructure.

Acquisition of land for public purpose displaces people, forcing them to give up their home, assets and means of livelihood. The GoI recognizes the need to minimize large scale displacement to the extent possible and, where displacement is inevitable, the need to handle with utmost care and forethought issues relating to Resettlement and Rehabilitation (R&R) of Project Affected Families (PAF) and formulate R&R Policies under Land Acquisition Act, 1894 and National Resettlement and Rrehabilitation Policy 2007 has been replaces by The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (RFCTLARR) Act, 2013. The ground reality differs from it.

Under Section 4 of Land Acquisition Act, 1894 land can be acquired only for a “Public Purpose” where as asper the new The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 government will define themself the term “Public Purpose” to include projects such as mining, tourism, sports, etc. Thus virtually everything is covered. The concept of public receives its meaning or definition within the given context of economic changes and the related “developmentalism”. This means that in a case where urbanization is required to rehabilitate large labour population, the public purpose will be construction of housing or improvement of village site to accommodate this additional population. The definition of “Public Purpose” is deficient, as it has been argued that land being acquired and handed over to a private developer as ‘Public Private Partnership (PPP)’ model by development agencies for creation of public utilities be considered as public purpose. The courts have allowed for this loose interpretation by adopting a hands off attitude and consistently holding that it is entirely State to decide whether a public purpose will be met by a given acquisition, as the courts are not competent enough to into the issue of whether a purpose is a public purpose or not. Thus interpretive liberties have taken by government while operationalising the concept (Ghatak & Ghosh, 2011). Planned development in India immediately after independence, 1947, especially the growth of core sectors such as power, mining, heavy industry and irrigation, displaced at least 30 to 50 million people; only about 25% of this number was resettled and the rest either died or took the road to poverty. If urban dislocation is included, the figure would increase further (Fernandes and Paranjpye 1997:6); and all this took place in the name of the national interest and ‘for the ultimate good of all’.

The importance of land policies and state control over urban development had always been a political and economic imperative. Historically it has been an instrument of exerting political controls. Today in democratic set up, it is a geographic and locational dimension of social and economic development and distribution of the resources. Land and society are profoundly linked: development and evolution of societies is expressed as corresponding to spatial organisation.

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2 INTRODUCTION

All strategic interventions on human development, spread across all social issues, need directives of policies and legal support to operationalise the appropriate actions. These policies and legislations help to overcome the constraints and support administrator, implementer, community and individual in delivery of justice in case of fast space quality infrastructure development, which is the need of current times. For any development, land is required and the land belongs to the people. Government is acquiring land for 'Public Purpose'. Government of India has substantially increased its focus towards infrastructure development, over the last few decades which lead to economic growth of the country. At the same time, there are national policies and legislations on some relevant issues like R&R, indigenous or tribal population, cultural properties etc.

Government of India comes up with new law for land acquisition which is the RFCTLARR Act, 2013. The new law replaces Land Acquisition Act, 1894 and National R&R Policy, 2007. The Act claims to better reflect Government's commitment towards securing a legal guarantee for the rights of project affected, and ensuring greater transparency in the land acquisition process. It is also claimed that this act will ensure, in concert with local institutions of self-government and Gram Sabhas established under the constitution, a humane, participative, informed, consultative and transparent process for land acquisition. This act is applicable in whole of India except J&K (The State Land Acquisition Act, 1990).

To tackle the issues on infrastructure development, industrialization and urbanization there is a need to provide right laws and procedures for the land acquisition. The balancing is tough, as on one hand, there is an urgent need for development, while on the other hand to safeguard the interest of the land owners/users and farmers are an important issue. There is a debate whether the new land act, as proposed, is a political attempt to appease a large vote bank and is, therefore, not balanced from the perspective of the development plan. The case can be argued from both sides equally. One of the objectives of the new land act is to make the process of land acquisition easy, transparent and fair for both sides. However, a perusal of the act shows that this objective is extremely difficult to be achieved as the procedure involved is quite lengthy, cumbersome and in some situations impractical. The historical incident, where the manufacturing unit of "Nano" shifted from West Bengal to Gujarat, manifests the importance of land acquisition as well as political will.

If the land is made available for development, it brings prosperity to the state, generating large volumes of employment opportunities; development of ancillary manufacturing units; manufacturing plant itself, increase in the production and the related trade and commerce as well as bringing revenues to the government under multiple heads of direct and indirect taxes. The procedure spelled out in the new land act and the nature of compensation to be given appears to be lopsided and may not give the right impetus to the new act for various reasons. The new land act enjoys primacy over other stabilized legislations that are currently in force and the provisions are in addition and not in derogation of the existing safeguards provided for in 13 other laws for the land acquisition (like highways, defense, railways etc). Now the question does the new land act a comprehensive solution?

3 REQUIREMENT OF NEW LAW

- Public Concern: Public concern on land acquisition is highlighted (inclusive planning), absence of national law for R&R and absence of compensation for loss of livelihoods (exclusive planning).
- Outdated Law: While multiple amendments have been made to the century old original act, the principal law continues to be the same, and
- Need for Balance: Addressing concerns of farmers loss of livelihoods while facilitating land acquisition for industrialization, infrastructure and urbanization.

3.1 Applicability

Both land acquisition and R&R provisions will apply when (1) government acquires land for its own use, hold and control; (2) government acquires land with the ultimate purpose to transfer it for the use of private companies for stated public purpose (including PPP projects); and (3) government acquires land for immediate and declared use by private companies for public purpose.

Public purpose inclusive planning once stated cannot be changed. Where the land acquisition is for private companies, 80% of the project affected families must give consent to the proposed acquisition. Where the land acquisition is for PPP projects, the prior consent of at least seventy per cent of those affected families is required.

3.2 Only R&R provisions will apply when

Private companies buy land, equal to or more than as may be prescribed by the appropriate government, on their own. The limit though originally suggested under the act was 100 acres, but now this has been left to respective governments, however, it is expected that minimum limit of 100 acres would be adopted.

Private company approaches government for partial acquisition for public purpose. The land acquisition and R&R apply only in the situations which are contemplated in the new land acquisition act. Where the land being acquired by any individual or a private company or a society is less than the minimum limit, the provisions of R&R are not applicable. This puts to rest concerns of the individuals and the companies buying and acquiring agricultural lands below the minimum limit, as the provisions of the act will not apply to such acquisition.

As a natural corollary there can be an abuse to this process as large track of lands can be acquired by an interested party by buying land below the prescribed minimum limit, in the name of different family members/different companies. Therefore, to what extent this concern can be mitigated is anyone’s guess. As per the provisions any multi cropped irrigated land cannot be acquired for public purposes. This is to ensure that the land under cultivation which can yield multi crop should not be touched.

3.3 Cost of acquisition and it is been defined in Section 3(i) which includes

- Compensation award amount by the competent authority and or the High Court;
- Demurrage to be paid for damages caused to the land and standing crops during the process of acquisition;
- Cost of acquisition of sites which are out of project land for settlement of displaced or adversely affected families;
- Cost of development of infrastructure and amenities at resettlement areas;
- Cost of R&R as per the act;
- Administrative cost of acquisition of land including both in project site and out of project area lands;
- Other administrative costs and;
- Cost of undertaking social impact assessment;

As is evident from the above there are several heads on compensatory packages and, therefore, cost of acquisition is going to be extremely high. More than that the procedure prescribed for acquiring the land and ascertaining the various costs/compensations in other parts of the act are quite cumbersome leaving ground for disputes and uncertainty.

3.4 Minimum Compensation for land

The compensation package includes:

(a) Market value of land to be assessed as per the formula in the act;

(b) Value of the asset attached to land; and

(c) Solatium which is 100% of total compensation arrived at by adding (a) & (b).

So far as the rural areas are concerned the market value so calculated shall be multiplied by 3. This means that for urban areas, the award amount would be not less than twice that of the market value determined, whereas in rural areas it would be not less than six times the original market value. This compels one to think if the compensation is more than liberal or wherever the compensation, R&R time to be consumed, procedure can be a death knell to any public or PPP project.

3.5 Minimum R&R entitlements

3.5.1 For Land Owners:

(a) Subsistence allowance at Rs. 3000 per month per family for a year;

(b) Rs. 2,000 per month per family as annuity for 20 years, with appropriate index for inflation;

(c) If house is lost, a constructed house of plinth area of 150 sqm. of house site in rural areas or 50 sum. plinth area in urban area;

(d) One acre of land to each family in the command area, if land is acquired for an irrigation project;

(e) One time transportation cost of Rs. 50000;

(a) Where land is acquired for urbanization, 20% of the developed land will be reserved and offered to land owners, in proportion to their land acquired;

(b) Upon every transfer of land within 10 years of the date of acquisition, 20% of the appreciated value shall be shared with the original owner whose land has been acquired;

- Mandatory employment for one member per affected family or Rs. 200000 if employment is not offered;
- Offer of shares up to 25% of the Compensation amount.

3.5.2 For Livelihood losers (including landless)

- Subsistence allowance at Rs. 3000 per month per family for a year.
- Rs. 2000 per month per family as annuity for 20 years, with appropriate index for inflation;
- If homeless, a constructed house (plinth area) on 150 sqm. of house site in rural areas or 50 sqm. in urban area, provided free of cost;
- A one-time resettlement allowance of Rs. 50000;
- Rs. 50000 for transportation;
- Mandatory employment for one member per affected family or Rs. 200000.

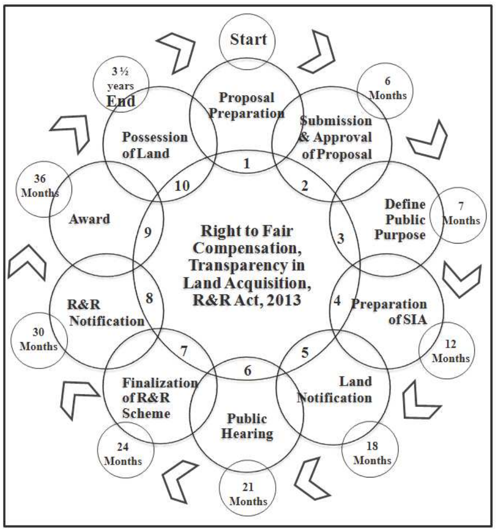

Fig. 1: Activities & Time Frame Required under RFCTLARR Act, 2013

3.5.3 Special Provisions for scheduled tribes:

- One acre of land to each scheduled tribe family in every project;
- One time financial assistance of Rs. 50000 for scheduled tribe families;
- ST families settled outside the district shall be entitled to an additional 25% R&R benefits (one-time payment of Rs. 50000) to which they are entitled in monetary terms;
- Payment of one third of the compensation amount at very outset to scheduled tribe families;

- Preference in relocation and resettlement in area in same compact block;
- Free land for community and social gatherings;
- In case of displacement of 100 or more scheduled tribe families, a tribal displacement plan is to be prepared;

3.6 Procedure

There is an exhaustive procedure spelled out under the act wherever any proposal is received by an Appropriate Government to acquire Land equal to or more than 100 acres for a public purpose (The process details in fig. 1).

3.7 Pre-Notification

(a) A social impact assessment shall be carried out in the affected areas in consultation with Gram Sabha. The social impact assessment will include assessment of nature of public interest involved, estimation of affected families, social economic impact, the families left behind.

(b) The appropriate government is to ensure that a public hearing on the report on social impact assessment is given in the affected area.

(c) The social impact assessment report shall be appraised by an independent multi-disciplinary expert group, which shall necessarily include the following persons:

- Two non-official social scientist;
- Two experts on rehabilitation; and
- A technical expert in the area relating to the project.
- If the government evokes urgency provisions social impact assessment will not be required.

Where the acquisition involved “any extent of land” a committee shall be constituted to examine proposals for land acquisition and social impact assessment report under the chairmanship of chief secretary and various other departments to ensure that there is a legitimate and bona fide public purpose behind public acquisition. The committee shall examine the report of the collector and the report given by the expert committee. The decision of the committee shall be made available in the public domain. The committee will also ascertain as to whether the consent of 80% of affected families have been obtained where the land is being acquired for the use of private companies for stated public purposes.

3.8 Notification, Award & Authorities

(a) Whenever the appropriate government is convinced that any area is required for public purpose, it shall appoint an administrator for R&R. Notification to the said affect along with details and the land to be acquired in rural and urban areas shall be published in the prescribed manner. It is important to note that if the preliminary notification is not published within 12 months from the date of appraisal of social impact assessment report by the expert committee, it shall be deemed to have lapsed and afresh social impact assessment will be required to be initiated. The process of notification as per Section 11 is quite exhaustive:

- Objections can be filed to any notice issued in connection with acquisition for public purpose within 60 days from the date of publication of the notification of the notification. The objections can be on:

(a) Extent and choice of land proposed to be acquired;

(b) Justification offered for public purposes;

(c) Findings of the social impact assessment report; and

(d) The collector is required to give an opportunity of being heard to the objector and, thereafter, the collector is expected to give his report to the appropriate government. The decision of the appropriate government on the objections shall be final.

- The administrator is expected to prepare R&R report after the publication of preliminary notification. For this purpose the administrator shall conduct a baseline survey and undertake a census of the affected families.

- As per Section 17 the R&R scheme to be prepared by administrator is expected to quite exhaustive and shall be time consuming. The draft R&R scheme is required to be given by publicity in the local area, followed by a public hearing. The scheme is to be submitted along with specific report on the schemes and objections received by the administrator to the collector. The R&R scheme is to be published in the official gadget by the administrator and made available in the affected areas. The collector shall review the scheme and submit the same with his remarks to the commissioner R&R for approval.

(b) Where the appropriate government is satisfied after considering the report on the need of a particular land to be acquired for public purpose the declaration shall be made to that affect. Along with declaration an area identified as the “resettlement area” is also to be declared for the purpose of R&R of the affected families.

(c) The collector is required to publish a summary of the R&R scheme along with draft declaration. Before the declaration is published the amount prescribed for the cost and acquisition is to be deposited.

(d) The declaration is to be published in the final gazette and papers giving the full publicity as prescribed in Section 20.

(e) After a declaration the land proposed to be acquired is to be marked, measured and planned. Further, notices are required to be issued to the interested persons regarding the government’s intention to take possession of land and to enable the concerned persons to receive compensation and benefits of R&R. The interested persons are interested to file their details, claims and objections not less than 30 days and more than six months.

(f) The collector shall look into the objections received from any person and then pass an award.

(g) It is important to note that the collector is required to make an award within a period of 12 months from the date of publication of the declaration under Section 20 and if no award is made within that period, the entire proceedings for the acquisition of the land shall lapse.

(h) While making the award the collector is expected to determine the market value as per the detailed mechanism provided in the act. He is also expected to include the asset attached to the land for the purpose of valuation which may be in the nature of building, trees, plants, standing crops etc. The collector is required to pass R&R awards in terms of mandatory entitlements provided in the schedule II of the act and in accordance with Section 27 of the act. The award given by the collector shall be filed in his office and shall be final and conclusive evidence of the award and the proceedings.

(i) The collector has been made responsible to ensure that R&R process is completed in all respects. The compensation is paid within a period of 3 months and the monetary part of R&R entitlements are handed over within a period of 6 months from the date of award. Only thereafter, the collector shall take possession of the land so acquired.

(j) R&R package in the second and third schedules that relate to infrastructural entitlements shall be provided within a period of eighteen months from the date of the award. (Section 39)

(k) special powers including power to take possession, publish without going through the process. However, these are rarest of rare situations like national security act.

(l) The act also provides for appointment of administrator for R&R if the appropriate government is satisfied that there is likely to be involuntary displacement of persons due to acquisition of land.

(m) The central government is expected to constitute a national monitoring committee for reviewing and monitor the implementation of R&R schemes or plans under the act. The states and union territories shall provide all the relevant information on the matters covered under this act, to the national monitoring committee in a regular and timely manner, and also as and when required.

(n) Part VI of the act provides for establishments of Land Acquisition, Rehabilitation and Resettlement, Dispute Settlement Authority for Centre and State. It is provided, inter alia that:

- Any person interested who has not accepted the award may, within the prescribed time, by written application to the Collector, require that the matter be referred by the Collector for the determination of the State or central authority, as the case may be,

- The Collector shall, within a period of thirty days from the date of receipt of application, the applicant make a reference to the appropriate authority.
- Where the Collector fails to make such reference within the period so specified, the applicant may apply to the State of Central Authority, as the case may be, requesting it to direct the Collector to make the reference to it within a period of thirty days.

Undoubtedly a bold attempt has been made under the act to protect the interest of persons impacted by land acquisition. However, duty time will tell on its actual efficacy for following reasons:

- The act seen is an attempt on the part of Government to appease a large vote bank and the intent is more political in nature than actual development in mind;
- Where private parties acquire land below the minimum limits by forming cartels or otherwise, this act is not applicable so it is doubtful if the interest of small farmers/land holders/users is actually protected;
- Act is not comprehensive and is to be read with several other acts in force on the land laws;
- The acquisition process pre-notification and post-notification is highly bureaucratic; time consuming and expensive;
- The compensation and R&R provisions sound exorbitant and prone to objections and legal disputes at different stages and before different authorities. Too many checks and balances have been provided which may lead to delays and prohibitive costs;
- Act has a socialist intent at heart and capitalist desire to achieve. How this hybrid mechanism will work is a million dollar question.

In the name of public purpose, the state should not be forcibly acquiring any land for the private corporation or their PPP project. Consent by majority of Gram Sabha members (or equivalent body in urban areas where these have been constituted) should be obtained in all matters pertaining to the act. There is no need to exempt any of the central acts used for land acquisition from the purview of the new act and to bring those at par with the new act, government should carry required amendments. Any unutilsied land shall return to the land owners. ‘Land bank of un-fertile, waste-lands’ for use by the industry or infrastructure projects should be prepared by the government not with the land remaining unutilised.

3.8.1 Applicability of the Law

The standing committee had recommended that all 16 central acts, used for land acquisition, should be brought under the purview of the new act, to make all equal before law (Article 14 of the Constitution). However, Section 105, Schedule IV excludes crucial 13 Central Acts including Industrial Development Act, Land Acquisition (Mines) Act, National Highways Act and others from the purview of the new act. This means that 90% of the land acquired as on today will continue with injustice and force used, with no change at all. It provides for issuing of notification mandating application of Schedule I and II within a year bringing all the acts, but the process based process of land acquisition will not be applied to them and arbitrariness and forced acquisitions will continue. RFCTLARR also mandates that the provisions of R&R under this act shall apply to acquisitions for private corporations, partial or full, and to purchase of land by private corporations beyond a certain limit, to be fixed by state governments, Section 2.3.

4 PUBLIC PURPOSE

Section 2 of RFCTLARR Act has an expansive definition of public purpose and infrastructure and also a clause which leaves the discretionary power to declare anything as infrastructure and of public purpose. Infrastructure has been equated with public purpose, which is ironic, given that expert committee is to make a decision about the public purpose. We must realise that every land to be acquired is serving public purpose of one kind or the other, single or multi crop land is also serving public purpose, hence a limited definition of public purpose was required, not an all encompassing, including even private profit projects.

4.1 Acquisition for Private and PPP Projects

The most regressive step in the RFCTLARR Act is the role of government in acquisition for private and PPP projects, which are for profit and not for public purpose, Section 2.2. In this era of neo-liberal economic

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reforms, private projects with corporate investment and interests are taking a much larger toll of land and other rich natural resources as also uprooting by killing communities which are generations old. This must come to an end and the same can happen only with stopping the State playing a role of facilitator and land dealer. At the cost of the livelihood of the nature based sections and working class section of society, the state can't transfer the most valuable livelihood resources such as land, water to the profiteering bodies in the garb of 'public interest' and 'public purpose'.

Provisions of free prior informed consent and consultation of local self Government institutions, one of the key features advertised in favour of the RFCTLARR Act is the 70% consent of land owners for PPP projects and 80% consent of the land owners for the private projects, Section 2.2.b. However, as we said that even with consent, government has no business acquiring land for the private corporation's profit, in the name of public purpose. Except for scheduled areas, Section 41.3, RFCTLARR Act mandates no consent of the Gram Sabha in government developed PPP. This is completely unacceptable given that post independence maximum acquisitions were done for the public sector companies leading to massive displacement.

Role of Gram Sabhas and other local self government institutions have found mentions at different places, Section 4, Section 5 (SIA); Section 16.5 (preparation of R&R scheme); Section 41.3 (Consent of Gram Sabha in SAs); Section 45 (Gram Sabha members in R&R Committee). In addition, provisions for two public hearings have been made, for preparation of SIA report and to prepare R&R Scheme. To its credit, RFCTLARR Act mandates publication of all the necessary information in the local language and made available to the Gram Sabha, Panchayat, Municipality and Municipal Corporation and also to project affected families.

4.2 Social impact assessment and determination of public purpose

One of the demands made by us was for compulsory social impact assessment to evaluate the extent of impact on various sections of society affected by displacement, given massive impoverishment and unnecessary acquisition of extra land and forcible acquisition without any options assessment. This has been incorporated in RFCTLARR, with exception of irrigation projects, for every project; Section II A, Section 4. Contrary to EIA the SIA report will be prepared by appropriate government in consultation with the Panchayat, Municipality and Municipal Corporation. A Public Hearing is also mandatory in the affected areas to ascertain the views of the affected families and included in the SIA report, Section 5. The expert group for appraisal of SIA report and to decide upon the nature of the public purpose, after consistent pressure, now has representatives of the democratically elected local self government institutions and non-official social scientists, expert's etc Section II B and Section 7. This is an improvement from the provisions of the earlier act where there was no process or provision for consulting or seeking consent of the people.

4.3 Food security and agricultural land acquisition

It is an irony that while food processing and other agriculture related secondary and tertiary sector industries have been brought in the public purpose definition but agriculture itself has not been considered a public purpose, something which would have meant no acquisition of agricultural land. The decision on quantum of agricultural land to be acquired has been left to State governments to decide, Section 10. However, the provision for development of an equivalent amount of culturable wasteland for agricultural purposes in lieu of land diverted is a welcome move, made possible by plea for ensuring food security, Section 10.3.

4.4 Return of unutilised land to farmers

Section 101 recommends that the land, if not used till 5 years, from the date of taking possession, it should be returned to the original land owners or to their heirs or to the land bank. We welcome this but the ownership over the land is of those who till it and if not used and unutilized then it must be returned to the owners or distributed amongst the project affected people. We oppose any such feature which will promote land bank, since it has promoted large scale acquisition in the past and later illegally transferred the same land to corporations for real estate and other purposes.

4.5 Retrospective application of the law

Section 24 deals with the retrospective application of the R&R provisions and the RFCTLARR Act and ongoing acquisitions under Land Acquisition Act, 1894. The act mandates only application of provisions of compensation, not of R&R scheme, in cases where the award under Section 11 of the Land Acquisition Act, 1894 has not been made. In case, the Award under Section 11 of Land Acquisition Act, 1894 has been made but possession not taken or compensation amount not deposited in majority cases then government may start fresh acquisition processes under the new act. It needs to be noted that nearly 100 million people have been displaced since independence and with a dismal 17 to 20% rate of R&R we had suggested that not only the retrospective application of the provisions of the new act but a National R&R Commission be established to deal with the claims of the projected affected people from various projects. Also the Land Acquisition Act, 1894 need to be repealed completely, two acts dealing with the land acquisition will bring in legal challenges and also negate the whole purpose of bringing in a new legislation with focus on process and consent based land acquisition process.

4.6 R&R Benefits

In terms of the R&R benefits, Section 26 to 30, schedule II, promote the principle of cash compensation rather than livelihood based R&R. It is a retrogressive step since it negates the land and employment based R&R as mandated in the Narmada water dispute tribunal award, and various other projects. The proposed provisions of compensating employment with money and high rates for land acquired will only lead to speculative land market and will destroy the fragile economy of the rural hinterland which will lead to further urban migration. Land for land provision is limited to one acre for general category farmers and two and a half acre for scheduled cast and scheduled tribe families in case of irrigation projects alone. By its own definition, marginal farmers are those who have one hectare of un-irrigated or half hectare of irrigated land, the provision of one acre land in command area is nothing but a cruel joke to farmers.

4.7 Compensation for Land

Section 26 to 30 and schedule one deals with the various provisions of calculation of compensation for land acquired but the power remains with the collector. It would have been fair to set up a land price determination commission which would have had participation of affected communities and also taken in account the various factors. Much hype has been generated that two times and four times of compensation amount would be paid in urban area and rural area, respectively. However, schedule one, mentions of a sliding scale, to be fixed by the State governments, which will mean that farmers in rural areas won’t get four times the market price of the land.

4.8 Urgency Clause

Section 40 of the act restricts the use of urgency clause to defence of India or national security or emergency arising out of natural calamities. However, the provisions of social impact assessment, consultations and consent of Gram Sabha or project affected families, or public hearings will not be applicable, except for the scheduled areas, but that too can be waived by the appropriate government. On one hand restricting the urgency provisions is welcome but expanding it to include anything related to defence or national security is unacceptable, since peace time operations and requirements doesn’t need urgency, and such projects must follow due process of law. Activities like constructions of cantonments, housing units, golf courses, play grounds, firing ranges etc for defence and security forces during the peace time need not apply urgency provisions of the act.

4.9 Urban Eviction

The act almost totally excludes and have unaddressed the situation in the urban areas, where there is no land acquisition, but eviction, brutal and unjust, for any and every elitist real estate development to infrastructure without guaranteeing right to shelter, right to life and livelihood. The silver line though is, Schedule II.3 provision of making available for purchase 20% of developed land for land owning families in urbanisation projects, and Section 3.c.vi where definition of project affected families includes, “a family residing on any land in the urban areas for preceding three years or more prior to the acquisition of the land or whose primary source of livelihood for three years prior to the acquisition of the land is affected by the acquisition of such land”.

“Requirement of separate land acquisition act for J&K State”. Due to article 370 of the Indian Constitution: Temporary provisions with respect to the State of J&K. Not with standing anything in this constitution, (a) The provisions of article 238 shall not apply in relation to the State of J&K; (b) The power of Parliament to make laws for the said State shall be limited to (i) Those matters in the union list and the concurrent list which, in consultation with the Government of the State, are declared by the President to correspond to matters specified in the Instrument of Accession governing the accession of the State to the dominion of India as the matters with respect to which the dominion legislature may make laws for that State, and (ii) Such other matters in the said lists as, with the concurrence of the Government of the State, the President may by order specify. Explanation for the purposes of this article, the Government of the State means the person for the time being recognized by the President as the Maharaja of J&K acting on the advice of the Council of Ministers for the time being in office under the Maharaja's Proclamation dated the fifth day of March, 1948; (c) The provisions of article 1 and of this article shall apply in relation to that State; (d) Such of the other provisions of this Constitution shall apply in relation to that State subject to such exceptions and modifications as the President may by order specify: Provided that no such order which relates to the matters specified in the Instrument of Accession of the State referred to in paragraph (i) Of sub-clause (b) shall be issued except in consultation with the Government of the State:

(1) Provided further that no such order, which relates to matters other than those referred to in the last preceding proviso, shall be issued except with the concurrence of that Government.

(2) If the concurrence of the Government of the State referred to in paragraph (ii) of sub-clause (b) of clause (1) or in the second provision to sub-clause (d) of that clause be given before the Constituent Assembly for the purpose of framing the Constitution of the State is convened, it shall be placed before such Assembly for such decision as it may take there on.

(3) Not withstanding anything in the foregoing provisions of this article, the President may, by public notification, declare that this article shall cease to be operative or shall be operative only with such exceptions and modifications and from such date as he may specify: Provided that the recommendation of the Constituent Assembly of the State referred to in clause (2) shall be necessary before the President issues such a notification.

Due to this article the Land Acquisition Act, 1894 visa vies RFCTLARR Act, 2013 is not applicable in the state of J&K. The State has its own Land Acquisition Act, which comes into existence in the year 1990. Which is different from Land Acquisition of 1893 (which is applicable in the rest of India) Thus the Land Acquisition process in both areas different from each other.

5 THE STATE LAND ACQUISITION ACT, 1990

The J&K Land Acquisition Act has been adapted from the Land Acquisition Act, 1894.The sections under the act which are changed for J&K keeping the requirements of the state in mind which are as follows:

- Section 11A deals with the correction of clerical or arithmetical errors etc. However, the Land Acquisition Act, 1894 of India under Section 11A dealt with period shall be which an award within made. The Land Acquisition Act, 1894 of India Section 13A dealt with the correction of clerical or arithmetical errors etc.
- The Land Acquisition Act, 1894 of India Section 15A dealt with power to call for records, etc. has been deleted in the Land Acquisition Act of J&K.
- The Land Acquisition Act, 1894 of India Section 17, which deals with Special Powers in case of Urgency (sub-section 2), has been deleted.
- The Land Acquisition Act, 1894 of J&K in Section 19A has been added.
- The Land Acquisition Act, 1894 of India Section 23, which deals Matters to be considered on determining compensation sub-section (1A), has been deleted from the Land Acquisition Act of J&K.
- Land Acquisition Act of J&K Section 25 on rules as to amount of compensation have been dealt in detail and it has been divided into three sub-sections.
- Land acquisition act of J&K Section 41 on agreement with the Government sub-section 4A deleted.
- Land Acquisition Act, 1894 Section 44 on how agreement with Infrastructure Company may be proved has been deleted from land acquisition act of J&K.

- Land acquisition act of J&K Section 52 on delegation have been added specifically to cater to the requirement.

The State of J&K is guided by the State Land Acquisition Act. According to this act also the collector will be the responsible person to acquire the land under the act for infrastructure development projects, to oversee distribution of the compensation and address to the grievances.

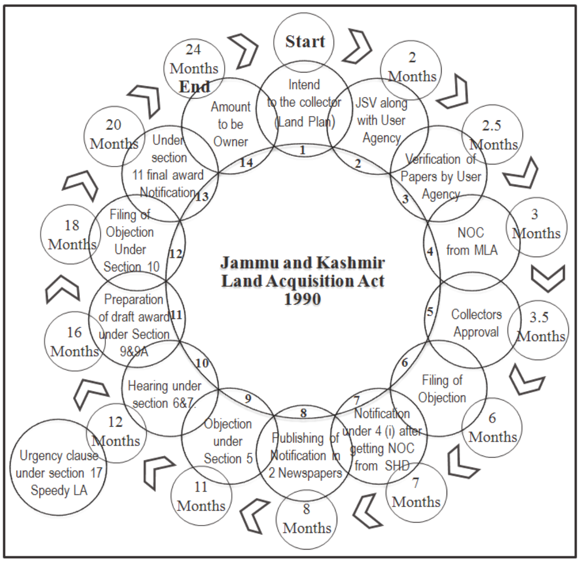

Fig. 2: Activities & Time Frame Required under J&K LA Act, 1990

5.1 Statement for Land Acquisition in J&K State (the process detailed in fig. 2):

(1) Intend to the collector: With site plan

- Where the certificate to be given to prove;
- Land is not engaged in other state/local level purposes;
- The land used for public purpose and
- Funds are available with the department who is acquiring the land.

(2) Spot location of land by the concerned department to update on the revenue records which are:

- Tatima Sajra (Revenue Map);
- Field Book (Land Measurement);
- Khasrs (Revenue Record)
- Gridarwary (Record of land under cultivation)
- Jamabandi (Revenue Records of Past and Current year)

(3) The concern party who is acquiring the land will verify the papers, which will be passed over to the interesting party by the collector office.

(4) No objection certificate will be required from the local minister of state legislation (MLA) if the central government is taking the land.

(5) The collector will give his recommendations.

(6) The collector will send it to the home department of the state for taking no objection certificate.

(7) After collecting no objection from the home department the collector will issue notification under Section 4(i).

(8) The gazette notification shall be published in 2 local newspapers.

(9) If somebody has some objection he will file the objection under Section 5 of land acquisition act of J&K.

(10) Under Section 6 and 7 this process will take place and if the concern party wants a speedy process they can apply it by Section 17 of land acquisition act of J&K.

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(11) Notice of land acquisition will be under Section 9 & 9a of J&K land acquisition act.

(12) Anybody wants to object it he can do it under Section 10 of J&K land acquisition act.

(13) Under Section 11 the drafts will be awarded.

(14) Compensation (in which upto 10 lacks: The collector will award the process of land acquisition, from 10 to 30 lacks: District Commissioner will award the process of land acquisition and from 30 to 50 lacks: Divisional Commissioner will award the process of land acquisition).

5.2 The J&K Land Revenue Act, 1996

It is an act to amend, consolidate and re-enact the J&K Land Revenue Regulations No. 1 of 1980. It is measure to consolidate, amend and declare the law in force in J&K State with respect to the making and maintenance of records-of-rights in land, the assessment and collection of the land revenue and other matters relating to land and the liabilities incident thereto. Provisions under the act:

- Section 24 describes the making of that part of the annual record, which relates to landholders, assignees of revenue and occupancy tenants;
- Section 25 deals with the making of that part of the annual record which relates to the other persons;
- Section 26 mentions determination of disputes;
- Section 27 provides restriction on variation of entries in records;
- Section 29 details the penalty for neglect to report acquisition of any right referred to in Section 24;
- Section 30 deals with obligation to furnish information necessary for the preparation of record;
- Section 41 to 53 gives details about the procedure of the assessment and
- Section 93 to 103 deals with the procedure of land revenue survey.

When the land is acquired for the infrastructure development projects (PMGSY) the records have to be updated and survey has to be conducted with the revenue department. The lists of PAPs are prepared from the land survey conducted by the revenue department.

6 CONCLUSION

There are many more detailed points in the act which need our attention, but overall, the act doesn’t protect land rights or deals with the historic injustices committed in the name of development and public purpose for inclusive planning. It is solely aimed at facilitating land acquisition for coporarates without any stock taking of the land acquired, used or lying vacant and so on. The rapacious use of Land Acquisition Act, 1894 by the government to secure land for ‘development projects’ has caused over 100 million people to be displaced from their land, livelihoods and shelters. The country is dotted with communities resisting State sponsored land grab which resonate the demand for a just law to ensure that there is no forced acquisition of land and resources, including minerals and ground water. The government must respond to the voices from movements across places such as Narmada, Koel Karo, Singur, Nandigram, Sonbhadra, Chindwara, Bhavnagarm, Kalinga Nagar, Kashipur, Raigarh, Srikakulam and mining areas in central India with genuine efforts to address the longstanding crisis concerning land acquisition and R&R.

If the political parties are serious about addressing the conflicts over the land and other natural resources then they must listen to the voices of those struggling or else it will only aggravate these conflicts all across the country. The need of growth, infrastructure and urbanisation can’t be fulfilled on the graveyard of millions. A pro-people development planning act with complete participation of the Gram Sabha will go a long way in stopping the massive corporate corruption and lead to decentralization of power having an overall impact on the politics of the country.

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reviewed paper

Leben2050 – Bürgerbeteiligung in einer vorausschauenden Studie zu selbstbestimmtem Leben im Alter in Wien

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1 ABSTRACT

Das vorgestellte Forschungsprojekt Leben2050 verbindet das Wissen von Wiener Bürgerinnen und Bürgern und Fachleuten, um Autonomie, gesellschaftliche Teilhabe und Lebensqualität im Alter langfristig zu sichern und zu erhöhen. Dazu werden aus Zukunftsvisionen von Wienerinnen und Wienern für ein autonomes Leben im Alter, mit Hilfe von Fachleuten, konkrete Empfehlungen für Politik, Forschung und Entwicklung erstellt. Bürgerinnen und Bürger präsentieren dabei nicht nur Ideen, sondern bewerten auch die Ergebnisse des Prozesses. So entsteht ein umfassendes Bild relevanter Zukunftsthemen als wertvolle Informationsquelle für Politik, Wirtschaft und Forschung. Soziale, technische und organisatorische Innovationen können dadurch aktiv angeregt und gesteuert werden, um Fehlplanungen in Forschung und Entwicklung (F&E) sowie F&E-Politik und Regulierung mit schweren volks- und betriebswirtschaftlichen Konsequenzen zu verhindern.

Das Hauptziel dieser Fallstudie ist es, implizites Wissen explizit nutzbar zu machen, um alle beteiligten Gruppen an einer produktiven Zukunftsplanung teilhaben zu lassen. Die Methode fördert eine transdisziplinäre Zusammenarbeit von Bürgerinnen und Bürgern, Expertinnen und Experten und Stakeholdern zum Thema autonomes Leben im Alter in Wien.

Leben2050 ist transdisziplinäre langfristige Zukunftspanung im demographischen Wandel, die auch kurz- und mittelfristige Maßnahmen berücksichtigt (leben2050.at). Das Projekt beruht auf der CIVISTI-Methode (civisti.org), welche zur Beratung des EU-Parlaments für das 8. Forschungsrahmenprogramm Horizon 2020 entwickelt und in sieben EU-Ländern getestet wurde. Leben2050 baut auf dieser Basis auf und ergänzt neue Elemente mit dem Fokus auf eine zukunftsfähigen Stadtentwicklung und berücksichtigt dabei die Bedürfnisse einer älter werdenden Gesellschaft in Wien. Neben der Beantwortung der für die Stadt Wien relevanten Forschungsfragen wurde die Methode weiterentwickelt und so an thematische und lokale Gegebenheiten angepasst. Leben2050 ist ein gemeinsames Forschungsprojekt der Beratungsfirma Innovendo und dem Institut für Technikfolgen-Abschätzung der Österreichischen Akademie der Wissenschaften. Das Projekt wurde im Rahmen des Calls Smart Vienna 2012 aus Mitteln der Stadt Wien durch die ZIT - die Technologieagentur der Stadt Wien GmbH gefördert.

In diesem Beitrag wird vor allem der Prozess vorgestellt, nachfolgend werden exemplarisch einige Ergebnisse dargestellt und deren Implikationen für Stadtplanung und -entwicklung präsentiert.

2 HINTERGRUND

In den letzten Jahren hat der Begriff smart city eine starke Ausweitung erfahren. Nachdem in den 1990er Jahren in smart-home Konzepten vor allem Gebäudeautomatisierung angesprochen wurde, entdeckten später vor allem Unternehmen aus dem erweiterten urbanen Infrastruktur-, Informations- und Kommunikationtechnologiebereich (IKT) den Begriff für sich (Saringer-Bory 2012). Heute wird der Begriff oft als Steckenpferd politischer Agenden genutzt, auch wenn eine einheitliche Definition des smart-city Konzeptes fehlt und die vorhandenen Definitionen stark vom lokalen Kontext abhängen (Neirotti et al. 2014). Einheitlich ist jedoch, dass smart cities nicht mehr allein an Verbreitung und Einsatz von IKTs gemessen werden können.

Auch Hollands (2008) beschreibt smart cities in einem erweiterten Kontext, indem IKTs zwar maßgeblich für ökonomische, soziale und räumliche Transformationen verantwortlich sind, aber für sich genommen noch keine smart city ausmachen. Es stehen vielmehr menschliche Faktoren im Vordergrund, wie beispielsweise Bildung und Einbeziehung der Stadtbewohnerinnen und Stadtbewohner in die politische Debatte um ihren Lebensraum. Paquet (2001) argumentiert, dass der ausschlaggebende Faktor für die Entwicklung von smart communities das wie der Interaktion der Menschen ist. Caragliu et al. (2011) definiert eine Stadt als smart, wenn Investitionen in Human- und Sozialkapital, Transport und IKTs ein nachaltiges Wirtschaftswachstum und einen hohen Lebensstandard auf der Grundlage von intelligentem Management natürlicher Ressourcen und partizipativer Governance nach sich ziehen.

Partizipation hat viele Gesichter. Laufend werden neue Beteiligungsmethoden entwickelt, die jedoch meistens eines gemeinsam haben: Sie sollen eine breitere Basis für bessere Entscheidungen schaffen, damit diese dann aufgrund ihrer höheren Legitimität robuster sind (Bobbio 2010; Boussaguet and Dehousse 2009). Forino (1990) unterscheidet mindestens drei Gründe für Bürgerbeteiligungen. Erstens sollen Entscheidungen besser werden, wenn sie nicht nur auf der Risiokabschätzung von Experten beruhen, sondern auch auf der Einschätzung von Laien. Das zweite Argument beruht auf der Annahme, dass die Öffentlichkeit am besten über Dinge entscheiden kann, die sie selbst betrifft und drittens wird angenommen, dass eben diese Entscheidungen dann eine breitere Zustimmung erfahren. Je nach dem wie viel Mitspracherecht Bürgerinnen und Bürger bei der Entscheidungsfindung erhalten, werden verschiedene Arten der Beteiligung unterschieden: Information, Konsultation und (echte) Partizipation (z. B. Arnstein 1969; Rowe and Frewer 2005; Ministerrat 2008).

Jasanoff (2003) beschreibt eine „partizipative Wende“ in der Wissenschaft, hervorgerufen durch wachsende Forderungen nach einer wissenschaftlichen Verantwortung gegenüber der Gesellschaft. Im Ressourcenmanagement sowie der Landnutzungs- und Gemeindeplanung haben sich Methoden wie die partizipative Systemmodellierung etabliert (Sieber 2006; Ritzema et al. 2010; Jankowski 2009). In der Technikfolgen-Abschätzung (TA) werden, aufgrund immer deutlicherer gesellschaftlicher Auswirkungen von Wissenschaft und Technik (Joss und Bellucci 2002), in den letzten 20 Jahren vermehrt partizipative Methoden zur Technikbewertung entwickelt und eingesetzt. Die laufende Entwicklung neuer Methoden und die Einbeziehung normativer Bewertungen in die Technikfolgen-Abschätzung führte zu einer lebhaften und anhaltenden konzeptionellen Diskussion (Abels 2007). Partizipative Methoden involvieren etweder Laien, Expertinnen und Experten oder Stakeholder, oder alle denkbaren Kombinationen dieser drei Gruppen. Eine ähnliche Entwicklung lässt sich im Feld vorrausschauender Studien nachvollziehen: Nach anfänglicher Anwendung vereinzelter Beteiligungsmetoden (1970er) erreichte die Entwicklung und Anwendung neuer Methoden einen Höhepunkt in den 1990er Jahren, der bis heute anhält (List 2006). Das Arbeiten mit Visionen wurde seit den 1980er Jahren vermehrt und in methodisch sehr verschiedenen Settings eingesetzt, immer mit dem Ziel Zukunftsbilder zu kreieren, die als Rahmen für eine erwünschte Zukunft gelten sollen (Shipley 2002).

Vor diesem Hintergrund setzt auch der hier vorgestellte Prozess von Leben2050 an. Technologien und Dienstleistungen im Bereich des Umgebung unterstützten Lebens (AAL- ambient assisted living) sollen es älteren Menschen erlauben, länger selbstständig zu leben. Dadurch sollen Autonomie, gesellschaftliche Teilhabe und Lebensqualität gesichert und erhöht werden.

Seifert und Schelling (2012) stellen fest, dass es „den älteren Menschen“ in der Stadt nicht gibt, sondern sözio-ökonomische Faktoren und sozialräumliche Aspekte Wahrnehmung und Bedürfnisse stärker prägen als Alter. Somit gibt es auch „den Nutzer“ von AAL-Technologie nicht und eine vielzahl von Bedürfnissen sollte in der Entwicklung der Technologie berücksichtigt werden.

Da es sich bei den Entwicklern oft um marktnahe Forschungs- und Entwicklungsunternehmen handelt, kommt es zwangsläufig zu einer starken Fokussierung auf ökonomische Zusammenhänge. Dieser alleinige Fokus kann Fehlplanungen in Forschung und Entwicklung (F&E) sowie F&E-Politik und Regulierung mit schweren volks- und betriebswirtschaftlichen Konsequenzen nach sich ziehen. Der partizipative Foresightprozess Leben2050 schafft hier eine breitere Entscheidungsgrundlage, damit andere gesellschaftlich relevante Bereiche nicht vernachlässigt werden, und der erweiterte gesellschaftliche, soziale und kulturelle Kontext bei der Entwicklung von Technologien und Dienstleistungen für selbstbestimmtes Leben im Alter berücksichtigt wird. Das vorgestellte Forschungsprojekt verbindet das Wissen von Laien und Fachleuten in Wien und kann so dazu beitragen, Innovationen aktiv zu steuern.

Im Prozess Leben2050 entwarfen Wiener Bürgerinnen und Bürger und Fachleute ein ganzheitliches Bild relevanter Zukunftsthemen für ein autonomes Leben im Alter. Das Hauptziel von Leben2050 ist es implizites Wissen explizit nutzbar zu machen um alle beteiligten Gruppen an einer produktiven Zukunftsplanung teilhaben zu lassen. Die Methode fördert eine transdisziplinäre Zusammenarbeit von Bürgerinnen und Bürgern, Expertinnen und Experten und Stakeholdern zum Thema autonomes Leben im Alter in Wien.

Bürgerinnen und Bürger präsentieren dabei nicht nur Ideen, sondern bewerten auch die Ergebnisse des Prozesses.

3 METHODE

Leben2050 beruht auf der CIVISTI-Methode, CIVISTI steht für „Citizen Visions on Science, Technology and Innovation". Diese CIVISTI Methode für vorausschauende Studien, wurde zur Beratung des EU-Parlaments für das 8. Forschungsrahmenprogramm Horizon 2020 entwickelt und in sieben EU-Ländern getestet (2008-2011). Die Stärken liegen darin, unterschiedliche Sichtweisen zu Problemen und gesellschaftlichen Spannungen aufzuzeigen (Gudowsky et al. 2012). Das vorgestellte Projekt ‚Leben2050 - Autonomes Leben in Wien' baut auf dieser Basis neue Elemente mit dem Fokus einer zukunftsfähigen Stadtentwicklung auf und berücksichtigt dabei die Bedürfnisse einer älter werdenden Gesellschaft in Wien. Neben der Beantwortung der für die Stadt Wien relevanten Forschungsfragen wurde die Methode weiterentwickelt und so an thematische und lokale Gegebenheiten angepasst.

Die CIVISTI-Methode verwendet die folgende Definition von Vision: Eine Vision ist ein Bild oder eine Vorstellung einer wünschenswerten Zukunft. Eine Vision kann auf Hoffnungen und Träumen beruhen. Sie kann aber auch auf Sorgen und Ängsten in Verbindung mit Problemen oder möglichen Bedrohungen beruhen, die es in der Zukunft nicht geben soll. Im Leben2050 Projekt wurden Visionen für die Zukunft in 30 bis 40 Jahren zu formulieren.

3.1 Prozessbeschreibung

Der Prozess besteht im Wesentlichen aus fünf Schritten: (1) Zu Beginn erstellt eine nach einer Standardmethode ausgewählte Gruppe von ca. 50 Bürgerinnen und Bürger mit Hilfe der weiterentwickelten CIVISTI- Methode Visionen für ein autonomes Leben älterer Menschen in Wien im Jahr 2050. (2) Auf Basis der in den Visionen enthaltenen Werte, Wünsche und Ängste formulieren Teams aus Expertinnen und Experten und Stakeholdern Empfehlungen für Forschung und Politik. (3) Es folgt eine Inhaltsanalyse und die Zusammenführung von Visionen und Empfehlungen zu einem imaginären Newsletter aus dem Jahr 2050. (4) Diese verknüpften Ergebnisse werden dann in einer Präsentation von allen teilnehmenden Bürgerinnen und Bürgern, Expertinnen und Experten und Stakeholdern bewertet, womit die Qualität der Synthesearbeit geprüft wird. (5) Die so gereihten Ergebnisse werden auf www.leben2050.at der breiten Öffentlichkeit präsentiert und zur Abstimmung freigegeben (Mai 2014). Die Ergebnisse dieser Abstimmung werden als „Themenbarometer" veröffentlicht. So kann ein umfassendes Bild relevanter Zukunftsthemen als wertvolle Informationsquelle für Politik, Wirtschaft und Forschung entstehen.

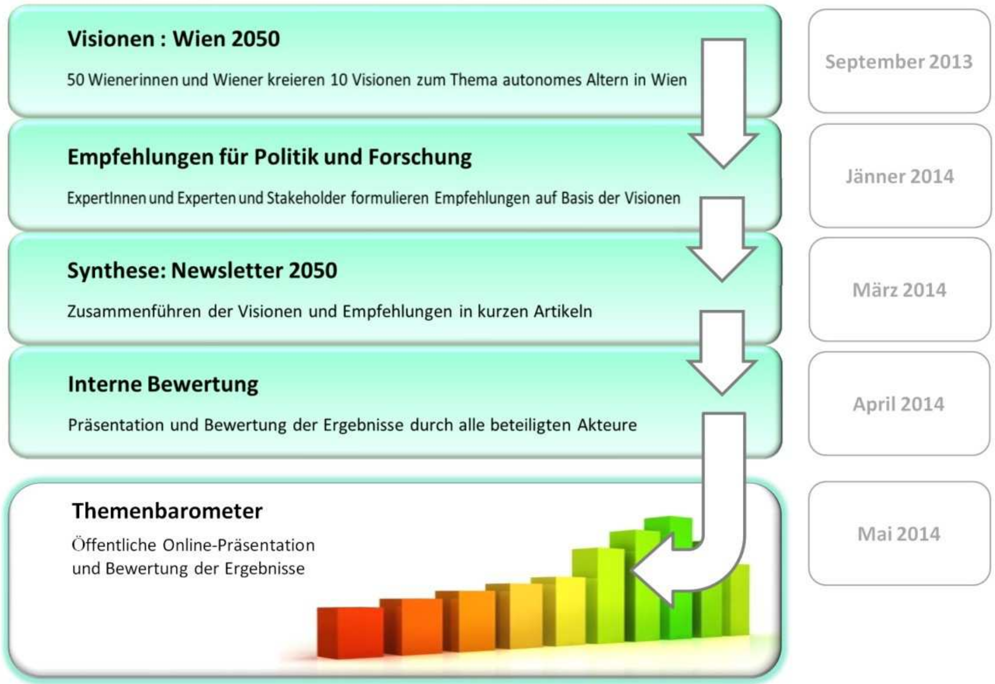

Fig. 1: Prozessüberblick Leben2050

3.2 Kommunikation und Einbeziehung

Leben2050 verfolgt eine breit angelegte Kommunikationsstrategie um die Vorhaben und Ergebnisse des Projektes öffentlich sichtbar zu machen und die interessierte Öffentlichkeit zu erreichen. Um interessierte Bürgerinnen und Bürger für das Bürgerinnen- und Bürgerforum zu finden, wurden neben Artikeln auf verschiedenen Webseiten, Magazinen und Tageszeitungen ein Flyer und eine Website produziert. Zudem wurde auch eine Hotline eingerichtet, die interessierten Bürgerinnen und Bürgern ermöglichte, sich für den Visionenworkshop telefonisch anzumelden. Ein wichtiger Teil der Strategie ist, potentielle Nutzerinnen und Nutzer der Ergebnisse frühzeitig in den Prozess einzubinden (Beirat, Expertinnen und Experten, Stakeholder), um dadurch gute Kommunikationsstrukturen zu schaffen und eine weite Diffusion der Ergebnisse zu erreichen.

Zur Suche interessierter Bürgerinnen und Bürger wurden ca. 8000 Flyer an öffentlichen Stellen (AMS, VHS, Bibliotheken, Schulen, Arztpraxen, Supermärkten etc.) verteilt und viele persönliche Gespräche bei verschiedenen Veranstaltungen und in Seniorenheimen geführt. Zusätzlich wurde ein Verteiler von über 3000 E-Mail Adressen aufgebaut, über den das Projekt und die Teilnehmerinnen- und Teilnehmersuche beworben wurden. Die Adressen setzen sich aus öffentlich zugänglichen Datenbanken wie zum Beispiel der Auflistung aller Sport- und Kulturvereine in Wien zusammen. Um die jüngere Zielgruppe zu erreichen, wurde auch mit Werbung in Facebook experimentiert. Zusätzlich wurden zwei Informationstreffen durchgeführt, bei denen Interessierte das Projekt und das Team kennenlernen konnten.

Alle Teilnehmerinnen und Teilnehmer erhielten im Vorfeld des Visionenworkshops ein eigens produziertes Magazin, welches zu Inspiration dienen und zu visionärem Denken anregen sollte ohne zu beeinflussen.

Die oben angesprochene Vielzahl der Kommunikationskanäle führte zu Erstkontakten via Kontaktformular auf der Projekthomepage oder der Hotline. Hauptziel der Zusammenstellung einer Gruppe von 50 Personen war das Erreichen einer höchstmöglichen Diversität verschiedener Kriterien. Zu den primären Kriterien gehören Alter, Geschlecht und Bildung. Es wurden 6 Alters- und drei Bildungsgruppen definiert, die alle gleichmäßig repräsentiert werden sollten. Auch die Geschlechterverteilung sollte gleich sein. Der Berufsstatus spielte ebenso eine Rolle, um eine möglichst ausgeglichen Verteilung von z. B. erwerbstätigen, Pensionisten oder Personen in Ausbildung zu erreichen.

Außerdem wurden berufsbedingte Ausschlusskriterien formuliert, da die CIVISTI-Methode klar zwischen interessierter Öffentlichkeit und Fachleuten unterscheidet. Ausgeschlossen wurden zum Beispiel alle Personen die im Gesundheitswesen und im Technikbereich beschäftigt sind oder sich beruflich in irgendeiner Form mit dem Thema Altern befassen. Interessierte Fachleute wurden zu verschiedenen Analyseworkshops oder dem Expertinnen- und Experten-Stakeholderworkshop eingeladen. Eine zusätzliche Recherche identifizierte thematisch relevante Fachleute, die ebenfalls zu Analyseworkshops eingeladen wurden. Insgesamt nahmen ca. 30 Fachleute an den Workshops teil.

3.3 Qualitätssicherung

Zur Qualitätssicherung wurde zu Beginn des Projekts ein zehnköpfiger externer Projektbeirat aus Wissenschaft, Wirtschaft und Stadtverwaltung gebildet. Zu den Aufgaben des Beirats gehören neben der Qualitätssicherung und Entscheidungshilfe auch die Unterstützung bei organisatorischen Belangen. Der Beirat traf sich quartalsweise mit dem Projektteam. Weitere wissenschaftliche Unterstützung erhielt das Projektteam durch eine externe Evaluatorin, die das Projekt begleitete. Mit Hilfe von vorher/ nachher Fragebögen und Interviews, die sie mit Bürgerinnen und Bürgern und Moderatoren durchführte, evaluierte sie den Visionenworkshop. Im Zentrum der Moderatorinnen- und Moderatoren befragung standen Fragen zur auf das AAL-Thema angepassten CIVISTI-Methode. Aufgrund der erstmaligen Anpassung auf ein spezifisches Thema mit regionaler Einschränkung (Stadt Wien) bildet diese Befragung eine wertvolle Quelle für die Verbesserung zukünftiger Prozesse. Die Bürgerinnen und Bürger konnten über einen Feedbackfragebogen den Ablauf des Prozesses bewerten und wurden zusätzlich zu ihrer Motivation, sowie ihren Einschätzungen zum Einfluss des Projekts auf Stadt- und Technikentwicklung befragt.

4 ERGEBNISSE

Als erste Ergebnisse des Prozesses wurden im Oktober 2013 die zehn Visionen der Bürgerinnen und Bürger veröffentlicht. Im Folgenden werden nur die Titel der Visionen aufgeführt, alle Volltexte sind auf der Website des Projektes verfügbar (www.leben2050.at) :

Gemeinsam reifen

Alt lernt von Jung – Jung lernt von Alt

Mehr Investitionen für unsere Gesundheit

Nachhaltiges Leben und Arbeiten

Gelungene Integration

Multilinguales Wien

Mobilität, barrierefreie Bewegung auf allen Ebenen

Gesundheitssystem 2050

Fortschritt durch Rückschritt

Gesellschaft und Einzelne profitieren voneinander

Zur qualitativen Inhaltsanalyse der Visionen wurden Kategorien gebildet und ein Glossar erstellt, um dann anhand der Häufigkeiten im Text Vernetzungen zwischen den Visionen zu überprüfen. Anhand der EU-Charta für Menschenrechte wurden dann die enthaltenen Werte identifiziert und den vier Grundwerten Freiheit, Solidarität, Gleichheit und Würde zugeordnet. Anhand der Häufigkeiten im Text ließ sich damit bestimmen welche dieser Grundwerte besonders stark in den einzelnen Visionen durch die Bürgerinnen und Bürger angesprochen wurden. Zusätzlich wurde eine Netzwerkanalyse mit allen identifizierten Themen durchgeführt, die zeigt welche Begriffe, Konzepte und Werte in welcher Form miteinander verknüpft sind. Die am häufigsten miteinander genannten Begriffe waren: neue Arbeitsmodelle, Austausch zwischen unterschiedlichen Gruppen, neue Bildungsmodelle, Integration, Wohlbefinden/Lebendsqualität und langfristige strukturelle Veränderungen. Genauere Ergebnisse werden nach Abschluss des Projektes veröffentlicht.

Auf der Grundlage der Visionen wurden in mehreren Expertinnen- und Experteninterviews Rohempfehlungen formuliert die die Grundlage für den Expertinnen- und Experten- und Stakeholderworkshop lieferten. Im Workshop wurden dann mehrere Empfehlungen für jeden der vier folgenden Themenschwerpunkte erarbeitet: (1) Öffentliche Begegnungsräume als Plattform der Wissensvermittlung, (2) Neue Wohn- und Transportmodelle in der urbanen Region Wien, (3) Kommunikation, Austausch und Gemeinschaft, (4) Gesundheit und Veränderung der Gesundheitsversorgung. Jede Empfehlung wurde einer oder mehreren der folgenden Kategorien zugeordnet: (a) weitere Workshops, Seminare oder Diskussionen, (b) Arbeitsgruppen zur Entwicklung weiterer Strategien, (c) Empfehlungen für gezielte (politische) Aktionen, (d) Pilotprojekte. Die Empfehlungen sind ein Zwischenergebnis und fließen in den Newsletter 2050 ein, das Enprodukt des Prozesses.

4.1 Von der Vision zur Empfehlung

Als Beispiel soll an dieser Stelle der Weg von einer Vision zu zwei Empfehlungen gezeigt werden. Dies dient der Illustration der in Kapitel drei beschriebenen Methode. Jede Vision ist eine kollektive Arbeit (die jeweilige Arbeitsgruppe tauschte sich in Rückmeldungsrunden mindestens zweimal mit einer anderen Gruppe über ihre Vision aus). Einige Visionen überschneiden sich thematisch, z. B. Vision drei „Mehr Investitionen für unsere Gesundheit“ und Vision acht „Gesundheitssystem 2050“. Auch die in den Visionen genannten Konzepte, wie beispielsweise die Forderung nach neuen Wohnmodellen wurden in verschiedenen Visionen genannt.

4.1.1 Vision

Als Beispiel soll hier Vision sieben: Mobilität, barrierefreie Bewegung auf allen Ebenen dienen. Auf den ersten Blick ein klassisches Stadtplanungsthema. Im Kontext einer älter werdenden Gesellschaft, geht diese Vision weiter und bezieht sich nicht nur auf den offentsichtlichen Zusammenhang zwischen körperlicher

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Mobilität und Barrierefreiheit. Die Vision erweitert den Mobilitätsbegriff um die Ebenen geistige und kommunikative Mobilität und berücksichtigt dabei alle Generationen.

Titel:

Mobilität, barrierefreie Bewegung auf allen Ebenen - Die körperliche, geistige und kommunikative Mobilität auf allen Ebenen und allen Generationen

Kurze Beschreibung:

Näheres Wohnumfeld („Grätzel"), das die körperliche, geistige und kommunikative Mobilität fördert :

- Keine Barriere für mobilitätseingeschränkte Personen (Rollstuhl, Rollator, Kinderwagen, ...)
- Soziale Kommunikation (jeweils für Alter, Kultur, Herkunft, generationenübergreifender Dialog)
- Gemeinschaft bilden, = gegenseitige Unterstützung bei Kinderbetreuung, Betreuung bei Krankheit, „Tauschbörse", schwarzes Brett
- Kommunikationszentren = Dorfplatz, Brunnen, öffentlicher Raum ohne Konsumationszwang
- Anbindung an das öffentliche Verkehrsnetz, weniger Individualverkehr
- „Förderband" zur Fortbewegung innerhalb des Wohnumfeldes (z. B. Förderband am Flughafen)

Was ist die Kernbotschaft Ihrer Vision?

Ermöglichung der körperlichen, geistigen und kommunikativen Mobilität durch Schaffung eines weitgehend barrierefreien Wohnbereiches/-umfeldes.

Welche Nutzen und welche Vorteile sind mit Ihrer Vision verbunden?

Förderung von sozialem, generationsüber-greifendem Miteinander. Hineinversetzen in die Lebenssituation anderer Menschen (z. B. Dialog im Dunkeln, Rollstuhl für 1 Tag, „GERT", ...).

Nachhaltigkeit durch das Mobilitätskonzept (weniger Individualverkehr) und weniger Energieverbrauch durch kurze Wege, aber auch durch gegenseitige Unterstützung im Leben miteinander.

Was könnten negative Auswirkung dieser Entwicklung sein?

- Technik schränkt Mobilität ein, Ziel gerichteter Fortschritt ist im Fokus.
- Ghettobildung, falls kein guter Mix im Grätzel zw. Jung und alt, arm und reich erreicht wird.
- Durch neue Technologie der Kommunika-tion die persönlichen Kontakte zurückdrängen.

Wer würde unter den negativen Konsequenzen leiden?

Selbstgewählte Isolation und Anonymität wird erschwert.

Diejenigen Personen, die die neuen Technologien nicht zur Gänze und Zufriedenheit nutzen können und daher ausgeschlossen werden.

4.1.2 Empfehlungen

Eine Empfehlung kann auf mehreren Visionen basieren. Da die Visionen durchschnittlich neun bis zehn Themen beinhalten, sind nicht alle in einer Vision angesprochenen Aspekte auch in einer dazugehörigen Empfehlung zu finden. Als Beispiel stehen hier zwei Empfehlungen die sich unter anderem auf die oben vorgestellte Vision beziehen.

Titel:

Begegnungsräume als Bewegungsräume

Empfehlung:

- Begegnungsräume werden als Bewegungsräume konzipiert:
- Spaß, Lust, Motivation und Spiel in der Bewegung wird in allen Lebensaltern gefördert. Dies kann durch Technik unterstützt werden.
- Bewegung in Alltagshandlungen kann in jedem Lebensalter sattfinden, führt zu Gesundheit und Wohlbefinden und schafft Bewusstsein für Bewegung und Mobilität.
- Sport wird als Motor für Integration eingesetzt

- Bewegungsangebote sind interdisziplinär und multiprofessionell und richten sich auch an Menschen mit Einschränkungen.

Welche Herausforderungen/Probleme werden angesprochen:

Bewegung ist ein wichtiger, derzeit aber oft wenig vorhandener Faktor für Gesundheit und Wohlbefinden in jedem Lebensalter. Problembeispiel: Muskuloskeletale Erkrankungen, Adipositas, psychische Erkrankungen.

Titel:

Grenzenlose Stadtplanung

Empfehlung:

Die Wiener Stadtverwaltung möge beschlussfassende Gremien einrichten, die Gemeinden, Bezirke und Bundesländer einschließen um eine überregionale Entwicklungszusammenarbeit zu gewährleisten (z. B. Öffentlicher Verkehr, Sozial- und Gesundheitsbereich,…).

Das Mobilitätskonzept der Stadt soll eine ungehinderte und effiziente Fortbewegung aller Bürgerinnen und Bürger, Besucherinnen und Besucher etc. ermöglichen (flächendeckendes Netz, „rund um die Uhr“, Leistbarkeit, Einbindung des Umlandes).

Welche Herausforderungen/Probleme werden angesprochen:

Föderalistische Barrieren

In der ersten Empfehlung „Begegnungsräume als Bewegungsräume“ wird das Thema Barrierefreieheit umfassend in sozialer und physischer Dimension betrachtet und detaillierte Maßnahmen dafür vorgeschlagen. In der Empfehlung „Grenzenlose Stadtplanung“ wird effiziente und leistbare Fortbewegung für alle Bürgerinnen und Bürger gefordert, die wirtschaftliche und soziale Komponente betont.

4.2 Newsletter

In einem weiteren Workshop mit Bürgerinnen- und Bürgerbeteiligung wird ein Newsletter aus dem Jahr 2050 produziert, welcher Visionen und Empfehlungen in leicht kommunizierbarer Form vereint. Durch die Zuordnung von Visionen und Empfehlungen wird die Synthese der beiden Teilergebnisse des Prozesses erleichtert. Der Newsletter wird dann allen Projektbeteiligten (Bürgerinnen und Bürger, Expertinnen und Experten, Beirat) präsentiert, um dann in einer letzten Überarbeitung alle Kommentare einzuarbeiten. Ab Juni 2014 wird der Newletter auf der Homepage des Projekts (www.leben2050.at) veröffentlicht. Ein frei zugänglicher Online-Abstimmungsmodus wird eingerichtet, dessen Ergebnisse dann in Form eines Themenbarometers die Prioritäten einer interessierten Öffentlichkeit abbilden werden. Diese öffentliche Prioritisierung von Themen im Zusammenhang mit selbstbestimmten Leben im Alter stellt das Endprodukt des Prozesses dar.

5 CONCLUSIONS

Das Projekt Leben2050 zeigt auf, dass eine Erweiterung des smart city Konzeptes um die Dimension der Partizipation notwendig und erfolgsversprechend für Politik und F&E ist. Der alleinige Fokus auf marktrelevante Parameter ist hier nicht zielführend. Partizipative Foresightprozesse schaffen eine breitere Entscheidungsgrundlage, damit andere gesellschaftlich relevante Bereiche nicht vernachlässigt werden und der erweiterte gesellschaftliche, soziale und kulturelle Kontext bei der Entwicklung von Technologien und Dienstleistungen für selbstbestimmtes Leben im Alter berücksichtigt werden kann.

Wie von Neirotti et al. (2014) bereits angemerkt, hängt die Konzeption und Definition der smart cities vom lokalen Kontext ab. Demnach ist es notwendig, Smart-City-Strategien stets auf die lokalen Verhältnisse zuzuschneiden. Forschungsprojekte und partizipative Prozesse wie Leben2050 können so einen wichtigen Beitrag zu mittel- und langfristigen Stadtplanung und Stadtentwicklung bzw. zur lokalen Konzeption und Definition von Qualitätskriterien in smart cities leisten. Basierend auf den identifizierten und gesellschaftlich definierten, lokalen Themenschwerpunkten können zielgerichtet zugeschnittene Smart City-Strategien entwickelt werden, deren soziale Akzeptanz höher ist. Diese sozial robusteren Strategien könnten ein integraler Bestandteil zukünftiger F&E.Politik sein.

Vorausschauende Studien, wie Leben2050, beinhalten ein hohes Lösungspotential für gesellschaftlich relevanten Herausforderungen. Das Leben2050 Projekt entwickelte eine kreative Plattform für die produktive Kommunikation zwischen Bürgerinnen und Bürgern, Stakeholder und Expertinnen und Experten über die Zukunft der Stadt. Dabei haben durch die standardisierte CIVISTI-Methode und klar definierte Rollen der Akteure weder bestehende Interessenskonflikten, noch Bedenken über die Finanzierbarkeit der Pläne die Zusammenarbeit an Zukunftsvisionen gestört. Nachdem nun Visionen und Ideen für die nächsten 40 Jahre vorliegen, steigt die Chance, kreative Lösungen für kurzfristige Probleme zu finden.

6 DANKSAGUNG

Ohne die umfangreiche freiwillige Arbeit der zahlreichen Bürgerinnen und Bürger, Expertinnen und Experten, Stakeholder und Projektbeiräte aus Wissenschaft, Wirtschaft und Verwaltung wäre die Durchführung des Projektes nicht möglich gewesen.

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Leitprojekt ECR Energy City Graz-Reininghaus

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1 ABSTRACT

Die Gelegenheit zur Erstellung des Rahmenplanes Energie ECR für das Areal von Graz-Reininghaus ist einzigartig. Erstmalig in der Steiermark kann die energetische Ausrichtung eines ganzen Stadtteils auf Gebäudeverbandsebene (Quartier- und Stadtteilebene) wissenschaftlich betrachtet und strategisch vorbereitet werden. Das Haus der Zukunft Plus Leitprojekt ECR Energy City Graz Reininghaus ist eine Kooperation zwischen der Stadt Graz, dem Land Steiermark und verschiedenen Instituten der TU Graz unter Leitung des Instituts für Städtebau. Das Grazer Umweltamt und die Energie Graz liefern fachlichen Input für das Projekt. Bei Bedarf werden zusätzliche Experten und Ämter der Stadt Graz zu Rate gezogen.

In Zukunft werden sich die Gebäude vom Energieverbraucher zum Energieerzeuger wandeln. Der Plus-Energieansatz soll in der ECR Energy City Graz Reininghaus nicht auf Gebäudeebene, sondern auf Quartiersebene stattfinden. Im Rahmenplan Energie ECR wird die Optimierung somit nicht innerhalb der Systemgrenze eines Gebäudes, sondern auf Ebene der einzelnen Stadtquartiere und auf Ebene des gesamten Stadtteils von Graz-Reininghaus erarbeitet. Ziel ist ein energieautarker, CO_2-neutraler Stadtteil. Derzeit entsteht der erste Stadtbaustein in Graz-Reininghaus: das Demobauvorhaben Wohnbau „Plus-Energieverbund Reininghaus Süd“. Im Süden der Peter-Rosegger-Straße, im Stadtquartier 9, errichtet die Fa. WEGRAZ und die Firma Aktiv Klimahaus GmbH. in vier Bauabschnitten ein städtisches Wohnquartier mit rund 140 Wohneinheiten. Der Plusenergieansatz findet gemäß dem Energierahmenplan innerhalb eines multifunktionalen Gebäudeverbundes statt. In einem ersten Schritt wird das einzelne Gebäude optimiert und wandelt sich vom Energieverbraucher zum Energieerzeuger, im zweiten Schritt bringen Synergien innerhalb des Gebäudeverbundes eine weitere Optimierung des Systems.

2 AUSGANGSSITUATION/MOTIVATION

Der Stadt Graz und der gesamten Region um Graz bietet das freie innerstädtische Areal (Urban Green Field) in Kombination mit dem Rahmenplan Energie ECR die einmalige Gelegenheit, für zukünftige Investoren und Bauträger bindende Kriterien für den energieoptimierten und nachhaltigen Stadtteil Graz-Reininghaus festzulegen. Im Gemeinderat der Stadt Graz (Dezember 2009) wurde per einstimmigen Beschluss folgender „Hauptnutzen für die Stadt Graz“ des Projektes festgehalten:

Mit dem Fokus der Förderung einer nachhaltigen energieoptimierten Stadtentwicklung kann die Stadt Graz durch das Projekt ECR im eigenen Einflussbereich substanzielle Zeichen setzen und gleichzeitig weiterführende nationale und internationale Förderschienen und damit verbundene Kofinanzierungen aus dem Bereich der nachhaltigen Stadtentwicklung akquirieren.

Das Haus der Zukunft Plus Leitprojekt gliedert sich in folgende Subprojekte:

- Subprojekt 1 – Leitprojekt-Management
- Subprojekt 2 – Rahmenplan Energie Graz-Reininghaus
- Subprojekt 3 – Demobauvorhaben Plus-Energieverbund Reininghaus Süd

Subprojekt 2 – Rahmenplan Energie Graz-Reininghaus: Im Rahmenplan Energie Energy City Graz-Reininghaus (RPE_ECR) wurden zwei Projektziele definiert. Zum einen die wissenschaftliche Bearbeitung und Darstellung der Vision des energieautarken, CO_2-neutralen Stadtteils Graz-Reininghaus und zum anderen die Initiierung und Begleitung eines Entwicklungsprozesses für den nachhaltigen Stadtteil Graz-Reininghaus. Konkret werden erarbeitet:

Abbildung 1: Überblick Projektgebiet Rahmenplan Energie Graz-Reininghaus und Demobauvorhaben Plus-Energieverbund Reininghaus Süd, Quelle ECR Team

- die Konzeption der Energieautarkie für den Stadtteil Graz-Reininghaus
- die Initiierung und Begleitung des Entwicklungsprozesses für den energieoptimierten nachhaltigen Stadtteil Graz-Reininghaus,
- die Grundlagen für die Verankerung von übertragbaren energetischen Zielwerten zwischen der Stadt Graz und zukünftigen Investoren am Standort
- die energetischen Zielwerte für die Integration in lokale Pläne (Stadtteilentwicklungskonzept Graz-Reininghaus und Bebauungspläne der 20 Stadtquartiere, FLÄWI, STEK)
- Handlungsempfehlungen für zukünftige energieoptimierte Stadtteilentwicklungen in Graz und der Steiermark
- die Wissensbasis für zukünftige energieoptimierte Stadtentwicklungen in der Steiermark

Subprojekt 3 – Demobauvorhaben Plus-Energieverbund Reininghaus Süd: Der Schulterschluss zwischen Stadt Graz – Stadtbaudirektion –, TU-Graz – Institut für Städtebau – und dem Land Steiermark bildet die Basis für die Abwicklung des Haus der Zukunft Plus Leitprojektes ECR Energy City Graz Reininghaus. Das Grazer Umweltamt und die Energie Graz liefern fachlichen Input für das Projekt. Bei Bedarf werden zusätzliche Experten und Ämter der Stadt Graz über die Koordination der Stadtbaudirektion zu Rate gezogen. Im Forschungsteam der TU Graz stehen das Institut für Städtebau, das Institut für Wärmetechnik, das Institut für Prozess- und Partikeltechnik, das Institut für Elektrische Anlagen, und das Institut für Materialprüfung und Baustofftechnologie mit angeschlossener TVFA für Festigkeits- und Materialprüfung. Das Projekt wird aus Mitteln des nationalen Förderprogrammes Haus der Zukunft Plus gefördert, die erforderliche Zusatzfinanzierung erfolgt über die Stadt Graz und das Land Steiermark. Im Projektkonsortium befinden sich die ECO-World Styria, mehrere Firmen und externe Konsulenten.

3 RAHMENPLAN ENERGIE GRAZ-REININGHAUS (ECR SUBPROJEKT 2)

3.1 Zielsetzungen Rahmenplan Energie

Die Projektziele sind umfassend: An erster Stelle steht die Konzeption einer autarken Energieversorgung des Stadtteils Graz-Reininghaus und die Initiierung und Begleitung des Entwicklungsprozesses für den energieoptimierten nachhaltigen Stadtteil. Des Weiteren soll ein Leitfaden von Handlungsempfehlungen und eine Checkliste für zukünftige energieoptimierte Stadtteilentwicklungen in Graz und der Steiermark erstellt werden.

Im Vordergrund steht auch die Entwicklung energetischer Zielwerte zur Verankerung in privatrechtlichen Verträgen zwischen der Stadt Graz und künftigen Investoren, gefördert durch Anreizsysteme wie beispielsweise Bonuskubaturen oder erhöhte Bebauungsdichten bei der Umsetzung. Dazu müssen Konzepte zur Integration der Zielwerte in geeigneter Weise in lokale Pläne/Verordnungen (Stadtentwicklungskonzept STEK Graz, Stadteilentwicklungskonzept Graz-Reininghaus und Bebauungspläne der 20 Stadtquartiere) erdacht werden.

Der RPE_ECR soll den Stadtteil Graz-Reininghaus innovativ am europäischen Immobilienmarkt positionieren. Diese USP (Unique Selling Proposition) soll als Anreiz für die Gewinnung von innovativen Investoren dienen. Bei den beteiligten Firmen, Konsulenten, Mitarbeitern der Stadt Graz und Forschern der TU Graz werden Wissens- und Humanressourcen generiert. Die Gründung eines interdisziplinären Expertennetzwerkes dient als Plattform für die energieautarke Stadtteilentwicklung Graz-Reininghaus. Es soll vernetztes Denken initiiert werden, um in weiterer Folge auch auf andere Stadtteilentwicklungen übertragbare energieautarke Lösungen ausarbeiten zu können.

Die Forschungsergebnisse werden unmittelbar in der Planung und Realisierung der Demonstrationsprojekte berücksichtigt. Die Integration in die Lehrinhalte erfolgt durch die Konsortialpartner TU Graz (Institut für Städtebau, Institut für Wärmetechnik, Institut für Elektrische Anlagen, Institut für Materialprüfung und Baustofftechnologie, Institut für Prozess- und Partikeltechnik).

Die Projektergebnisse vom RPE_ECR sollen maßgeblich zur Gründung eines Fonds für nachhaltige Stadtentwicklung in Graz beitragen. Zukunftsziel der Stadt Graz ist die Einrichtung eines mit EU-Mitteln kofinanzierten revolvierenden Nachhaltigkeitsfonds. Das im Projekt aufgebaute Wissensnetzwerk mit internationalen Experten soll nach dem Projekt über neu einzureichende EU-Programme erweitert werden, wodurch weitere Folgeprojekte für Graz initiiert werden sollen.

3.2 Potenzialermittlung Rahmenplan Energie Graz Reininghaus

Im Zuge der Potenzialermittlung wurden folgende Stadtteile in Österreich und EU-weit vor Ort besucht und deren Entwicklung analysiert:

- Salzburg StadtWerkLehen
- Linz Solar City Pichling
- Wien Aspern
- Freiburg Rieselfeld und Vauban
- Hannover Kronsberg
- Kopenhagen Carlsberg-Brauerei und Nordhavnen
- Malmö Bo02 (auf Empfehlung von Kolleginnen und Kollegen aus Kopenhagen)
- 2000-Watt-Arealentwicklungen in Zürich und Basel

Die Analyse der Referenzprojekte hat zu wichtigen Erkenntnissen geführt. Alle untersuchten Städte verfolgen im Bereich energieeffizienter und nachhaltiger Stadtentwicklung ambitionierte Ziele und positionieren sich europäisch und global. Die genannten Stadtteilentwicklungen werden als Pilotprojektgebiete in den jeweiligen Regionen definiert, wobei die energetischen Baustandards immer weit über den nationalen Standards liegen. Die Standards werden auf gesamtstädtischer Ebene und auf Stadtteils-, Quartiers- und Bauwerksebene evaluiert.

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Bei den gezeigten Projekten spielen regional gegründete Experten- und Firmenplattformen immer eine entscheidende Rolle. Alle gezeigten Projekte werden immer von den Städten in Kooperation mit den Grundeigentümern und Firmen umgesetzt. Dabei werden bewusst die „weichen Entwicklungsfaktoren“ wie Synergien, Netzwerke und Kooperationsmodelle (PPP) als wichtigste Strategie angesetzt (vor dem Einsatz von neuen Technologien!). Bei den harten Faktoren (Einsatz von Technologien) wird der Einsatz von erneuerbaren Energiesystemen und die Nutzung von Abwärmepotenzialen von innerstädtischen Gewerbe- und Industriebetrieben angestrebt. Ziel ist es, keine anfallende Energie „zu verlieren“ (kaskadische Nutzung der Energiepotenziale). Letztendlich lieferte die Analyse der 2000-Watt-Areal-Entwicklungen in Zürich und Basel die Bestätigung des umfassenden Systemansatzes vom ECR Rahmenplan Energie.

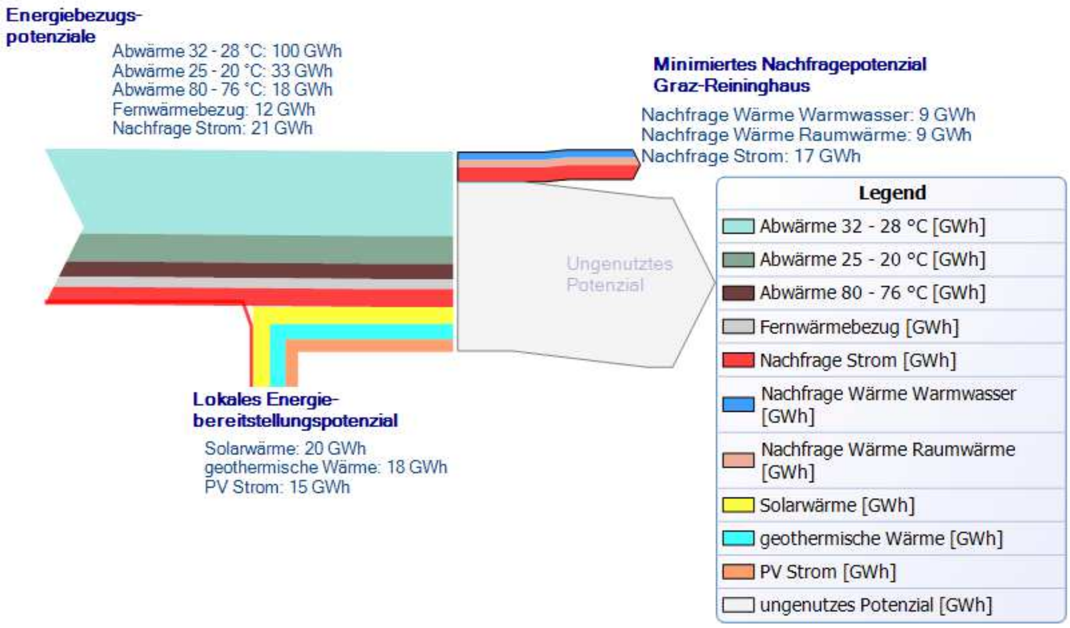

Abbildung 2: Zusammenfassung der Potenziale für Graz-Reininghaus (ohne Bereitstellungsverluste), Quelle ECR Team

Die Erhebungen im Rahmen der Potenzialermittlung für Graz-Reininghaus ergaben, dass der maximale Energiedienstleitungsbedarf (Wärme und Strom) voraussichtlich in zwei bis drei Jahrzehnten erreicht wird. Die absolute jährliche Energienachfrage nach Raumwärme und Brauch(warm)wasser wird in etwa gleich sein. Bei energetisch guten Standards (HWB <15 kWh/m².a) wird für die Warmwasserbereitstellung ein höherer Energiebedarf benötigt als für Raumwärme. Zudem wird für Warmwasser eine höhere Temperatur benötigt (>60 °C) als für die Vorlauftemperatur bei Raumwärme (30-40 °C).

Solarthermie kann bei einer optimalen Systemintegration einen hohen Bereitstellungsgrad erreichen. Wesentlich ist die Frage, wie die Gebäude untereinander vernetzt sind und ob Speicherkapazitäten (Saisonspeicher) aufgebaut werden können, womit der solare Deckungsgrad gesteigert werden kann. Die vollständige Deckung des Strombedarfs durch Photovoltaik wird voraussichtlich nicht erreicht. Ausschlaggebend dafür sind die mehrgeschoßigen Gebäude, bei denen die Dachflächen in Relation zur Bruttogeschoßfläche relativ klein sind. Weitere Flächenpotenziale müssen genutzt werden (Fassaden, Beschattungselemente, Garagen, städtisches Umfeld, ...) bzw. andere implementierbare Technologien langfristig untersucht werden (Bioraffinerie, Tiefe Geothermie), um eine vollständige Abdeckung des Strombedarfs anzustreben.

Es sind ausreichend Potenziale zur autarken Wärmeversorgung des Stadtteils vorhanden. Der Wärmebedarf kann am Standort durch die Nutzung der oberflächennahen Geothermie oder durch die Nutzung der verfügbaren Abwärmepotenziale (von Marienhütte und Linde Gas) oder mittels einer Ausweitung des Fernwärmenetzes gedeckt werden. Durch die Integration von Solarthermie kann der sonstige Energiebedarf für Raumwärme und Warmwasser um zumindest ein Drittel reduziert werden. Aufgrund der geringen Wärmebedarfsdichten werden neue wirtschaftliche Kriterien bei der Errichtung der notwendigen Infrastruktur im Vordergrund stehen.

Die Betrachtung von Gebäudeverbänden kann dazu beitragen, dass das einzelne Gebäude von der Maximalanforderung entlastet wird und sich „Plus Energieverbände“ als ökonomische und ökologische

„Optimallösung“ profilieren. Vor allem in dicht verbauten Gebieten ergänzen sich unterschiedliche Gebäudearten und deren (zeitliche) Nutzungsprofile durch gegenseitige Vernetzung. Der „Plus-Energie-Standard“ soll hier auch über Gebäudeverbände definiert werden und nicht nur über das Einzelgebäude.

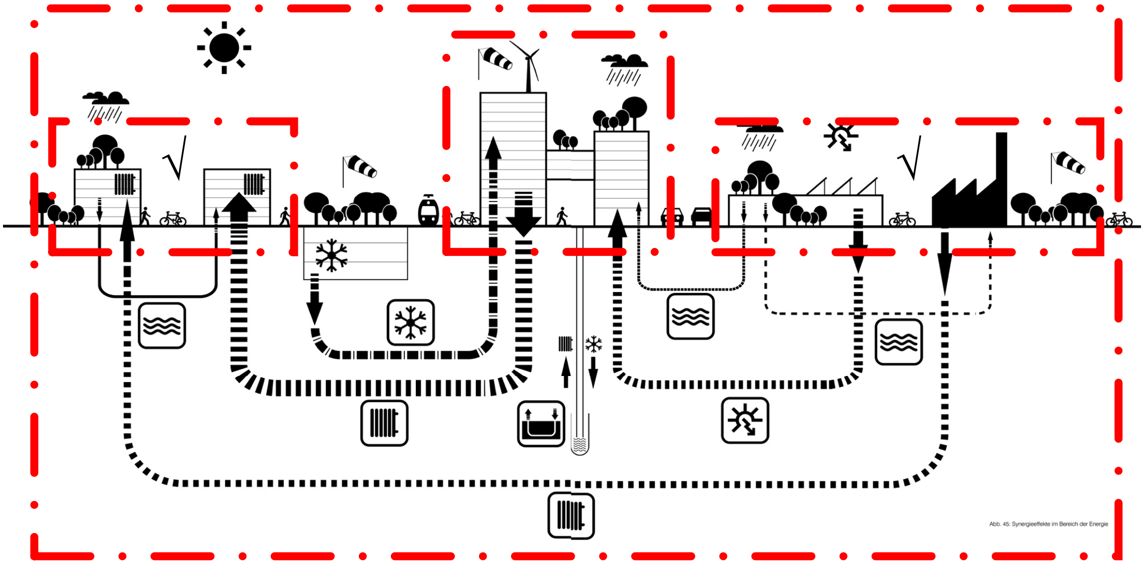

Abbildung 3: Darstellung Energienetzwerk, Quelle: ECR Team

3.3 Konzepterstellung Gesamtenergiekonzept Graz-Reininghaus

Es zeigt sich, dass der im Rahmenplan Graz-Reininghaus vorgesehene urbane Nutzungsmix kombiniert mit der Energieoptimierung zu neuen Erkenntnissen über die nachhaltige und zukunftsfähige Stadtteilentwicklung führen wird.

In der laufenden Optimierung der Bebauungsszenarien stellte sich heraus, dass urbane Blockrandstrukturen aufgrund ihrer Kompaktheit gleichzeitig ein sehr großes urbanes und ein energetisches Entwicklungspotenzial aufweisen. Die Vorgaben des Flächenwidmungsplanes des zukünftigen Stadtgebietes bildeten die Basis für die Erstellung der Bebauungsszenarien. Von den Bebauungsszenarien der Stadtquartiere wurden die geometrischen Parameter (BGF, Hüllflächen, Volumen, Fassadenflächen, Dachflächen, mögliche Fensterflächenanteile etc.) und der Flächenanteil der möglichen Nutzungsarten Wohnen, Büro und Gewerbe rechnerisch erfasst. Diese ermittelten Werte bilden nun die Grundlage für die weitere energetische Optimierung der Bebauungsszenarien.

3.4 Stadtklimatische Bewertung der Bebauungsszenarien Rahmenplan Energie

Wie sich bereits im Zuge der Potenzialbewertung des bestehenden Stadtteilklimas herauskristallisiert hat, werden in der mesoklimatischen Bewertung die Hauptwindrichtung, die solar optimierte Baukörperstellung und das Stadtgrünraumnetz (Baumbewuchs, Wiesen, Wasserflächen, Dachbegrünung etc.) von entscheidender Rolle sein. Das Städtebauinstitut hat gemeinsam mit dem Institut für Stadtklimatologie der Karl-Franzens-Universität Graz die Bebauungsszenarien bezogen auf den Aspekt der Durchlüftung und Begrünung optimiert. Durch Erfahrungsaustausch mit Freiburg Rieselfeld sowie die stadtklimatische Bewertung der Bebauungsszenarien wurde erkannt, dass eine Zonierung der Grünräume in öffentliche, private und in kooperative Grünraume zielführend ist.

Eine geschlossene und kompakte Blockrandbebauung definiert klar ablesbare urbane Räume. Die Zonierung der Grünräume in öffentliche, private und in kooperative Grünraume führt zu einer sehr vielfältig durchgrünten Stadtstruktur. Das entstehende vielfältige Grünraumnetz ermöglicht die Ausbildung einer stadtklimatisch optimierten urbanen Bebauungsstruktur.

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Abbildung 4: Intensive Begrünung als Basis zur stadtklimatischen Optimierung, Quelle: ECR Team

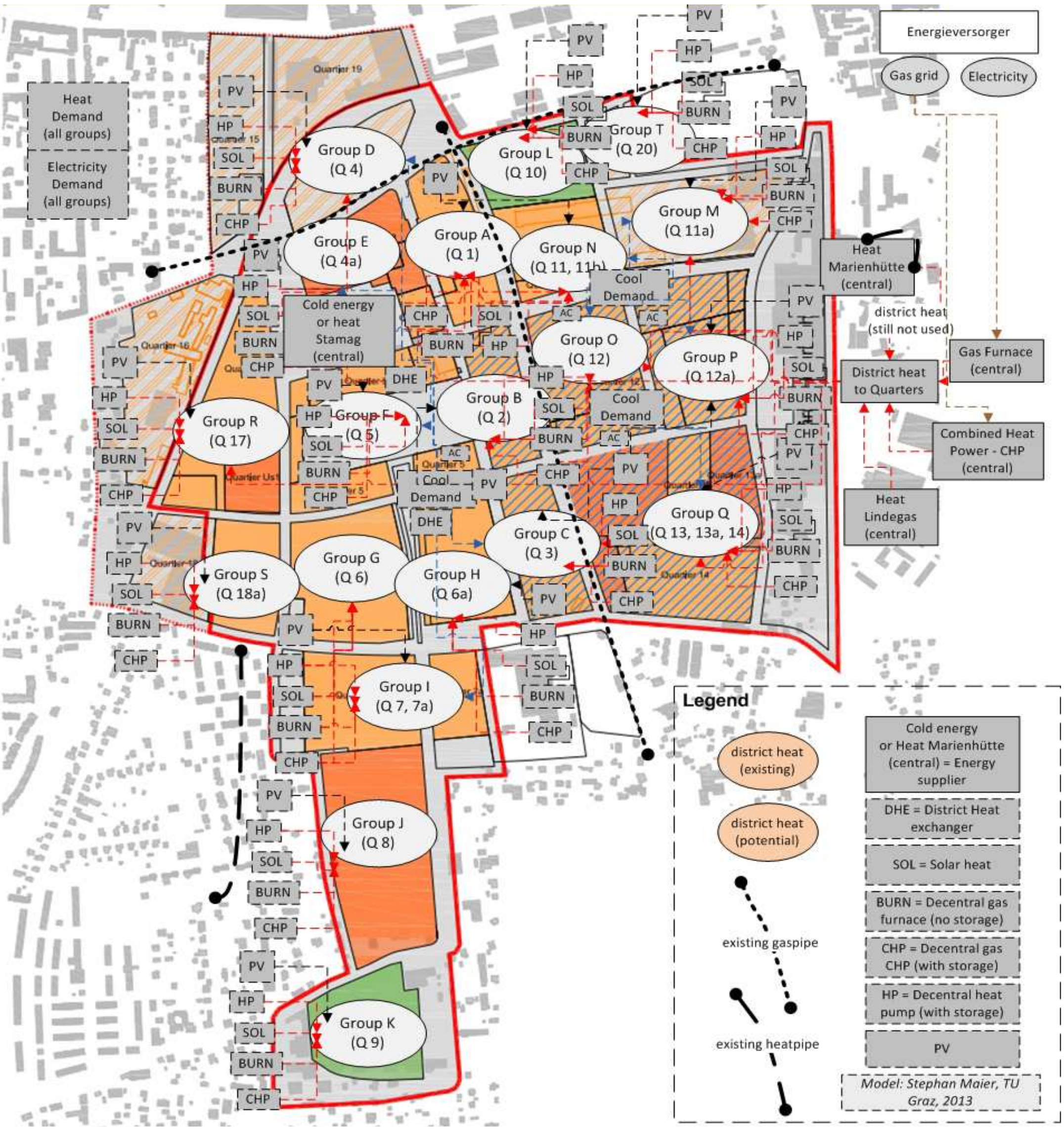

Abbildung 5: Schematische Generalübersicht Quartiersgruppen und Energiestruktur, Quelle: ECR Team

3.5 Optimierung des urbanen Energiesystems

Die energetische Optimierung der urbanen Bebauungsstrukturen erfolgt zurzeit auf zwei Betrachtungsebenen – auf Gebäudeverbandsebene (Quartiersebene) und auf Gesamtstadtteilebene (Netzoptimierung) – und in interdisziplinärer Rückkoppelung mit den anderen Arbeitspaketen bzw. beteiligten Expertinnen und Experten.

In den Arbeitsmeetings mit den Energieversorgern (Energie Graz und Energie Steiermark) kristallisierte sich heraus, dass die Integration von unterschiedlichen erneuerbaren Energiesystemen in ein urbanes Energiesystem und deren Optimierung eine sehr anspruchsvolle Aufgabe darstellt. Um diese Herausforderung erfolgreich zu bewältigen, wurde das Institut für Prozess- und Partikeltechnik zur Mitarbeit im Projekt eingeladen. Vor allem die am Institut im Rahmen von früheren Forschungsprojekten entwickelte Prozess-Netzwerk-Synthese wird zu neuen Erkenntnissen im Bereich der Optimierung des urbanen Energiesystems von Graz-Reininghaus führen.

3.6 Zusammenführen der Teilaspekte zu einem Gesamtenergiesystems

Das Gesamtenergiesystem ist in das Umfeld in Graz eingebunden. Das Umfeld definiert sich durch die vorhandene Infrastruktur (Fernwärmenetze, Gasnetz, Stromnetze, industrielle Abwärme, solare Einstrahlung, Erdreichwärme etc.) und den Bedarf an verschiedenen Energiedienstleistungen. Das Energiesystem muss deshalb in dieses Umfeld eingebunden werden.

Es müssen daher Informationen hinsichtlich Raumplanung, Gebäudeplanung, Energietechnik und Infrastrukturplanung verarbeitet werden. Das betrifft die Typologie der Gebäude und hieraus abgeleitet deren Nutzer und deren energetischen Bedarf, den Energiebedarf der Gebäude, die Eigenenergieherstellung in den Gebäuden und die Verfügbarkeit externer Netze (FW-Vorlauf, FW-Rücklauf, Gas, Strom etc.).

4 DEMOBAUVORHABEN: PLUS-ENERGIEVERBUND REININGHAUS SÜD (ECR SUBPROJEKT 3)

Derzeit entsteht der erste Stadtbaustein in Graz-Reininghaus: das Demobauvorhaben Wohnbau „Plus-Energieverbund Reininghaus Süd“. Die Gesamtfläche des Areals beläuft sich auf 17.000m2 und bietet Lebens und Arbeitsraum für ca. 500 Personen.

Im Süden der Peter-Rosegger-Straße, im Stadtquartier 9, wurde von der WEGRAZ Gesellschaft für Stadterneuerung und Assanierung GmbH gemeinsam mit der Stadtbaudirektion ein städtebauliches Gutachterverfahren zur Entwicklung eines neuen multifunktionalen Stadtteilzentrums ausgeschrieben, aus dem das Büro Nussmüller Architekten ZT GmbH als Sieger hervorging. Das Projekt wird nunmehr von der Firma WEGRAZ Gesellschaft für Stadterneuerung und Assanierung mbH und der Firma Aktiv Klimahaus GmbH in zwei Bauetappen umgesetzt.

Entlang der Peter-Rosegger-Straße werden ein Einkaufsmarkt, ein Restaurant mit Gastgarten und Dienstleister errichtet, die zur Belebung des Roseggerplatzes beitragen. Die darüber befindlichen Büroflächen erhalten ihre Attraktivität durch gute Erreichbarkeit und luftige Atmosphäre. Das Zentrum Reininghaus Süd wird zu einem lebendigem Standort für Handel, Büros und Wohnungen. Über den Geschäfts- und Büroeinheiten schwebt ein verbindender zweigeschoßiger Bauteil, in dem behindertengerechte Wohneinheiten für Senioren untergebracht werden. Der Riegelbau ist nicht in Passivhausbauweise errichtet sondern ist ein Niedrigenergiehaus.

Im Süden entstehen 143 Wohnungen in 12 Punkthäusern. Die Häuser sind gestaffelt in Höhe und Ausrichtung und optimieren so die internen Ausblicke und die Verschattung bzw. den Sonneneinfall. Jede Wohnung verfügt über einen Balkon, Loggia oder einen kleinen Garten, je nach Geschoß. Die Wohnungsgröße variiert zwischen 60 und 110 m², drei bis vier Wohnungen bilden ein Geschoß. Das höchste Punkthaus umfasst fünf Geschoße.

Das städtebauliche Konzept des Stadtteilzentrums ergibt sich aus der Übernahme der Typologie der Umgebung. Die angrenzenden Einfamilienhäuser waren Vorbild für die Struktur der Punkthäuser. Somit ist der Übergang zwischen Alt und Neu möglichst sanft gelöst und das neue Stadtteilzentrum fügt sich in die Umgebung ein. Die Gesamtfläche des Areals beläuft sich auf 17.000 m2 und bietet Lebens- und Arbeitsraum für ca. 500 Personen. Die Freiräume sind in Form von Gemeinschaftsgärten gestaltet. So kann ein

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interessierter Wohnungseigentümer seinen eigenen Kräutergarten und gleichzeitig nachbarschaftliche Beziehungen pflegen.

Abbildung 6: Modell des Demobauvorhabens, Quelle: Nussmüller Architekten ZT GmbH

Die Punkthäuser sind in Holzbauweise um einen Betonkern, der das Stiegenhaus beinhaltet, errichtet. Die Decken der Wohnungen sind in Sichtholz gehalten, an den Wänden ist zum Teil Lehm angebracht, so dass ein angenehmes Raumklima erzeugt wird. Lehm nimmt Feuchtigkeit aus der Luft auf und gibt sie geregelt wieder ab. Die Außenwand setzt sich somit wie folgt zusammen: Putz, Mineralwolle, 14cm BSB Platten, 3,5cm Lehmbauplatten und 1 cm Lehmputz.Feuersicherheitsprüfungen wurden mit der MA39 in Wien vorgenommen. Jede Wohnung ist ein eigener Brandabschnitt.

Die Wohnhäuser sind nicht nur Passivhäuser sondern sie produzieren mehr Energie, als sie brauchen. Energiequellen sind dabei Geothermie sowie Solarkollektoren. Die Energiepfähle der Anlage befinden sich unter den Gebäuden im Schottergrund der Baustelle. Insgesamt gibt es 573 Energiepfähle mit 12 Metern Tiefe, die für die Fußbodenheizungen sorgen und zusammen mit den Sollarkollektoren am Dach auch für die Warmwasseraufbereitung.

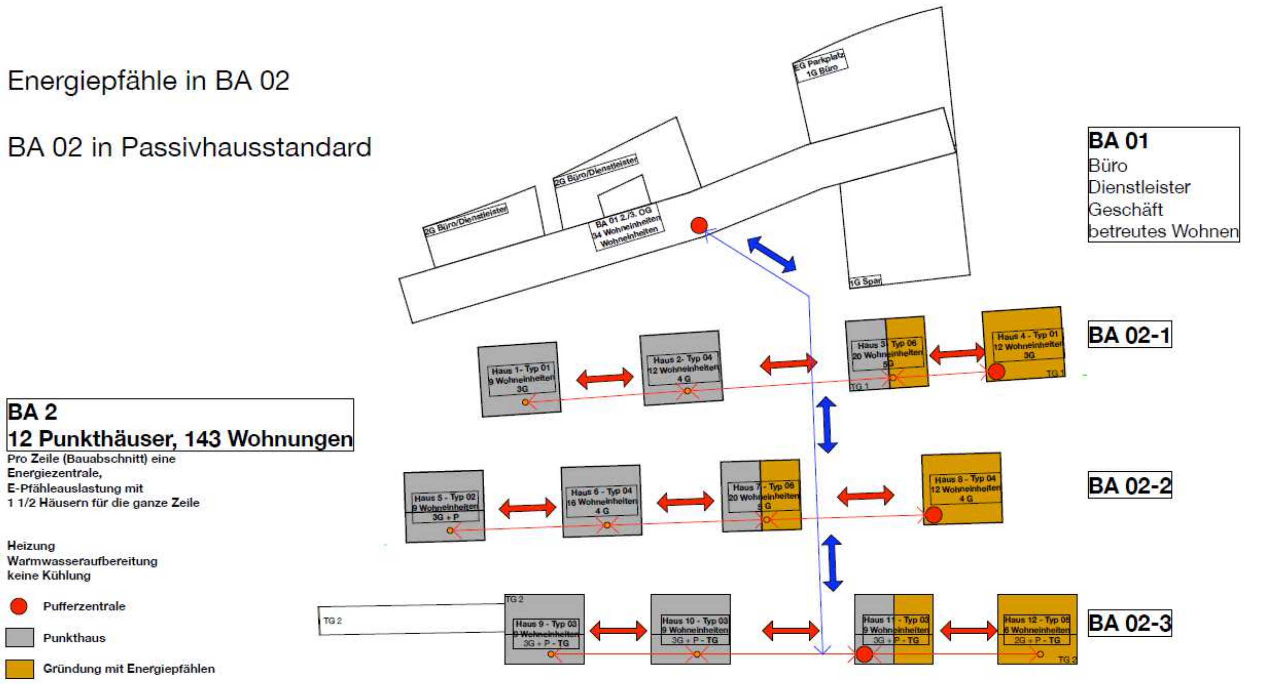

Abbildung 7: Energynetzwerk des Demobauvorhabens, Quelle: Nussmüller Architekten ZT GmbH, AEE INTEC

In den semizentralen Lüftungsanlagen der einzelnen Wohnhäuser wird die Frischluft aus dem Erdärmetauscher durch die Soleleitung auf 10C nachgewärmt und geht dann in eine der drei Wärmepumpen. Die solcherart produzierte Energie versorgt den Pufferspeicher mit 5000 Liter Wasser und geht danach in die Fußbodenheizung und Warmwasseraufbereitung. Die Wärmepumen mit einer Leistung von ca. 216 KW decken in Verbindung mit der thermischen Solaranlage den gesamten Heizwärme und Warmwasserbedarf der insgesamt 143 Wohnungen. Die thermischen Solaranlagen befinden sich auf den Dächern der Punkthäuser, bestehend aus sechs Kollektorflächen mit je 15m2. Diese Flächen sollen einen jährlichen Gesamtertrag von ca. 30.000 kWh bringen. Davon sind 70 Prozent für die Warmwasserzubereitung gedacht und 30 Prozent für die Heizungsunterstützung.

Nach den Plänen der AEE Intec wird jede Gebäudereihe mit einer Wärmezentrale ausgestattet, die einerseits miteinander verbunden sind, um solcherart wechselweise Spitzenlasten in der Erzeugung oder im Verbrauch auszugleichen, und die andererseits an den vorgelagerten Büro- und Geschäftskomplex angebunden sind wodurch mehrere Synergieeffekte angestrebt werden: Im Sommer kann die für die Wohnhäuser nicht benötigte Energie der Energieschleife vom Büro und Geschäftskomplex genutzt werden. Das ergibt eine Kühlleistung von ca 240 kWh, womit sich bei ca. 800 Betriebsstunden eine jährliche Kühlleistung von 192.000 kWh ergibt. In der Heizperiode hingegen kann überschüssige Wärmeenergie vom Büro- und Geschäftskomplex zu den Punkthäusern geliefert werden. Die Energieflüsse übers Jahr aufsummiert sollten mehr Energieerzeugung bringen als Energieverbrauch, nämlich einen Überschuss von mehr als 26.000 kWh.

Das Projekt Plus-Energieverbund Reininghaus Süd wurde von der österreichischen Gesellschaft für nachhaltiges Bauen mit der Zertifizierung TQB, Total Quality Building ausgezeichnet. Dieses Gütesiegel steht für besonders herausragende Leistungen im nachhaltigen Bauen, wie etwa den rekordverdächtigen 7,28kh/m², die eine Energieklasse von A++ ermöglichen.

Bauabschnitt 1	**Bauabschnitt 2**
Auftraggeber: WEGRAZ	Auftraggeber: Aktiv Klimahaus
Grundstücksgröße: 13.467 m²	Grundstücksgröße: 15.476 m²
BGF: 8.853 m²	BGF: 14.065 m²
Bebaute Fläche: 4.472 m²	Bebaute Fläche: 4.321 m²
Bebauungsdichte: 0,79	Bebauungsdichte: 0,8
Bebauungsgrad: 0,3	Bebauungsgrad: 0,3
Geschoßanzahl: 2–4 Geschoße	Geschoßanzahl: 3–5 Geschoße
Frei finanzierte Wohnungen: 10 Wohneinheiten, ~ 665 m²	Frei finanzierte Wohnungen: 143 Wohneinheiten, ~ 10.337 m²
Betreutes Wohnen: 38 Wohneinheiten, ~ 1.997 m²	
Sparmarkt: ~ 1.070 m² Nutzfläche	
Cafe, Restaurant: ~ 409 m² Nutzfläche	
Büroflächen: ~ 1.765 m² Nutzfläche	
Dienstleister: ~ 432 m² Nutzfläche	
Tiefgarage: 62 Stellplätze	Tiefgarage: 143 Stellplätze
Parkplätze: 18 bzw. 35 Sparmarkt	Parkplätze: 15
Baubeginn: Mai 2012	Baubeginn: Juli 2012
Unterbauabschnitte: 1	Unterbauabschnitte: 3

Tabelle 1: Darstellung der Bauabschnitte des Plus-Energieverbund Reininghaus Süd, Quelle: Nussmüller Architekten ZT GmbH, Aktiv Klimahaus GmbH

5 WEITERE PROJEKTINFOS

http://www.hausderzukunft.at/results.html/id5854
http://www.hausderzukunft.at/results.html/id6881
http://www.hausderzukunft.at/results.html/id6854
http://www.aktivklimahaus.at/de/projekte/graz_zentrum_reininghaus_sued/
http://www.aktivklimahaus.at/de/nachrichten/

6 AUSZUG THEMATISCH RELEVANTER VERÖFFENTLICHUNGEN DES PROJEKTTEAMS

PASSER, A., WALL, J., RAINER, E., MACH, T., HOFBAUER, K., HÖFLER, K., GEIER, S., HOFFER, K.-U., A long way to go - from urban development to plus energy buildings - case study: Energy City Graz Reininghaus, Conference „Sustainable Urban Neighborhoods 2012 - Towards a Systemic Approach for Cross-Scale Indicators“ (SUN 2012), 21st - 23rd June 2012, Trondheim, Norway

RAINER, E., HOFBAUER, C.; SCHNITZER, H., MACH, T., MAIER, S., HOCHENAUER, C., PASSER, A., KREINER, H., MAYDL, P., FICKERT, L., WIELAND, T., ECR Energy City Graz-Reininghaus. - in: FULL Papers of the International conference on Sustainable Buildings – Construction Products & Technologies. (2013), S. 617 - 628

RAINER, E., HOFBAUER, C., MACH, T., PASSER, A., ECR Energy City Graz-Reininghaus, Internationaler Kongress e-nova 2010, Nachhaltige Gebäude, Planung-Betrieb-Bewertung

Fachhochschulstudiengänge Burgenland GmBH, Seiten 183 -187, Pinkafeld, November 2010

Linked Open Data for Environmental Protection in Smart Regions – the New Challenge for the Use of Environmental Data and Information

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1 ABSTRACT

This paper will introduce the specific objectives of the recently initiated project SmartOpenData - "Linked Open Data for Environmental Protection in Smart Regions" (SOD project) that is supported by Seventh Framework ENV.2013.6.5-3: Exploiting the European Open Data Strategy to Mobilize the Use of Environmental Data and Information. The main concept of the project is to create a Linked Open Data (SOD) infrastructure (including software tools and data sets) fed by public and freely available data resources, existing sources for biodiversity and environment protection and research in rural and European protected areas and its national parks. The aim of the SOD project to develop real proposals for building a SOD infrastructure for biodiversity and environment protection in European protected areas that satisfy the requirements of four kinds of target users: public bodies, researchers, companies (also small and medium enterprises (SMEs) and citizens. The SOD project will focus also on how the SOD Initiative can be linked with the INSPIRE directive, GEOSS Data-CORE, GMES, completed European scale Geographic Information System (GIS) projects (like a Habitats project, which defines models and tools for managing spatial data in environmental protection areas), and external third parties, as well as how it can impact economic and sustainability progress in European environmental research and protection. The key elements of the project will be five target pilot projects in related areas (agro forestry management, environmental research and biodiversity, water monitoring, forest sustainability and environmental data re-use), where harmonization of metadata, improvement of spatial data fusion, as well as visualization and publication of the resulting information according to user requirements will take place.

2 THE CONTEXT OF THE SINGLE EUROPEAN INFORMATION SPACE

"Information is knowledge, information is power, information is security" Christiane Amanpour, fabulous CNN journalist and ABC Global Affair Ancor tells us again and again from the TV screen, and she is right. Nowadays the availability and content of genius and precise information is crutial and the decisive factor in the adoption of important, urgent and correct decisions. In using the term "information", very often we mean "spatial" or "geographic information" due to recent global "revolution" in consumer's habits and manner of information consumption – to use images as the most proofvisible evidence instead of (or in combination with) descriptive data.

Access to spatial information is becoming more and more possible for various purposes due to local, national and European initiatives. The INSPIRE directive (2007) laid down general rules for establishing an infrastructure for spatial information in the entire Community that is the basis of support for the Community's policies and for the fulfilment of the requirements of environmental issues around Europe. [3] To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and trans-boundary context, the INSPIRE directive requires that common implementation rules are adopted in a number of specific areas: metadata, data specifications, network services, network services and technologies; licenses on sharing, access and use; and coordination and monitoring mechanisms, processes and procedures, established, operated or made available in accordance with the INSPIRE directive requirements. [3]

The ability of information technologies to handle geographic data has improved during the past two decades and GIS is well suited for the integration and management of local, national and international land and natural resources. [2] In particular, various sectors of the "property industry" represent significant market potential for GIS, especially in the use and processing of LC and LU geographic data for commercial and non-commercial purposes. [2] [4] [15] Many Europen initiatives took place in an effort to harmonize land information related data sets (for example: land use and land cover), but these past, mostly independently developed, activities produced numerous, mainly incompatible land related geographic data sets from the local to the Europen level, usually addressing their specific requremets to the information (scale, accuracy, data sources, update cicles, data standards, etc.) or the user (usually public, private bodies, also individuals). However in the context of monitoring environmental changes (loss of biodiversity, climate changes, food safety etc.), harmonization activities have increasingly touched global issues with regard to better integration of various sources of information on various scales (for example: the European CORINE Land Cover Initiative is integrated into the initial GMES programme framework). [6] [11] [12] [13] There are also exist many different open data sources for protecting biodiversity and environmental research in Europe (in coastal zones, agricultural areas, forestry, etc.), mainly focused on the Natura 2000 network [10] [19], and areas where environmental protection and activities like agriculture, forestry or tourism need to be balanced with the Habitats Directive [1] and the European Charter for Sustainable Tourism in Protected Areas [2].

3 THE MAIN CONCEPT AND OBJECTIVES OF THE PROJECT

The SOD project is a recently started (2013) activity supported by Seventh Framework ENV.2013.6.5-3: Exploiting the European Open Data Strategy to mobilize the use of environmental data and Information. The original idea of this project was funded by the EC and is a result of collaboration of 16 European organizations from nine European countries (Spain, Ireland, Italy, France, Czech Republic, Norway, Latvia, Portugal and Slovakia). The duration of the project is 24 months (2013-2015). [15]

The main strategy of the SOD project is to create a real SOD infrastructure (including software tools and data sets) fed by public and freely available data resources, existing sources for biodiversity and environment protection and research in rural and European protected areas and its National Parks. Nevertheless, in order for this strategy to become a reality, it is necessary to advance the publication of existing environmental data, usually owned by public bodies. The project also considers the idea that only a better understanding and managing of existing developed open data sources for protecting biodiversity and environmental research in Europe can provide real economic value for these areas (where real value is largely unknown), but will enable organizations to develop new services based on these data and open up new possibilities for public bodies and rural and protected areas to benefit from using data in innovative ways, improving their knowledge and environment protection through new innovation ecosystems. [5] [15]

The SOD project reuses existing European Spatial Data Infrastructures (SDI), based on INSPIRE, GMES and GEOSS. It will use and extend using SOD, free pan-European Data Sets such as those from Corine Land Cover, Natura 2000, Habitats, Plan4all, Plan4business, EnviroGRIDS, Briseide [15] [19], GEOSS registries, national INSPIRE portals, thematic portals like National Forestry portals together with local and regional data as well as related registers content (for example INSPIRE Registry or UKGovLD Registry). [15] [19]

It is also planned to concentrate ono how to create proposals and build a SOD infrastructure for biodiversity and environment protection in European protected areas that satisfy the requirements of four kinds of stakeholders (target users): public bodies, researchers, companies and citizens. The EU invests billions of euros in building the INSPIRE infrastructure, but most of all European users use Google maps for their applications. The potential of national and regional SDI information is not used because of this information is not available on Google. [15]

Project developments will also provide new opportunities for SMEs to generate new innovative products and services that can lead to new businesses in environmental areas, as well as promote successful (transparent) regional and national scale decision-making processes in environment protection.

It is planned to harmonize metadata, improve spatial data fusion and visualization, as well as publish the resulting information according to user requirements through five target pilot projects - in agro-forestry management, environmental research and biodiversity, water monitoring, forest sustainability and environmental data reuse. SMEs, researchers and citizens will play a central role in the pilots developed to enhance the potential of protected areas. Innovation by third party SMEs will be encouraged by the promotion of royalty-free open standards and best practices initiated by SOD.

The value of the data will be greatly enhanced by making it available through a common query language that gives access to related datasets available in the linked open data cloud. The commonality of data structure and query language will overcome the monolingual nature of typical datasets, making them available in multiple languages.

The research focus of the SOD project will address how to use existing geographic information (GI) data within the Resource Description Framework (RDF) and how existing GI data can be accessed as part of linked data. To achieve this, the SOD project will develop algorithms that expose the wealth of environmental data held by the partners as linked data. It is planned to test developed infrastructure and validate the project results in real scenarios in Smart Regions (http://www.smartregions.eu/). The evaluation of the project outcomes will be based on user feedback and recommendations.

SOD Project has determined the following core objectives:

- To create a sustainable SOD infrastructure [14] with the purpose of promoting environmental protection data sharing among public bodies in the European Union (EU);
- To make INSPIRE/GMES/GEOSS infrastructure [9] more available to all stakeholders: citizens, public and private organizations and SMEs developers;
- To enhance SOD with semantic support by integrating semantic technologies built upon connected SOD catalogues aimed at developing sustainable, profitable and standardized environment protection and climate change surveillance services;
- To define specific business models focused on the needs of stakeholders (especially on that of SMEs) and based on innovative services as new opportunities to align research results, previous work and projects, taking active involvement in the whole value chain in Smart Regions [1] [15] at policy, industry and society levels;
- To demonstrate the impact of the sharing and exploiting data and information from many varied resources, in rural and European protected areas;
- To provide public access to the data and developing demonstrators that will show how services can provide high quality results in regional development working with semantically integrated resources. [15] [18]

4 WHEN DOES IT MAKES SENSE TO DO IT?

The building of a semantic Linked Data structure makes sense when we need to integrate heterogeneous data based on different domains. This structure does not depend on any formats of data, size of databases or other attributes, but on common geographic concepts (river, road etc) and their relations (a road crosses a river). The relevant part of real data and, where needed, metadata will be transformed to subelements of basic concepts and then the relationship between concrete objects can be described. This approach enables us to integrate or harmonise originally heterogeneous data based on the same concepts. As an example we could mention: Protected Area “x” near road “y”; in protected area “XY” you can see bird “YY”. Results of such combination could be that near road “zy” you can see the bird “YY”. [15] [18]

To achieve this, the project partners foresee a number of key steps to be taken, each of which occurs in one or more of the planned five target pilots:

- Describe target use case/s domain/s focused on agroforestry management, environmental research and biodiversity, water monitoring, forest sustainability andenvironmental data reuse. The use cases will be dealt with from end user’s (related stakeholders) point of view. Each use case will be described with a minimal essential structure and list the basic concepts to be taken into consideration. The SOD project expect a maximal re-using of existing semantic structures (controlled vocabularies, gazetteers, registers, registry services, etc.);
- Analyse current available data and also current data models, which are available (in the ideal case INSPIRE base);
- Define new data RDF models (concepts and relations) or identify possible extensions of INSPIRE data models, which are optimal in order to fulfil all or particular use cases;
- Where necessary, define transformation model/s (processing service) for transferring original data into RDF. This could be a complex process running for a long time and through many databases.
- Run the transformation model (it could also include access to distributed databases).

- Eventually store or generate on the fly new transformed data in RDF (this information needs to also include links to the original data).
- Prepare user-friendly application interface for querying data (as a simple form to be able query data without standard experience). The queries should be divided (or fragmented) into two groups – spatial queries (processed in traditional spatial database) and semantic queries based on SPARQL;
- Prepare a visualization of the results of queries. It will include visualization list of objects in some form and cartographic visualization, which has to be provided in relation with the original data. So it will be necessary to define some mechanisms (like Filter Encoding etc. that could visualise results on the basis of queries).

In undertaking these steps there are several underlying questions to bear in mind:

- Which use cases really benefit from OLDa?
- How can we guarantee consistency among the RDF database and the original data? The application and possible extension of existing standards, if not the creation of new ones, will be important in this respect;
- How should we define the best possible protocol for accessing original data (WFS, SOS or querying directly database using SQL for example);
- How can we make the best use of existing tools for visualization;

How will this new mechanism influence efficiency and speed in data processing and querying? [15] [18

5 LINKED DATA FOR SPATIAL INFORMATION

In the context of the SOD the project, using linked data for spatial data means identifying possibilities for the establishment of semantic connections between INSPIRE/GMES/GEOSS and SOD spatial related content in order to generate added value. The project requirements are within the environmental research domain. This will be achieved by making existing “INSPIRE based” relevant spatial data sets, services and appropriate metadata available through a new SOD data structure. The main motivation to use the potential of SOD is to enrich the INSPIRE spatial content to enable improved related services to be offered and to increase the number, performance and functionality of applications. The project will allow for the avoidance of duplicating information. [19]

For the purpose of achieving the objectives of the SOD project, it is necessary to advance the publication of existing environmental data, which is mostly owned by public bodies. The SOD project will try to answer the following questions:

- How can SOD be applied generally to spatial data resource and specifically to public open data portals, GEOSS Data-CORE, GMES, INSPIRE and voluntary data (OpenStreetMap, GEP-WIKI, etc.)?
- How will it impact economic and sustainability progress in European environment research and biodiversity protection (this questions need to be addressed in order for us to benefit from an improved understanding and management of environmental data)?
- How can we make European Spatial Data also easily re-usable by various organizations and individuals at a larger scale (not only GIS professionals)? [15]
- To realize this, on a technical level, the SOD project will:
- Harmonise geospatial metadata (ISO19115/19119 based) with principles of Semantic Web;
- Provide spatial data fusion introducing principles of Linked Open Data (LOD);
- Improve spatial data visualization of Geospatial LOD;
- Publish the resulting information according to user requirements and LOD principles.[15]

The most advanced technical effort to reconcile the Linked Data and Geospatial Data worlds is embodied by OGC's GeoSPARQL standard [15]. This merges the two technologies, with the GeoSPARQL engine translating queries back and forth between RDF and geospatial engines. The INSPIRE standards have been developed entirely in an XML-centric manner and the EC's Joint Research Centre is currently working on making better use of linked data. Community Group is also considering better interplay between Web and geospatial technologies. SmartOpenData (SOD), pan-European initiative targeting to facilitate access to published local and national open datasets, also brings together specialists in both disciplines: RDF to describe a location or point of interest, GI to define where it is on the Earth's surface. [15] [19]

6 CONNECTION OPEN LINKED DATA TO METADATA

Qualitative and “low cost” metadata plays the crucial role as an interface to the spatial content it describes. In the context of SOD, metadata serves as the exchange component allowing the bridging of INSPIRE requrements with other spatial worlds. Metadata will act as the entry point (interface) providing essential information for transformation of spatial data to RDF structures. It is still an open question whether a file or a database should be one of the core concepts with attributes derived from metadata. Therefore primarily the SOD project will deal with objects that can inherit some attributes from metadata. [15] [19]

7 MULTIGINGUALISM

Multiligualism is among most important problems to be addressed in the context of SOD. The issues of translating geographical data and metadata has not yet been solved inside INSPIRE or GEOSS and seems it is a global problem of data utilization by local communities and local data by foreigners. Translation of geographical data is a great challenge for everyone within the SDI community and its importance will grow in relation with growing of SDI.

There are two principal approaches to machine translation: rule-based and statistical. Current state-of-the-art machine translation technology is based on the statistical machine translation (SMT) paradigm, which assumes the application data to match the training data, used during the learning phase to extract and generalise the parameters of the system. Combined methods are also being investigated currently, bringing together the linguistic and translation knowledge accumulated over the last 40 years with the SMT systems as deployed today. For SMT systems, the more distant the actual data is from the data used for training, the worse the results are. Concerning environmental and geographical data, there will be explore resource-limited adaptation to those domains in the context of SOD. [15] [19]

8 THE RESEARCH FOCUS

The research focus for SOD will address how to use existing GI data within an RDF framework and how existing GI data can be accessed as part of linked data. New algorithms will be developed that expose the wealth of environmental data as linked data. This may require some extra human intervention in some cases but such intervention will be minimized with a view to making it repeatable and scalable. For example, the Open Refine tool allows the same operation to be carried out on tabular datasets of unlimited size and is likely to be useful in this task, perhaps supported by a SOD reconciliation API. In a linked data environment, the definition of points, lines and polygons remains untouched. A more difficult task is the discovery of links to data already available in the linked open data cloud, such as GeoSpecies. [15]

Another area of research within a project will be the handling of large volumes of real time data. This puts a strain on the infrastructure and so methods to reduce that stress will need to be researched, possibly using the W3C POWDER technology as a data compression tool. Tracking the provenance of any data is important of course but as yet there is no (standardised) linkage within the Semantic Web technology stack between Provenance and SPARQL Update. [15]

However, creating the data as RDF and adding it to a triple store is only the first step. More difficult is the discovery of links to data already available in the linked open data cloud, such as GeoSpecies. [15]

Challenges that SOD must address in Open Data include:

- Discoverability - in order for data to be useful, it needs to be discoverable. Building strong catalogues of metadata from numerous sources is one of the best ways this can be achieved. Building referenceability into data catalogues is also an effective way of tracking how data propagates through different work products from a raw dataset;
- Federation - as open data becomes part of the day to day business of these organizations, the work of cultivating, publishing, and maintaining datasets and data catalogues will become more

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decentralized. These decentralized catalogues still need to be aggregated into combined organizational catalogues, but their maintainers should still be able to pick and choose which open data technologies are most appropriate to their needs;

- Interoperability - catalogues from multiple sources are composed by federation, it becomes more and more important for the platforms that these data catalogues on which they are built be compatible, even if they are built by different providers. [15] [19]

9 LEGACY ARCHITECTURES AND BUILDING ON PREVIOUS RESULTS: THE HABITAS PROJECT

One of the objectives of the LOD project is also to reuse existing European SDI, based on developments of INSPIRE, GMES and GEOSS. There exist many different open data sources for protecting biodiversity and environmental research in Europe (in coastal zones, agricultural areas, forestry, etc.) mainly focused on the NATURA 2000 network, and areas where environmental protection and activities (like agriculture, forestry or tourism) need to be balanced with the Habitats Directive and the European Charter for Sustainable Tourism in Protected Areas. [5]

In the context of the SOD project, in addition to using tools (such as those available on the Plan4Business Open Data Repository, Habitas Reference Laboratory and EnviroGRIDS portal), use of linked data for spatial data means identifying possibilities for the establishment of semantic connections between INSPIRE/GMES/GEOSS and LOD spatially related content in order to generate added value. The project requirements are within the environmental research domain. This will be achieved by making existing “INSPIRE based” relevant spatial data sets, services and appropriate metadata available through a new Linked Data structure.

The Habitas project (Social Validation of INSPIRE Annex III Data Structures in EU Habitats) was a CIP PSP ICT project that focused on the adoption of INSPIRE directive standards through a participatory process to design and validate data, metadata and services specifications with real citizens and business.

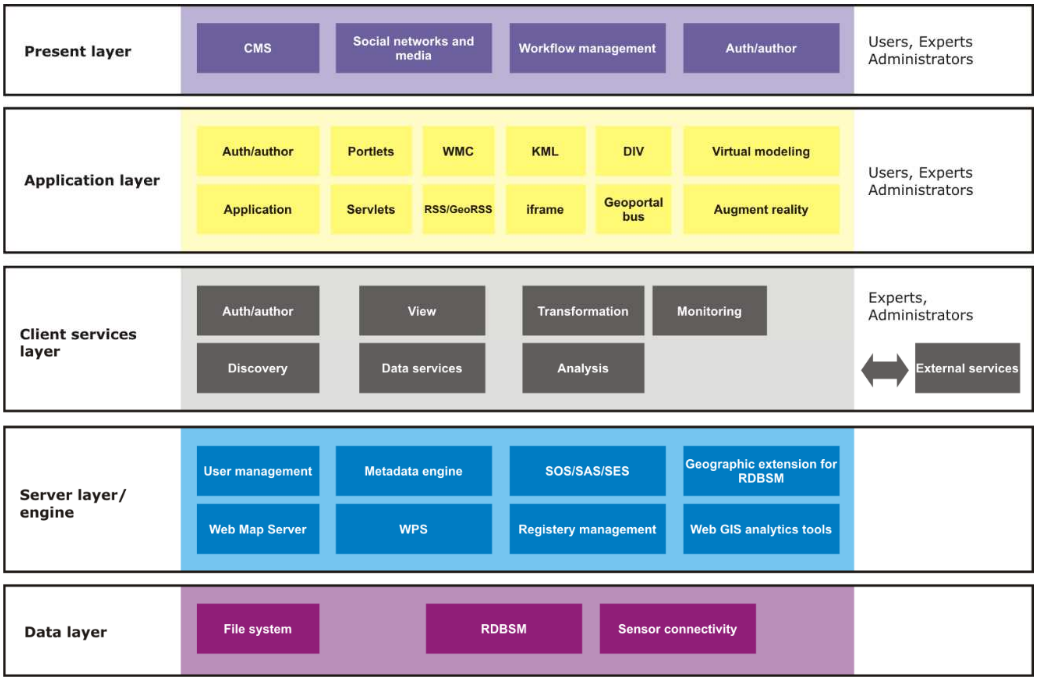

Fig. 1: The design of the SOD infrastructure. [15] [19]

The Habitas project [5] was built as an environment that enables to share and combine data from various sources. This project results were validated through the Habitats Reference Laboratory and developed pilot applications. On the basis of different pilot projects, Habitats defined and tested harmonization rules for spatial environmental data and designed the concept of Habitas Reference Laboratory as a tool for testing the interoperability and supporting unification of outputs across different pilots. [16] [17] The Habitas Reference Laboratory Architecture is shown in Fig.1. [5]

The challenges faced by Habitats were mainly due to data availability, integration and usage ability for decision-making and, in particular, its focus on metadata, Data Specifications, Network Services, Data and Service Sharing and Monitoring and Reporting. Habitats is to support the INSPIRE directive. [11]

The specific usage scenarios, including the state of the art baseline and user requirements coming from them represent the key input for the planned data and meta-data modeling activities and the SDI services that were developed in the Habitats project. In general, a positive correlation in all the pilots was detected between service development and user satisfaction. It cannot be taken for granted that the new services provided are also INSPIRE compliant. This can be due to several reasons, two of which seem more prominent than others:

- On the “supply side”, the cost of increasing the compliance, in terms of time, resources, etc., from the perspective of the SDI “owner”;
- On the “demand side”, lack of interest or simply ignorance of the advantages of compliance, from the perspective of the end users. [5]

10 THE DESIGN OF SMART OPEN DATA INFRASTRUCUTURE

From a user perspective the SOD system will meet the following high level requirements, as “web-based” flexible architecture, socio-environmental data (spatial and non-spatial data) content, all data and models used in the system must be tagged by origin (metadata), data integrity, INSPIRE defined services, and the system will be scalable for increasing number of users and further five pilots. [14] [16] [17]

The requirements of infrastructure of SOD are based on a description and analysis of:

- The relevant components in the proposed scenarios of the SOD project;
- The characteristics of the data components;
- How these components can be classified or generalized;
- What legacy architectures exist;
- What the relevant legal and political fundamentals are;
- What quality constraints exist and how they can be defined in the context of service level agreements;
- The requirements of the five target pilot projects.

The infrastructure will enhance SOD with semantic support by integrating semantic technologies built upon connected SOD catalogues aimed at building sustainable, profitable and standardized environmental protection and climate change surveillance services. This will cover the use of semantic technologies to build a new paradigm of environmental protection services through the extensive use of SOD, significantly improving their accuracy, power and scope and reducing implementation costs making them affordable and sustainable for the first time.

The project will research the integration of semantic results among public open data sources available by partners and other available public data including INSPIRE, GEOSS and GMES and external semantic services (such as DBPedia, Freebase, GeoLinkedData, the Commission’s Open Data Portal including valuable datasets by the EEA and Eurostat), in order to enrich environmental services, thus making available geographical and environment data also to other applications and service domains.

The main elements of SOD infrastructure are shown in Fig. 2. [1] [15]

All data sources can be grouped in two different sets:

- First - data sources that fulfil some of the standards supported by SOD system - green boxes;
- Second - data sources that does not fulfil those standards - blue boxes.

All external data sources are indicated in the lower layer. In the upper layer, three different scenarios have been identified: scenario for researchers, scenario for companies and a scenario for end-users. Each scenario will focus on one specific segment using provided functionalities of the SOD system and services for each group illustrating how the availability of such services can provide advantages to them.

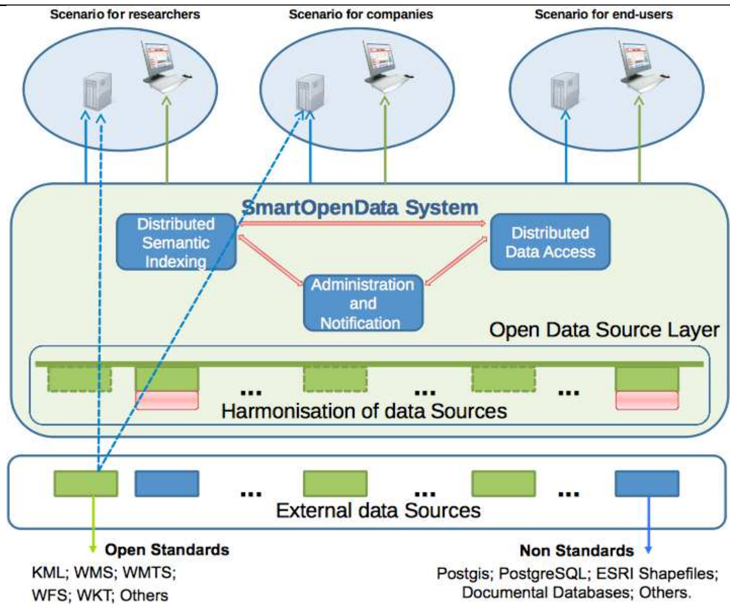

Fig. 2: The designe of SOD infrastructure. [15]

The basic element of the SOD system is the harmonization of data sources. The open data source layer provides semantic information of the data and data themselves. Three key functionalities are coordinated inside the SOD system, creating a distributed service system which can be accessed transparently from the scenarios:

- Distributed semantic indexing - provides a service for searching and locating data based on semantic information collected from all the available data sources;
- Distributed data access - provides data collected from external data sources, as an extra data source
- for easier and uniform data gathering from the users at the identified scenarios;
- Administration and notification, which provides administration facilities for managing users, workflows and data to data providers.

It is very important that services created on the scenarios be able to access directly external data sources selected through the distributed semantic indexing functionality of the SOD system if they are provided using one standard as shown on the scheme.

11 THE PILOTS

The most important objective of the SOD project are the five pilot projects in environment protection related areas:

- The pilot "Agro diversity management" (Spain and Portugal) – with the focus on building a web-based collaborative spatial data infrastructure prototype with the main goal of promoting sustainable agroforestry management; it will be built as a collaborative powerful tool for environment protection and economic development of rural areas, and as a key factor for water management and drinking water protection; [17]
- The pilot "Environmental Research and Biodiversity" (Ireland) – with the focus on the use of the SOD to provide open data and open "INSPIRE compliant" geospatial sources for environmental researchers particularly focused on biodiversity and habitats, building on the participative social validation and pilots of the Habitas project in particular;
- The pilot "Water Monitoring" (Italy) - this pilot in Sicily will explore the role of aggregating information from different Open Data sources in order to support ARPAÔÇÖ's institutional mission of providing up to date monitoring of water quality in Sicily. Some of the main issues to to be sddressed of overcoming the barriers (cultural, political, administrative) to opening up data and identifying the optimal role of the general public in crowdsourcing environmental information;

- The pilot “Forest Sustainability” (Czech Republic) – will be focused on forest site classification, sustainable management and the utilization of forest road network using the National Forest Inventory and the Regional Plans for Development datasets. Data products and statistical outcomes will be widely open, standardized and accessible by foresters and public bodies through web services and applications;
- The pilot “Environmental Data Reuse” (Slovakia) - will include the proposal, development and deployment of two conceptually different types of web applications in order to achieve the reuse of environmental data and information in line with European Open Data Strategy. [15]

The pilot applications will be developed by pilot partners with support of main technological partners (HSRS, SINDICE, FBK, and SDATI). The objectives of the pilots are to evaluate the SOD infrastructure and tools by the development and deployment of advanced demonstrators with:

- A specific focus on evaluation of the approach for the LOD and semantic services;
- An evvaluation of how well the proposed SOD architecture can be adapted to different scenarios for the purpose of environment protection;
- An evaluation of the limitations and benefits of the approach by comparing existing technologies.
- In general the SOD project will address demonstrators in the domains of public bodies, researchers, companies and citizens.

A first iteration of the demonstrator will provide early prototypes for its evaluation and assessment in order to provide feedback on project review and will be first tested by partners for the enhancement and completeness of the integrated architecture and bug fixing. Then an in-depth evaluation and assessment will be carried out by end users to get their user experiences and feedback to iteratively improve the project. All the demonstrators will be available on the public web site and will contribute as training material to the dissemination of the infrastructure. The final iteration of pilots will be based on the feedback collected by the first iteration of demonstrators as well as will provide final prototypes for their evaluation and testing. The focus of this evaluation will be the validation of the SOD infrastructure in real life case studies. [15]

12 CONCLUSIONS

The SOD project is a challenge to create a SOD Data infrastructure (including software tools and data) fed by public and freely available data resources, existing sources for biodiversity and environment protection and research in rural and European protected areas and its National Parks.

SOD infrastructure has been used to evaluate infrastructure and tools by the development and deployment of five advanced demonstrators focused on agroforestry management, environmental research water monitoring respectivwly, forest sustainability and environmental data reuse. This will provide opportunities for organizations (also SMEs) to generate new innovative products and services that can lead to new businesses in, among others, the environmental, regional decision-making and policy areas. The value of the data will be greatly enhanced by making it available through a common query language that gives access to related datasets available in the linked open data cloud. Organizations such as environmental agencies and national parks will benefit by improving their knowledge of biodiversity status, maintenance and protection, including achievement of “the INSPIRE and Open Data Ready” status for their digital (not only spatial) content. Public bodies, researchers, companies and European citizens will play a central role in user-driven pilots developed to enhance the potential of protected areas. Innovation by third party companies will be encouraged by the promotion of royalty-free open standards and best practices generated, initiated or simply highlighted by SmartOpenData. The project will also contribute and, where possible, benefit from ongoing and upcoming related initiatives like the Open Government Partnership, the INSPIRE maintenance and implementation framework, the EU Location Framework and Interoperability Solutions for European Public Administrations (also the Working Group on Spatial Information and Services). [1] [4] [7] [8]

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Metrical Analyses on Population and Economic Growth and Urban "Quality Of Life" of Metropolitan Cities in China during the 00s

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1 ABSTRACT

In the first decade of the 21st century, along with rapid economic growth, China also experienced rapid urbanization, more specifically, the concentration of large populations from rural areas into urban areas. In 2005, the Chinese Government, in its Eleventh Five-Year Plan, had an attitude of promoting the sound development of urbanization, while also promoting cooperative development in regions. However, there has emerging some mass media reports on the shadow side of the rapid growth and the rapid concentration such as environmental problems e.g. pollution affairs since early of the 2010's. These are the same as Japan had already suffered from the 1960's to 70's, so it suggests that the new era has come when Chinese inquire their 'Quality Of Life (QOL)'.

This paper analyses 51 metropolitan cities (prefecture-level cities with over one million population in 2000). Firstly, mainly based on Population Census Reports data in 2000 and 2010, we examine the economic growth and the urban in-flow migration, and the relationship between these two kinds of the indicators in detail. We show a classification of 51 cities through cluster analysis and their geographical distributions, and then we summarize the dynamics of all over China economy and population during this decade.

Based on published statistical data in 2005 and 2010 such as China City Statistical Yearbooks, we propose an indicator-system on China urban QOL of the 51 metropolitan cities. This QOL system is consisted of five groups of indicators (Education/ Daily-Life Convenience/ Urban-Life Enivironment/ Consumer-Side Sustainability/ Indstry-Side Sustainability) of 23 elemental indicators. At one time-point, QOL value is defined as an average of the group indicators, each of which is an average of each standard scores of the elemental indicators. On the other hand, 'Change of QOL' value is defined as an average of each standard scores of the change ratios of the elemental indicators. Using these kinds of QOL indicators, we also show a classification of the metropolitan cities through cluster analysis and their geographical distributions in China.

Furthermore, we analyse correlations between the five group indicators of the QOL system and the economic level and its growth through MRA. As the results, there can be observed the negative values of correlation between GRP per capita and Consumer-Side Sustainability and so on statistical significantly.

2 RESEARCH BACKGROUND AND OBJECTIVES

The Chinese Government proclaimed that the Twelfth Five-Year Plan (2011 - 2015) would improve the life of citizens and establish equal basic social services throughout the basic national public service system. The basic public services cover such areas as education, employment, medical treatment and hygiene, transportation, communications, and environmental conservation, all of which are closely associated with every aspect of people's daily life. During the decade from 2000 to 2010, along with China's rapid economic growth, massive migration to metropolitan areas was seen, and such migration can be considered to have had both a positive and negative effect on the people's "Quality of Life"; for example, in recent years, increasing air pollution and traffic congestion in the metropolitan areas has been noted.

This paper examines population censuses, which are basically fact-finding surveys conducted once every ten years, and newly establishes a Quality of Life indicator system for the 51 metropolitan areas in China, and then analyzes these Quality of Life indicators from 2005 to 2010. Moreover, the paper explores three interwoven themes: the relations among migration, the economic level of each metropolitan area, and changes to the Quality of Life.

3 EXPLANATION OF DATA USED IN THIS RESEARCH

3.1 Spatial administration system in China and selection of cities for research

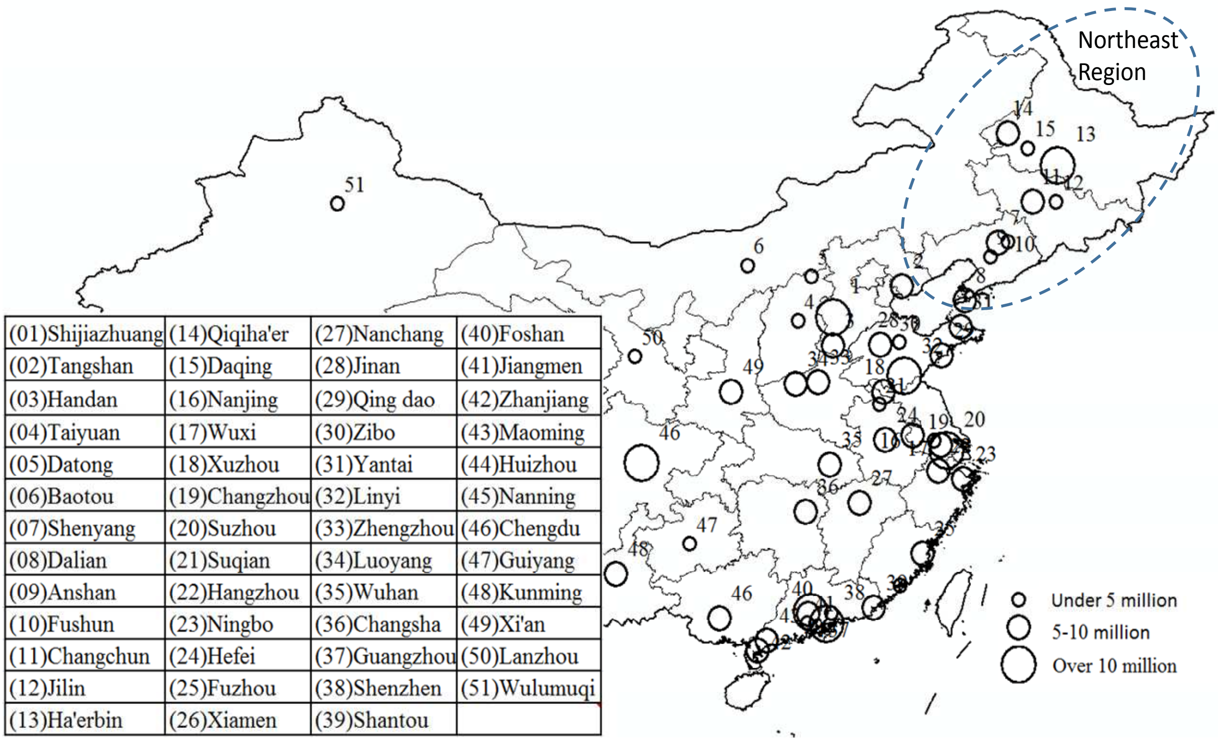
Historically, China had used three-layered spatial administrative systems: Province, Prefecture, and Township; however, to deal with urbanization, currently four-layers have been established: Province-level, Prefecture-level, County-level, and Township-level (Table 1).

3.2 Selection of cities for research

In this research, from among 333 prefecture-level administrative units, 51 prefecture-level cities with populations in excess of 1 million in 2000 were selected (Table 2 [1]). These prefecture-level cities generally include county-level cities and counties; therefore, in this paper they are referred to as metropolitan areas. In addition, Beijing, Shanghai, Tianjin, and Chongqing, the four Direct-Controlled Municipalities, were excluded from the research. In this research an entire city is referred to as a metropolitan area, and cities and wards are referred to as urban zones. Fig. 1 shows the sizes of the resident populations of the 51 target metropolitan areas according to the 2010 population census. The region encircled with a broken line indicates nine metropolitan areas in the Three Northeastern Provinces. The numbers 1 to 51 on the map correspond to the target metropolitan areas in the table.

Source Number	Source name	Years	Publisher
[1]	China City Statistical Yearbook	2000,2005,2010	National Bureau of Statistics of China
[2]	China Population Census	2000,2010	National Bureau of Statistics of China
[3]	China City Construction Statistical Yearbook	2005,2010	National Bureau of Statistics of China
[4]	China Regional Economics Statistical Yearbook	2005,2010	National Bureau of Statistics of China

Table 2: Data Sources



(01)Shijiazhuang	(14)Qiqiha'er	(27)Nanchang	(40)Foshan
(02)Tangshan	(15)Daqing	(28)Jinan	(41)Jiangmen
(03)Handan	(16)Nanjing	(29)Qing dao	(42)Zhanjiang
(04)Taiyuan	(17)Wuxi	(30)Zibo	(43)Maoming
(05)Datong	(18)Xuzhou	(31)Yantai	(44)Huizhou
(06)Baotou	(19)Changzhou	(32)Linyi	(45)Nanning
(07)Shenyang	(20)Suzhou	(33)Zhengzhou	(46)Chengdu
(08)Dalian	(21)Suqian	(34)Luoyang	(47)Guiyang
(09)Anshan	(22)Hangzhou	(35)Wuhan	(48)Kunming
(10)Fushun	(23)Ningbo	(36)Changsha	(49)Xi'an
(11)Changchun	(24)Hefei	(37)Guangzhou	(50)Lanzhou
(12)Jilin	(25)Fuzhou	(38)Shenzhen	(51)Wulumuqi
(13)Ha'erbin	(26)Xiamen	(39)Shantou	

Fig. 1: Selected 51 Prefecture-Level Citys (Metropolitan areas) in China.

3.3 Sources and explanation of the data

The sources for the research data are as follows: Section 3 is based upon two population censuses; and Section 4 is based upon the China City Statistical Yearbook, and in addition the China Urban Construction Statistical Yearbook and the China Statistical Yearbook for Regional Economy were also used as complementary materials in this section. The urban population data from the China City Statistical Yearbook [1] has an established reputation for use in comparing cities, but with a middle-level of accuracy.

The metropolitan area population recorded by the population census [2] is based on a survey of the actual state and has a correspondingly high-level of accuracy; however, very little detailed data has been officially announced.

4 EFFECT OF ECONOMIC GROWTH AND MIGRATION ON CHINESE METROPOLITAN AREAS FROM 2000 TO 2010

4.1 Analysis of metropolitan area populations from 2000 to 2010 found in the population census

Population growth in metropolitan areas consists of a natural increase, which is the difference between births and deaths, and migration, which is the difference between the recorded inflow and outflow of people. In this research, the migration figures were calculated by subtracting the natural increase of population from the total increase of population in the metropolitan areas and urban zones. In a metropolitan area, migration is an increase due to drift from outside the area, whereas in an urban zone, it is an increase due to both drift from outside and from the suburbs within the metropolitan area. To examine the population growth composition in each metropolitan area, the following indicators were established (Table 3). The natural increase ratios in the population census were calculated by assuming that they were the same as in the City Statistical Yearbook.

(1) Natural increase ratio for 10 years in a metropolitan area: $E = (\prod_{t=01}^{t=10}(Q_{t-1} E_t))^{1/10} / Q_{t-1}$

(2) Urbanization ratio (Table 3): $C_t = P_t / Q_t$

Fundamental statistics	2010 Metropolitan area population (10thousands person)	2000 Metropolitan area population (10thousands person)	Population increase in metropolitan area (10thousands person)	2010 Urban zone population (10thousands person)	2000 Urban zone population (10thousands person)	Population increase in urban zone (10thousands person)	Population of natural increase in metropolitan area (10thousands person)	Population of natural increase in urban zone (10thousands person)	Population of net social migration in metropolitan area (10thousands person)	Population of net social migration in urban zone (10thousands person)	Net social migration ratio in metropolitan area (%)	Net social migration ratio in urban zone (%)
Calculation formula	Q_{10}	Q_{00}	$\Delta Q = Q_{10} - Q_{00}$	P_{10}	P_{00}	$\Delta P = P_{10} - P_{00}$	$\Delta NQ = Q_{00} E$	$\Delta NP = P_{00} F$	$\Delta SQ = \Delta Q - \Delta NQ$	$\Delta SP = \Delta P - \Delta NP$	$\alpha = \Delta SQ / Q_{00}$	$\beta = \Delta SP / P_{00}$
Average	671.2	569.3	101.9	392.4	238.9	143.7	26.8	12 4	75.0	128.5	15%	86%
Standard deviation	261.9	222.0	91.9	235.2	172.0	140.9	24.1	16 2	87.6	136.8	18%	141%
Maximum value	1,404.8	1,110.9	367.4	1,107.1	852.5	642.6	136.9	116 0	362.0	624.5	90%	812%
Minimum value	213.8	205.3	-34.6	121.8	24.5	-135.1	-0.1	-0.3	-67.7	-147.4	-13%	-109%

Table 3: Basic Statistics in 51 Metropolitan Areas.

The natural increase ratio of an urban zone for 10 years is , and the calculation method is the same as E. In the formula, t represents a year, and is an annual natural increase ratio from the year t-1 to the year t.

From Table 3 it can be seen that the natural increase of population in the metropolitan areas is higher than in the urban zones, but the difference is small. Regarding the migration population, however, the figure of the urban zones is double that of the metropolitan areas. Based on this finding, it can be considered that the migration population from outside a metropolitan area drifts into the urban zone, and there is also a considerably large migration population from the suburbs within the metropolitan area.

4.2 Factor analysis of the migration in the metropolitan areas

Concerning the 51 metropolitan areas at two points of time, the years 2000 and 2010, regression analysis was conducted to explain the urbanization ratios by using the GRP growth, and the results were compared. The cities shown in Fig. 2 are nine metropolitan areas in the Three Northeastern Provinces. As can be seen, in both years, the urbanization ratio and GRP per capita have a positive correlation, and as the economic levels improved, urbanization progressed. Moreover, compared with the year 2000, the year 2010 shows increased economic discrepancies, and over the period, in the nine metropolitan areas of the Northeast region these became considerably larger.

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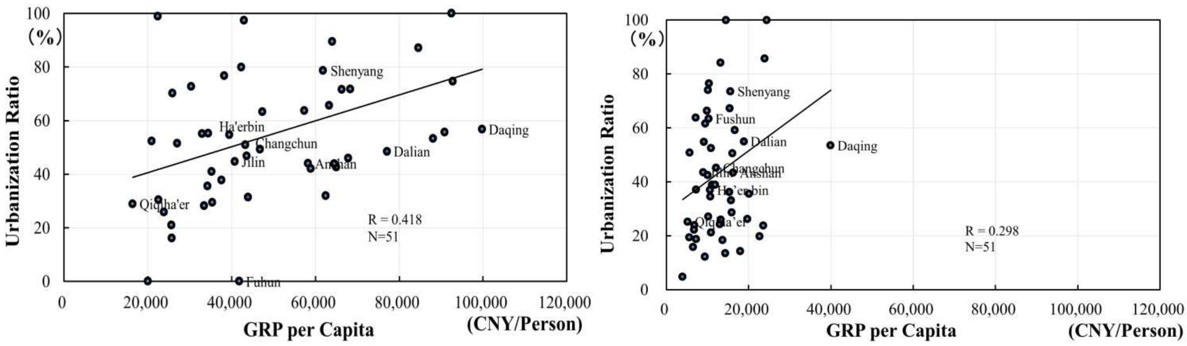


Fig. 2: Correlation between Urbanization Ratio and GRP per Capita, 2000(Left), 2010(Right).

In order to explore the main factors of migration, multiple regression analysis was conducted to explain migration to the metropolitan areas ($Y=\Delta SQ$) by using two variables, economic growth ($X1= GRP10/GRP00$) and area population size ($X2=Q_{00}$). Here, an objective variable Y and explanatory variables X1 and X2 are all a log-log model using logarithms.

Linear model: $y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \varepsilon_i$

Log-log model: $\log y_i = \beta_0 + \beta_1 \log x_{i1} + \beta_2 \log x_{i2} + \varepsilon_i$

When both sides are positioned at the upper right of e, the following is obtained:

The results of the analysis demonstrated that the population size factor had little effect on migration, but the economic factor had a significant impact (Table 4).

response variable $\log Y (Y=\Delta SQ)$ / predictor variable	Partial regression coefficient	t- Value	p- value	Statistical significance test
$\log X_1$ ($X_1=GRP_{10}/GRP_{00}$)	1.615	2.878	0.006	1%- significant difference
$\log X_2$ ($X_2= Q_{00}$)	0.583	1.691	0.097	
Constant	-0.937	-0.916	0.364	

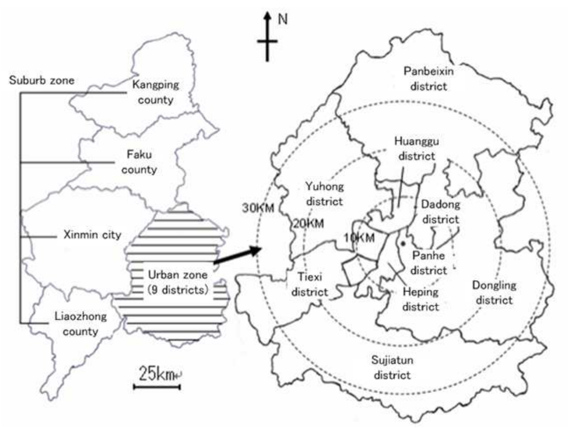
Table 4: Results of MRA on Population Increase in Metropolitan Areas.

5 ANALYSIS OF POPULATION INCREASE: CASE STUDY OF SHENYANG METROPOLITAN AREA

5.1 Summary of Shenyang metropolitan area

To understand the composition of population increase in the metropolitan areas from 2000 to 2010, this section takes Shenyang metropolitan area as a case study and analyses the actual state of population increase using Source C. The Shenyang metropolitan area is located in the central part of the Liaoning Province, the southern part of the Northeast region (Figure 3). It is the capital of the Liaoning Province, and the metropolitan area population in 2010 was 8.106 million, which is the largest population in the Northeast region.

The Shenyang metropolitan area is composed of 9 districts as the intra-urban area, 1 county-level city, and 3 counties (total area: 12,942 km²). The Shenyang urban zone with 9 districts covers 3,464 km², with a population of 6.381 million and includes Heping, Shenhe, Huanggu, Dadong, Tiexi, Sujiatun, Dongling, and Yuhong Districts and the Shenbei New District; the Shenyang suburban zone includes the one county-level city, Xinmin and the 3 counties, Liaozhong, Kangping, and Faku and covers 9,478 km² with a population of 1.726 million.



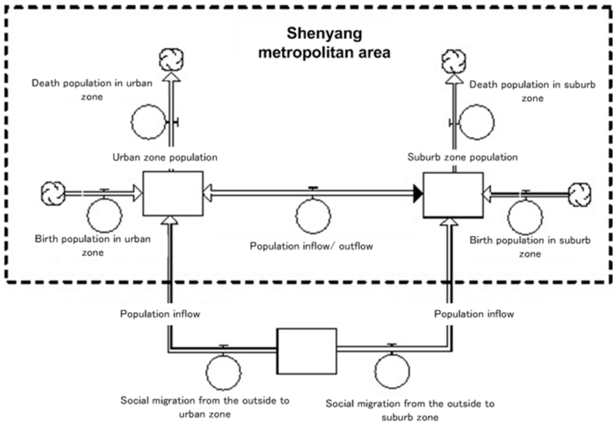


Fig. 3: Shenyang prefectural-level city (metropolitan area), Fig. 4: Diagram among the inflow/ outflow of metropolitan population.

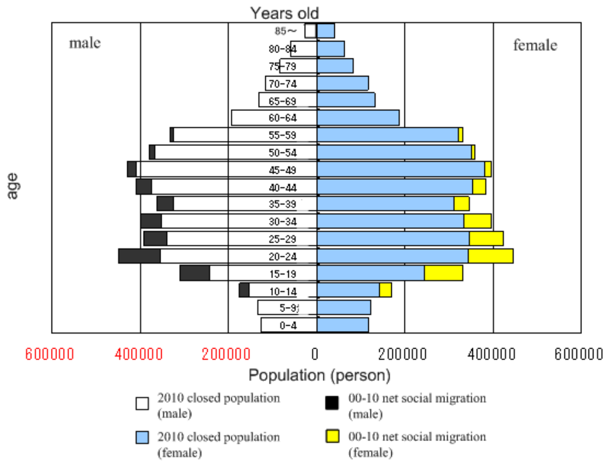
5.2 Estimation of social migration population using the cohort method

In accordance with the framework shown in Figure 4, the Shenyang metropolitan area and the surrounding were aggregated into three zones: an urban zone, the suburb zone, and the outside, and using the cohort method the population move between these three zones was estimated.

The steps of the cohort analysis are as follows: (1) Calculation of survival ratio for 5 years: Multiply the arithmetic average between the 2000 and 2010 values of each 5-year age cohort annual survival ratio by itself 5 times; (2) Calculation of closed population: A closed population is an estimated population on the assumption that there is no social move. Multiply each 5-year age cohort population by the survival ratio for 5 years 2 times to obtain the closed population in 2010; (3) Calculation of net social migration: Find the difference between each 5-year age cohort population in 2010 and the closed population to obtain the net social migration.

5.3 Analysis of social migration in the Shenyang metropolitan area

Figure. 5 show the population pyramid in 2010 in the urban zones of the Shenyang metropolitan area, overlapped by social population change found by cohort analysis. Due to the nature of the cohort method, it was not possible to estimate all age cohorts; however, for these 10 years, in each of the metropolitan area and urban zone, the social migration of population is observed in each age group. When these figures are summed up, it can be estimated that the population increase for 10 years were 902,000 for the metropolitan area and 548,000 for the urban zone, and the social migration were 565,000 and 875,000 respectively.



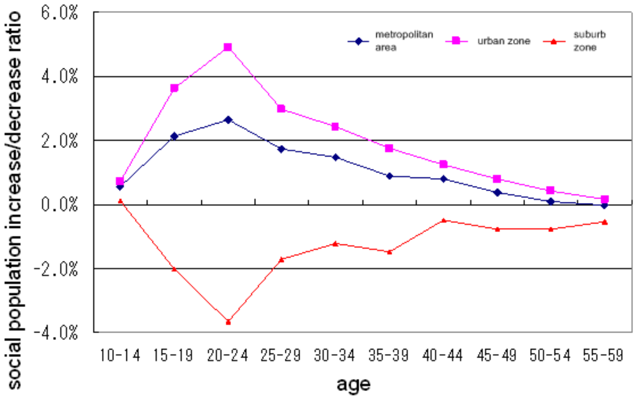


Fig. 5 (Left): Estimation of net social migration in Shenyang metropolitan area using the cohort method (2000-2010), Fig. 6 (Right): Social migration ratio in urban zone in Shenyang metropolitan area (2000-2010).

Figure 6 shows the net social migration ratios of each cohort (10-54 years olds) in Shenyang. For each of the urban zone and the suburbs, using the urban zone population, and suburbs population in 2000 as denominators, the net social migration ratios were estimated. In the entire metropolitan area all cohorts showed the positive values, which was caused by the population inflow from the outside. Inflow excess from the suburbs to the urban zone can be seen mainly in the 15 to 29 cohorts; employment or entering a higher-

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level educational institution can be considered as the main factors. When the urban zone is focused on, inflow from the suburbs can be estimated as 308,000, and inflow from the outside 567,000. When these figures are compared with the indicators of the Shenyang metropolitan area, found in Section 3, a difference of 46.4% is found, which suggests that population increase with no change of household registration is included.

6 ANALYSIS OF THE QUALITY OF LIFE IN CHINESE METROPOLITAN AREAS

6.1 Establishment of a Quality of Life indicator system

6.1.1 Method to select indicators for evaluating the Quality of Life

By employing data [1], [3], and [4] from the two points of time, 2005 and 2010, this section establishes indicators to evaluate the Quality of Life (excluding economy-related indicators), and attempts an analysis (see Table 4).

the Structure of "quality of life" indicator System			
First-level index	The second level index	Third level index	data
(EC) Education and Culture	a)Primary education	①Number of primary school per capita (School / 10thousands person)	[1]
		②Number of primary school teacher per pupil (Person / 10thousands person)	[1]
	b) Secondary education	①Number of Junior high school per capita (School / 10thousands person)	[1]
		②Number of Junior high school teacher per pupil(Person / people)	[1]
	c) High education	①Number of high education student per population (People / 10thousands person)	[1]
	d) Public library	①Number of public library per capita (Thousand books / 10thousands person)	[1]
(DC) Daily-life Convenience	a) Communication	①Number of household use of internet per capita (household/10thousands person)	[1]
		②Number of set-up phone per capita (household/people)	[1]
		③Number of mobile phone per capita (household/people)	[1]
	b) Movie theater, post office	①Number of movie theater per capita (a movie/10thousands person)	[1]
		②Number of post office per capita(a post office/10thousands person)	[1]
	c) Transportation cost	①Area amounts of city road per capita (㎡/person)	[1]
		②Number of public bus per capita (a bus/10thousands person)	[1]
		③Number of annual bus passengers per capita (time/person・Year)	[1]
	d) Electricity	①Number of Electricity Consumption of household per capita (Ten thousand kWh / million people)	[1]
(UE) Urban Environment	a) Housing price	①Average house price/annual citizen income (Year/People/100㎡・person) [Metropolitan area]	[4]
	b) Open space	①Area amounts of public park per capita (㎡/person)	[3]
	c) Medical care	①Number of hospitals per capita (a hospitals/10thousands person)	[1]
		②Number of medical doctor per capita(People / 10thousands person)	[1]
		③Total number of bed in hospital (a bed/10thousands person)	[1]
	d) Water-supply	①Water-supply coverage (%) covered pop./total pop.	[3]
		②Total amounts of water-supply per capita (Ton/person) total amounts of water-supply /total pop.	[3]
(CS) Consumption Sustainability	a) Household garbage	①Treatment ratio of household garbage (%) amounts of treatment of garbage/total household garbage	[3]
		②total household garbage per capita (Ton/person) total household garbage/total pop.	[3]
	b) Household sewage	①Treatment ratio of household sewage (%) [Metropolitan area]	[1]
(IS) Industrial Sustainability	a) Industrial recycling	①Rcycle ratio of Industrial garbage (%) [Metropolitan area]	[1]
	b) Industrial wastewater	①Capita per industrial wastewater without the treatment [Metropolitan area]	[1]
	c) SO2	① Industrial SO2 treatment ratio (%) Industrial SO2 removal amounts /the total industrial SO2 emission [Metropolitan area]	[1]
		②Capita per industrial SO2 emission without the treatment(10thousands person/Ton) total pop./the total industrial SO2 emission [Metropolitan area]	[1]
	d) Smoke	①Industrial smoke treatment ratio (%) industrial smoke removal amounts/the total industrial smoke emission[Metropolitan area]	[1]
		②Capita per industrial smoke emission without the treatment (10thousands person/Ton) total pop./the total industrial smoke emission[Metropolitan area]	[1]

Table 4: The Structure of "quality of life" indicator System.

Firstly, from among 53 indicators for which data was available at both points of time, 38 indicators were selected using the KJ method, and then, missing data and correlation analysis were confirmed, and finally 31 indicators were selected as element indicators (third-level indicators). By combining several indicators second-level indicators were created; and the second-level indicators were further combined to establish the five Quality of Life indicators, each of which cosists of a number of element indicators as follows:

(1) Education and Culture (EC): 6 element indicators

(2) Daily-life Convenience (DC): 9

(3) Urban Environment (UE): 7

(4) Consumption Sustainability (CS): 3

(5) Industrial Sustainability (IS): 6

6.1.2 Quality of Life indicators and Change to Quality of Life indicators

To combine the Quality of Life indicators at each point of time, the deviation value was first found for each element indicator, and each higher level indicator was obtained by successively calculating the mean value of the deviation values.

In addition, to combine the Change to Quality of Life indicators between the two points of time, the deviation value was found for the ratio between the two points of time of each element indicator, and each higher level indicator, in the same manner as above, was obtained by successively calculating the mean value of the deviation values.

When creating indicators, histograms for original data and indicators at each level were created to confirm the existence of outliers, and the outliers were treated as missing data. Many outliers were found for Shenzhen; this would appear to be a consequence of the city being designated as a Special Economic Zone, and its ranking immediately under the Direct-Controlled Municipalities.

6.2 Analysis of Chinese metropolitan areas employing the Quality of Life indicator system

6.2.1 Classification of metropolitan areas according to the Quality of Life indicators in the years 2005 and 2010

Using these five Quality of Life indicators, 51 metropolitan areas in the years 2005 and 2010 were classified according to type. After applying cluster analysis (Ward's method) the metropolitan areas were divided into five groups (Fig. 7), and similarities were found in classification for both years; therefore, the two points of time were overlapped and any movement between the metropolitan area groups was added as shown in Fig.8.

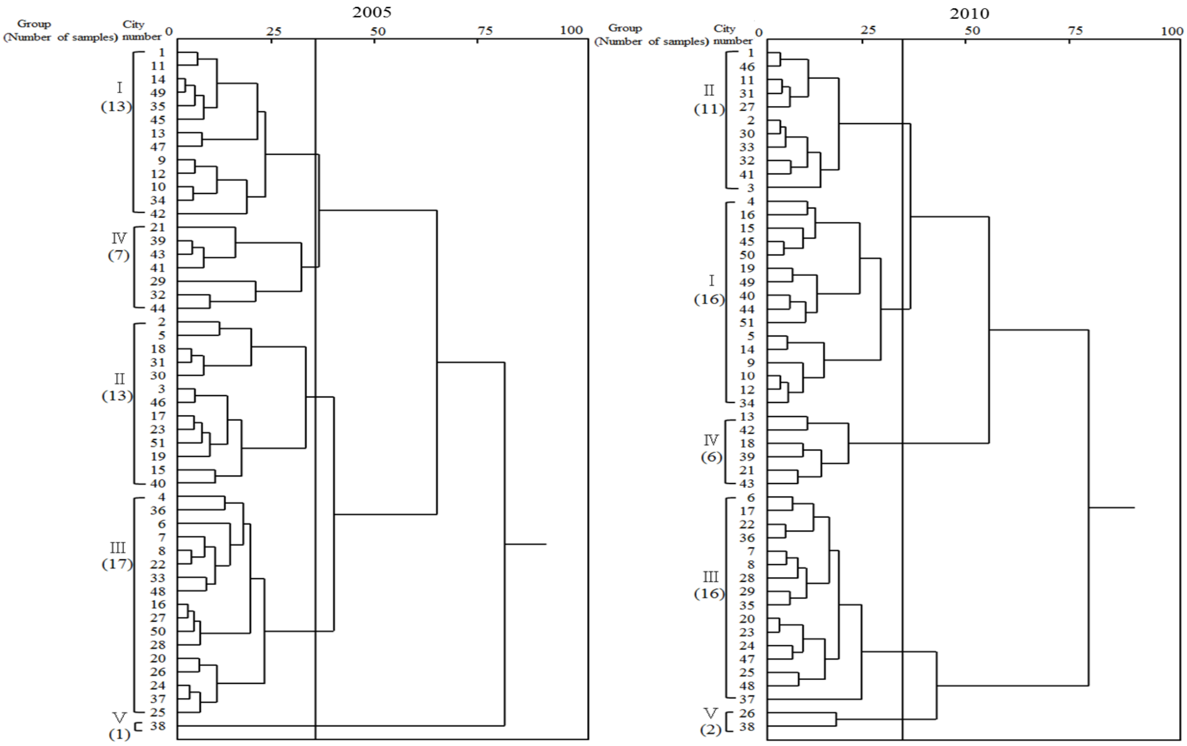

Fig. 7: Dendrogram of the metropolitan areas as.

The characteristics of each group are as follows (the figure within brackets indicates the number of metropilitan areas in 2010):

Group I (16): The Education and Culture indicator is close to the mean value, and the other four indicators are lower than the mean value.

Group II (11): The Daily-life Convenience indictator is close to the mean value, along with the particularly-high Consumption Sustainability indicator, and the remaining three indicators are lower than the mean value.

Group III (16): The four indicators other than the Industrial Sustainability indicator are almost uniformly higher than the mean value.

Group IV (6): Among the five groups, the Industrial Sustainability indicator is the highest, but the other four indicators are all the lowerst.

Group Ⅴ (2): This group shows the highest overall in all five Quality of Life indicators (Fig. 8).

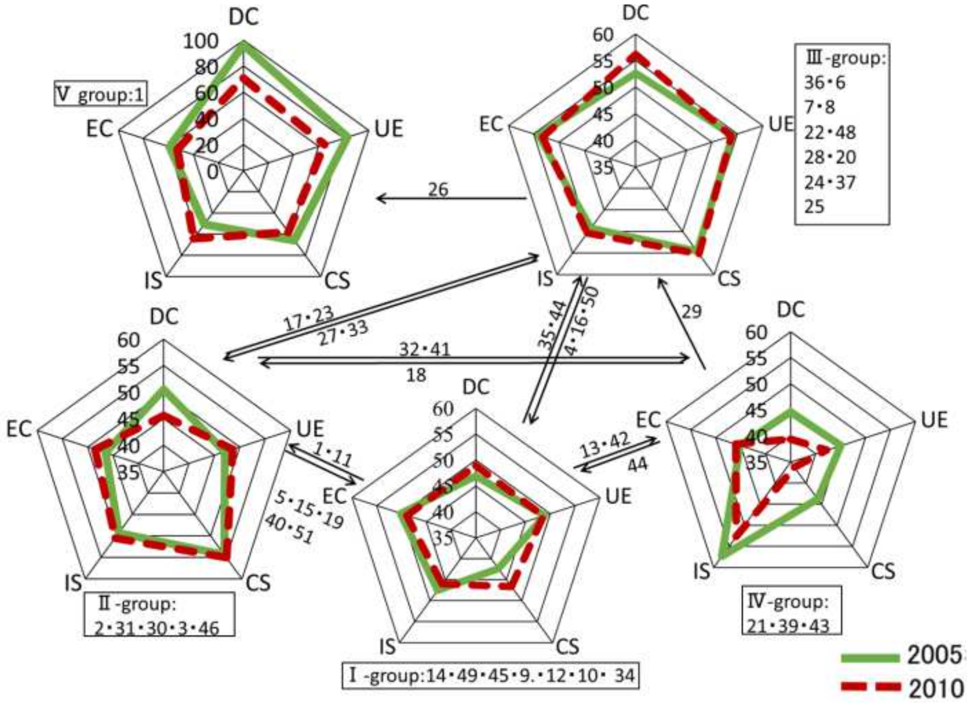

Fig. 8: Types of metropolitan areas as measured by the index "quality of life" index('10 And '05).

Next, for the five groups classified according to the Quality of Life, their ranking order was determined by the Pareto superiority/inferiority method, and in order of the highest Quality of Life they were arranged as V III (II IV I). Among three groups II, IV, and I, it was difficult to definitively judge superiority/inferiority. Over the five years, 24 cities moved between the groups, and six metropolitan areas moved to a group with a higher Quality of Life: Xiamen (26) moved from Group III to Group V; Wuxi (17) and Ningbo (23) moved from Group II to Group III; Wuhan (35) and Huizhou (44) moved from Group I to Group III; and Qing dao (29) moved from Group IV to Group III. It can be considered that these metropolitan areas developed their Quality of Life more quickly than other areas, and by 2010 the Quality of Life level had improved. These 6 metropolitan areas are mainly located on the coast and showed remarkable economic growth.

6.2.2 Linkage analysis of economic growth, migration, and area population size with the Change to Quality of Life indicators

Stepwise multiple regression analysis (method of decreasing the variables) was conducted and the results are shown in Fig. 9 as a linkage diagram. The following three elements were used as objective variables: GRP per capita in 2010 (Y_1) , migration to the urban zones from 2000 to 2010 (Y_2=ΔSP), and the area population size in 2010 ($Y_3=P_{10}$). The following five Change to Quality of Life indicators from 2005 to 2010 were used as explanatory variables: ECc(X1), DCc(X2), UEc(X3), CSc(X4), and ISc(X5).

Y_1 has a positive correlation with EC (Education and Culture), and a negative correlation with CS (Consumption Sustainability).

Y_2 has a positive correlation with UE (Urban Environment).

For Y_3, all explanatory variables were rejected, which indicates it had a weak correlation with the change to the Quality of Life.

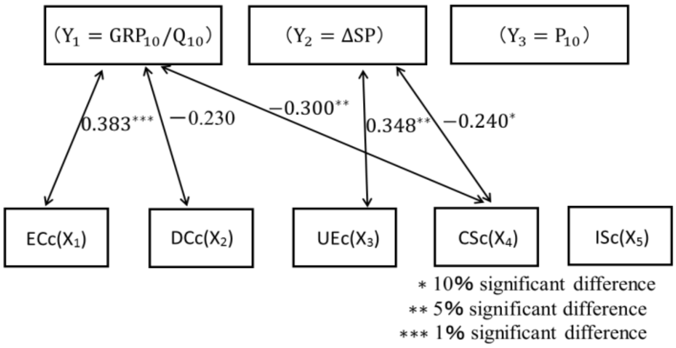

Fig. 9: Correlation diagram of each of "change in quality of life" indicators and the economic level, population influx and urban scale.

6.2.3 Relation between economic growth and the Change to Quality of Life indicators: Examining the Northeast region as a case study

For each of the nine metropolitan areas in the Northeast region, a radar chart was created to show the five Change to Quality of Life indicators and the indicator of the GRP per capita ratio between two points of time as shown in Fig. 10. The nine metropolitan area charts show that the Change to Quality of Life indicators and the indicator of the change to GRP per capita are close to the mean values, which demonstrates both the levels of economic growth and change to Quality of Life hold a middle-ranking position in the Chinese 51 metropolitan areas. Moreover, among the nine metropolitan areas Shenyang and Dalian belong to the second highest ranked Group III. The other seven metropolitan areas remain in Group I, II, or IV.

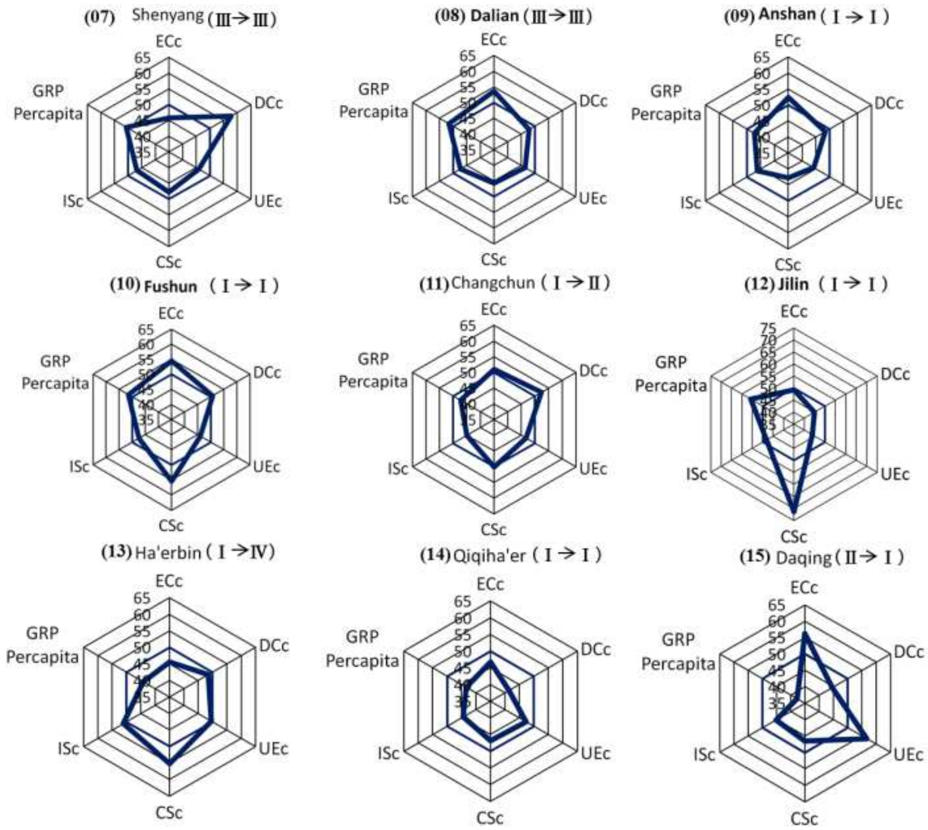

Fig. 10: The change index chart in each metropolitan area in the Northeast Region.

7 CONCLUSION

(1) The main factor of migration to each metropolitan area from 2000 through to 2010 is economic growth, rather than area population size.

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(2) According to the Quality of Life indicators established for 2005 and 2010, Chinese metropolitan areas were examined and classified into five groups, and a trend was seen that a metropolitan area with an overall growing economy also had a higher level of Quality of Life. However, depedning on the economic growth level of each metropolitan area, the Change to the Quality of Life differed.

(3) The linkage of economic level, migration, and area population size with the Change to Quality of Life indicators was analyized. The economic level had a positive correlation with EC (Education and Culture), and a negative correlation with CS (Consumption Sustainability). In addition, migration had a positive correlation with UE (Urban Environment).

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Urban Sensing App – A Mobile Tool for Urban Sensing and Climate Monitoring in Smart Cities

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1 ABSTRACT

Mobility is a central aspect of today´s life. Humans have becomedigital nomads, just as information and knowledge is increasingly ubiquitously available. In addition to the smart networks (grid-based and wireless), which create a new urban topography, a new multifunctional tool becomes prominent: the smartphone. It has developed into an all-rounder and has established its significance for urban life. The homo sapiens has developed into the permanently wired homo junctus (or homo sapiens junctus). He takes in and designs his surroundings by using this new tool. It is the key to bi-directional exchange of information, money, authentications, support and communication with other people.

The aim of this paper is to present a newly developed application, which will extend the smartphone functions in order to collect climate data automatically and autonomously in an urban sensing scenario. The smartphone sensors are read out and the results are converted into climate data. Thus, combined with crowd sourcing, a new type of climate monitoring is created. Additionally, it is demonstrated how the results of such measurements can be saved, interpreted, and of course used. Furthermore, some specific examples of mobile monitoring using smartphones, coupled with crowd sourcing, are presented, which illustrate how this type of climate measurement can increase the quality of life of the urban population.

2 INTRODUCTION

2.1 Smartphone market analysis – Smartphone market conditions

At the moment, there are almost innumerable different smartphones available. Every year, new models are introduced. In 2013, 1,804,334 smartphones were sold around the world. The predominant systems are Android, iOS, Windows, and Rim. It is predicted that even more smartphones and tablet PCs will be sold in the future. In 2013, 877.9 million devices running the Android system, were sold. This equates to approximately 38 % of all PCs, cellphones, ultraphones, and tablets which were sold in that year. Until 2015, the market share of Android could increase to 50 % [GARTNER, 2014]. Android 4.4.2 (KitKat) is the latest version of this system, and by January 2014 it was used on 1.5 % of all Android smartphones. Currently approximately 60 % of Android owners are using versions 4.1.x – 4.3 (Jelly Bean) [STATISTA, 2014]. Within every smartphone sensors are integrated. Such a sensor consists of two elements: a sensing device and an evaluation unit. Thus, it is possible to conduct quantitative and qualitative analyses of chemical, physical, climatological, biological conditions, as well as of medical conditions. Sensors in our enviroments are ubiquitous and can have various forms [cf. HERING; ET AL, 2012:1FF]. For instance, absolute position transducer, acceleration sensor, and lighting sensor are part of most smartphones. GPS is another sensor which allows to enhance every information with the specific location of the smartphone. The spreading of smartphones in our society changes the spatial and temporal availability of knowledge. Additionally, new ways to acquire knowledge are created. The possibility of individuals to participate in creating and spreading knowledge is increased by the internet. Thus, the knowledge of the masses is in opposition to the knowledge of experts. The free online encyclopaedia Wikipedia is one of the most prominent examples [cf. SCHWALBE; MEYER, 2010:34FF].

For meteorology as well as urban climatology the collection of data by urban sensing is of interest and has various advantages for climate monitoring [cf. ALLBACH; HENNINGER, 2013:1FF]. The Committee on Urban Meteorology states that the usage of “personal digital assistants” (e.g. smartphones and their sensors) might lead to improved databases for urban climatology [cf. SNOW; ET AL, 2012]. Mobile measurements are well suited to analyse the climate in an urban area. There are various methods of measurement which are conducted, for instance, by car, by bicycle, or on foot [cf. HENNINGER, 2011]. Smartphones have become a new tool for such mobile measurements (Fig. 1). A detailed analysis of the currently available smartphone

'Samsung Galaxy S4', which uses the Android system, would be the best choice because of its integrated sensors.

2.2 Best sensing smartphone

The Samsung Galaxy S4 has a multitude of sensors: a GPS sensor to track one's position, a temperature sensor to measure air temperature, and a humidity sensor to measure the air humidity. Additionally, the barometer can determine atmospheric pressure and the altitude. The integrated RGB sensor measures light intensity and colour temperature and can automatically adapt the brightness of the display to the local lighting conditions. The gyro-sensor coordinates the 'intelligent turning' and orientation of the smartphone. The Galaxy S4 uses 'smart stay' in order to assess if the display needs to be rotated or if the user is lying down. An electromagnetic sensor (the Hall-Geber; S view cover) enables the Galaxy S4 to know if its protective cover is open or closed. Thus, depending on the status of the protective cover, the display can be switched on or off automatically. The accelerometer can measure how far and how fast the smartphone has moved. The digital compass measures the magnetic fields and is also used by navigation apps. All these mentioned sensors allow its user to measure the ambient atmosphere at a specific location.

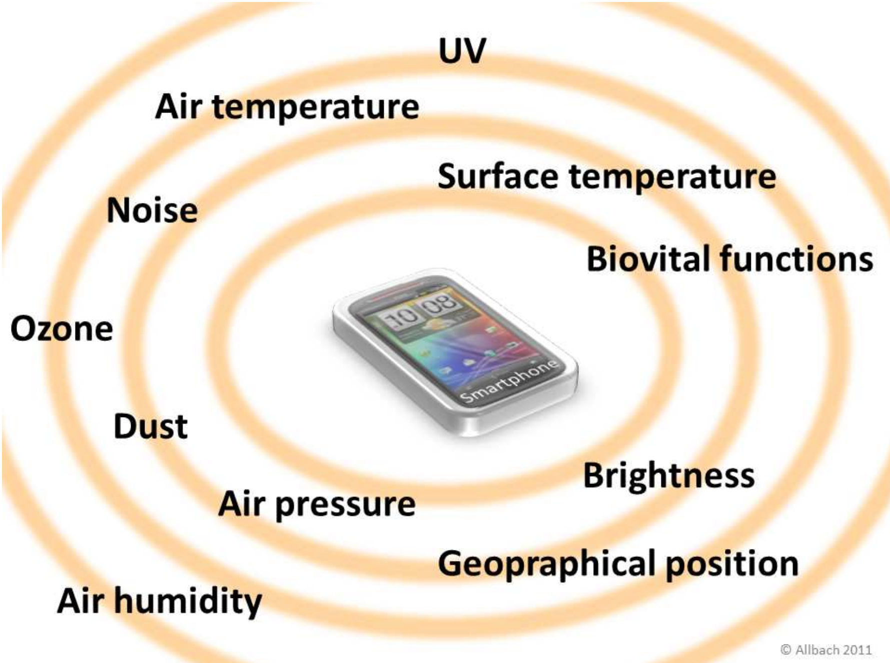

Fig. 1: Smartphone as a "Sensing Device".

Entwickler	Maciej Komur	Sensirion AG	ThePaze	Boneco Switzerland	pabl3st	Delamaire Nicolas	Moletag	YD Visual
Market-Link (Download)	/store/apps/details?id=pl.komur.android.g	e/apps/details?id=com.sens	/store/apps/details?id=com.the	/store/apps/details?id=at.s	https://play.google.com/store/apps	https://play.google.com/store/a	https://play.google.com/store/apps/de	https://play.google.com/st
Sensoren Anzahl	4	2	4	2	6	4	9	4, zusätzlich 5 Batteriesens
Geoposition	nein	nein	nein	ja	nein	nein	nein	nein
Umgebungstemperatur	ja in °C und °F	ja in °C und °F	ja in °C und °F	ja in °C und °F	ja in °C	ja in °C	ja in °C und °F und °K	ja in °C
Luftdruck Umgebung	ja in hPa, PSI und Hg	nein	ja in hPa	nein	ja in Hg	ja in hPa	ja in hPa, PSI und Hg	ja in mbar
Lichtintensität	ja in lx	nein	nein	nein	ja in lx	nein	ja in lx	ja in lx
Höhe (ü.n.N.)	nein	nein	ja in m	nein	nein	nein	ja in m und ft	nein
Relative Feuchtigkeit	ja in %	ja in %	ja in %	ja in %	ja in %	ja in %	ja in %	ja in %
Darstellung	grafisch, numerisch	grafisch, numerisch	numerisch	grafisch, numerisch	numerisch	numerisch	numerisch	numerisch
Benutzeradaptivität	Einheiten	inheiten, grafische Darstellur	Themes, Einheiten	Einheiten	Themes	Schriftgröße	Einheiten, Widgetrate	nein
Datenübermittlung und Speicherung	nein	ung lokal, Verlaufskurvendars	nein	kal, Verlaufskurvendarstellun	nein	nein	nein	nein
Exportfunktion	nein	nein	nein	nein	nein	nein	nein	nein
Betriebssystem	Andoid	Android	Android	Android	Android	Android	Android	Android
Preis	kostenlos	kostenlos	kostenlos	kostenlos	kostenlos	kostenlos	kostenlos	0,73€ (11.02.2104)
Aktueller Stand	02.06.13	13.01.14	31.05.2013	27.09.13	02.02.14	17.10.2013	30.01.2014	07.02.2013
Größe	134k	182k	365k	4,7M	851k	450k	381k	15M
Installationen (Android Market)	100.000 – 500.000	10.000 – 50.000	10.000 – 50.000	1.000 - 5.000	10.000 - 50.000	10.000 - 50.000	1.000 - 5.000	500 - 1.000
Aktuelle Version	1.0	1.2.2	1.3.2	1.2.1	3.1	1.6	1.2	2.0
Erforderliche Android-Version (min.)	4.2	4.0	4.2	2.2	2.2	3.0	4.0	3.0
Sonstiges	nur mit Samsung Galaxy S4	nur mit Samsung Galaxy S4 und Samsung Galaxy Note3, Widget Rate anpassbar, Messungen können im Hintergrund laufen	nur mit Samsung Galaxy S4	Messungen nur mit Samsung Galaxy S4, mit anderen Geräten nur standortabhängige Schätzangaben, Feature von Gerätehersteller zur Regulierung der Luftfeuchtigkeit und -reinigung	Messung von Nähe und Beschleunigung, läuft nur mit Samsung Galaxy S4, Einheiten nicht anpassbar	nur mit Samsung Galaxy S4 und Samsung Galaxy Note3, Widget, zusätzliche Anzeige der Akkutemperatur	nur mit Samsung Galaxy S4 und Samsung Galaxy Note3, zusätzlich Rotations-, Magnetfeld-, Beschleunigungs-, und Nähesensor	Läuft auf allen Smartphones, auch wenn die entsprechenden Sensoren fehlen, am besten mit Galaxy S4 und Note 3

Table 1: Extract and functions of Sensing Apps.

2.3 Analysing "Sensing Apps" for the Samsung Galaxy S4

Before the development of the "Urban Sensing App", various apps for urban sensing scenarios (e.g. 'Baumkataster [cf. ALLBACH; HENNINGER, 2013] or concepts like the „Baumbestimmungs-App" [cf. GRUB, 2013]) had already been programmed. After the integrated sensors of the Galaxy S4 were announced, it became obvious that this smartphone could be suited for local climate monitoring. Samsung had already provided the Galaxy S4 with a health and environment app, and later on several other applications followed. It is therefore necessary to analyse and evaluate the functions of these available apps

(Table 1). The publication „Crowdsourcing urban air temperatures from smartphone battery temperatures“ has to be acknowledged, because its focus is on the air temperature, and because it has a huge data base [cf. OVEREEM; ET AL, 2013]. However, the “Urban Sensing App” will be able to record more than one climatological parameter.

3 “URBAN SENSING APP”

3.1 Functions and Characteristics of the “Urban Sensing App”

- Measurement of climate data and other relevant information (meta-data)
- Recording the geoposition
- Recording the data
- Possibility to export the data
- Measurement of the present data (action point & of data for a specific time period
- Possibility to present the data in a list
- Gateway for additional sensors (under construction)

The “Urban Sensing App” is able to measure climatological and environmental data by using the smartphone’s sensors. Futhermore, the app records the date, time, position, and identity (anonymized). All data is saved on the smartphone and, additionally, the app offers the possibility to export the datato use them, for instance, in an “Urban Sensing System” [cf. ALLBACH; HENNINGER; DEITCHE, 2014]. There are two ways of collecting the data: 1. actively by pressing a button to start a measurement of the current situation, or 2. passively by pressing an extra button to start measuring over a specific period of time („∞“).

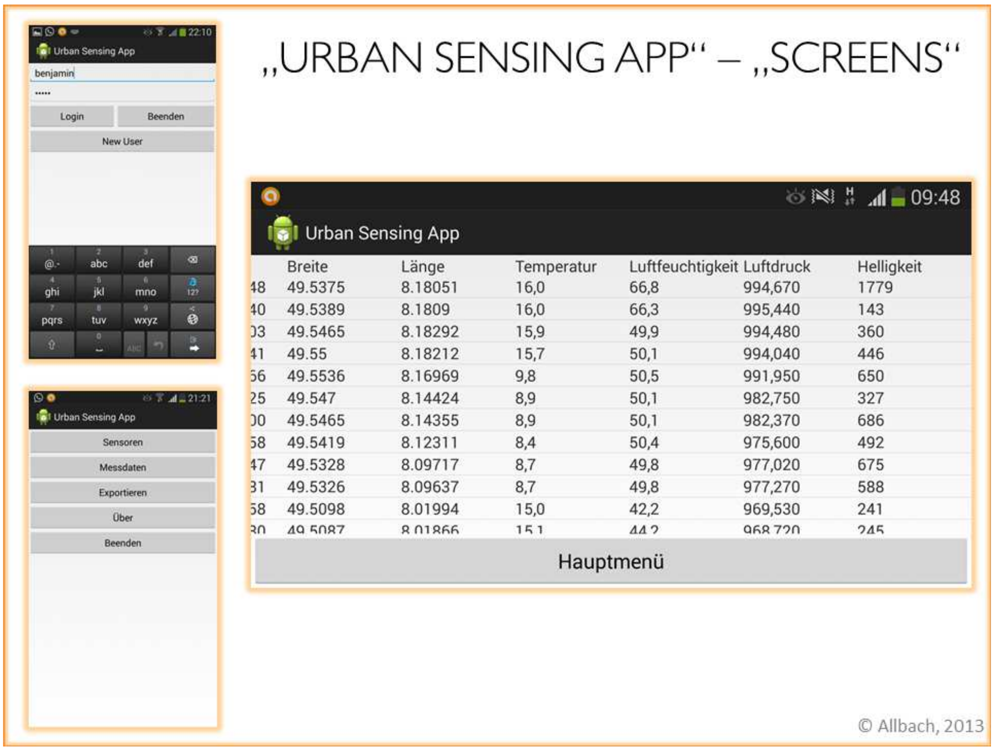

Fig. 2: “Urban Sensing App” – “Screens”.

The current version of the “Urban Sensing App” allows to display the collected data in a listing (Fig. 2). At some future date it is planned to extend this function with additional graphs and options for comparison. A function to read out and save data collected by other sensors, which are not part of the smartphone, via USB, WLAN, or Bluetooth has currently not yet been developed.

3.2 Tools for the Development and Programming of an App

In this chapter, a brief introduction to programming an application is given. While a markup language describes the “how”, a programming language stands for “what” should be done. Every Android App is

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based on Sun`s, or rather now Oracle`s programming language Java. Eclipse is mostly used as the development environment for Java. Originally, it was exclusively used for Java development and (version 4.3, its name is "Kepler") it provides a lot of plug-ins and extensions [cf. Eclipse, 2014]. This is the reason why eclipse is also used for other development tasks. Due to Android Development Tool (ADT-Plugin) it is possible to integrate the APIs (Application Programming Interface) and tools of Google`s Android SDK (Software Development Kit) with an emulator, a project assistant with a special view and a GUI-Editor. This is necessary for the development of Java-based Android Apps in eclipse [cf. LAU, 2011].

The Java platform consists of the Java APIs, which contains the virtual machine (VM) and compiled libraries that can be integrated into programs. The VM executes and interprets the machine-readable code. Thus, it is possible, that each system with the Java VM, can execute the code independently of the system on which the code was originally developed. A compiler is used to transform the source code into a byte code. If the program was compiled successfully, the code interpreter translates it into a platform dependent code that can be understood and executed by the system [cf. PAWLA, 2000]. Java is a powerful and common object-oriented programming language that pursues the following objectives: simplicity, object orientation, platform independence, robustness, security, interpretability, performance, distribution, adaptability and multi-threading. Despite the similarities with C++, Java is a slim language. It provides help to the programmer, e.g. by automatic memory-management, space allocation and the garbage collection.

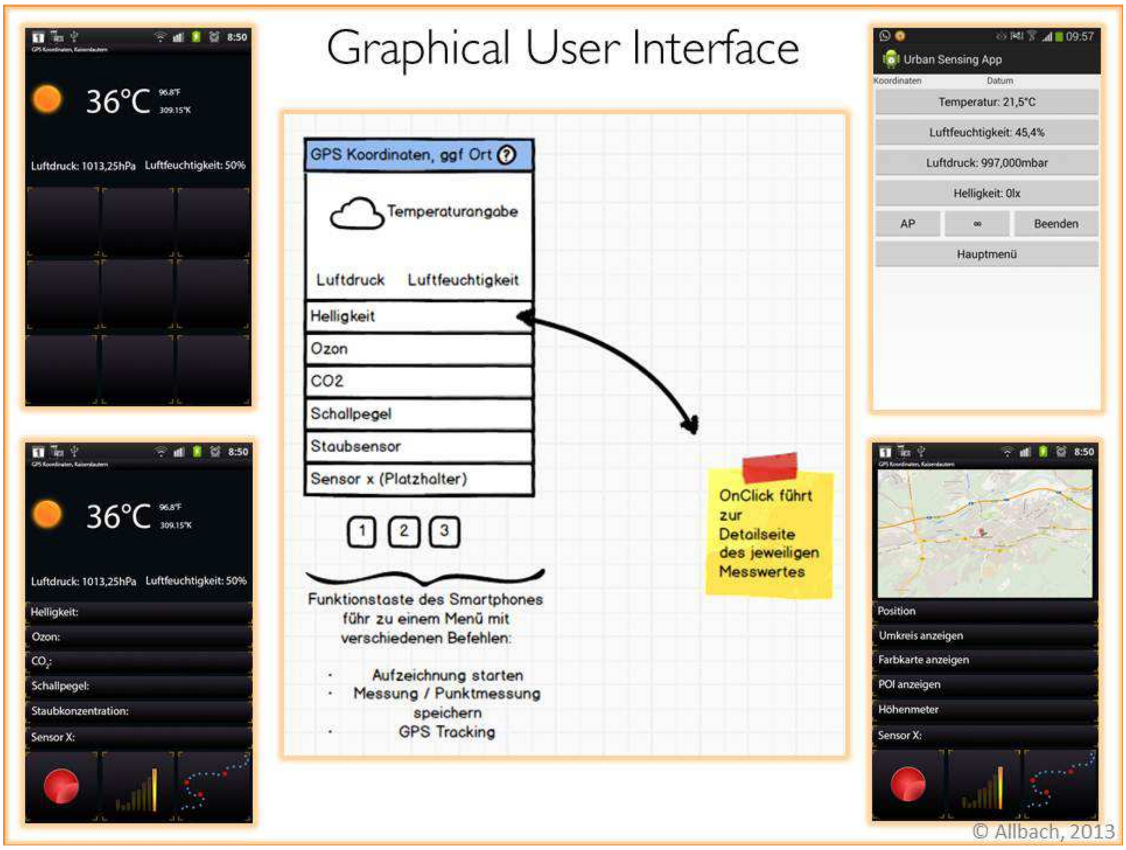

Fig. 3: Graphical User Interface.

Java applets are programs that are initiated within a HTML page. These external programs, which are executed on the user`s machine, could potentially cause many security risks. To avoid damage, the Java applets are executed on a virtual machine, the so called "sandbox". All programming commands are translated and executed at runtime. Java, as a dynamic language, is able to adapt flexibly to its environment. Database access via SQL is made possible by the Java Database Connectivity API (JDBC). With the aid of JDBC classes and interfaces, it is possible to implement a database entirely in Java and to send SQL requests to any relational database. The closer a programming language is to the machine code, the faster it can be processed. Java is efficient due to using a compiler and the multi-threading, even though is an interpreted language. For optimum performance, the virtual machine uses just-in-time compilers.

Beside the development of graphical user interfaces, Java is applied on servers and mobile devices. JSP (Java Server Pages) is able to produce content dynamically, which is why Java is used for web-server programming. J2ME (Java Platform 2 Micro Edition) completes the Java-family. J2ME is mainly used on mobile devices with only limited resources. Java is particularly suited for client/server applications, because it implements APIs for distributed applications as well as its database connection with JDBC [cf. TEIA, 2002].

3.3 Development & Evolution of the "Urban Sensing App"

During the "Urban Sensing App" project, the application was not only programmed in code; Structures, hierarchies, graphical elements of the display, and the GUI (Graphical User Interface) were also created (Fig 3). This development has not yet been completed and is constantly under construction as well as, improvement.

Diverse layouts have been created, improved, slashed, and recreated. In order to create sketches of the user interface, the program Balsamiq Mockup (Fig. 3 middle) is used, because it can present the graphical user interface and a simplified scope of operation [cf. BALSAMIQ STUDIOS, 2013]. Balsamiq Mockup is coded in Adobe Flex and can easily and intuitively be used to create wireframes and sketches. The integrated molds appear as if drawn by hand and help the user to create a digital version. However, wireframes are often misinterpreted by users as suggestions for a design [ANNEN; SCHMITZ, 2010].

3.4 Data Storage

The recorded sensor data is stored straight onto the smartphone. The most popular storage solutions are TinyDB, TinyWebDB, and the SQLite software library. So, the focus of the following consideration is really on the requirements of mobile applications. Foremost, TinyDB and TinyWebDB of the Google-based App-Inventor are introduced, because they offer several simplifications to the user. The surface provides some components, which reduces the communication between user and database to simplify storage- and call-functions. It depends on the purpose of the application whether TinyDB or TinyWebDB is chosen. If it is sufficient to store the date on the device, Tiny DB is appropriate. Since most apps require data-sharing, TinyWebDB is usually chosen. In comparison to TinyDB, the selection of data from TinyWebDB is more complex, because two steps are necessary: 1. TinyWebDB sends a data-request via the World Wide Web to a web-database. 2. the database processes the request and sends it back to the device. An event-handler on the device passes the arguments to another function. Such an event-handler is called "callback-procedure" [cf. WOLBER; ET AL., 2011: 305FF].

One database that is frequently used in combination with mobile devices operating systems is SQLite. This is a compact, open source program library, programmed in C, which provides an embedded database server. The special feature of the program library is, that it can be directly integrated without the need for an extra server. SQLite is a transaction-consistent database. It comprises different tables, indices, triggers, and views. Because of its platform-independent format, it is possible to copy the database between 32- and 64-bit systems. The particular suitability for resource-limited devices, like cellphones, results in the need of a minimal stack-space with a size of 4kB, and a minimal heap-pace size of 100kB [cf. MELTON; ET AL., 1993]. The following goals were in focus at the development of SQLite: simple administration, simple execution, simple embedding in larger programs, simple maintenance and simple adaption. Typical uses of SQLite as application-data-format for embedded applications are e.g. internal and temporal databases or websites. For large websites, client/server applications, and very large datasets, this library is not suitable Overall, SQLite supports the SQL92 standard [cf. SQLITE, 2014]. For the "Urban Sensing App", a SQLite database is sufficient and is therefore used. Additionally, it is possible to store the data in comma-separated-value files (CSV) that facilitates storing and processing the data in other systems. The application offers the option to send locally stored data to a web database. In this case, the information is stored in an "Urban Sensing System" [cf. ALLBACH; HENNINGER; DEITCHE, 2014].

4 TEST OF THE "URBAN SENSING APP"

4.1 Validity of data – Samsung Galaxy S4 vs. common measurement devices

To ensure the validity and accuracy of the data, various tests were run multiple times (Fig.4). For this purpose one version of the Samsung Galaxy S4 was compared to different mobile measurement devices.

Fig. 4: Samsung Galaxy S4 vs. common measurement devices.

Initial tests confirm similar results in comparing the "Urban Sensing App" with mobile measuring devices regularly used for climatological measurements within urban areas. Of course, it has to be noted that even these devices do not always deliver exact values and should therefore not be regarded as absolute. After elaborate, specifically conducted tests, the difference in air temperature is at $\Delta T_{max} = 1{,}5°$ C; the difference in air humidity was no more than 3 %. The results of the light intensity (brightness) were almost incommensurable, but considering the different methods of measurement, they are still within the same range. However, differences in brightness were noticed while measuring during movement; the position of the smartphone has great influence on the outcome. Small changes in position can result in great changes in e.g. brightness. Further development is also necessary for measuring noise. The precision of GPS is consistent with other measurement devices; it typically varies depending on where it was used. Depending on the singular measuring device used, the reaction time of these is quicker in comparison to the Galaxy S4. However, this could be modified by adapting the frequency of measurement intervals in the "Urban Sensing App."

4.2 Comparing Samsung Galaxy S4 to Samsung Galaxy S4

Fig. 5: Samsung Galaxy S4 vs. Samsung Galaxy S4.

Tests comparing seemingly identical Samsung Galaxy S4 models offered differing results, even though the same version of the sensing app was used. The test results indicated that there is only a minimal discrepancy between different Samsung S4 smartphones (Fig. 5). However, some tests did show striking deviations (e.g. ~2°C, ~3% humidity, ~10 millibar air pressure) as well as a different measuring speed.

Fig. 6: Samsung Galaxy S4 vs. Samsung Galaxy S: different system versions may cause difference.

It was also found that the sensors' differences in accuracy not only occur between different models but also between different system versions. In addition to the various sensor models, the age of the sensors and how long the smartphone has already been used for, influences the measurement results (Fig. 5 & Fig. 6). Hence, it is necessary to gather this meta-information along with the measurement results.

4.3 Comparison of the location of the smartphone: unobstructed vs. in a pocket/ bag

A huge discrepancy between the measurement results depending on the position of the smartphone can be expected. Depending on whether it is held in the hand, carried in a pocket or bag, close to the body, or positioned at a fixed location, different readings will be received. Tests indicated that air temperature, brightness, and humidity differ if the smartphone is located close to the body. The measurement of brightness, obviously, makes no sense if the smartphone is in a pocket or bag and not exposed to light. Additionally, noise levels of the surroundings would be adulterated by the pocket or bag. Likewise, the body temperature could influence the measurement results just like sweat would influence the humidity measurement. Whether these results would be even more falsified by different seasons could not be tested, but it can be assumed. The GPS sensor is not affected by whether the smartphone is carried close to the body or if it is unobstructed. In the future, special algorithms have to be developed in order to correct these disruptive factors.

5 USE CASES

It is necessary to have a data basis for energetic, economic, urban and ecologic simulations. This basis can be created by the "Urban Sensing App" and smartphones. The data of the App can be used as a basis for the presentation as a map, e.g. heatmaps and climate-function maps. A heatmap, or hot-spot-map, is a map based on the accumulation of a certain phenomenon at a specific location. Thus, the "heat" in the heatmap does not necessarily show the temperature of the environment. Phenomena could be criminality, traffic accidents, air quality, pollutants, and humidity [cf. DEMPSEY, 2012]. These offer information and can be interpreted by planners and scientists as well as by non-professional users. Thus, the "Urban Sensing App" in connection with a freely available "Urban Sensing System" could become a helpful tool for mapping. A connection of the App with devices used in sports (e.g. cyclometer and heart rate monitor) in order to record their data would be interesting. The analysis of the data in relation to the altitude and climate situation could lead to improved training schedules. Additionally, individuals could be warned about environmental hazards. The App is able to record and analyse the indoor climatic conditions. Based on that, the average humidity, noise, or temperature of an indoor situation could be analysed. Climate and weather monitoring are complex and complicated circumstances, just like the urban area. Further investigations are necessary in order to gain a better understanding of the interrelation between city, climate, human being, and individual health. Using the "Urban Sensing App", makes possible to collect and analyse data, relevant for planning and climatology, in a new way.

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6 PERSPECTIVES – FUTURE – UPCOMING VERSIONS

In a future version, additional new functions will be integrated in the App. In the future, it will be possible to draw conclusions from meta-data for the general as well as climate monitoring. For instance, through acceleration sensor, GPS, light intensity sensor, and position sensor it is possible to tell how the smartphone is transported and, thereby, how accurate the measurements are. Additionally, information about calorie consumption, speed, means of transportation, and typical routines in movement and recreational behaviour of the user can be collected. The "Urban Sensing App" should be used on as many Android smartphones as possible. Even if sensors like the humidity sensor are lacking on some smartphones, all other sensors can still be used and the collected data be saved. The possibility to connect the App with another "Urban Sensing Device," which is based on a microcontroller, allows one to conduct specialized measurements, for instance of the air quality or climate accessibility. Even heart rate monitors could be connected to the App. The well-being of the user could be evaluated by various mathematical calculations. A simple and adequate method would be PMV (Predicted Mean Vote). It compares the absorbed and the emitted heat of the human body. The calculated PMV value depicts the average thermal sensation of the majority of humans. A positive PMV value shows an overload of heat, while a negative one offers the opposite. In order to calculate the PMV value, air and radiation temperature, humidity, and average wind speed are included. Additionally, physical activity and clothes are of importance. In order to gain significant and comparable results by smartphones, it is necessary to create formulas for bug-fixing and optimized interpretation of the data. For instance, by including the date and season, external conditions, average body temperature, and location of the smartphone on the body, a factor could be calculated to correct the measured air temperature and humidity.

7 CONCLUSION

The developed application shows the potential of our daily available gadgets, like smartphones and tablet PCs. Even if measurements are currently not as accurate as other mobile measurement instruments, the spread of smartphones and tablet PCs in today's society allows a multitude of measurements over a longer period of time. Since not all measurements can be conducted using the traditional methods (e.g. counting), smartphones offer the possibility to conduct these measurements cost-efficiently and simultaneously by various individuals. Furthermore, the smartphone is mobile, light, and can be used in terrains that are difficult to access. Furthermore, the hardware is cost-efficient, and through the depicted method and technology it is already possible to collect and analyse datarelevant for planning.

Currently, it is being attempted to analyse a connection between climate, city, and people. By using the "Urban Sensing App" and the "Urban Sensing System," it is possible to collect new and specialized data and scenarios about our society. This new technology can lead to new ideas and results. Consequently, urban sensing scenarios have a huge potential irrespective of privacy protection concerns. This technology can influence the planning of and the living conditions in a city, if data is anonymized Since data can be send as well as received, it is possible to analyse it in an "Urban Sensing System." Users can then be informed, warned, or guided. Thus, the smartphone becomes an important tool for the urban being and, additionally, becomes a measurement device for Smart Cities. However, this technology is still not fully developed and its reliability, system stability, and usability needs improvement.

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reviewed paper

Modelling Day and Night Time Population using a 3D Urban Model

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1 ABSTRACT

Dasymetric methods are commonly used to redistribute or disaggregate (census) population data, using either simple binary or multi-layer models. Most models show limitations in high density built-up areas as they commonly ignore the 3D dimension (meaning buildings height) of multi-story urban environments. For example, simple dasymetric models only allocate the population counts to built-up areas, without considering differences between areas of multi-story and single-story buildings. Furthermore, such models only allow the disaggregation of 'night-time' population data, while for many urban applications such as transport, health or hazard, the location of 'day-time' population is of interest. This research presents an initial approach to model day and night-time population using as case study an Indian city (Kalyan-Dombivli). For most Indian cities, census population data is only available for wards, while day-time population data is either not available or of very poor quality. Besides census data and ancillary spatial data, this research uses a 3D urban model, extracted from Cartosat stereo-images. First, the extracted height from the stereo-image is used in combination with building footprints to disaggregate census population data at wards to 'night-time' population per building. Second, a classification of economically active areas is constructed based on the 3D urban model in combination with other spatial layers (e.g. transport layers) to model the day-time population. The result shows different concentration of population during day and night-time across ward boundaries as well as it confirms the potential of 3D data to disaggregate population data.

2 INTRODUCTION

2.1 Context

In the past years many researchers (e.g. Briggs et al., 2007, Langford, 2007, Maantay et al., 2007, Mennis and Hultgren, 2006 and Su et al., 2010) explored dasymetric methods to essentially disaggregate (census) population data, using either simple binary or multi-layer models. Due to high costs, low frequency and problems related to the aggregation levels of census population data the use of remote sensing for estimating and/or disaggregating population data have been explored since the 1950s (Liu, Clarke, & Herold, 2006). However, most models show limitations in high-density built-up areas as they commonly ignore the third dimension (meaning building heights) of multi-story urban environments (Aubrecht et al. 2009). Furthermore, such models commonly only consider the 'night-time' population (e.g. extracted by census counts or registers), while for many applications such as transport, health or hazard the day-time population would be important (Briggs, et al., 2007). Part of the day-time population is the workforce, which is sometimes captured by economic census statistics as number of employees per areal unit (job location). Most developed countries and some emerging economies (e.g. China) have information on job locations (either by economic census or public registers). However, in many countries the employment counts and therefore the location of jobs are not very accurate as they exclude often small and medium size companies, as well as the informal sector. Generally, in most developing countries and emerging economies employment statistics are of poor accuracy if available at all.

2.2 Population Data

Census statistics provide the amount of residential population at night-time (where people are living). Such census data are publically available only at aggregated administrative units, which are often very heterogeneous in terms of socio-economic characteristics. Furthermore, census wards can be partially built-up and non-built-up. Thus the main problems of census population data are that the administrative units used are commonly "geographically meaningless" (arbitrary) as well as they "smooth local variability" (Wu & Murray, 2005). Furthermore, modifications of (ward) boundaries are happing frequently, making temporal analysis difficult (Langford, 2006). To avoid such problems several researches (e.g. Mennis and Hultgren 2006, Maantay et al. 2007) have been conducted to disaggregate population data.

The concept of day-time population is rather complex because of the complex daily agenda of people. An important source to locate day-time population is the location of jobs. Such data can be extracted in some countries from business or economic census. An economic census is also conducted in India, but data have severe problems with full coverage and temporal accuracy. Such problems even exist in countries like the USA, where the economic census is held every 5 years. Micarelli (1998) indicates two major problems of the economic census; first, not all companies are included and second, the self-reporting is prone to bias. Thus, for many countries employment locations are not available or of very limited accuracy, as well as models covering the complete day-time population (including various daily activities beyond labour) hardly exists.

2.3 Dasymetric Methods

Dasymetric mapping is a technique for disaggregating spatial data (e.g. census ward population) from larger to smaller spatial units using ancillary data (e.g. land use data). These techniques have been employed since more than 200 years (Maantay et al. 2007). The results of dasymetric methods aim at more homogeneous areas and therefore at better representation units of the modelled phenomena, e.g. avoiding population data to be allocated to areas that are not inhabited. Dasymetric models avoid displaying data with arbitrary (census) boundaries, which are often very heterogeneous and therefore a poor representation level. Higgs and Langford (2009) stated that dasymetric techniques have a great potential for a more “accurate representations of the spatial distribution” of population data. For instance, Holt et al. (2004) used Landsat images to extract land-use/-cover data to disaggregate population densities using dasymetric methods.

Commonly used binary dasymetric methods divide an area into inhabited and non-inhabited and assign the population (of a census ward) to the inhabited areas. Whereas multi-class weighted dasymetric model use a subdivision of areas into additional categories which are e.g. related to different population densities using additional data layer e.g. land use, zoning, land value, accessibility, infrastructure density, home living style (Su, et al., 2010). Common methods to disaggregate population data are according to Biggs et al. (2007), Langford (2006), Maantay, et al. (2007) the following:

- Simple (e.g. binary) and filtered area-weighting/interpolation, which is often used to compare and assess more advanced dasymetric techniques (as benchmark),
- Global regression, which builds a global relationship between e.g. population data and land cover information,
- Regional regression, which uses independent fitting for different zones,
- Multi-class dasymetric method, which uses different density zones based e.g. on socio-economic variations, different housing types,
- Dasymetric mapping in combination with an expert system using e.g. cadastral data.

Most of these techniques (with the exception of the expert system) show limitations in high density built-up areas with multi-story buildings as population is simply redistributed to built-up areas without considering the building height. Therefore Bajat et al. (2011) suggests the use of Lidar data to allow modelling the 3D dimension, which is believed to have the potential to improve population mapping. Aubrecht et al. (2009) showed that building footprint and Lidar data in combination with company information gave the best result to disaggregate population data. However Lidar data are for many developing countries and emerging economies not available due to high costs and other data access restrictions. Therefore, this paper explores the use of high resolution stereo-images (Cartosat) for dasymetric mapping. Stereo-images (e.g. Cartosat-1 data) are easily available at much lower costs compared to Lidar data. Thus, the focus of the research is on disaggregating population data to the spatial unit of individual buildings by taking the building height into account. Further, the population estimation per building is used to generate day and night-time population density maps that do not use census ward boundaries.

3 METHODOLOGY

3.1 Data set and case study area

The city of Kalyan-Dombivli, one of the major urban agglomerations of the Indian state of Maharashtra, is situated in close proximity to Mumbai. The twin city has according to the 2011 census about 1.2 million inhabitants. Large parts of the city are densely built-up, with vast areas of slums (44% according to the city development plan).

Sensor/layer	Date	Attributes/spatial resolution
Resourcesat	12.11.2007	5.8 m
Cartosat-1 (stereo pair)	26.02.2008	2.5 m
Building footprints	2007/8	Use of buildings, partially building height
Ward boundaries	2001	Census ward ID
Population census	2001	Population and workforce per ward
Road network	2007/8	Main and minor roads
Public transport stops	2007/8	Location of bus and railway stops

Table 1: Spatial and census dataset

Building footprints were available from the KDMC (Kalyan Dombivli Municipal Cooperation). However, for many slum areas not individual buildings are digitised but a slum area is delineated as an entity. Reason for not having individual buildings of slums is most slums are of such high density that even a visual delineation of individual buildings is difficult. Building footprints are classified into 3 main use classes (residential, mixed and economic use). The footprint data were checked and updated (e.g. omitted buildings) using Resourcesat and Cartosat images (Table 1). A digital surface model was created using a Cartosat-1 stereo pair (2.5 m resolution) using Erdas LPS. This dataset was available from an earlier research (Mishra et al. 2011). Ancillary spatial data were available, including the road network and location of public transport stops. In addition to the spatial data, census statistics from 2001 were available (unfortunately the more recent census of 2011 is not available at this moment). The census gives the number of inhabitants and total workforce per ward. The temporal consistency between the spatial and statistical data is not optimal. Thus, a central ward with little change is selected to develop the model (ward No. 17) (Figure 1).

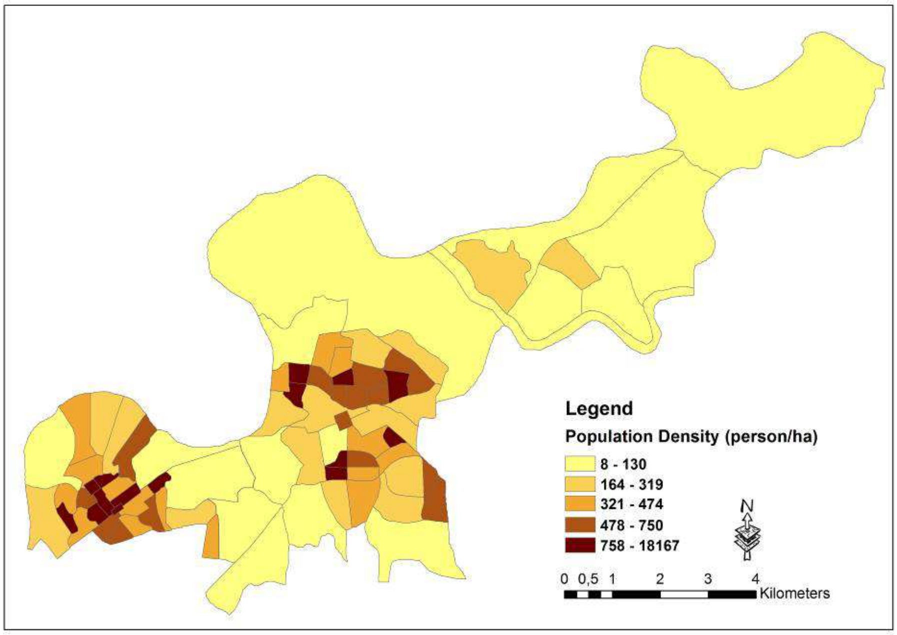

Figure 1. Population density (person/ha)

Figure 1 shows the population density distribution for the entire city of Kalyan Dombivli using the ward boundaries. Many of the wards are a mix of built-up/non-built-up. Moreover, in many wards a mix of single versus multi-story buildings can be found.

3.2 Methodology

In order to disaggregate the census population data to the units of individual buildings the model is set-up in two major steps (Figure 2). In a first step, the night-time census population (available per ward) is disaggregated using the height information in combination with the building footprints. Here the assumption is made that an average floor area ratio is occupied per person. This assumption has two major limitations,

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first it does not differentiate between different socio-economic areas (e.g. slum and non-slum areas) (see Figure 3); second it assumes that people stay at home during night. Thus, for extracting the night time (census) population the average height per building is modelled using the height extracted from the Carotsat-1 stereo-pair (see figure 4). In order to calculate the number of floors, the assumption is made that in average 3 meter height represents one floor. This allows estimating the number of floors per buildings. In a next step a ratio is built by dividing the floor area of a specific ward by the number of inhabitants (of the ward). The result gives an average m²/person ration. This ratio is applied to the individual buildings to estimate the number of persons per building.

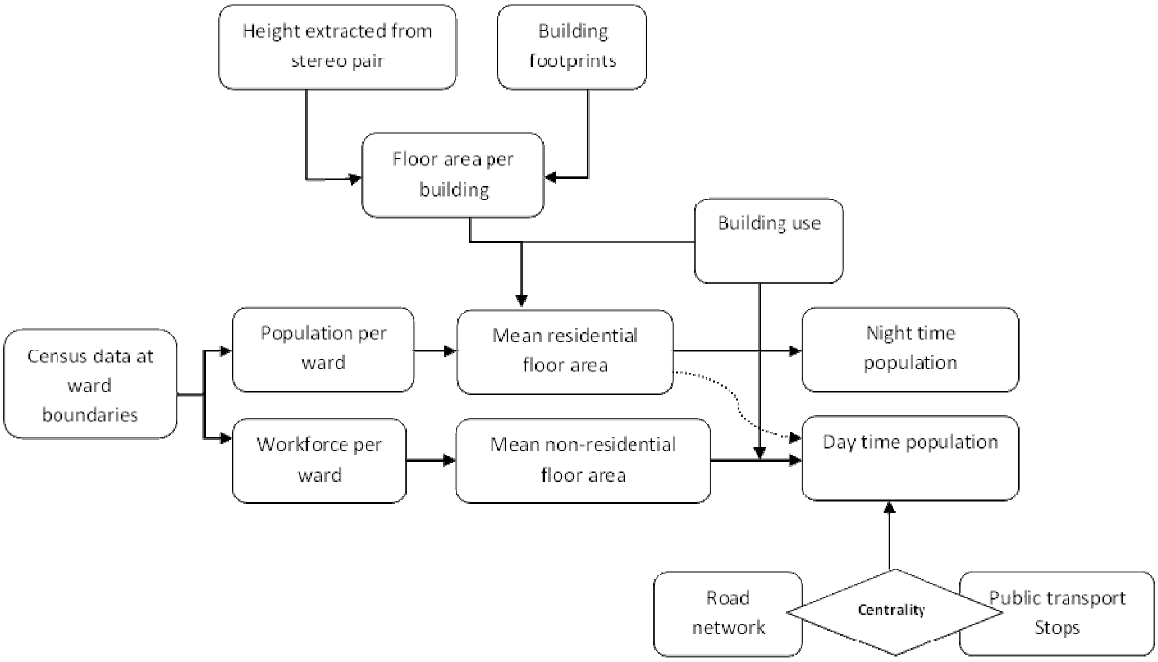

Figure 2. Overview of Methodology

The second step models the day-time population. This includes extracting buildings where economic activities are performed and redistributing the workforce to areas of such activities, as well as modelling the location of the 'remaining population' (people not counted as workforce).

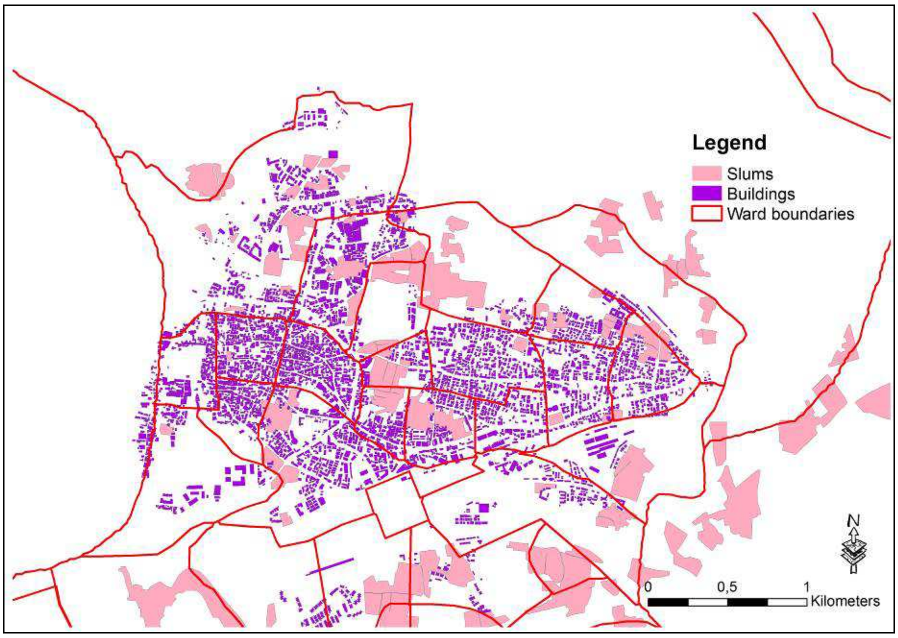

Figure 3. Buildings and slum areas of part of Kalyan-Dombivli

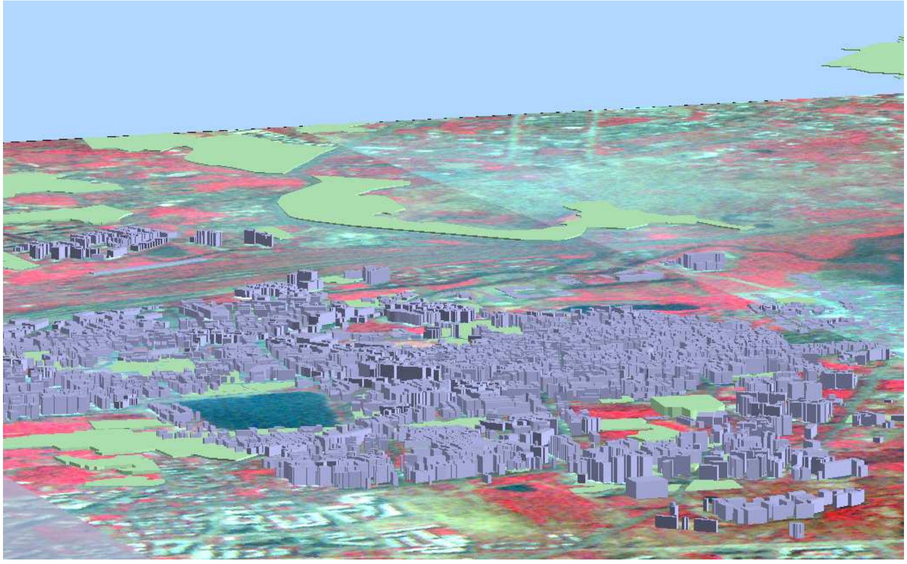

Figure 4. Extruded buildings using the height information from Cartosat-1 images (displayed on the Resourcesat image)

Thus, for extracting the day-time population the data available from the census is used. The data give the workforce and non-workforce population. The registered workforce population is redistributed towards areas of economic building use. Here the module works again with an economic floor area/workforce ratio in m2 per employee. The remaining day-time population (not part of the workforce) is redistributed to residential buildings as well as to buildings that are,

- located along roads,
- located in proximity to public transport modes.

The reason for including besides the buildings classified as economic use also other buildings is that some inhabitant will be at their residence but also to include economic and other activities that are not included into the workforce statistic. For example informal economic as well as shopping and leisure activities commonly occur along roads, public transport points and at central locations. Therefore, this is also an attempt to include informal economic activities into the model. Therefore buildings with high likelihood of having economic activities in its surrounding are selected using the above mentioned criteria. This part of the day-time population (which is not registered as workforce) is assigned to buildings with high likelihood of economic activities on the street. The remaining population is assumed to be at residential buildings. This assumption is again a limitation of the model as optimally also other activities e.g. educational activities need to be included.

4 RESULTS AND DISCUSSION

The results have two major outputs, first a model of the night-time population per building and second a model of the day time population per building. In a final step population density maps (day and night time) are generated that do not rely on ward boundaries.

Difference in Floors (reference – extracted)	**Frequency**	**Percentage**
3+	92	4
2	91	4
1	90	4
0	774	33
-1	638	28
-2	329	14
-3+	301	13
SUM	2315	100

Table 2. Extracted floor number compared with municipal reference data

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4.1 Modelling the height of buildings

The extracted surface model using the Cartosat-1 (stereo pair) allows an estimation of the building height information. Using an average floor height of 3 m, the number of floors per building is calculated. The results are compared with a municipal data set containing for parts of the buildings the number of floors (unfortunately without information about temporal consistency). Comparing the extracted number of floors with the reference, 33% have an optimal match, while 64% of the buildings have a match of +/-1 floors. The major problem of the extracted floor heights using the stereo module is an overestimation of the number of floors (Table 2).

4.2 Modelling the night and day time population per building

For the example ward No. 17 (displayed in figure 4) the ratio used for calculating the night time population is 19.5 m2 floor area per person. Thus lager numbers of night-time inhabitants are allocated to multi-story buildings while buildings of fewer floors have fewer inhabitants (Figure 5).

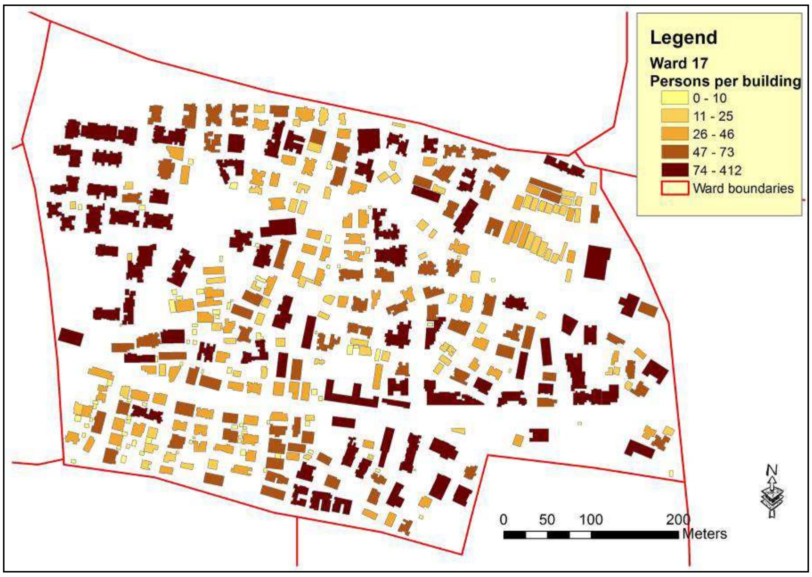

Figure 5. Model of night time (census based) population distribution

The ratio for ward 17 to allocate the workforce is 16 m2 floor area per employee. The day-time population model shows higher number of population in areas of economic activities and along major roads while part of the population (non-workforce) is allocated to residential areas (Figure 6). Validation of both models is still missing.

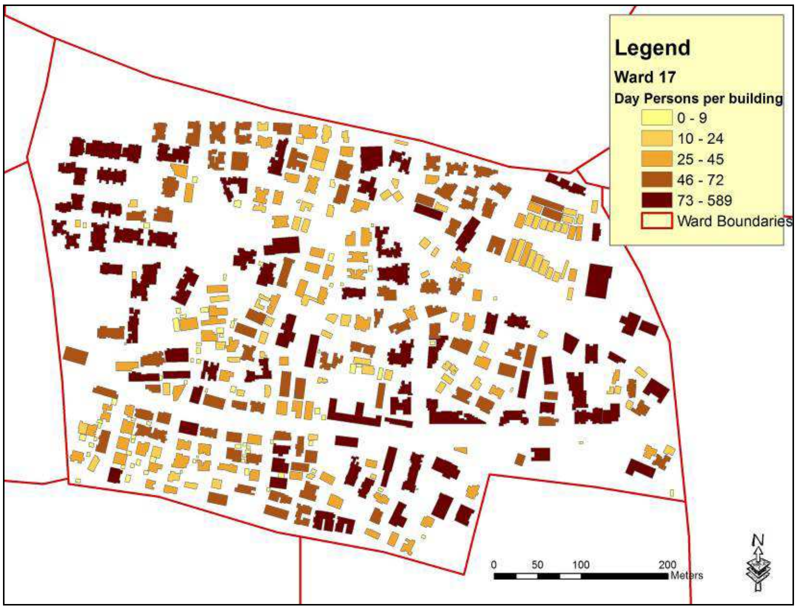

Figure 6. Model of day-time population

4.3 Modelling the night and day time population density

In order to illustrate the different day and night time density distribution of the ward No. 17 (a high density area), kernel density maps (weighted by the number of inhabitants per building) are generated. The resulting maps of night time (Figure 7) and day-time (Figure 8) density distribution illustrates the heterogeneity of the ward, which is commonly neglected by displaying density maps aggregated at ward boundaries. Moreover, the density maps illustrate differences between night and day-time, where during day-time more persons can be found in economically active areas.

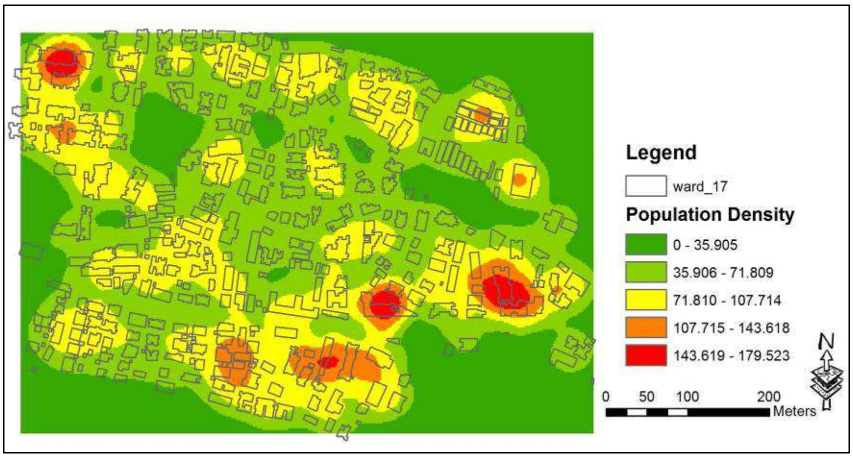

Figure 7. Night time population density distribution of ward No.17

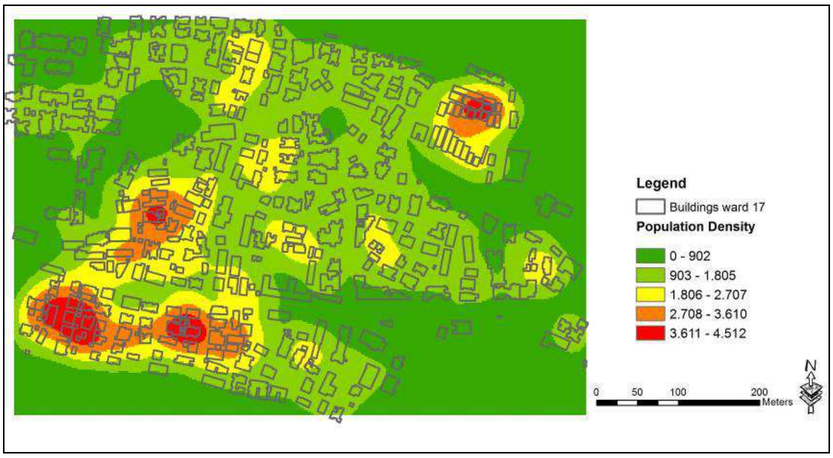

Figure 8. Day time population density distribution of ward No.17

One visible problem of the example ward No. 17 in the case of the night time population is that an area covered by ‘Chawls’ (small multi-storied dwelling units used for workers) in the North-East part is accounted with the same ratio of m2/persons as better-off areas. This definitely allocates too less people to the Chawls area (slum like conditions). However besides this problem (planned to be addressed in upcoming research) the results give a general impression of difference between day and night-time population density distribution.

For a selected larger part of the city of Kalyan-Dombivli the difference between day and night-time population was displayed across ward boundaries (Figure 9 and 10). This illustrates the advantage of not aggregating data at ward boundaries, which allows displaying cross-ward clusters of high versus low population densities. The selected area is covering a relatively stable part (with little development dynamic) to minimize problems of temporal inconsistency of the data used for this research.

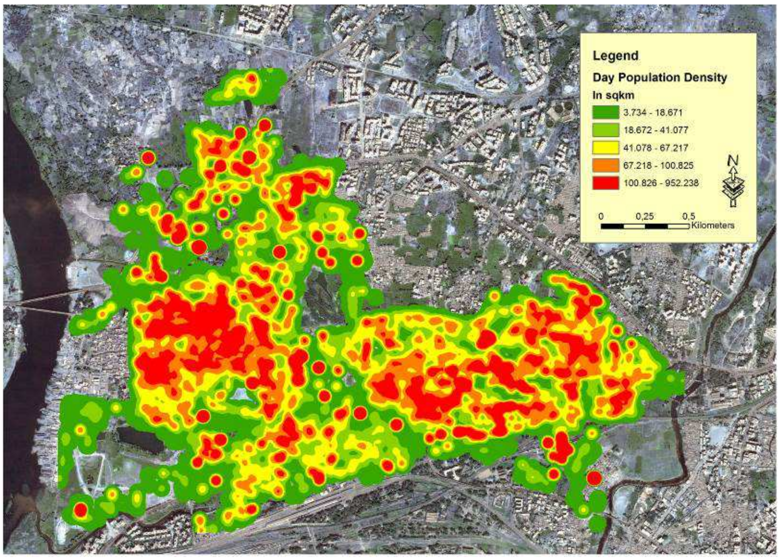

Figure 9. Day time population density distribution of part of Kalyan-Dombivli

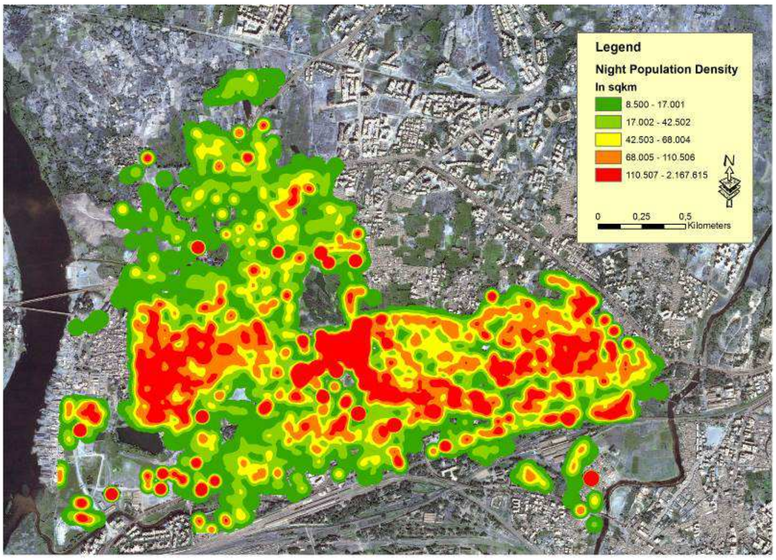

Figure 10. Night time population density distribution of part of Kalyan-Dombivli

Several difference between the day and night-time population distribution can be observed, e.g. some areas in the North-West have higher day time densities caused by the location of areas of economic use, while some of the residential areas have during daytime less density. Areas of high density during day and night time were in particular densely built-up residential areas, which includes in particular areas of multi-story buildings and slum areas.

5 CONCLUSION

Models that address differences between day and night-time population at disaggregated level are not much found in published research. Such models are of high complexity caused by the complex daily activity patterns of urban population, to model this complexity is a challenge. This research aimed at a first exploration of the use of height information in such models coming from high-resolution stereo-images. The presented research output illustrated that such height information allowed disaggregating night-time population data (census) to individual buildings using here a simple m2/person ratio for the individual wards. Day-time population models are more complex as urban inhabitants have diverse activities patterns. Part of the population is working while others participate in educational activities, shop or stay at home etc. The presented model used a simple approach, dividing the population in registered working and non-working population and redistributing the working population into areas of economic use. While the “officially” non-working population was partially assigned to areas of economic activities (streets and central location) and partially to residential locations.

This research aims at opening a first thought towards providing more temporal detailed and disaggregated population data which is of high demand as input information for urban models (e.g. transport models). Relatively simply built and available stereo-images have a potential to be used in areas were more accurate Lidar data is not available for extracting building height information. An accuracy of 64% of +/-1 floor could be achieved; this allowed distinguishing between single and multi-story buildings within the limitation of the obtained accuracy. The extracted model of day and night-time population for a central part of the study area gave an indication of density variations without being limited by ward boundaries, while including also the 3rd dimension (showing e.g. high densities in areas of multi-story buildings).

The future research focus will be on refining the day-time model of population distribution allowing the modelling of other activities as well as the refinement of the night-time population by considering areas of different socio-economic classes. Also validation of this simple model presented in this paper needs to be still conducted.

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More Green Open Space in a Densified City

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1 ABSTRACT

Fig. 1: Potential for creating green open spaces in the densely built-up city fabric, e.g. along the Wienzeile, by transforming side-streets, source: Tillner & Willinger

The City of Vienna is growing rapidly by a figure of around 18,000 people a year. This steady increase in population is a positive development in the light of the many urban and rural areas in Europe where the population is declining. The growing population stimulates an increased demand for housing, social services, schools, kindergardens and open spaces. While the need for parks, squares and playgrounds is generally acknowledged, financial restrictions mean that it is fulfilled only at the minimum level required by the building code. In larger-scale newly planned districts, i.e. Seestadt Aspern, Sonnwendviertel, Karree St. Marx or Eurogate, parks are part of the masterplan and are integrated into the concepts more easily. The willingness of developers to co-finance green open spaces is greater, due to the larger economic dimensions of the developments and their investment, the percentage of the cost for urban design and landscape design, is therefore lower. But even then, the main focus of investors and architects lies on the buildings and the open spaces are often underfinanced. Furthermore, the quality of the design suffers from a lack of coordination between the different developers and architects on adjacent sites, resulting in undesigned edges and borders.

In comparison smaller projects, i.e. infill developments within the existing city fabric, face extreme difficulties in attempting to meet the need for open space on already constrained urban sites. Generally, the requirements of the building code are met at a minimum level by providing a playground for small children. Sometimes just a modestly landscaped communal courtyard with insufficient sunlight is provided.

From an urbanistic standpoint it is wise to increase the housing supply within the city area also, and not just on the outskirts. This is especially true as large new sites suitable for affordable housing have become scarce and now more remote sites with less favourable public transport access have to be chosen for development. Currently, non-profit developers planning affordable housing projects are confronted by the challenges presented by increasing land speculation and soaring property prices. As a result, private developers with no demand for public subsidies are better able to meet the expectations of higher land prices. Cost-intensive redevelopment projects within the city boundaries have a better chance of being economically feasible – leading to a "rebuilding- and renovation boom" of the building-stock from the end of the 19th century to the present. The city planning department aims for an equal distribution of the additional housing needed by building new developments on the outskirts and also increasing density.

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This concentration on densification in the inner city should, ideally, be accompanied by generous open space design – but in practical terms there are no new sites for green open spaces available. The solution therefore lies in redesigning the existing spaces in-between buildings to make them into pedestrian-friendly open spaces. This strategy can only succeed by simultaneously implementing traffic calming measures resulting in a reduction of the space used by cars. Parked cars in particular require an disproportionate amount of public space on streets. By reducing car-parking and transforming side-lanes and cul-de-sacs into pocket parks, accompanied by an increase in the area of permeable surfaces, tree-planting and greening of walls, the quality of life within the city could be improved dramatically. This is a difficult undertaking due to a strong and well-organized car-lobby supported by the trade-union; currently, this conflict of interest can be observed currently in the heated discussions regarding the proposed transformation of Mariahilfer Street into a pedestrian zone.

The paper will focus on the potential for creating new open spaces by transforming existing streets and will highlight areas where this could be done in the city of Vienna, i.e. along the Ringstraße, Viennas most prestigious and well-known historic boulevard, or the Wienzeile. These streets are characterized by beautiful historic buildings, many of them famous landmarks, but the design of the space in-between the buildings still largely reflects the car-dominated traffic-planning philosophy of the 1960s. Population growth and densification should become the stimulus for rethinking the planning strategy for all public spaces in general and designing a few case-study projects in particular to showcase the enormous potential for open space supply and greening the city.

Potential sites and some examples of redesign will be presented.

2 POPULATION DEVELOPMENT IN THE CITY OF VIENNA

Population Projection 2013 to 2050

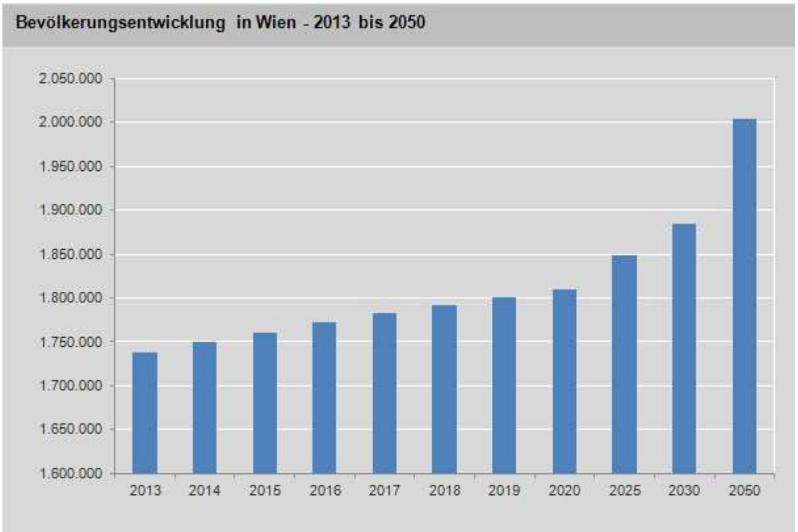

Fig. 2: Population forecast for the city of Vienna, source 1): Statistik Austria.

The transformation of the demographic structure influences the development and attractiveness of regions, their economic viability, local tax-base and the capacity of the infrastructure. In terms of function these individual factors are closely linked. The Statistik Austria bases their assumptions for the future population projection on proven demographic findings of the past. Although these projections are plausibly based on facts their validity can be affected by unpredictable migration movements. The current prognosis for the city of Vienna projects a steady intense increase in population reaching 1.88 million in 2030 and exceeding 2 million inhabitants by the year 2050. 1) Statistik Austria.

3 INFLUENCE OF THE POPULATION GROWTH ON PLANNING AND HOUSING

3.1 Impact on the housing market

Currently, in the city of Vienna, the most immediate impact of population growth on planning is an increased demand for housing, especially for affordable housing. The population growth is good news for the city of

Vienna, as it reflects a dynamic situation, increases the tax base and stimulates a building boom. This comes at a time when the land resources owned by the city of Vienna are shrinking and land prices have risen generally since the economic crisis in 2009. The housing department of the city of Vienna has therefore refocused on “smart-living” which means smaller sized apartments that become more affordable due to reduced amount square metres per room. But new housing construction is coupled with responsibilities for improving the social and technical infrastructure as well, resulting in substantial public expenditure. New kindergardens, schools, parks, and sporting facilities have to be constructed despite the scarcity of available land. The excellent public transportation system has to be further improved, subway lines extended, new tram and bus routes planned and intervals shortened.

3.2 Densification and creative conversions

Private developers have exploited the opportunities to build market-rate housing with a special focus on condominiums, where the prices per m² have risen continuously over the last few years, reaching a peak in 2010 2)

The potential for densification of “Gründerzeit” city blocks has been explored considerably in recent years by converting unused attic space into luxury loft condominiums and reorganizing and renovating the existing apartments, resulting either in rent increases or highly profitable sales. The positive results are obvious, too: many run-down buildings have been exquisitely renovated, even difficult cases, i.e. the long-term vacancies of 1970s office buildings, have been solved thanks to creative conversions. A good example is the Hotel Daniel, now located in a formerly vacant office building from the 1970s which was a particularly difficult case because of its status as a protected monument with a glass curtain wall glass that caused high energy loss.

Fig. 3 left: Hotel Daniel on Wiedner Gürtel in a converted 1970s office building, right: vacant office building on Schubertring soon to be converted into a further Hotel Daniel

This type of creative conversion project will become more common in the near future, as some of these vacant buildings are located in prime locations, such as the former secret service building (BVT) on Schubertring 10-12, which is soon also to be transformed into a hip hotel. From an ecological standpoint, due to the minimum of material consumption involved safeguarding existing structures and reusing them represents a viable alternative to demolitions. Mixed-use projects are more easily implemented in existing buildings. These adaptive re-use projects should be prioritized in areas where a transformation of the streetscape is possible.

4 THE PUBLIC REALM – EXAMPLE RINGSTRASSE

4.1 History – present situation

The Ringstrasse was inaugurated in 1865 by Emperor Franz Joseph I. At the time, the centre of the boulevard was reserved for faster-moving horse carriages, while the two side lanes under a double row of trees were for pedestrians. The situation was comparable to the great Haussmann boulevards in Paris, where a leisurely stroll in order to see and be seen was a favourite pastime of the bourgeoisie and led to the creation of term “flaneur” (urban stroller). Over the course of time, pedestrian areas were converted into side- and parking lanes.

Currently, the central roadway has a reasonable width of about 15 metres (50 feet): three lanes in one direction plus two streetcar lanes, one running in the opposite direction to the flow of motorised traffic.

The general organization of the street has not changed since the 1960s when more space for cars was needed and additional parking lanes were accommodated. The central street width is sufficient to accommodate the traffic flow. The two side-lanes are rarely used except for parking. While a drop-off area for taxis and guests is required in front of the hotels, all other parking is unnecessary. Except at the intersections with important streets there are few shops and cafés along the street.

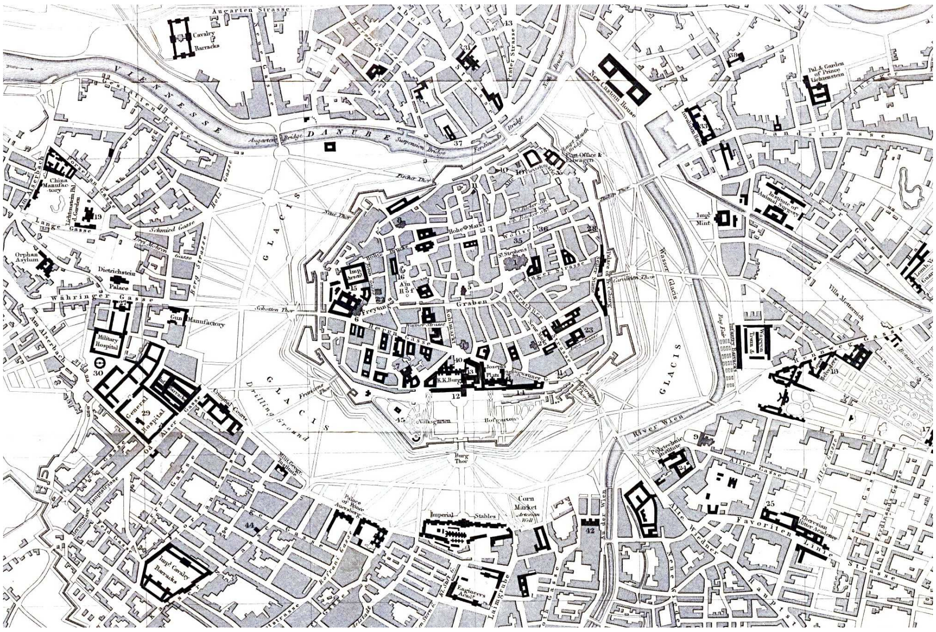

Fig. 4 the former “Glacis” surrounded the inner district as a protective zone for military purposes until the fortifications became obsolete and were demolished. A ring of monumental public buildings along the new Ringstrasse was planned in this location. Source: National Library Vienna

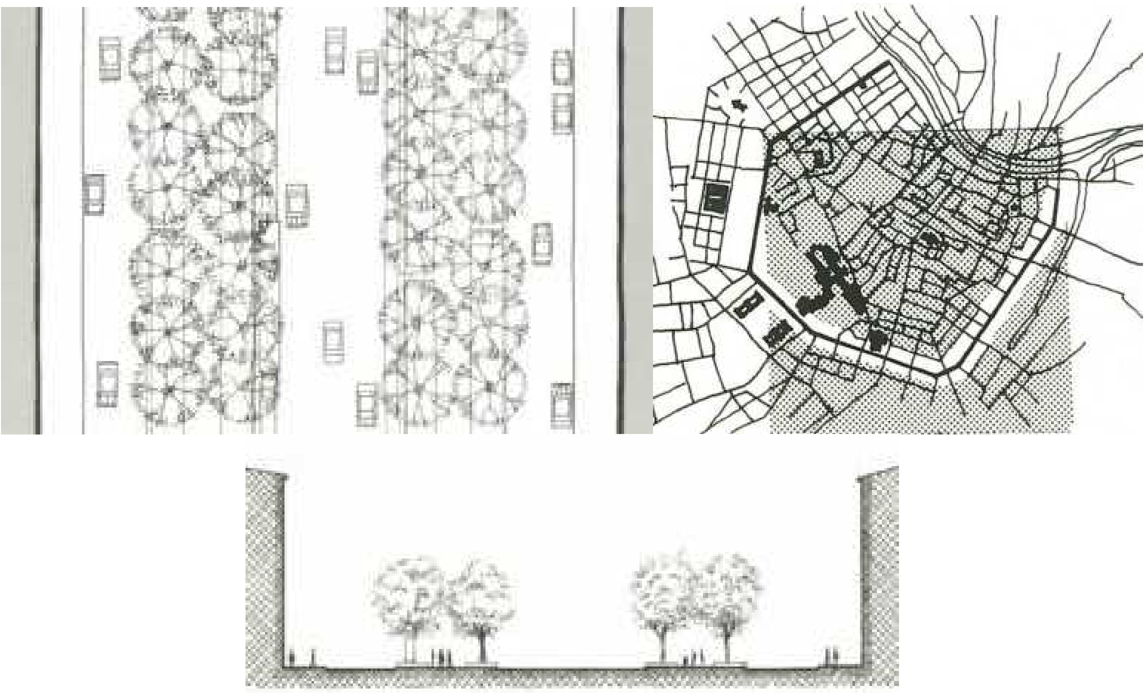

Fig. 5 right: location of the Ringstrasse within the city on the former “Glacis”, Left: plan and section showing current traffic organization, 3) Allan B. Jacobs “Great Streets”

4.2 Future potential of the Ringstrasse as an open space resource

This situation offers an enormous potential as an open space resource for the future. The underutilized side-lanes could easily be reconverted into pedestrian priority streets in accordance with the original intention. This transformation would invigorate pedestrian life along the building fronts and activate ground-floor uses, especially sidewalk cafés. These cafés have become favourite outdoor facilities in European cities with moderate climate and become even more attractive when vehicular traffic is reduced. A positive case-study that proves this point is the city centre of Copenhagen, where traffic has been reduced successfully over the last decades and pedestrian areas and pedestrian-friendly streets have been simultaneously expanded. In spite of initial fears of businesses, the number of people visiting the city centre has increased as has their spending in shops and restaurants and cafés 5). Generally, the car-free public squares invite all residents to spend time outdoors and congregate and communicate in these inviting public spaces which become a kind of communal public "living-room".

As favourable exposure to the sun is a prerequisite for outdoor seating areas in spring and fall, the Ringstrasse has enormous potential due to its width and its curved layout. On balmy spring and fall days sunny sidewalks invite people to stop and rest, on hot summer days the mature trees offer welcoming shade. This favourable setting could be far better used for the benefit of both citizens and visitors than as car parking for just a privileged few. There should be park benches for people taking a stroll can take a rest and are not required to consume anything as well as outdoor seating in cafés – which would become more common and more affordable than today, where only luxury 5 * hotels and two prestigious traditional cafés offer outdoor service at extremely high prices..

Fig. 6 left right: vacant 1950s office building on Schubertring 10-12 and potential open space resource in the side lanes

In front of the vacant office building on Schubertring, one finds the typical streetscape of the Ring Boulevard with side-lanes on either side of the boulevard, in front of the buildings, with two rows of parked cars. The side-walks in front of the buildings are fairly narrow, preventing side-walk seating or outdoor cafés, consequently there are very few cafés located along the Ring, despite the overall beauty of this famous street.

The proposal is to increase the amount of green open space, by reducing the number of parking spaces in the inner city and transforming the side-lanes into linear, pedestrian-friendly streets with a higher percentage of permeable surfaces and green spaces, informal seating, i.e. benches, and a considerably increased amount of space for pedestrians and cyclists. Cars could still pass through, stop and deliver, but not park.

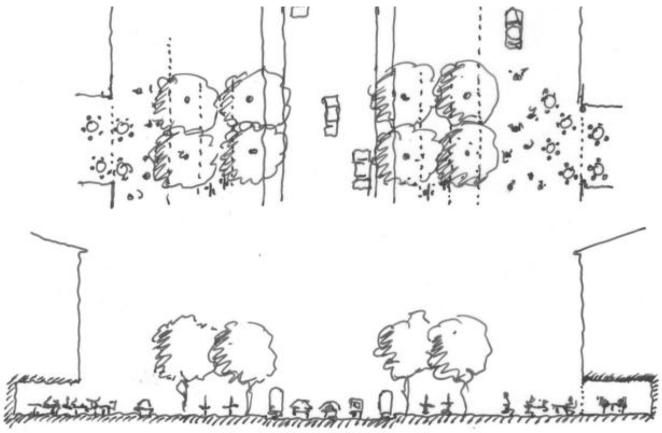

Fig. 7 sketch showing potential conversion of side lanes along the Ringstrasse into pedestrian-friendly streets with priority given to pedestrians and areas for outdoor seating, source: Tillner

Furthermore, as the map in figure 4 shows, at the intersections with crossing streets the space is widened and dominated by traffic movement. At these crossing-points and corners where the street changes direction,

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there is potential for the creation of larger green spaces, i.e. small parks etc. In any case, the Ringstrasse should be reserved as an open space resource and no further building sites should be allowed.

Proposed permanent measures are e.g. the transformation of traffic-spaces into green open spaces.

Temporary measures include the closure of streets for events. The Ringstrasse is occasionally closed down for demonstrations or a marathon. While these temporary closures cause no problems at week-ends, during the week they trigger traffic jams on the only street that runs parallel to the Ring. It would be easy to close the Ringstrasse every Sunday to allow people to stroll, cycle and run without an adverse impact on traffic flow. Even in cities that are considerably more car-oriented, such as Mexico City, it has been possible to close a major thoroughfare every Sunday.

These temporary closures would also stimulate informal and spontaneous use of public spaces and contribute to communication among the citizens.

Active side-walks stimulate people to walk slower, linger, or even stop and chat. This can be observed even on busy roads: as soon as a café with an attractive outdoor-seating area opens up, there is an increase in pedestrian activity.

Fig. 8 Linke Wienzeile, a short stretch of an attractive side-walk with a café attracts people to stop and chat, despite the high volume of motorised traffic.

5 POTENTIAL OPEN SPACE RESOURCE IN THE CITY CENTRE

Almost all of the streets in the city of Vienna are devoted to motorised vehicles, i.e. traffic flow or car-parking. Citizens and visitors have grown used to parking their cars at comparatively low rates in the public realm. Every effort by planners or local politicians to change this established privilege and to transform street-space into open space is met with fierce resistance – mostly by local business people, but also by residents. This is the reason why the city of Vienna, in spite of its great reputation as a beautiful and attractive city and its high ranking as a place to live (e.g. Mercer Study), lags behind with regard to international trends in restricting traffic movement in city centres and converting even intensely used thoroughfares, such as Broadway in New York, into pedestrianized areas. The measures applied internationally range from temporary closures as practised in Mexico City to permanent ones as demonstrated in New York, London or Copenhagen. They are often accompanied by taxes or charges imposed on in-coming traffic, for instance in Stockholm, Paris or London.

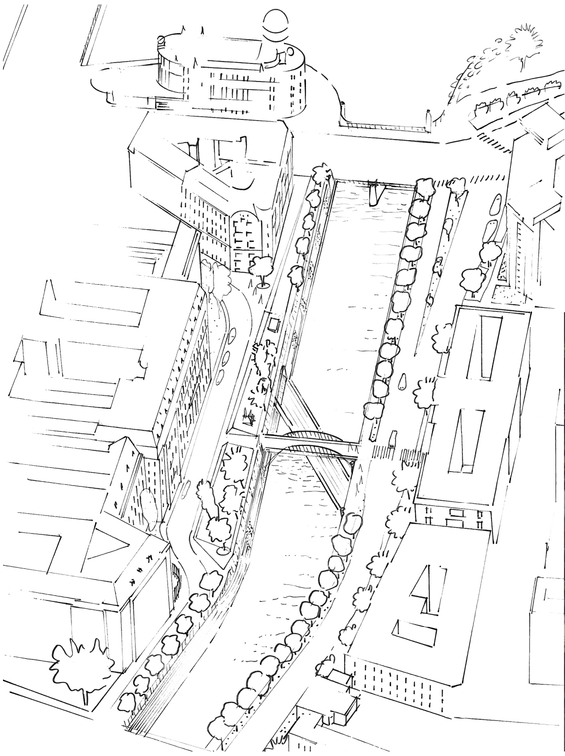

Fig. 9 left: Sketch for Schallautzer Gasse – potential for a pedestrian-friendly street or a linear park instead of a narrow street, proposal by Tillner & Willinger. Fig.10 right: example for a pedestrian-friendly street

5.1 Informal seating in the public realm

Fig. 11: Informal seating on objects never intended as seats and in unplanned locations, illustrating the need for more seating opportunities in the public realm; source: Tillner

While in parks benches are provided, along regular streets there are practically no seating opportunities for strollers. This proves to be quite an impediment to seniors needing to rest, shoppers, and parents with children or strollers wanting to participate in public life. The interest in watching the activities of others is one of the prime reasons for spending time outdoors in cities. In parks this opportunity is quite limited, therefore people spend time in parks when they want to rest or read quietly, while people-watching can only take place on streets. These behavioural patterns have been studied extensively by Jan Gehl. 5), 7).

5.2 Ground floor uses

Many side-streets in Vienna have experienced the phenomenon of vacant or underutilized ground-floor uses. Driveways, storage spaces or vacant ground-floors are a detriment to public life along the streets. Certain streets that are not vital links in the traffic network could be selected for traffic calming and transformation into usable open space with landscaping and seating opportunities. This would make the ground-floor zone more attractive and reprogram it. With green open space facing the buildings, even apartments with a combined studio space or gallery could become feasible. This kind of combination of uses is already practised successfully in the city of Amsterdam and could inspire similar transformations for quiet streets in Vienna.

Fig. 12: Vacant ground-floor uses in centrally located side-streets that could be closed to traffic, photos Tillner

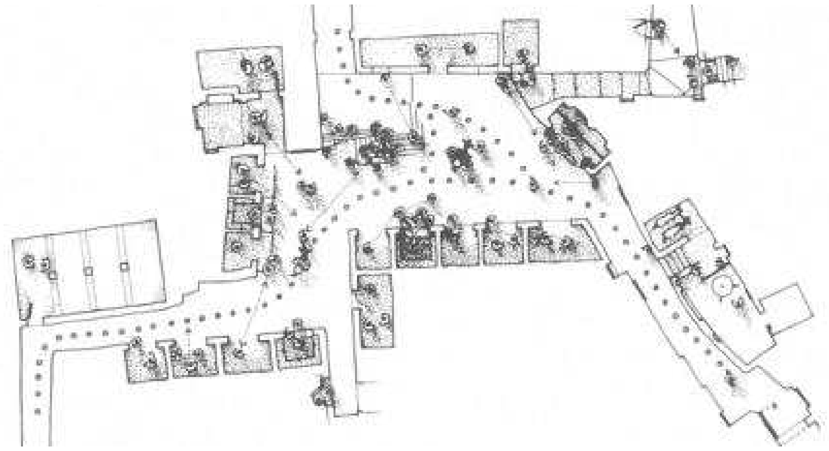

Fig. 13: The interaction of active ground-floor uses with the adjacent streets and squares is illustrated in this sketch of a square in the Medina of the city of Fes Source: 8)

Fig. 14: The proposal for a square in front of the subway station instead of a street, source Tillner & Willinger 9)

6 TEMPORARAY ACTIVITIES IN THE PUBLIC REALM

Successful public spaces are used by people all the time for activities usually carried out indoors, such as playing an instrument or practising sports. In Asian cities with much higher densities and smaller apartments, these activities regularly take place in the public realm.

Fig. 15: Citizens playing an instrument or practising Tai-Chi in Shanghai and Wuhan, source: Tillner

As the result of increased densities and smaller apartments as well as the growing number of single households, these activities will increasingly be found outdoors where they can stimulate communication among the performers and practitioners. Temporary street closures at week-ends could stimulate such activities and offer an intermediate strategy.

7 CONCLUSION

In order to not only conceive but also implement long-term planning projects that improve the public realm within the built-up city fabric, the strategy chosen must take into account the various existing situations and include a certain level of flexibility to respond and react to obstacles and difficulties.

In the long-term the conversion of currently under-utilized traffic areas into pedestrian zones or pedestrian priority streets, novel connections between the districts, and the introduction of green landscaping should be the goal for the city. Small, easily implemented projects should be selected first to demonstrate the positive effects and to provide case studies. These interventions should happen in urban areas with a high population density and low amounts of existing green open space.

First of all, streets with little traffic could be closed to motorised vehicles and used as public green space then more central streets could follow.

As a result, vacant buildings or vacant or under-utilized ground-floor spaces would be used again and become livelier, communication amongst residents, visitors, vendors and workers would improve, and outdoor activities would proliferate.

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Moving Objects Tracking in Distributed Maritime Observation Systems

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1 ABSTRACT

This paper considers the processes of target tracking complicated by big data gaps in complex media such as Distributed Maritime Observation System (DMOS). The main purpose of DMOS is to support the favorable navigation conditions, monitoring, life-saving on the sea for different ships in harbors, maritime roads and open sea. DMOS can be considered as a heterogeneous distributed computer system, it includes different layers of services at different levels of abstraction: ship, harbor; regional and global levels. Such a framework is based on several satellite and maritime information systems that nowadays favor the integration of maritime data (e.g., AIS, ECDIS, OPTIMARE, GMDSS). Despite of the input data big volume the situations exist when gaps (e.g., time delays from minutes to hours) between target observations' points are different. Well known algorithms of target tracking do not work properly in such situations. The proposed approach describes synthesis of analytical and simulation methods at tactical hypothesis development for the cases when suitable direct analytics is not applicable. Also, a joined artificial techniques' scenario approach to tactical situation hypothesis development is proposed.

2 INTRODUCTION

An experience so far accumulated by this paper's authors at developing grand distributed systems of maritime monitoring shows that disregarding a great number of various interacting systems (e.g., AIS, ECDIS, OPTIMARE, GMDSS, etc) the problem of objects' tracking in the sea remains actual and is somewhat far from its solution. Even in the coastal zone the occurrences arise when the information systems and radars discontinue the release of information as caused by different reasons.

The case when many targets are clumping within one space's resolution gives a rise to other problems. The above problem is known under a special notation "Cloud Targets". In spite of their heterogeneous nature the given problems in their mathematical statement are homothetic. The currently available literature does not present any appropriate mathematical solutions of the above problems, and in this regard this paper proposes and discusses an originally developed approach.

2.1 Statement of the information integration problem in DMOS

In some area functions a distributed maritime observation system (DMOS) that incorporates N information sources and controls. The following elements are used as sources of information about situations:

- Space-distributed monitoring facilities (mobile and immobile), that possess different capabilities in registration of the objects under monitoring, in measuring coordinates and parameters of the objects' motion, and in intensity of the information release to the controls;
- Other distributed observation systems that release their data discretely in an integrated form.

Upon the processing the data from the i – th monitoring facility or from the - th distributed system ( ) are send to the DMOS controls in a form f discrete messages, at that, each message is related to one, j-th object (j = 1,…, M, M – is a number of objects operating within the system function zone) Each message could be represented as vector :

$$C_{ij} = [\, i \;\; j \;\; K_{ij} \;\; \varphi_{ij} \;\; \lambda_{ij} \;\; h_{ij} \;\; k_{ij} \;\; v_{ij} \;\; P_{ij} \;\; t_{ij} \,],$$

Here i – is the information source number;

j – is the object number assigned by the *i-th* information source;

K_{ij} - is the monitoring object class;

φ_{ij} - is the object's locality latitude;

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λ_{ij} - is the object's locality longitude;

h_{ij} - is the object's locality height (depth);

k_{ij} – is the object's source;

v_{ij} – is the object's velocity (speed);

P_{ij} – other object's features that can be generated by the monitoring facility, like feature of novelty, feature of object's maneuver attribute, feature of the object's loss, etc.

t_{ij} – the time of an information receipt (may differ from the message receipt time).

For all *i*, *j* the covariance matrices that describe an uncertainty of the *j-th* object coordinates' assessment by the *i-th* source are known;

$$\psi_{ij} = \begin{bmatrix} \sigma_x^2 & K_{xy} \\ K_{xy} & \sigma_y^2 \end{bmatrix},$$

where σ_x^2, σ_y^2 - are variances of the object's locality assessments in the x and y directions correspondingly, K_{xy} – is the above assessments covariance.

The monitoring system controls have available the additional information that specifies a situation within a region and affects the information processing, like information about the:

- Localities of the monitoring system's elements;
- monitoring facilities characteristics (detection range of the objects from various classes, resolution, silent spaces, etc.);
- Region infrastructure (fairwaters, navigable waterways, navigational aids and other);
- Hydrometeorological situation;
- Ice conditions;
- Fishing conditions.

This additional information allow for putting forward certain tactical situational hypotheses that are formalized in a form of exogenous Bayes distributions being sequentially shaped as messages continue to arrive.

DMOS is intended to solve problems of integrating the information arriving from various monitoring facilities and other distributed systems; these problems are as follows:

(a) calculation and construction of the zones of monitoring objects' possible localities.

(b) extrapolation of the discriminated object locality at a definite point of time.

(c) identification and mapping of the tracks for objects followed by the observation system elements.

3 BAYES RECURSIVE ASSESSMENT UNDER RESTRICTIVE STATEMENT

Task of the track analysis [5] represents one of the versions in the problem of recursive non-linear assessment [2], and an extended Kalman filter is the most commonly used approach for the case. The task is exposed to linearization within a neighborhood of the predicted value and the sought density is approximated by the Gaussian density that may not match the real data structure and, in particular, lead to divergence. Other analytic approaches are based upon the approximation of the first two density moments [4, 7]. The better direct numerical approach uses the density assessment at the grid nodes in the state space [3], at that, the case of multi dimensional space requires calculations for an excessively great number of points (nodes), thus, involving considerable computational power for each point (node).

It is assumed that a state vector $x_k \in R^n$ keeps evolving in accordance with the dynamics model

$$x_{k+1} = f_k(x_k, w_k), \qquad (1m)$$

where $f_k : R_n \times R_m \to R_n$ - is the system transient function, $w_k \in R^m$ - is a sequence of errors with a zero average (mean) and independent of the state vector past and future values. The probability density w_k is assumed known. In terms of a discrete time there exist measurements $y_k \in R^p$ linked to the state vector values by the observation equation:

$$y_k = h_k(x_k, v_k), \quad \text{(2m)}$$

where $h_k : R^n \times R^r \to R^p$ - is the measurements' transient function and $v_k \in R^r$ - is the other sequence with a zero average (mean) and known probability density independent of the past and future system states and noises. The initial density is assumed known for the state vector and function f_i, h_i, i =1,…, k.

Exogenuos information based upon the current tactical situational hypothesis in most cases is formalized as an even distribution in some polygon U_k, independent of the past and future system states and noises. Let us denote the appropriate density as $u_k(x_k)$.

So, at the step k the available information is represented by the sequence of measurements' $\{y_i\}$ and the exogenous density $u_k(x_k)$: $D_k = \{y_i, i = 1,...,k, u_k(x_k)\}$. The task consists in arriving at the values of state vector $p(x_k|D_k)$ based on complete information available by the moment k. This process is performed recurrently in two stages: prognosis and update.

Suppose that the sough density $p(x_{k-1}|D_{k-1})$ at step k-1 is already received. Then using the system dynamics model a priory density can be received as follows:

$$p(x_k|D_{k-1}) = \int p(x_k|x_{k-1})\, p(x_{k-1}|D_{k-1})dx_{k-1}. \quad \text{(3m)}$$

The probability model for the state vector $p(x_k|x_{k-1})$ is the Markov one and is determined by the system of equations:

$$p(x_k|x_{k-1}) = \int p(x_k|x_{k-1}, w_{k-1})\, p(w_{k-1}|x_{k-1})dw_{k-1}.$$

Under an assumption $p(w_{k-1}|x_{k-1}) = p(w_{k-1})$ we have

$$p(x_k|x_{k-1}) = \int \delta(x_{k-1} - f_{k-1}(x_{k-1}, w_{k-1}))\, p(w_{k-1})dw_{k-1},$$

Where $\delta(\cdot)$ - the Dirac delta function. Delta function appears since under the unknown $x_{k\text{-}1}$ and $w_{k\text{-}1}$ the assessment x_k is received from the determinate relation (1m). At the step k become available the measurement y_k and exogenous distribution $u_k(x_k)$ that are used to update a priori distribution of the state vector based on the Bayes rule

$$p(x_k|D_k) = \frac{p(y_k|x_k)\, p(x_k|D_{k-1})u_k(x_k)}{p(y_k|D_k)}, \quad \text{(4m)}$$

where a normalizing multiplier is determined through the relation

$$p(y_k|D_k) = \int p(y_k|x_k)\, p(x_k|D_{k-1})u_k(x_k)dx_k. \quad \text{(5m)}$$

The conditional density y_k under the given x_k, $p(y_k|x_k)$ is determined by the measurements' model and by the known statistics distribution v_k:

$$p(y_k|x_k) = \int \delta(y_k - h_k(x_k, v_k))\, p(v_k)dv_k. \quad \text{(6m)}$$

In the equation (4m) the measurement y_k and density u_k are used for a correction of the prognosis starting from the preceding step and the receiving of a posteriori distribution for the state vector.

The equations (4m) and (6m) give a formal solution for the problem of the Bayes recurrent assessment. Here an analytical solution is only possible within a restricted class of evolution models, measurements and exogenous information. The case when f_k and h_k are linear, w_k and v_k are the additive Gaussian noises with the known covariance matrices, and u_k are the Gaussian densities is considered to be the most important, though for many applications this problem statement turns out the inadequate one.

4 RESTRICTIVE BAYES BOOTSTRAP-FILTER

Suppose that there exists a set of independent realizations for a random vector

$$\{ x_{k-1}(i),\ i = 1,\dots, N \},$$

conforming to the distribution $p(x_{k-1}|D_{k-1})$. Bootstrap-filter [2,3] is an algorithm allowing based on the above to receive a set of independent realizations $\{ x_k(i),\ i=1,\dots, N \}$, approximately conforming to the distribution $p(x_k|D_k)$ Such a filter presents a mechanism approximately emulating relations (3m) and (4m).

Prognosis: each sampling realization is transformed in accordance with the formula

$$x_k^*(i) = f_{k-1}(x_{k-1}(i), w_{k-1}(i)),\ i = 1,\dots,N\ ,$$

Where $w_{k-1}(i)$ – are sampling realizations of the random vector with distribution $p(w_{k-1})$. So, in accordance with (3m), $x_k^*(i)$ - is a vector sample matching distribution $p(x_k|D_{k-1})$.

Update: Based on y_k measurement the likelihood function is derived and weight coefficients are received for each realization:

$$q_i = \frac{p(y_k|x_k^*(i)) \cdot u_k(x_k^*(i))}{\sum_{j=1}^{N} p(y_k|x_k^*(j)) \cdot u_k(x_k^*(j))}. \qquad (7m)$$

In this way is defined the discrete distribution over the ensemble of points $\{x_k^*(i),\ i=1,\dots,N\}$ with a probabilistic weight q_i in the i-th point. Let us construct out of this discrete distribution N random realizations and generate a sample $\{x_k(i),\ i=1,\dots, N\}$ so that for any i, j

$$P\{x_k(i) = x_k^*(i)\} = q_i.$$

These prognosis and update procedures compose one the *k-th* iteration step. At the first step the process is being initialized by N realizations of the random vector with a known distribution $p(x_1)$.

The update procedure is based on the results received by Smith and Gelfand in [14]. Their work proves that Bayes formula could be interpreted as a weighted bootstrap [5]. Suppose that set $\{x_k^*(i)\}$ is received as a random sample out of a continuous distribution with density $G(x)$, and it is necessary to receive a sample out of distribution with a density proportional to $L(x)\ G(x)$, where $L(x)$ – is a known nonnegative function. The Smith-Gelfand theorem claims that an empirical distribution of a random sample out of discrete distribution concentrated in points $\{x_k^*(i)\}$ with probabilistic weights

$$q_i = \frac{L(x_k^*(i))}{\sum_{j=1}^{N} L(x_k^*(j))}$$

is a distribution converging one assumed that $N \to \infty$ to a distribution with sought density. In the case under consideration $G(x)$ replaced by $p(x_k|D_{k-1})$, and $L(x)$ – by $p(y_k|x_k) \cdot u_k(x_k)$.

The main advantage of the proposed approach is that it imposes no constrains on the functions' f_k , h_k and u_k form. The major requirements consist in the following:

- Distribution $p(x_1)$ is known and assumes modeling based on Monte-Carlo techniques;
- Distribution $p(y_k|x_k)$ is known;
- Distributions $p(w_k)$ and $u_k(x_k)$ are known and assume modeling based on Monte-Carlo techniques.

At each step of the filter output appears a vector sample that could be disposed in a variety of ways. Say, a posteriori probability of hitting some zone could be assessed as a rate of the sample values that have hit this zone. In case the reasons exist to suppose that a posteriori distribution is a unimodal one the statistic characteristics for each component of the state vector and their any function.

The proofs of the proposed approach appropriateness are based upon the asymptotic results [8]. To study the bootstrap properties for the finite samples is difficult enough. Moreover, the relation between the samples N volume and the received results accuracy is not clear [2,3], it is influenced upon by three factors:

- The states space dimension;
- The goodness of a priori and a posteriori distributions;

- The number of steps required for recurrence.

It should be expected that N grows rapidly along with the task dimension growth, at that, the rapidity depends on the correlation between the components. Same time under the independent components this rapidity does not depend on the task dimension.

If the state space region where the likelihood function $p(y_k|x_k)$ takes on relatively great values is somewhat restricted in comparison with a similar region for a priori density $p(x_k|D_{k-1})$, many values $x_k*(i)$ will be assigned low weights q_i. At that, the points from the first region will gain the greatest value. In the absence of the system noises all N vectors after several steps can get concentrated in the vicinity of one point. So, modification of the basic algorithm will be possible together with the growth of the points' number emulated by a priory distribution

5 CONCLUSION

Simulation and the developed real time algorithms operation demonstrate their good convergence. Probability of the tracks' recovery for 24 objects within one "cloud" composes over 80%. On the other hand the coordination of data received from heterogeneous sources in one "cloud" is not yet a completely solved problem for the case of large blanks. This problem is not expected to be solved exclusively via mathematic and scenario approach; its solution requires special organizational efforts in information processing and priorities identification among the sources.

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New Concepts for Urban Highways Control

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1 ABSTRACT

In recent decades a significant increase in traffic demand has occurred. This trend is especially present in dense populated areas where daily traffic congestions during rush hours occur regularly. Congestions are significant in road traffic where they can simultaneously reduce public transportation level of service (LoS) also. As consequence, even more people are using their car additionally increasing the congestion problem. Classic solution for solving the road traffic congestion problem is infrastructure build up. Today's dense urban areas mostly do not allow this approach because of the lack of available building space. More advanced road traffic control solutions from the domain of intelligent transportation systems (ITS) are being more and more applied to optimally use the existing infrastructure (Papageorgiou et al., 2003.). Such solutions include coordination between several consecutive crossroads, dynamic traffic assignment, driver informing systems, etc. One of the ITS application areas is related to urban highways which present a class of highways used as a city bypass or are just passing a dense urban are. Their main characteristic is that they have a larger number of on- and off-ramps often placed at small distances. Due to the small distance, mutual on-ramp influence can occur enlarging the problems of daily congestions and associated decrease of highway LoS. In order to prevent the appearance of traffic standstill or to reduce its duration control approaches as ramp metering and variable speed limit control (VSLC) are being applied (Hegyi et al., 2010.). In recent years, new cooperative concepts between several on-ramps and VSLC are used as a combined urban highway control system (Ghods et al., 2007.). This paper presents a new learning based cooperative ramp metering strategy in which several well-known ramp metering strategies (ALIENA, SWARM, HERO) are used to create a learning set for an ANFIS (Gregurić et al., 2013.) based control structure. Optimal ramp metering values are obtained for a wide range of traffic demand on the urban highway and belonging on-ramps. Optimal ramp metering values for specific traffic demand characteristics obtained from most suitable ramp metering strategies are integrated into only one control strategy. Thus, the need of applying several ramp metering strategies and switching between them is avoided. Additionally, cooperation between VSLC and vehicle control by an on-board unit is described and a discussion about possible implementation is given. Proposed cooperative urban highway management approach is tested in simulations using the city of Zagreb bypass as case study. For simulation, the macroscopic highway traffic simulator CTMsim (Kurzhanskiy et al., 2008.) is used. Used CTMsim simulator augmented to enable simulation of VSLC and cooperative ramp metering approaches.

2 INTRODUCTION

Nowadays one of the most prominent problems of urban areas is traffic congestion. Traffic congestion can be defined as a condition on road networks that occurs as result of traffic demand increase and is characterized by lower speeds, longer trip times, and increased vehicular queuing. Most pronounced negative impact of traffic congestions are delays in goods delivery, public and personal transport, etc. Delays induced by traffic congestions cause waste of drivers and passengers time, and fuel. Fuel waste consequently produces increased air pollution and transport expenses. Furthermore, delays in public transport schedule and longer trip times cause general dissatisfaction for public transport use. As consequence even more people are using their personal vehicles additionally increasing the congestion problem. There are three main reasons for creation of congestion in urban areas: increased traffic demand in specific interval of a day (rush hours), large number of vehicles owned by residents and inability to expand urban traffic network capacity.

Urban highways are planned to provide bypass of the urban arterial roads by absorbing part of their traffic load. This solution has quickly shown as unsatisfactorily due to further increases in traffic demand and transit traffic, which also burdens urban highway capacity. Residents of urban areas regularly use urban highway to avoid congestion in urban traffic network during daily peak hours. Consequently, that behaviour

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combined with transit traffic at the mainstream commonly causes congestions at on-ramp areas. In other words generally high Level of Service (LoS) projected for urban highways is significantly reduced due to traffic overload. LoS is defined as group of qualitative measures that characterize operational conditions within traffic flow and their perception by drivers (Directive 2010/40/EU).

Nowadays traffic infrastructure cannot anymore track increase in traffic demand because of the lack of available building space. It is imperative to develop effective highway management control methods over the urban highway traffic flows in order to mitigate congestions and restore originally planned LoS. Such traffic management control methods are considered under intelligent transportation systems (ITS). ITS is functionally build as a superstructure of classic transportation system based on advanced optimization of transport processes with use of information-communication infrastructure and devices. This paper describes highway control strategies including ramp metering, prohibiting lane changes and variable speed limit control (VSLC). Additionally, paper proposes novel cooperative approach between them, along with automatic, and semi-automatic control over vehicles near urban highway on-ramps.

This paper is organized as follows. Second section briefly describes problems on urban highways regarding creation of congestions. Ramp metering control methods and its categorization is presented in the third section. Concept of learning based cooperative ramp metering is given in the fourth section. Fifth sections describes cooperation between highway management control methods. Simulation results of the comparative analysis of implemented ramp metering algorithms and VSLC is given in the sixth chapter. Paper ends with conclusion and future work description.

3 PROBLEMS OF URBAN HIGHWAYS

Despite the fact that urban highways are originally planned to provide high LoS, almost every day it is possible to observe traffic congestions or at least traffic slowdowns on them. In spatial and temporal aspects congestions are common in parts of the urban highway near on- and off-ramps during the early morning or late afternoon (Barcelo, 2010.). These types of congestion are known as peak hours. Daily migrations (to and from the place of employment, education, etc.) are the cause of peak hours congestions if they are intense and accurate enough. Periodic congestions such as peak hours are easy to predict and therefore easier to handle. On the other hand, various traffic accidents or events of great public interest (sport events, concerts, sell-outs in malls, etc.) are the sources of non-periodic congestions. Non-periodic congestions usually cause a sudden drop in the traffic throughput of a particular urban highway.

As mentioned earlier, problems with congestions on urban highways are most noticeable near on-ramps. Congestions at urban highways can have one or more following indicators: traffic demand in particular segments of highway exceeds capacity, increased number of accidents and incidents, queues on arterial roads that spill over into the highway or peaks in traffic demand resulting from platooned vehicle entry from on-ramps (Papageorgiou et al., 2003.). Area where on-ramp flow and mainstream are actually coming in interaction is known as downstream bottleneck. In Fig. 1 location of the downstream bottleneck close to the on-ramp and cooperative control infrastructure for ramp metering is given.

Even in case when mainstream is near maximum capacity, it can adopt one or two merging vehicle from on-ramp. However, in cases when platoons of vehicles attempt to do aggressive merging into the mainstream, this action usually leads to turbulences. These turbulences cause mainstream break down and consequently, congestion on highway (Treiber and Kesting, 2013.). Turbulences in the merging zones can also conduct various types of accidents during heavy traffic conditions.

4 RAMP METERING TRAFFIC CONTROL APPROACH

Uncontrolled platooned vehicle entry from on-ramps into mainstream can induce significant slowdowns in mainstream and queues at on-ramps. Highway management method, known as ramp metering, controls interactions between on-ramp and mainstream flow. Ramp metering uses special traffic signals at on-ramps to control the rate or size of vehicles platoons entering mainstream traffic according to the current traffic conditions (Papageorgiou and Kotsialos, 2002.). Awareness of current traffic conditions for particular highway segment (traffic flow, speed and occupancy levels, etc.) is achieved by analysing data collected in real time by road sensors (inductive loops, cameras, etc.). Sensors are usually placed on the on-ramps and on the main road as presented in Fig. 1. Control algorithm, which produces decisions about the amount of on-ramp vehicles that are allowed to merge with mainstream traffic flow, is the core part of ramp metering. It is possible to divide ramp metering algorithms in two major categories or strategies: local (or isolated) and coordinated.

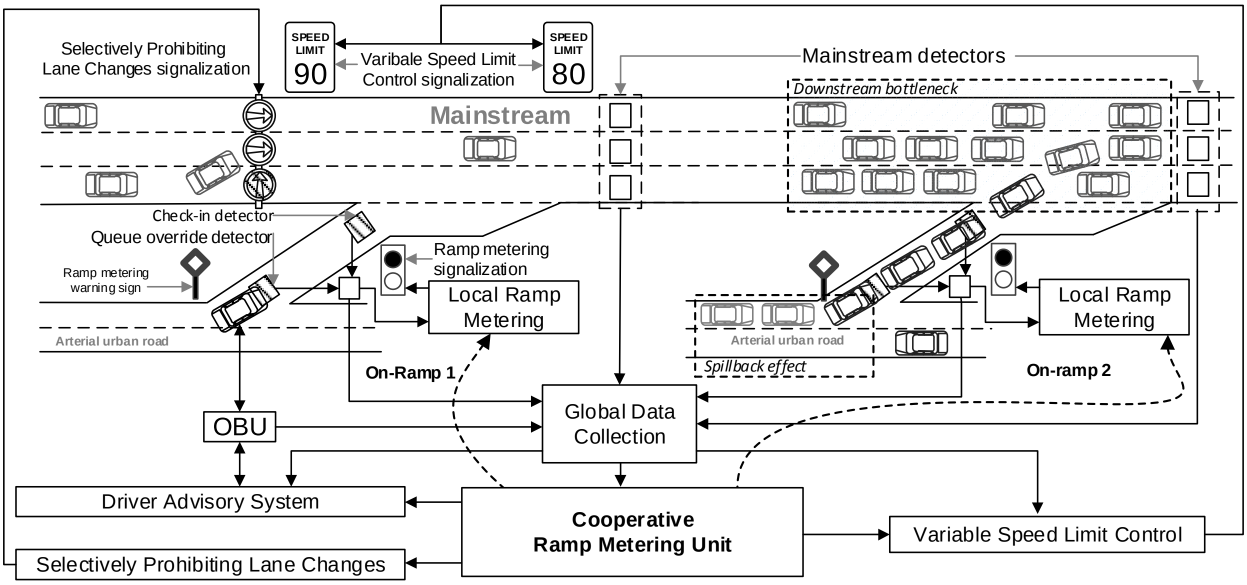

Fig. 1: Illustration of downstream bottleneck location with cooperative ramp metering architecture

4.1 Local Ramp Metering

Ramp metering algorithms categorized as local, take into account the traffic condition on particular on-ramp and nearby segment of urban highway where they are applied. Drawback of local ramp metering algorithms is unawareness of overall traffic situation on the controlled highway segment. One of the first ramp metering algorithms was Demand-Capacity algorithm. Mentioned algorithm uses the downstream occupancy measurement data. If downstream occupancy is above a specified critical occupancy, it is assumed that congestion exist and metering rate is set to the minimum value. Otherwise, metering rate is set according to difference between downstream capacity and the measured upstream traffic volume. Today, most often used local ramp metering is ALINEA. It has optimal ratio between simplicity and efficiency. Core concept of ALINEA is to keep the downstream occupancy of the on-ramp at a specified level by adjusting the metering rate (Papageorgiou et al., 1991.). Main disadvantages of ALINEA are its inability to resolve upstream congestions of the particular ramp and problems to locate optimal detector mounting zone. Modern approaches in local algorithm development include neural networks, which are using their learning capabilities to produce metering plans. Other modern approaches in local algorithm development are based on fuzzy logic and hybrid intelligent systems (Ghods et al., 2007.).

4.2 Coordinated Ramp Metering

Ramp metering algorithms are categorized as coordinated if they take into account the overall highway traffic situation (Hegyi et al., 2005.). According to overall highway traffic state, metering rate for every on-ramp is adjusted. It is possible to divided coordinated algorithms into: cooperative, competitive and integrated algorithms (Papageorgiou et al., 2003.). Usual procedure for cooperative algorithms is to detect bottleneck and enrol several upstream on-ramps to create virtual on-ramp queues. HELPER as the most prominent cooperative ramp metering algorithm is based on a hierarchical structure consisting of local ramp metering units and a cooperative unit. Cooperative unit uses data obtained from local ramp metering units to monitor the completely controlled highway section. If congestion or a long on-ramp queue is detected, it declares the belonging highway section with its on-ramp as master. Furthermore, several upstream on-ramps are declared as slave on-ramps. Slave on-ramps have the role to create virtual queues in order to reduce queue length on the congested on-ramp. Main idea is to exploit their queues capacity in order to mitigate downstream congestions at mainstream.

Competitive algorithms are based on two different control logics. Generally, there are locally and globally based control logics. During ramp metering algorithm execution, local and global control logics provide appropriate solution for current traffic situation. As final ramp metering value the more restrictive one is

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chosen. System-Wide Adaptive Ramp Metering (SWARM) is the most efficient algorithm in this group. SWARM contains two types of control algorithms: SWARM1 and SWARM2B. SWARM1 algorithm conducts global coordination by taking into account traffic state on each on-ramp. SWARM2B is a local algorithm and defines metering rate according to the difference between current and critical traffic density for a particular on-ramp. Metering rates obtained by local and global algorithm are compared and smaller value is selected.

Integrated algorithms are the most recent developed ramp metering algorithms and are still in experimental phase. Most important part of integrated algorithms is their control module. Control module logic is based on an optimization engine with defined boundaries and a goal that has to be achieved during control period. Typical representatives of these algorithms are METALINE, FHWA/BALL Space, DYNAMIC, and fuzzy logic based algorithms (Hegyi et al., 2005.). Most sophisticated algorithms in that group are algorithms based on fuzzy logic. Fuzzy logic based algorithm can be described as the one type of expert systems for ramp metering (Papamichail et. al., 2010.).

5 LEARNING BASED COOPERATIVE RAMP METERING

Adaptive neural-fuzzy inference system (ANFIS) algorithm is used in order to create a learning based cooperative ramp metering algorithm. ANFIS uses an artificial neural network (ANN) to modify parameters of a Takagi–Sugeno fuzzy inference system. ANN optimizes its interconnection structure trough learning methods and so provides optimization capabilities. Fuzzy inference system (FIS) contains a set of fuzzy IF–THEN rules that have learning capabilities to approximate nonlinear functions (Yu-Sheng et. al., 2010). Reasoning sub-mechanism provide inference procedure upon the fuzzy rules and given inputs to provide reasonable output.

First, it is necessary to define the learning structure and select appropriate procedures for acquiring knowledge to teach the ramp metering algorithm. To cover wide range of traffic scenarios on a particular urban highway three algorithms are chosen in this paper as teaching ramp metering. ALINEA algorithm is chosen as local algorithm, HELPER as cooperative and SWARM as competitive ramp metering algorithm. Proposed ANFIS based ramp metering algorithm learning scheme is shown in Fig. 2.

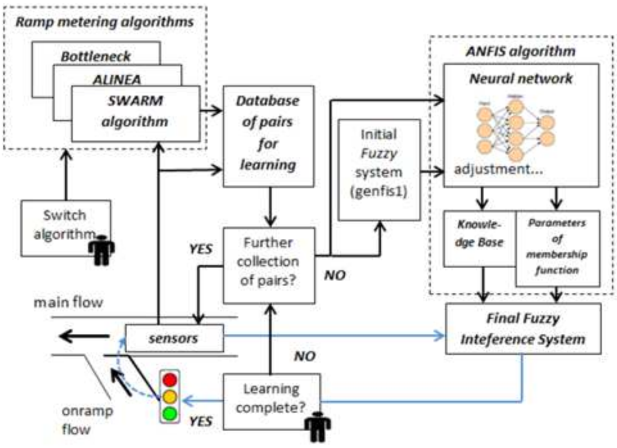

Figure. 2: Scheme of ANFIS algorithm for ramp metering control.

Next step is to create a learning dataset, which contains different types of traffic parameters according to the simulation results of all mentioned teaching algorithms. After creation of a learning dataset, best solution between all solutions provided by all the simulated ramp metering algorithms has to be selected. This is done by using the following function:

f(r)=0.5 traveltime+0.5 delay. (1)

According to the adjusted learning data set it is necessary to select suitable inputs and outputs among traffic variables relevant for ramp metering. This procedure is achieved by brute force optimization (Gregurić et al., 2013.), appropriate fuzzification, and defuzzification methods. Presented model has two input variables and each input variable has five membership functions and one output in form of ramp metering rate value. For fuzzification combination of Gaussian and triangular fuzzifiers is used. The middle of maximum method is used for defuzzification. ANFIS is commonly trained by a hybrid learning algorithm (Feng et al., 2011.).

Combination of feedback error propagation and least squares is used as ANN learning method. During the learning process, every element of the training data set (only inputs) is presented to the ANN in order to calibrate parameters of fuzzy interference system (Gregurić et al., 2013.). ANFIS returns an output in form of metering rate prediction. Output predictions are compared with output training data. Based on the difference between these two values, degree of matching is derived in form of Root Mean Square Error.

6 COOPERATION BETWEEN RAMP METERING, VSLC AND VEHICLES

Cooperative ramp metering implies cooperation between adjacent on-ramps in order to perform effective mitigation of congestion related to a particular highway area. At urban highways with dense traffic, mentioned control strategy is not efficient enough to resolve congestions. To increase efficiency of original cooperative ramp metering several other highway management strategies are considered to be added into the cooperative framwork. Generally, cooperative systems can be defined to be a set of control entities that share information and/or tasks to accomplish a common, though perhaps not singular, objective. According to this definition, other highway management strategies are entities, which communicate with original ramp metering algorithm entity in order to effective mitigate congestion. Effective mitigation of congestions is the goal of every highway management strategy regardless if its implemented separately or as part of a cooperative traffic control system.

Latest work in cooperative ramp metering includes cooperation between classic cooperative ramp metering framework and other highway management services, driver information systems and vehicles itself (Gregurić et al., 2013.). Proposed cooperative ramp metering architecture with all mentioned highway management strategies can be seen in Fig. 1.

6.1 Ramp Metering and VSLC

VSLC is in most cases used as standalone traffic management system at urban highways. It uses Variable-Message Signs (VMS) to inform drivers. Main purpose of VSLC as standalone application is to homogenize vehicle speeds. Induced reduction of speed differences among vehicles and mean speed differences between lanes by VSLC provide suppression of the congestion shockwaves (Hegyi et al., 2010.). Simultaneously traffic safety is increased. Possibility of cooperation between VSLC and ramp metering with benefits of such cooperation is described in (Hegyi et al., 2005.).

VSLC in cooperation with cooperative ramp metering algorithm such as HELPER has the main function to decrease speed of the incoming vehicles to the area between last slave on-ramp and congested highway segment. Virtual queues provided by HELPER and speed reduction in area between last slave on-ramp and congested highway segment induced by VSLC significantly reduce traffic density upstream of the congested on-ramp. Lower upstream density of the congested on-ramp leaves additional mainstream capacity to accept vehicles, which have origin from congestion back-propagation.

6.2 Ramp Metering and Vehicles

Additional cooperation between vehicle On-Board-Unit (OBU) and on-ramp control computer (RMS-r2v) in order to provide semi-automatic support can be established. Support is oriented to the inexperienced drivers, which are waiting in on-ramp queue and intend to perform merging with mainstream flow. Inexperienced driver in on-ramp queue end usually turn the engine off to safe fuel or hesitate to perform merging with mainstream if the driver is first in the queue. Hesitation in merging and failing in turning on the engine can cause situations in which an inexperienced driver does not perform merging with mainstream traffic during the green light phase. Several consecutive failed merging (on-ramp green light) phases can lead to increased number of vehicles in on-ramp queue.

To avoid that problem cooperation between vehicle and ramp metering should be established when the vehicle is stopped at the on-ramp queue and is waiting for green light. The on-ramp control unit keeps the vehicle engine in running state if vehicle is the first in on-ramp queue. When the green light is turned on, on-ramp control unit obtains throttle control over the first vehicle in queue. Engines of other vehicles in queue are also turned on if they are not currently running. The on-ramp control unit will forward all necessary merging manoeuvre data to the vehicle OBU. Types of mainstream merging manoeuvres depend on the subsystem, which is in cooperation with the ramp metering control system. Diagram of basic RMS-r2v activities can be seen in Fig. 3.

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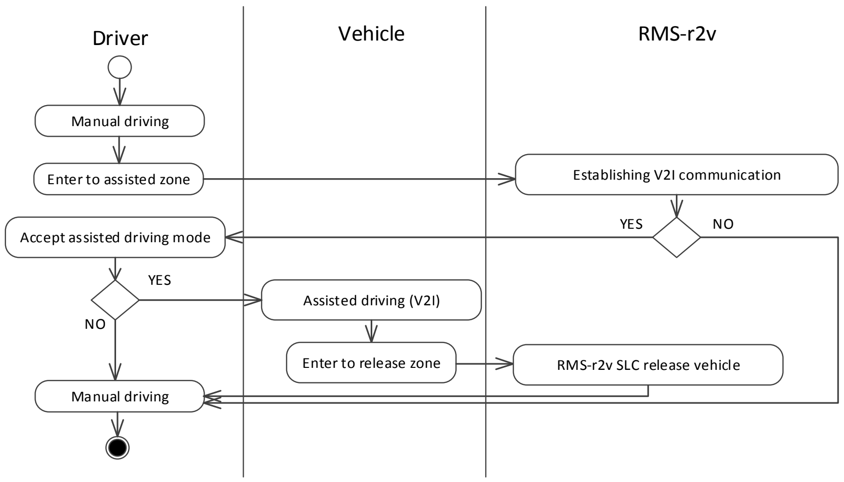

Fig. 3: Basic activity diagram of on-Ramp Metering System based on ramp metering-to-vehicle communication.

7 SIMULATOR CTMSIM AUGMENTATION

Working principle of cooperative ramp metering algorithms can be very complex and sensitive considering fluctuations in traffic parameters. Because of the mentioned reasons, it is imperative to conduct simulations in order to analysis impact of cooperative ramp metering on the traffic flows. In this paper, CTMSIM is selected as an appropriate simulator for such systems. It is an open-source interactive simulator based on macroscopic traffic models specifically designed for highway traffic flows and respective control systems simulations. It is developed and run under MATLAB program package and allows implementation and development of user-pluggable on-ramp flow and queue controllers (Kurzhanskiy and Varaiya, 2008.). Highway model is based on the Asymmetric Cell Transmission Model (ACTM).

CTMSIM does not support direct cooperative ramp metering features so it was necessary to develop adequate simulation framework augmentation. Firstly, framework for the cooperation between on-ramps is developed. This framework was used to implement HELPER cooperative ramp metering. Additionally, this framework is then augmented in order to support cooperation between HELPER and VSLC.

7.1 Augmentation for cooperative ramp metering

In order to simulate cooperative highway control systems first step in CTMSIM augmentation was to design a cooperative ramp metering module. Main task of this module is to provide support for cooperation between on-ramps. As it can be seen in the bottom part of Fig. 4 the original CTMSIM simulation sequence goes only through defined highway cells in a particular time step. An additional simulation step related to the cooperative ramp metering module is added to enable simulation of cooperative control systems as it can be seen in the top part in Fig. 4. Cooperative module has access to data from all cells. This feature enables computation of optimal local ramp metering rates and VSLC values used in the next simulation time interval.

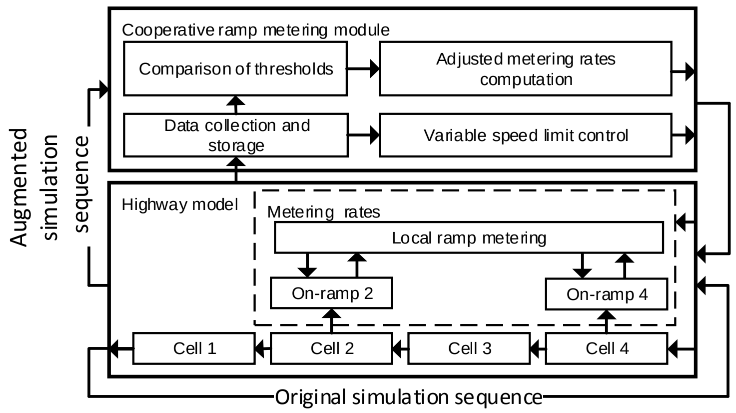

Fig. 4: Augmented CTMSIM simulation structure.

With use of mentioned cooperative module, the HELPER algorithm was implemented. Cooperative ramp metering module now monitors traffic conditions at every on-ramp during simulation. If critical density is exceeded in a current simulation time step, central monitor module marks this cell's on-ramp as the master on-ramp. HELPER algorithm uses information about master on-ramps locations obtained by cooperative module to decrease metering rate for 10 % of current traffic demand. Three upstream cells with on-ramps regarding the master on-ramp location are declared as slave on-ramps. Metering rate at the slave on-ramps are decreased for 40 % of current traffic demand what creates virtual queues on them.

Additionally, cooperative module has one more important task. During every simulation interval, HELPER firstly computes metering rates for every on-ramp according to the local algorithm. If master on-ramp is detected, cooperative module computes new metering rates for master on-ramp and three upstream on-ramps. Metering rates computed by local algorithm are overridden with these new values. Override possibility is added to the cooperative ramp metering module if existence of a master on-ramp is detected.

7.2 Augmentation for VLSC

CTMSIM was upgraded with possibility to perform simulation of VSLC system. Original CTMSIM traffic fundamental diagram GUI is modified to support adding the default speed limit value for every cell in the model. This is implemented through modification of the cell mean speed equation described in (Kurzhanskiy and Varaiya, 2008.) into:

$$v_i^c = \min\left(v_i^{SLC},\ \frac{f_{i[k]}/(1-\beta_{i[k]})}{n_{i[k]}+\gamma r_{i[k]}}\left(\frac{L_i}{\Delta t}\right), v_i^{ff}\right), \qquad (2)$$

where parameter $r_{i[k]}$ denotes number of vehicle entering cell *i*, from its associated on-ramp at time step *k*, while $\beta_{i[k]}$ denotes split ratio for off-ramp flow. Parameter γ denotes on-ramp flow blending coefficient, both from interval [0, 1]. Free flow speed value is denoted by v_i^{ff} for cell *i*, and L_i denotes length of cell *i*, v_i^{SLC} denotes the current SLC value for *i*-th cell. Mainstream flow during interval *k* in cell *i* is denoted by $f_{i[k]}$. Simulation time is divided into *K* intervals with length Δ*t* where $n_{i[k]}$ denotes number of vehicles (or mainstream density) in cell *i* at time step *k*. Default VSLC value must be lower than free flow speed value of the current cell. Modification to the fundamental diagram GUI to include the VSLC option is presented in Fig. 5. VSLC enables changes in speed limit values during simulation.

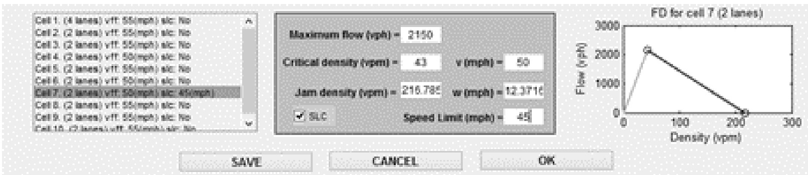

Fig. 5: Fundamental diagram GUI agumentation for definition of the SLC.

8 SIMULATION RESULTS

This section firstly presents results from comparative analysis between commonly used ramp metering algorithms and proposed ANFIS based learning based approach. The simulation of the cooperation between vehicles and ramp metering is beyond the scope of this paper. Urban highway section between the nodes Jankomir and Lučko on the Zagreb bypass is selected as the simulation use case model. Additionally, this section includes comparative analysis between cooperation of VSLC with the HELPER ramp metering algorithm, representatives of different ramp metering algorithm types and VSLC as a standalone application. Analysis is conducted using the following ramp metering algorithms: ALINEA (local), SWARM (competitive) and HELPER (cooperative).

8.1 Simulation setup

Zagreb bypass can be categorized as urban bypass highway with prominent seasonal overloads and therefor it is selected for use case scenario. To simplify the simulation model, section between the nodes Jankomir and Lučko of the Zagreb bypass is isolated. Physical simulation model of the Zagreb bypass is designed according to its real constructional parameters. In 2009 the Average Annual Daily Traffic (AADT) based on traffic count data at Zagreb bypass was recorded of 54,542 [veh/h] (Štefančić et. all., 2012.). The Zagreb bypass with marked on-ramp nodes can be seen in Fig. 6.

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Fig. 6: Zagreb bypass with marked nodes.

Section between nodes Jankomir and Lučko, and the Lučko interchange have already become part of the Zagreb urban road network on which about 70% of traffic is generated by the nearby town Zagreb (Štefančić et. all., 2012.). This section is interesting as use case model also due to the combination of increased traffic load during whole day and prominent effect of daily migrations. On-ramps traffic demand characteristics of the Zagreb bypass simulation model are reconstructed according to Ljubljana bypass traffic data.

8.2 Cooperative Ramp Metering

This paper considers two cooperative ramp metering algorithms. First of them is HELPER which is implemented using proposed CTMSIM augmentation for cooperative ramp metering. Second cooperative algorithm is based on proposed learned ANFIS algorithm. Both cooperative ramp metering algorithms will be compared with local (ALINEA) and competitive (SWARM) ramp metering algorithms. All mentioned ramp metering algorithms are simulated under the same simulation model for the sake of comparison. For implemented ramp metering algorithms comparison LoS measures travel time (TT) and delay are used. TT gives information how much time one vehicle needs to travel through observed highway segment. This measure observe throughput of mainstream in the same time ignoring queues at on-ramps and it is measured in minutes. Difference between the actual time spend by all vehicles on a congested highway and the time spend in case they have travelled at free flow speed is defined as delay. Unlike TT delay considers also vehicles are waiting in on-ramp queues or at mainstream queues caused by the bottlenecks. Delay is measured in vehicle-hours. Results of comparative analysis can be seen in Tab. 1.

Traffic control algorithm	TT (min)	Delay (vehicle-hour)
None	7.06	15.87
ALINEA	3.90	36.88
SWARM	3.71	41.49
HELPER	3.40	22.63
VSLC	5.59	12.24
HELPER + VSLC	3.30	21.50
ANFIS	4.10	19.75

Table 1: Results of cooperative analysis between different traffic control algorithms.

According to the results given in Tab. 1 it is possible to conclude that cooperation between HELPER ramp metering algorithm and VSLC provides best value of TT. Among the stand-alone ramp metering algorithms, cooperative algorithm HELPER has achieved best TT due its restrictive nature. ANFIS has achieved higher TT value compared to the ALINEA and SWARM ramp metering algorithms but TT value achieved by ANFIS algorithm is a much lower compared to the situation without ramp metering and standalone VSLC. It can be concluded that ANFIS algorithm has learned necessary ramp metering control knowledge based on higher values of metering rates.

In simulation scenario without ramp metering, on-ramp vehicles are immediately merged with mainstream vehicles. Process is conducted only under the condition that in a current cell maximal mainstream capacity is not exceeded. This is reason why scenario without ramp metering provides best values of delay. HELPER induces in both cases, standalone and in cooperation with VSLC longer queues at particular slave on-ramps increasing the delay, respectively. ANFIS achieved best average delay value among compared ramp metering algorithms and its value is similar to the HELPER algorithm delay value. Such result was expected due to the higher value of TT. Additionally, this result confirms that ANFIS has partly adopted HELPER on-ramp virtual queue control strategy during the learning process.

8.3 Cooperation between Ramp Metering and VSLC

This section provides simulation results analysis between cooperative ramp metering algorithms and cooperation between HELPER and VSLC. Into analysis results with standalone VSLC application and previously analysed ramp metering algorithms are also included. VSLC as the standalone application and in cooperation with HELPER is applied in the cells 2, 5 and 6. In both cases, the primarily role of VSLC is to gradually decrease speed of the upstream flow before congestion starts. VSLC firstly reduce speed of vehicles in mainstream at segment before congested zone and in segments near the place where congestion starts to form. This action enables higher speeds in upstream cells compared to the congested cell during the congestion period. Figure 7 presents results of comparative analysis regarding TT (left part in Fig. 7) and delay (right part in Fig. 7).

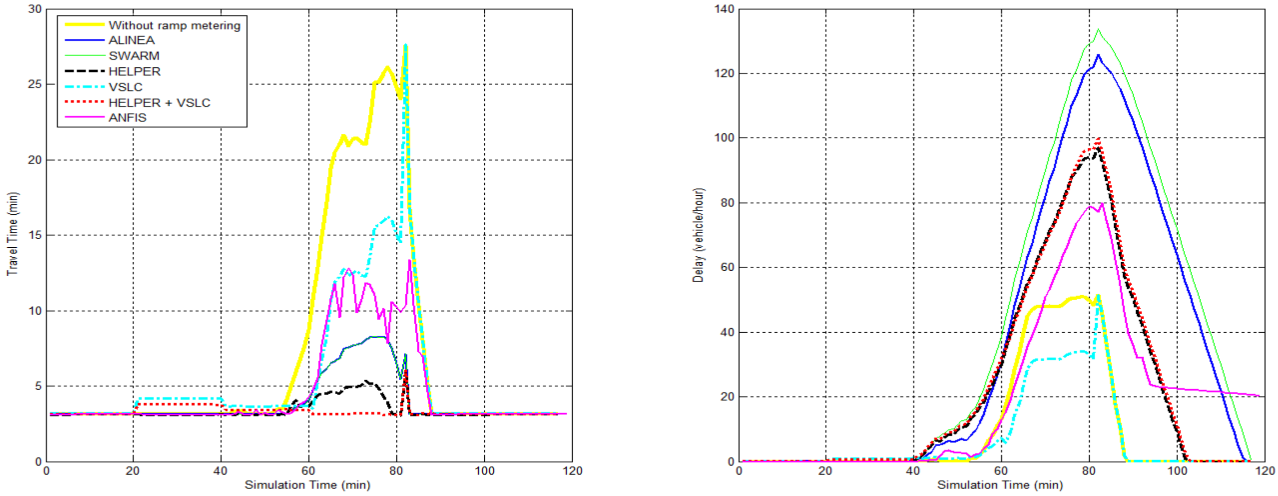

Fig. 7: Results of comparative analysis according to TT and delay.

According to Fig. 7 it is possible to conclude that cooperation between HELPER ramp metering algorithm and VSLC produces smallest TT. Zone between congested and last slave on-ramp is affected by decreased speed induced by VSLC what consequently decrease values of density in that zone. Virtual queues provided by HELPER ramp metering algorithm, which cooperates with VSLC, additionally reduce traffic density upstream of the congested on-ramp. Lower upstream density of the congested on-ramp leaves additional mainstream capacity to accept vehicles, which originating from congestion back-propagation.

Similar values of delay are produced by standalone HELPER and in case of cooperation between HELPER and VSLC. In both cases reduction of metering rates on the slave on-ramps by HELPER ramp metering algorithm is present, which is the main reason for similar results regarding delay. Reduced metering rates create queues at on-ramp, which increases values of delay. It can be concluded that VSLC has lower influence on delay if the mainstream density is decreased by HELPER exploitation of on-ramp queues. Standalone VSLC produces better delay results because of higher value of mainstream density. Other ramp metering algorithms produce higher values of delay due to higher number of vehicles in the congested on-ramp queue. ANFIS has produced values of TT higher than other ramp metering algorithms. Its TT curve shows similarities with the behaviour of other ramp metering algorithms TT curves. This feature verifies ANFIS learning capabilities, which can be additionally tuned in future development. ANFIS delay values are lower than other ramp metering algorithms what is consequence of generally higher TT values. Furthermore, from the similarity of the ANFIS TT curve during the most of the simulation to the HELPER delay curve can be concluded that ANFIS algorithm has partialy learned HELPER strategy of creating virtual queues.

9 CONCLUSION AND FUTURE WORK

In this paper a new approach to urban highway management control based on cooperation is proposed. Cooperative control concepts are introduced between ramp metering, prohibiting lane changes, VSLC and the vehicle itself. In order to ensure a suitable simulation platform the CTMSIM simulator is augmented to enable development and implementation of cooperative ramp metering approaches. With use of mentioned CTMsim augmentation, cooperative ramp metering algorithm HELPER is implemented to verify proposed simulator augmentation. Higher level of highway traffic control systems cooperation is achieved by adding

VSLC into cooperation with HELPER. Additionally, a learning framework based on ANFIS is designed to provide platform for cooperation between different ramp metering algorithms. The Zagreb bypass between nodes Lučko and Jankomir is used as test case for situational evaluation of proposed ANFIS based ramp metering algorithm learning framework.

According to the simulation results cooperation between VSLC and cooperative ramp metering provides best ratio between TT and delay values compared with other ramp metering algorithms. Overall results archived by ANFIS based approach indicate its potential to learn control strategies of several different ramp metering algorithms. Proposed achieved best delay, while TT value is still larger compared to other standalone ramp metering algorithms. Future work will include an optimization algorithm for better cooperation between ramp metering and VSLC. Additionally, possible adjustments of learning criterion function for ANFIS based approach will be examined in order to achieve better results.

10 ACKNOWLEDGMENT

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Open Street Map for Multi-Modal Freight Transport Planning

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1 ABSTRACT

Route planning for transportation of goods is an essential task. Determining a route for e.g. a truck is simple if the road network including the legal and technical limitations like truck ban or weight restriction are known. Planning of multi-modal routes is a bit more complex. The change of mode of transportation is only possible at specific locations. This change takes time and is often subjet to additional technical or legal restrictions. Thus the different networks, e.g., road and rail, need to be connected.

An obvious approach for multi-modal transport planning would be the use of Open Street Map (OSM) data since it does not only contain information about roads but also about trains and rivers. In this paper we first present some existing solutions for multi-modal transport planning and then discuss the use of OSM data in such a process. We identify missing elements in OSM and show opportunities for further development and interventions.

2 INTRODUCTION

Transport of persons and goods is an important part of current business. Production centres are distributed around the globe and exchange of goods from raw materials to finished products is essential. Within cities the transport of persons between the residential areas and the place of work is equally important. A number of different modes of transportation is available to solve this task. The simplest form from an organizational point of view is individual (motorized) traffic. However, the maximum amount of individual transport is restricted by the capacity of the road network. Thus, especially in cities and other densely populated areas, other forms of transportation are necessary. In case of transport of persons this is mainly public transportation: Busses, trams, subways, trains, ships, airplanes, etc. There are different modes of transport for goods as well. The counterpart for individual traffic is transportation by trucks. Other possibilities include ships, trains, and airplanes. The advantages of individual traffic are flexibility and speed. Other modes of transport are less flexible and take more time but are more energy efficient and thus cheaper.

Transportation is also a basic requirement for modern economy and society. In Europe, 10 million people are directly working in the transport industry and this branch is responsible for 5% of the gross domestic product (EC, 2011). Transportation in general includes both, transportation of people and transportation of goods. Passenger transportation is the process of moving people from one point to another point, while freight transportation moves goods. The major difference between these two types is that passengers are assumed to have cognitive abilities, i.e., if something does not work as planned, passengers will collect information, make a decision, and move on with the trip. This is not the case for freight. In the remainder of the paper we will concentrate on freight transportation, however some of the examples used for illustration deal with passenger transport.

There are numerous factors affecting movement of goods. Ortúzar (2011, p.463) lists the following:

- location factors (dependency on source materials),
- chain of dependencies,
- physical factors of goods (e.g., steel vs. milk),
- operational factors (e.g., company size and internal regulations),
- geographical factors (e.g., population density),
- dynamic factors (e.g., seasonal changes), and
- pricing factors (usually not published like with passenger transport).

Not all of these factors are of importance to this paper. The factors discussed here are geography and dynamic changes. Topology of networks are part of the geographical factors and route planning tools depend

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on correct topological relations. Another important aspect is scheduling. Trains, ships and ferries have specific timetables and are not available on a continuous basis. This is one of the dynamic factors of freight transportation. There are numerous others like, e.g., weather (e.g., Litzinger et al., 2012) or traffic (e.g., Partusch et al., 2014) but these are not subjects for considerations in this paper.

There are different modes of transport like roads, railways, airways, and waterways. Nowadays, a large part of transportation is road-based. According to Eurostat (2013), the modal split between roads, railways and inland waterways between 2000 and 2011 has been fairly constant at 5% inland waterways, 20% railways, and 75% roads. Since the total amount of transportation is still growing, the traffic density on the roads is increasing unless the modal split changes or road capacity is increasing. In order to avoid problems with traffic density, adopting other modes of transportation should be promoted.

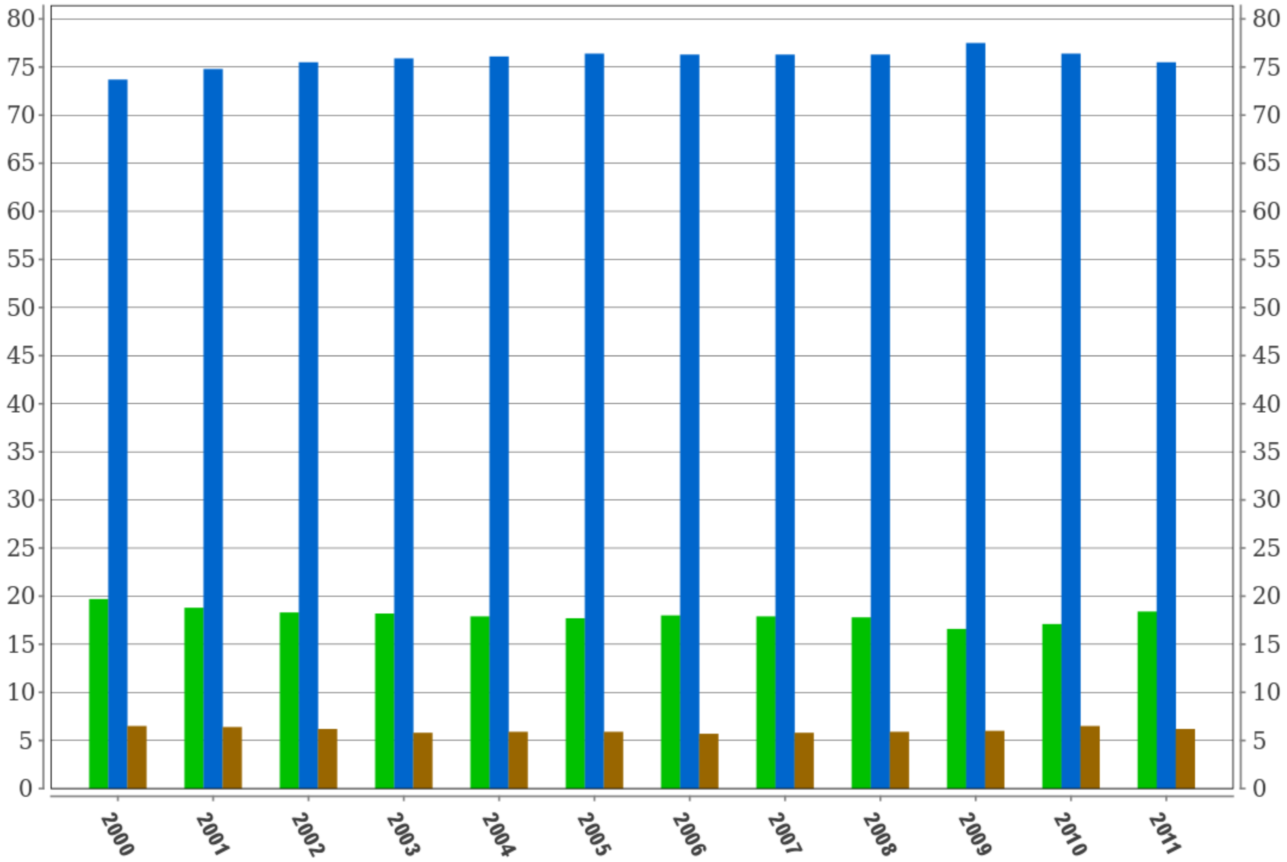

Fig. 1: Modal split of freight transport in the EU27-countries between 2000 and 2011, units display the percentage in total inland freight tonne-km (Source: Eurostat[1])

Literature distinguishes between monomodal transportation and multimodal transportation (Macharis & Bonekoning, 2004). Monomodal transportation denotes the case when only one mode of transportation is used. An example would be the transportation of goods directly from their origin of production to the processing facility without changing the means of transportation along the way. Multimodal transportation combines at least two modes of transport, e.g., by truck to the railway station, then by rail to the port, etc. A variant of multimodal transportation is intermodal transportation where the transportation vehicle itself is transported, e.g., by putting the truck with the freight on a train or vessel. This work deals with multimodal transportation and ignores the difference between multimodal and intermodal transportation.

The paper is structured as follows: In section 2 we discuss the basic properties of multi-modal transportation and the planning thereof. We introduce the concepts of Open Street Map (OSM) in section 3 and show the implementation of multimodal transportation planning in section 4. In section 5 we discuss the problems of this approach. Some remarks then conclude the paper.

[1] http://epp.eurostat.ec.europa.eu/tgm/graph.do?tab=graph&plugin=1&pcode=tsdtr220&language=en&toolbox=data

3 MULTI-MODAL TRANSPORT PLANNING

Transport planning has the goal to find an optimal route of transportation where the optimality criterion can be time, price, security, simplicity, etc. The difference between security and simplicity can be tricky: A simple route consists of a small number of different segments or a small number of turns (compare Duckham and Kulik, 2003). A secure route provides the highest protection against problems like piracy.

It is obvious that freight transport planning is more complex than individual trip planning because there are more variable parameters. Goods need to be declared and depending on the route, different goods may not be allowed. Also, some modes of transportation may not be feasible for some types of goods. Finally, quantitative differences in freight transportation are much more relevant than in passenger transportation.

The basis for any route planning application is

- a routable graph,
- a routing engine, and
- additional (real-time) data.

The routable graph defines the available connections and their static properties. If there are different graphs, it is important that connections between these graphs are modelled. This is necessary, for example, if national data sets are used because the connections at the national boundaries are essential for transnational routing. The same is true for multimodal routing. The additional data then models the variable properties of the graph. Some links may operate on a specific schedule. A ferry, for example, is only available at specific times. Other information may include winter closure, restrictions due to maintenance work, or temporary unnavigable river segments.

There are several routing algorithms to find an optimal path in a graph. Sanders & Schultes (2007) explore some of them and also give some estimates on strengths and weaknesses in special scenarios. One of these scenarios is transportation with time-dependent edge weights that becomes relevant when dealing with scheduled multimodal transport systems. Algorithms that, e.g., use a bidirectional search for optimization become unusable when there are time dependencies in the graph.

According to Rodrigues et al. (2013, ch. 3), modes of transportation include

- road,
- rail,
- pipeline,
- maritime,
- air,
- intermodal, and
- telecommunication.

Not all modes are relevant in the context of this paper. Telecommunication is a special case because several copies of the same data could be sent on different paths to determine the fastest connection. This is not easily feasable for freight transportation. Pipelines are special cases as well, because they only work with specific types of goods. The other modes may be relevant.

All modes except two are restricted to graphs These exceptions are air and maritime. Maritime transportation is only bound to a pre-defined network if it occures on rivers and air traffic is (at least theoretically) not restricted to a graph at all. Theoretically, air traffic, from a logistic point of view, is defined by airports and there is a possible connection by air between any two airports. This is not necessarily true for the other modes of transport, since, e.g., two railway stations may not be connected by rails if they lie on different continents.

4 OPEN STREET MAP

The OpenStreetMap project was started in 2004 by Steve Coast and is commonly described as the wikipedia of maps (Ramm et al., 2010). A superficial but sufficient introduction to the way data is stored in OpenStreetMap is the following: Real world entities can be entered into a publicly accessible database.

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These entities are assigned attributes by a number of loosely defined key-value pairs, so-called “tags”. A street, for example, is identified by a tag called “highway” which is also the key to a possible value of “primary”. This would denote a main road. Any entity can have as many tags as necessary to sufficiently describe it.

In addition to simple geometric objects it is also possible to group single entities to “relations”. These are ordered lists of entities which can themselves have tags assigned to them. It is therefore possible to describe the route of a bus by a sequence of single streets. Relations are widely used when dealing with non-physical entities like bus lines which are composed of many single roads and stops.

4.1 Street Network

While the origins of OpenStreetMap lie within mapping the network of streets, no bias towards an intended purpose is given. This explains the dominance of streets besides buildings and the commonly applied “source” tag (which denotes the source a mapper has collected the information entered into the map, e.g. an aerial photography or GPS device) in contrast to the variety of other information that can be found in the OpenStreetMap database (see figure 2).

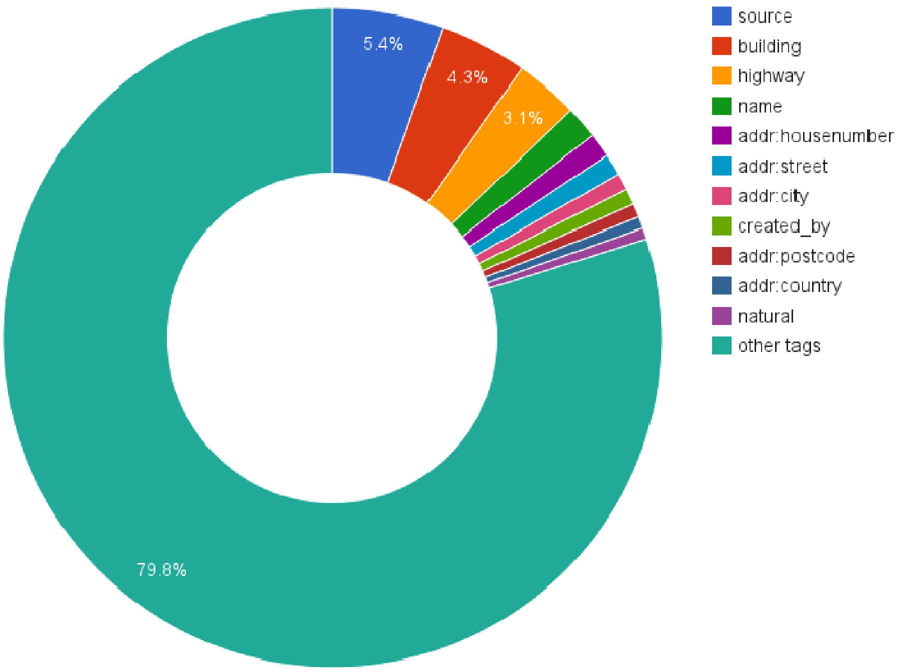

Fig. 2: The most often used tags in the worldwide database of OSM (Source: Topf, 2012)

Following this, there have already been done several analyses of the quality of the street network. These attest a good quality of the mapped streets. Ludwig (2010) shows that main-roads correlate up to 90% with her comparative dataset in German cities while this correlation drops rapidly when moving to more rural regions. Haklay (2010) was able to detect an overlap with administrative data of up to 100% of high ranked roads in five areas in London. Graser et al. (2013) did an analysis of the street network around the city of Vienna. Their findings include that when dealing with streets of high order there are less errors in OSM as well as in her comparative administrative dataset.

It is usually possible to generate a routing graph from OpenStreetMap road data with little effort (e.g. by using the pgRouting tool (pgRouting Community, 2014)). While it is more difficult to include more advanced rules like turning restrictions into a routing engine it has already been done by several services (e.g. a routing application for Android Smartphones (OsmAnd Community, 2014)).

4.2 Relevant Elements of OpenStreetMap

4.2.1 Railways

Railways are easily mapped since they do not occur as often as streets and feature a more constant linehaul. Stops and stations along the tracks can be mapped but usually do not contain additional information about whether it is possible to transfer goods at this location or not

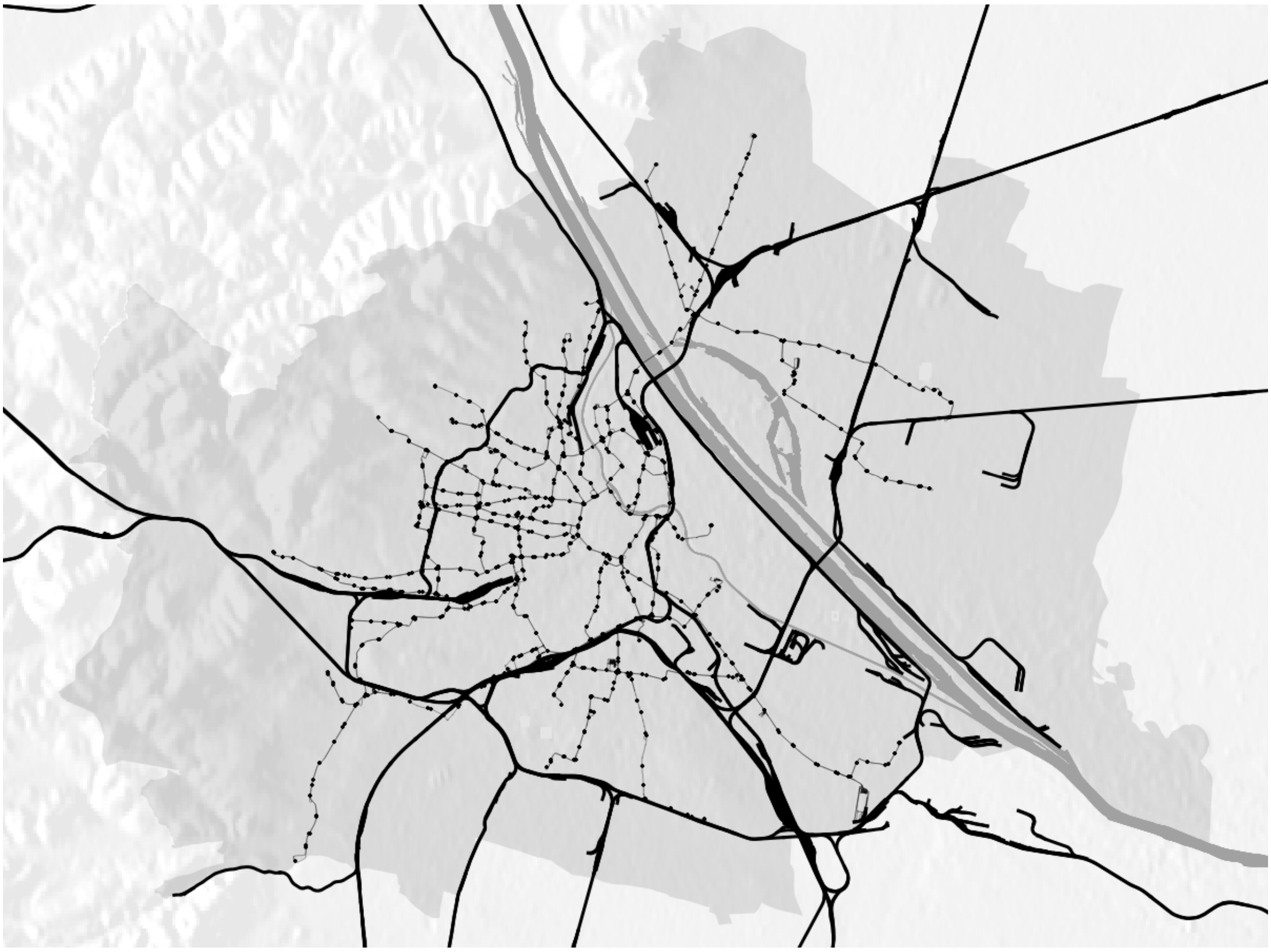

Fig. 3: Railways (thick black lines), Trams (thin black lines) with their stops (black dots) and the river Danube (thick grey lines) mapped in OSM in the area of the city of Vienna (grey area)

4.2.2 Aircraft

Whilst aircraft routes are not mapped, the infrastructure supporting airborne transportation is. These are airports, terminals, storage buildings and runways, to name only a few. A special case is the airport of Vienna where the OpenStreetMap community was provided with official, highly detailed maps of the airport to map it as accurately as possible (Schweikert, 2013).

4.2.3 Water/Ferries

There are many ways to describe water in OpenStreetMap. When dealing with a water surface one uses the tag “natural=water” while flows are mapped with the key “waterway”. The accompanying value describes the extent and size of the the flow (e.g. “river”, “stream”, …). Additionally to that it is possible (but not used very often) to give details about the maximum allowed draught, size and speed of ships and other official information like the European river classification for navigable waterways (European Conference of Ministers of Transport, 1992).

Ship lines, when they do not represent ferries, are not mapped explicitly since they can be easily deferred from waterways.

Ferries are mapped as lines along which a ferry operates. Also, the entry and exit points of a ferry can be mapped and may have attached more information about what is allowed to be transported.

4.2.4 Connections

Connections between single lines of travel are important when dealing with navigation. They symbolize situations where a traveller can switch to a different path.

When two lines share a common node in OSM, they intersect. Non-material entities like tram routes are represented by relations as was explained before. When it comes to more complicated scenarios like turning

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restrictions so-called “turn restriction relations” are used. This is a special kind of relation that lists the street from where to where and via which point or street a vehicle is or is not allowed to go. These kinds of relations are well proven and pose no problem with monomodal routing information.

When it comes to multimodal route planning, locations of intersection of different modes of transportation where goods or persons can be interchanged need to be mapped. Stops of various means of transportation are designated by a single tag named “public_transport=platform”, usually assigned to an area. This tag is common to multiple different types of transportation. They also may be part of a relation (tagged as “public_transport=station”) containing elements describing different modes of transportation. By utilizing this relations, an intersection between different modes of transportation can be constructed. It is even possible to specify details on whether a certain means of transportation supports freight transfer at this location or not.

A simpler variant which is in use quite commonly is to just connect the end-points (or intersecting points) of ways from different modes of transportation to one another. But this poses some difficulties when e.g. there is no direct connection between two modes of transportation and the line connecting these is mapped by a footway. Where to put additional information about the intersection like e.g. weight of goods to be transported? Also, a simple footway may beneficial to the structural integrity of the graph but not to its cartographic representation.

4.3 About Vienna

To give a better understanding of the quantity of information one is dealing with when looking at Vienna, some numbers are presented here. These data was computed from an OpenStreetMap extract of the Vienna region from Migurski (2014) after it was clipped to the exact extent of the city of Vienna.

On the 18.02.2014 there were 139 railway halts, 270 railway stations, one airport, two ferries and one harbour mapped in Vienna. Waterbound transportation routes other than ferries are not mapped explicitly but can be deferred from rivers.

5 MULTIMODAL TRIP PLANNING APPLICATIONS

There are a number of products for multimodal transportation planning. The most important systems used by Austrian companies are:

- FLAVIA (Raicu et al., 2011)
- LAMBIT
- European Intermodal Route Finder
- AnachB (Heimbuchner K., 2011)

Some of these systems, like FLAVIA, have been developed by universities, others, like AnachB are developments of public service providers. Basic graph data from various sources are used for all mentioned systems: TeleAtlas, NAVTEQ, public administration, and OSM. One of the typical bottlenecks is real-time information. Although FLAVIA, for example, is an online system, it does not connect to data sources providing information on aspects like traffic congestions. This needs to be dealt with in the future. One of the emerging problems is the availability and harmonization of these data.

AnachB is currently the only system that can incorporate these data. However, it is currently restricted to the eastern part of Austria. Data integration is based on the graph integration platform (Kollartis S., 2010), a common nationwide road graph. Since it was designed as an Austrian system, it is questionable if it can be opened for other countries without significant adaptation.

An OSM-based multimodal system is Open Trip Planner. It was developed by the National Center for Transit Research of the University of South Florida. The open trip planner is a tool enabling multimodal trip planning only for individuals (Hillsman & Barbeau, 2011) and is displayed in figure 4. There have been performed extensive analysis of how to integrate OSM into the tool (Hillsman & Barbeau, 2011; McHugh, 2011). While it is optimized for personal transport, it is still possible to identify various points in their study that are also valid for multimodal freight transport planning.

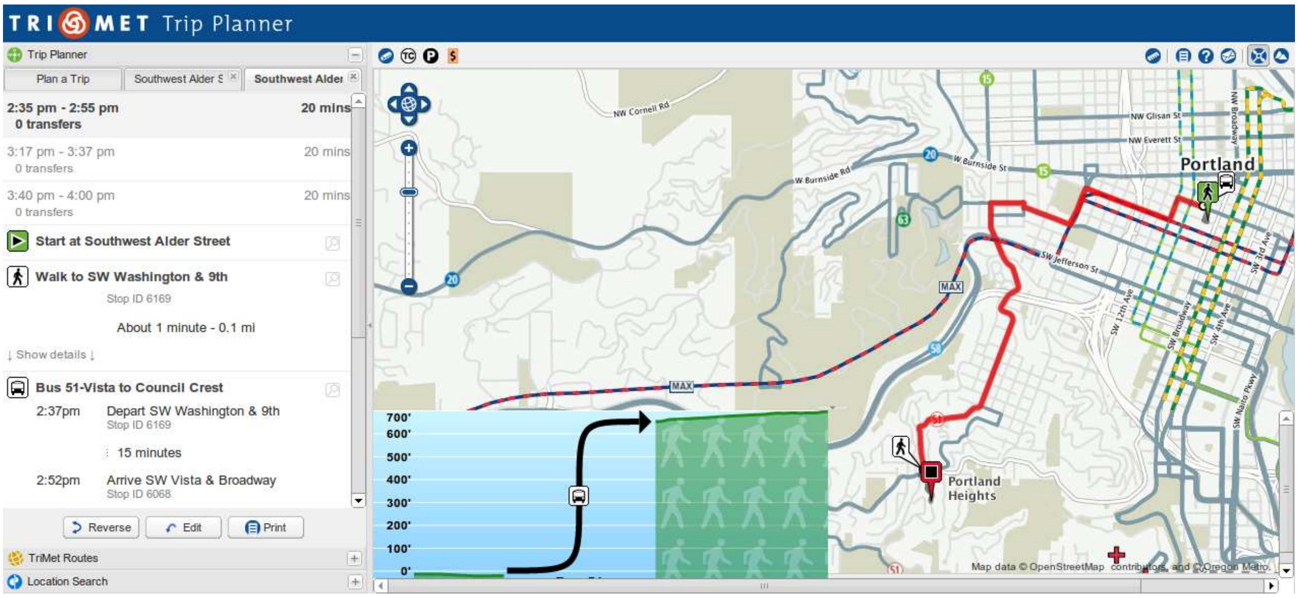

Fig. 4: An instance of Open Trip Planner (source: TriMet)

The most important finding was that they call “Implementing a multimodal trip planner using open-source software and open sources of data is very feasible” on page IX. The creators also denote that OSM alone is not capable of storing all relevant information in its database because this would be too impractical. Instead, they propose the use of the open GTFS (“General Transit Feed Specification”) (Google Developers, 2012) to synchronize existing data from OSM with schedule information. The Open Trip Planner goes even a step further by using GTFS files as its primary data source which means that a certain amount of OSM information has to be converted.

6 WHAT IS MISSING IN OSM

Looking back at the previously defined prerequisites for and implementations of a working multimodal (transport) planning system it is now possible to identify components of the OpenStreetMap project that prevent the exclusive use of OSM data for a multimodal freight transport routing system.

6.1 Concerning the graph

While it is an easy task to operate on graphs from different modes of transportation from the OSM database, it is more difficult to connect these graphs with one another. The existence of a tag describing areas of access to public transport facilities (“public_transport=station”) may serve as a blueprint for a more general scheme describing intersection points. Information about how long to wait with a certain amount of goods for a specific connection can be added to this areas.

Hillsman and Barbeau (2011) observe that certain data is too difficult or even hazardous to collect for non-professionals. This includes data on volumes of vehicle traffic, width of lanes, operating characteristics of signals to just name a few. This is a point reached where OSM data alone is not sufficient enough by quality.

Another important point made by Hillsman and Barbeau (2011) is that OpenStreetMap is not mapped with equal detail in every location. It is necessary to motivate users to map essential features and explain the requirements for multimodal routing to the community.

6.2 Concerning real-time data/schedules

There are ongoing discussions on community mailing lists of the OpenStreetMap project about how much attributive information should be inserted into its database. Leaving this very subjective matter aside, it is simply impractical to a point of impossibility to store extremely short-dated real-time information inside the OSM database. OSM is not suited to hold all information of this kind because of the quantity and frequency of real-time data.

6.3 Concerning route-planning

The OpenStreetMap project itself does not provide any routing algorithm, but there exist multiple OpenSource projects that take over this part. These ranges from implementations as web services to stand-alone solutions which are integrated in desktop GIS (e.g. Corti et al., 2014, chapter 6; Furieri, 2011).

Little is left to say about this cornerstone of multimodal transport planning in this context since routing is not a problem OpenStreetMap is intended to or is able to solve on its own.

7 CONCLUSION

In this paper it became clear that the OpenStreetMap project alone can not solve the problems arising from multi modal transport planning on its own. While OSM is a valuable contributor, its database lacks functions and descriptive powers necessary for state-of-the-art multimodal transport planning. Table 1 gives an overview of the aspects missing in OSM.

Type	Description of missing information	Example
Quality	missing information that can not be gathered	volume of traffic, storehouse capacity
Frequency	information that is changing too often	real-time data on usage
Quantity	information that is too specific in relation to its size and geometric reference	train schedules
Availability	service that is not provided	routing algorithm

Table 1: Four points why OSM alone is not sufficient for multimodal transport planning

Hillsman and Barbeau (2011) have proven that it is possible to synchronize OSM data with databases from other sources to compensate for the information missing which would account for missing information of the type frequency and quantity (according to table 1).

Crucial elements relevant for multimodal route planning are locations where two or more different modes of transportation intersect each other. This can be mapped but users have to do so. Information too difficult or impossible for private individuals to collect may be entered by experts or has to be provided by a specialized database. This accounts for problems about quality.

What can be seen is that the problems identified are not unique to OpenStreetMap but are also valid for commercial datasets. The solution most general to most of the problems is about combining different datasets to receive all the information needed. The challenges of this synthesis are a chance for OpenStreetMap to prove its flexibility and openness. Theses two attributes turn OSM into an ideal candidate for research and development in the field of multimodal transport planning.

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reviewed paper

Ökotopia – Multidimensional Cities need Multidimensional Data

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1 ABSTRACT

The development of a multidimensional criteria catalog brings along data for the evaluation of the actual situation for cities or areas in cities. The criteria are defined in four research groups in the area of social living, building, energy and transport. The criteria are defined by different indicators weighted due to their importance. The indicators themselves are described by values, which depend on the approachableness of sustainability. The data from the criteria catalog is available for specific applications or services for town-planers either from authorities or planning offices or the commercial developers of areas. The main objective is not only to define data, but also use it for the validation of sustainable smart cities.

2 MULTIDIMENSIONAL CITIES

Places where people live together are always multidimensional. Some of these dimensions are the design of buildings to life and work; the quality of the places to move around or to relax; the different modes of energy used; the form of transport that is based on the needs, the availability of attractive public transport and cycle possibilities; the availability of shops and services and the infrastructure and the social dimensions like the availability of places to meet, family and social structures. The dimensions named are not complete to describe the evolution of cities; they just show the complexity of the development of cities. These dimensions are represented by specific data. The relationship between the dimensions is very complex but the violation of the relationships leads to cities with difficulties like crime or dangerous places and in the end separation of people with all its difficulties. As the development of cities is in an on-going process it is necessary to have a tool that supports the town planners and delivers data to the public for services. The mentioned data is long term planning data.

A city of high living quality – a smart (sustainable) city – has to cover many dimensions with high quality, only these cities (or living areas) are successful in business and economics. Sustainable Smart Cities are not only based on short term data, but also on long term multidimensional data to show the development and "smartness" of cities or living areas.

3 ÖKOTOPIA – RESEARCH PROJECT TO RETRIEVE DATA

To research on the coherences of different sciences for sustainable areas a research project was set up. The project Ökotopia was based on the fruitful cooperation between the research institutes Social work; Energy-, Transport- and Environmental Management and Construction Design and Economics of FH JOANNEUM University of Applied Sciences at Graz and Kapfenberg. This combination covers scientific approaches in different fields with their specific methods.

It was one of the results the content of the research project ÖKOTOPIA to develop an evaluation tool for areas in cities covering the specific knowledge of the different fields of research. This evaluation tool can be used for collecting data that can be used to evaluate planned developments, for actual town planning or for the observation of long term processes. This evaluation tool is a catalog of criteria in the four fields of research: building environment, social science, energy and transport.

To develop a standardized catalog seven different living areas in the city of Graz were specified. The definition of the areas was based on three pairs with equal density, building structures and common visual appearance. One living area was additionally selected as it shows a specific high density with large and high structures.

4 SUSTAINABILITY

To study the sustainability the definition of sustainability is necessary. Helms defines the sustainability as shown in the following figure.

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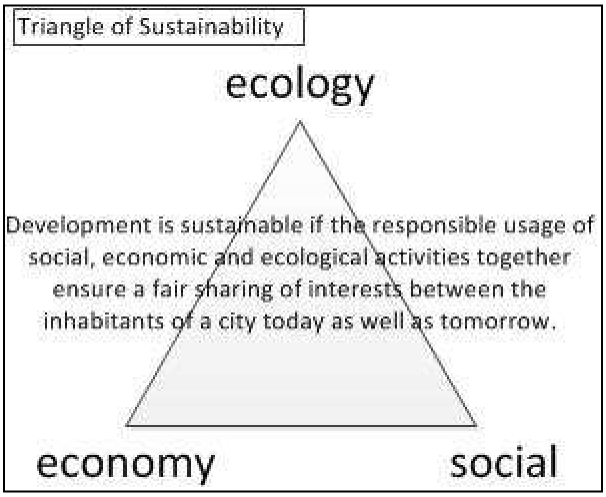

Figure 1: Definition of Sustainability (source: Helms)

To define the level of sustainability in the living areas every research group defined the most sustainable solutions.

5 DATA TO DESCRIBE LIVING AREAS

The specific result of the project Ökotopia is a multidimensional set of criteria, based on specific different data retrieving methods from the research groups. The cooperation of the research groups based on an approach where the combinations, of the sometimes quit different scientific methods, of the participating researching institutes with their specific knowledge is very unique and very fruitful.

The range of methods to retrieve data covers the interpreting of plans, scientific designing of a questionnaire with a survey performed and interpreting the results and the analysis of energy and geological data. The research groups cover specific knowledge and experience in the area of social research, the retrieving and interpretation of geographical data and analysis of energy sources and consumption.

The data is based on criteria defined by the four different fields of research: architecture, social science, energy and mobility. Every area defined criteria, the criteria themselves are compound by indicators, and those indicators have specific values. The values themselves have the range from 0 to 10. The most sustainable solution defines the highest values. The definition of the best values is based in literature or on the knowledge of the researchers. The different indicators were weighted and combined to define the criteria. They were again weighted and combined to show the valuation of the area in form of numerical indices. The final results are four figures for the fields of building environment, social life, energy and mobility that describe the researched area.

This data can not only be used for the analysis of areas at the present, but also for the forecast of developments. If the data is already collected it can be stored and together with the collection of new data in the future it will be used again to look back and analyze the developments.

6 EXAMPLES

This chapters show some examples of criteria in the different research groups.

The research group of mobility values the distance between the areas and the objects of basic functions for living, work and social life. Another figure shows the access to good public transport as it correlates to the number of cars owned by the inhabitants in this area.

Examples for the valuation of the research group of building are the quantity and quality of the surfaces, and the public spaces available.

Energy based data is defined on the kind of energy sources used including their production and its amount of usage in the different households.

Social data concerns for example, the quality of relations to the neighborhood, the identification with the living area and the employment rate.

For the named examples data is collected from different official sources or a specific questionnaire developed for the project. Some of the figures are made up different indicators.

7 CONCLUSION

The project Ökotopia developed a catalogue of criteria that delivers the data that can be used to evaluate a specific area with different scientific approaches from four research groups in the fields of building, social life, energy and mobility. The data can be used to evaluate the present, make forecats or if looked back to show developments. In the actual project the criteria are based on the sustainablity but the adaption towards "smart" is easily possible. The defintion of "smart" itself was not part of the project, it is still open.

The data of this project could be a source to proof if the cities are "smart" or how the development goes on.

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reviewed paper

Planning Smart Cities ... Sustainable, Healthy, Liveable, Creative Cities ... Or Just Planning Cities?

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1 ABSTRACT

The paper explores the notion of „smart city“ by contrasting a narrow with a wide understanding of „smart cities“ and by putting the notion of „smart city“ into the context of some city typologies generated over the last few decades. It draws on debates, research, government policies and industry declarations about „smart cities“, and other „adjectified“ cities, to single out the specificities of „smart cities“, and explore what they may contribute over and above to current urban policies and planning strategies.

2 WHAT IS A "SMART CITY"?

Is the notion of „smart city“ yet another attempt to grapple with the complexity of cities by deconstructing the concept of „city“ and making its component parts easier to understand and eventually to plan for? Or does it stem from yet another commercial offensive set to invent new products and services and to find outlets for them by creating new demands? Or, less likely, do „smart cities“ and in particular their operational innovations represent a paradigmatic change of urban living, akin to the introduction of electricity as some claim?[1] This paper explores these questions based on selected debates, research outcomes, government policies and industry declarations.

Like so many new expressions which come on-stream in the academic world or in commerce, the idea of „smart city“ appeared in different places simultaneously some two decades ago. It may be traced back to the notion of „smart communities“, themselves possibly an evolution from the ecological grass-root movements in California and elsewhere. The Global Forum[2] has included „smart communities“ already in 1997 in its tri-partite events bringing together industry, regulators and users in the field of telecommunications.[3]

The World Foundation for Smart Communities[4] was created in 1997 at the International Center for Communications in San Diego USA. It defined a „smart community“ as:

„…a community that has made a conscious effort to use information technology to transform life and work within its region in significant and fundamental rather than incremental ways. The goal of such an effort is more than the mere deployment of technology. Rather it is about preparing one's community to meet the challenges of a global, knowledge economy..."

Before that, the concept of „smart growth“ appeared in 1992 when the United Nations adopted the Agenda 21 programme at the UN Conference on Environment and Development in Rio de Janeiro, Brazil. Later, the American Planning Association put this idea into practice when it devised a regulatory framework for „smart growth“ in 1997.[5]

Critical minds may object to the hijacking, reinterpreting and sometimes even patenting of ordinary words like „smart“ used in everyday life. The same happened to „gay“ a word that cannot be used anymore in its former sense since the homosexual community appropriated it to itself. „Smart“ meant a person who is streetwise, commonsensically clever, astute, even canning. In the realm of the built environment „smart“ has been reduced to ICT applications for practical urban living. In fairness, part of the academic world is attributing a broader meaning to „smart“ and „smart city“. The fact is though that a human being can be

[1] For example Irving Wladawsky-Berger in the Wall Street Journal 19 December 2012.

[2] See far example the early annual conferences of the Global Forum, a tripartite organisation bringing together (telecommunications) industry, regulator and user (some of them "smart communities"). http://globalforum.items-int.com/

[3] Judith Ryser. 1997. Smart Communities Forum, Nice (Sophia Antipolis) and Rome. Information and Communication Technology Applications: the contribution of "smart communities" to the Information Society. Report on the event for ITEMs International, France.

[4] http://www.smartcommunities.org/about.htm It published the "Smart Communities Implementation Guidebook" for the State of California.

[5] Growing Smart Legislative Guidebook: Model Statutes for Planning and the Management of Change, APA. 1997. https://www.planning.org/growingsmart/guidebook/print/

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smart, but not a material object like a city, a utility, a technology, whatever. This remark applies also to other „adjectified“ city types, such as „creative city“, „intelligent city“, „digital city“, „healthy city“, „resilient city, and many more which have emerged over the last few decades. Like for them, the definition and use of „smart city“ remains fuzzy, albeit a possible advantage in disguise.

3 "SMART CITY" TYPES

There exists a proliferation of „smart city“ definitions. The German „National Academy of Technology and Engineering“ defines „smart city“ as „intelligent, integrated and networked".

The definition advocated by the UK Department for Business, Innovation and Skills (significantly changed from Department for Trade and Industry) includes references to technology and data capture as well as sustainability:

„…"smart city“ brings together hard infrastructure, social capital including local skills and community institutions, and digital technologies to fuel sustainable economic development and provide an attractive environment for all… "smart city“ harnesses data capture and communication management technologies… „smart „approaches“ to services, transport, utilities, waste management transform efficiency and sustainability of urban communities … potential cost and CO2 emission reduction… improvement of quality of life…"

Among the many definitions, two main strands of „smart cities“ seem to have established themselves: a narrow understanding promoted by the ICT industry and a wider notion supported by academics and the urban planning and policy community.

3.1 "Smart city“ confined to ICT support systems

Is „smart city“ just confounded with high-tech? Such a narrow definition is often used by the ICT industry which is developing remote control and monitoring devices related to energy or other resource consuming urban activities, with the apparent aim to reduce consumption. This narrow and technological definition of „smart city“ has close connections with the „sustainable city“, the „resilient city“, the „liveable“, „playable“, „healthy“, „senseable", „green city“, and more directly the „eco-city“. In this sense, a „smart city“ is a „platform for innovation, where converging technologies transform government"[6] (or governance). Sectorally this translates into „smart water“, „smart energy“, „smart transportation“, the key fields in which ICT is being put to use, most frequently at the level of buildings, to control their utilisation and more specifically that of their appliances, as well as to measure their technical performance. Cisco postulates that the Internet has become the fourth „essential utility“.[7]

3.1.1 Smart City Expo World Congresses

The „Smart City Expo World Congresses", founded and held in Barcelona, are a concrete global manifestation of the commercial approach to „smart cities“.[8] The style of the „reports“, more photo opportunity than explanatory words,[9] shows the commercial fair approach of the protagonists, mainly ICT companies with a lot at stake.[10]

[6] http://eu-smartcities.eu/content/presenting-european-innovation-partnership-smart-cities-and-communities

[7] http://www.cisco.com/web/strategy/smart_connected_communities.html

[8] http://www.smartcityexpo.com/en/home The next event is in Kyoto, Japan in March 2014 which promotes the exchange of knowledge, practices and businesses on Smart Cities while creating a network between Asia, Europe and South America.

[9] http://media.firabcn.es/content/S078012/SmartCity2012Memoria.pdf Only headlines of the conference themes are quoted without details or cross references. See 2012 report themed „smart strategies for transforming cities“ under urban planning and building.

[10] Global partners of the Smart City Expo World Congresses are multinational and global firms like Cisco, IBM, FCC, Schneider Electric, Indra, Aqualogy, Urbanser, Abertis telecom, Atos, Microsoft, Thales, red,es and ThyssenKrupp. Event partners participate as well, including Nissan, Philips, Siemens, Telefonica, T System, SilverSpring, Oracle, Ericsson and many others. The EU, UN Habitat and the The World Bank was among the supporting institutions, besides the Barcelona administration.

In fairness, the „Smart City Expo World Congress“ sessions in 2012, under the umbrella of „Smart Thinking Solutions”, included „urban planning and building“,[11] as well as „smart society and collaborative city“,[12] besides the technological subjects considered to be core to „smart cities“, dealing with energy, technology and innovation, environment, mobility, emergencies and security, governance and economy.[13] Interestingly, while „smart society and collaborative city”[14] was maintained in 2013, planning was substituted by „sustainable built environment”[15] - closer to the application of ICT to building technology; „emergencies and security“ were transformed into „city resilience and security“,[16] while the „smart city“ techno subjects were maintained under the general title „Smart Cities Change the World”.

The first congress in Barcelona in 2011 had focused on „Smart Society for Innovative and Sustainable Cities”. All the key topics related to „smart cities“ were covered: energy and environment, urban planning, governance and funding, living and people, mobility and technology, with topics structured around three major themes: liveable cities for people, integrated vision, and sustainable cities. The debates raised four key issues: the need for new models, new industrial and ecological revolutions, and self-sufficient neighbourhoods, the latter taken up by the „new urbanism“ movement. In 2014, the congress branches out to Kyoto under the theme: „Next Generation Cities and New Industries through Green Innovation”.[17]

This quick overview of arguably the most global organisation dedicated to „smart cities“ shows the wide overlaps between the notion of „smart city“ and other „adjectified“ cities, such as „sustainable city“, „green city“, „resilient city“, „intelligent city“, ‚innovative city“, competitive city“, notions which are used almost interchangeably. Moreover, the narrow technological preoccupations of „smart cities“ overlap with what eco-cities stand for,[18] but most importantly with their pursuit of global recognition for their standards and levels of excellence which are promoted by the Barcelona „Smart Cities Expo World Congresses“ with awards.

Fairs like the „Smart City Expo World Congresses“ are lucrative and other international fairs are emulating their successful formula. Examples in the field of the built environment which also invoke „smart cities“ and „smart buildings“ are MIPIM,[19] „the world’s property market and leading international real estate event” which celebrates its 25th anniversary this year, and „Ecobuild“, a relative newcomer which claims to be „the world’s biggest event for sustainable design, construction and the built environment”.

3.1.2 European Union „smart city“ initiatives

The EU as well took on board the narrow notion of „smart cities“ in the interest of globally competing European „smart“ technology companies.[20] An EU initative carried out by a consortium between the Vienna University of Technology, the University of Ljubljana, the Delft University of Technology and AssetOne encourages cities to name themselves „smart city“ and to join the project which aims to establish a (unique?) „smart cities“ model, provide a system of rank ordering the cities as „smart“, and benchmarking their compliance with „smartness“.

[11] introduced by: „Urban planning deals with the design and management of the space where we live and work. After half a century of car-centred planning, city planning is refocusing on the human scale”.

[12] introduced by: „ICTs are setting a new landscape to empower citizens to develop their initiatives, fostering creativity and innovation, in both more developed and developing countries”.

[13] http://media.firabcn.es/content/S078012/SmartCity2012Memoria.pdf

[14] introduced by: „ICTs are setting a new landscape for analysing society, to enable interaction and collaboration, to empower citizens to develop their initiatives, and to foster creativity”

[15] introduced by: „The world is facing major environmental challenges caused by the production of energy and the consumption of natural resources needed by our cities. A sustainable built environment tackles these challenges by rethinking how we live and work in them. „

[16] introduced by: „City resilience refers to the city’s capacity to react to unexpected situations such as natural disasters or accidents that could cause disruption in urban services or transportation networks. ICTs are becoming a key partner to help manage, monitor and detect critical situations once they occur. „

[17] Two strands are available: „smart cities for urban and social development“ (smart society/urban transformation); and technological research and industry for smart cities (sustainable mobility/ green economic development).

[18] See, for example, the comprehensive review: Simon Joss, Daniel Tomozeiu, Robert Cowley. 2011. Eco-Cities – Global Survey 2011. Eco-City Profiles. University of Westminster http://www.westminster.ac.uk/?a=119909

[19] MIPIM, Marche International des Professionnels de l’Immobilier, was created in Cannes in 1989. https://www.mipim.com/

[20] http://www.smart-cities.eu/ http://www.epic-cities.eu/content/smart-cities

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The EU broadened its approach by adding „smart communities" to „smart cities". It focuses on technological innovation and invites cities to share their „smart city" solutions and best practices.[21] They encompass applied innovation, planning, participatory approach, energy efficiency, transport and „intelligent" use of ICT. These innovative solutions are linked to the EU 20/20 climate action goals and overlap with those sought by „eco-cities". This EU programme with a €365m budget allocated in 2012 looks to:

„establish strategic partnerships between industry and European cities to develop the urban systems and infrastructures of tomorrow."

The members are a combination of industry, city administrations and universities which are working to a 10 year rolling agenda.[22] The stated priority areas are to create, enlarge and „green" markets (for smart city technology) and to foster „enablers" (i.e. enabling capacity" for smart integrated city planning and innovative governance; finance; open data, standards and interoperability; training and engaging stakeholders).

3.1.3 "Smart city" industry

At the Smart Cities Forum Volker Buscher, director of Arup[23] estimated the global „smart cities" industry value at $400billion by 2020.[24] The UK government forecasts that the UK will capture 10% market share of $40billion assisted by its „smart cities programme.[25] UK government support is apparent, for example, in a paper on „Smart Cities Market Opportunities for the UK", focusing on a more efficient way to consume resources (water, waste, energy transport, and for assisted living).[26]

Many of the international industries penetrating the „smart city" market are creating credentials for themselves in this field, besides being members of many „smart city" networks. One of many examples is the Crystal, built by Siemens in London's Docklands, „one of the most sustainable buildings in the world" where Siemens has established „the world's largest public exhibition on the future of cities".[27] Although Siemens adopts the concept of „sustainable city", what it promotes is „smart city" technologies.

„…Technologies are major levers and base for further sustainable city development…efficient buildings, a reliable power grid and capable mobility solutions….The complexity involved requires a holistic view and sustainable solutions for cities. Siemens has the portfolio, know-how and consulting expertise to make cities more liveable, competitive and sustainable."

A similar optimistic technology fix was advocated at the European Urban Summer School 2013 in Madrid[28] by Jorge Manuel Martin Garcia of Telefonica, who postulated a future of everyday urban life based on cloud communication. Smart digital communication is supposed to offer individuals timed and remote controls over their living spaces. It could be argued though, that by abdicating their control over communications to cloud computing, they create a total dependence on a privately run centralised system which mines data for commercial use and trading from individual users without their knowledge or consent.

3.2 "Smart city" understood in a wider sense

The wider understanding of the „smart city" includes „the social" with people in mind as an active part of the planning process. For urban policy makers urban communities learn to learn, adapt and innovate. In rarer cases this extends to the issue of social inclusion in a wider sense, public participation and co-design for practical implementation of physical „smart city" strategies. The latter makes sense as those who advocate the wider notion of „smart city" incorporate behaviour change and adaptation as a condition to make all the ICT solutions for „smart cities" viable in practice.

[21] http://eu-smartcities.eu/content/presenting-european-innovation-partnership-smart-cities-and-communities
[22] http://eu-smartcities.eu/sites/all/files/10YRA%20final_january.pdf
[23] http://www.arup.com/ ARUP has grown from an engineering company into a global independent firm of designers, planners, engineers, consultants and technical specialists with 90 offices in 30 countries, and 11,000 professional staff.
[24] https://www.gov.uk/government/publications/smart-city-market-uk-opportunities
[25] https://www.gov.uk/government/news/new-initiative-to-support-40-billion-smart-cities-in-the-uk
[26] https://www.gov.uk/government/news/new-initiative-to-support-40-billion-smart-cities-in-the-uk
[27] http://www.thecrystal.org/
[28] EUSS13 proceedings to be published by AESOP. Teresa Franchini, Juan Arana Giralt, Judith Ryser (eds), 2014.

3.2.1 Cities

Certain cities use a wider definition of „smart city", especially large conurbations as well as new settlements in the developing world. Early examples of cities which have put these principles into practice are Issy-les-Moulineaux in the outskirts of Paris where the mayor has pioneered real time digital interactive citizen participation, and is expanding it continuously, possibly to e-voting and far more direct decision-making on urban policies and their implementation.[29]

The authors of „Smart Cities in Europe" give a wider definition of „smart city", with emphasis on the quality of knowledge communication and social infrastructure.

„We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources through participatory governance…"[30]

3.2.2 Academe

The academic world has also adopted a range of wide understandings of „smart cities". For Richard Florida „smart cities" encompass explicitly soft infrastructure, such as knowledge networks and voluntary organisations. Only thus can the creativity of „smart city" inhabitants be put to innovative use. For many other academics „smart cities" encompass human capital, education, social and relational capital, environmental interests, besides ICT infrastructure. This is also the position of many urban policy makers and their „theoretical" advisers who aim to apply ICT to increase competitiveness and local prosperity, business-led urban development, local intelligence capacity and collective community intelligence. Some universities aim to appropriate the notion of, and control over „smart city" themselves, akin to MIT which appropriated the term CityLab and turned it into a trademark and tradable asset.

3.2.3 Industry

Industry is also active in shaping „smart cities". At a larger city scale, industry advocates „smart grids". They are defined as various functional and technological (most likely business driven) additions of a digital layer to a grid during improvements and modernisation. This can apply to power lines as well as broadband infrastructure. „Smart grids" are said to provide reliability, flexibility in network topology, efficiency, sustainability, market-enabling demand response support, which means a platform for advanced services to cover latent demand.

Another concept which is linked to smart grids are „smart meters". They are deemed to boost energy company profits, peak demand management through remote control and kill switches – all that outside the control of the user, and arguably an intrusion into users" privacy. Critics consider them as un-transparent and over-complex rating systems. They also query their legitimacy of capturing, transmitting and organising massive amount of data collected from smart meters, as well as from other intruding „smart technologies" applied in buildings as well as in cities at a large scale.

3.2.4 Commerce and international agencies

It cannot be an accident that the global institutions which dominate the neo-liberal economic system, such as the World Bank,[31] the Asian Development Bank,[32] the OECD[33], and to some extent the UNEP[34] and the EU have taken up „smart cities" in their portfolios.

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[29] http://www.issy.com/numerique. See the city's website: Smart City+, la plateforme de services d'hyperproximite. Citizens can test the platform of new digital local services and provide feedback.

[30] Caragliu, A., Del Bo, C., Nijkamp, P.: Smart cities in Europe. Series Research Memoranda 0048. VU University Amsterdam, Faculty of Economics, Business Administration and Econometrics (2009) http://ideas.repec.org/p/dgr/vuarem/2009-48.html

[31] World Bank: „smartness is about doing more with less". Also: „support of the role of the private sector in partnering with („smart) cities" http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSDNET/0,,contentMDK:23146568~menuPK:64885113~pagePK:7278667~piPK:64911824~theSitePK:5929282,00.html

[32] http://www.japantimes.co.jp/text/nb20121101a8.html

[33] OECD: „…"smart cities" plan for future infrastructure needs and avoid replicating haphazard past practices."

[34] UNEP was supporting „climate - smart cities day" at the 2013 UN Climate Change conference, Warsaw

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3.3 Putting „smart city“ into context of other city typologies

It is worth remembering that all these reflections and policy options apply also, for example, to the „sustainable city“, thus blurring the boundaries between „smart cities“ and other „adjectified“ cities, at least in the wider sense.

The question remains whether there is a dichotomy or contradiction between the narrow and the wide understanding of „smart city“, or whether these two interpretations can relate to a common denominator, namely their common claim that they intend to improve „quality of life“. If so, this claim is shared with many other „adjectified“ cities”: sustainable, resilient, healthy, liveable, creative cities for example. The question is whether they share the same understanding of „quality of life“, whose quality of life, provided by whom?

It could be argued that for the narrow interpretation of „smart cities“ „quality of life“ is confined to comfort in the home, (or at the workplace, and to a lesser extent for leisure activities), provided by ICT controls and monitoring of household appliances and building services. However, these objectives are shared by other „adjectified“ cities. For example, Siemens refers to „sustainable cities”[35] or „green cities”[36] when it relates its technological expertise to „quality of life“:

„…use intelligent networking capabilities to bring together people, services, community assets, and information to help community leaders address these world challenges…”[37]

Taking the example of „eco-cities“, they promote „quality of life“ driven by more ecologically responsible lifestyles assisted by technological solutions. They claim to provide:

„…opportunities for ecological, technological innovation, application of information and communication technologies..”[38]

„Eco-cities“, „sustainable cities“, „intelligent cities“ „connected cities“ have other communalities with „smart cities“ at city scale when they consider themselves as hubs for knowledge intense, competitive economic activities, or nodes in interconnectedness of urban systems in need for integrated networked solutions. There may be many more ICT driven attributes which these various city types are sharing, thus it may be difficult to establish what distinguishes them.

The question remains: if the aim of „smart cities“ is to achieve a higher „quality of life“ and better management of scarce resources, how does that distinguish them from just „cities“ which surely share these aims?

4 IMPLICATIONS OF “SMART CITY” APPROACHES FOR PLANNING

Planning contains a normative dimension. For that reason, „smart city“ protagonists are lobbying for the inclusion of „smart city“ standards in planning, alongside „smart city“ policies. To that end they need to establish accepted measures, in this case related to the improvement of „quality of life“ and „efficient use of finite resources“. These objectives are not confined to „smart cities“ though, which have resorted to „eco-cities“ for their aspiration to deliver measurable improvements. Simon Joss leading the „International Eco-Cities Initiative“ (IEI) hosted at the University of Westminster,[39] has participated in the initiative to standardise „smart cities“ akin to „eco-cities“ for which IEI has elaborated indicators, standards and benchmarks to make these concepts operational for city planners and managers.

Other countries (Germany, the UK, China, Korea among them) are working towards national „smart city“ policies and the inclusion of Public Available Specifications (PAS). PAS 181 proposes a Smart Cities Framework which postulates the inclusion of „smart technology“ into planning. Such proposals for

http://www.unep.org/climatechange/ClimateChangeConferences/COP19-new/Events/tabid/131172/ModuleID/189510/ItemID/132/mctl/EventDetails/language/en-US/Default.aspx

35 http://www.thecrystal.org/

36 The Green City Index, Economist Intelligence Unit, sponsored by Siemens, 2012 http://www.thecrystal.org/assets/download/120724_GCI_SummaryReport_final2.pdf

37 http://www.cisco.com/web/strategy/smart_connected_communities.html

38 Simon Joss. Smart-cities-Blog-Dec-2013.pdf

39 Joss, S., Cowley, R., and Tomozeiu, D. 2013. „Towards the „ubiquitous eco-city”: an analysis of the internationalisation of eco-city policy and practice.“ Journal of Urban Research & Practice, 6:1, 54-74. University of Westminster.

„blueprint" „smart city" design can be perceived as a recycling of blueprints previously put forward under the heading of „sustainable city" or „future city".[40] Some countries go even further and seek to devise „model smart cities", inspired by Masdar in the UAE and Songdo in South Korea. However, critics consider these examples „sterile enclaves",[41] arguably not ecological, nor even equivalent to „garden cities of tomorrow" which themselves have dubious ecological credentials.

A trend regarding controls of existing cities, urban management, growth and development has become detectable. Many cities, and especially the self-designated „smart cities" in the narrow sense are adopting targets, indicators and/or standards for building technologies and are incorporating „smart grids" into the city. Citywide „smartness" occurs more likely in new towns designed on greenfield sites, many in the emerging economies of Asia. In existing cities, „eco-city" (or „smart city") indicators and certification are incorporated into planning policies to make cities „smarter".[42] The examples of Songdo and London are used to illustrate these approaches briefly.

4.1 Songdo, a greenfield „smart city"

Songdo being built on the outskirts of Seoul in South Korea lends itself well to illustrate the (con)-fusion between „smart city", „eco-city", „green city", „digital city" and much more. Not surprisingly, it has been included in a discussion about Asian „eco-cities.[43] This project designed by Foster and partners with Arup and developed by American „Gale International" has all the techno-gadgets to run utilities and appliances.[44] Yet, such a „smart city" may well be utopic in its ambition to reproduce „the diversity and vitality that organic development creates in and of itself"[45] in less than two generations. Meanwhile, Songdo is the most hyped of the Asian „smart cities". However, Yokohama in Japan was the true precursor in establishing a comprehensive, integrated masterplan to retrofit the city with every possible ICT input, elevating it initially to a „digital city", later to an „eco-city", and now to a „smart city".

4.2 London, a retrofitting „smart city"

London has adopted the „smart city" brand with gusto. It has produced a „Smart London Vision";[46] a „Smart London Board" in 2013 led by Ricky Burdett[47] and a „Smart London Plan"[48] targeting businesses, investors, researchers, etc. with the aim to integrate opportunities from new digital technologies into the fabric of London, incorporated in a „Smart London Export Programme". It is worth noting that the pioneering interactive London Datastore[49] predates these initiatives and has arisen from one of the most advanced municipal Intelligence and Research services which had generated open data at the Greater London Council, abolished in 1986. London is a typical example of how „smart city" has been added to previous „adjectified city" tags, such as „world class city", „creative city". „zero-carbon city".

Nevertheless, London has a very long way to go in retrofitting its ancient housing stock into „smart" uses, upgrading its Victorian infrastructure - sewage, water mains, public transport, waste disposal, and to reuse waste heat, increase efficiency in energy use, and supply digital broadband and wifi facilities which are much more advanced with wider coverage in many other cities. The „smart London milestones" are spelt out in the „Smart London Plan". They include the delivery of a pan-London digital inclusion strategy by the end of 2014, as well as networking with „Future Cities Catapult", „Connected Digital Economy Catapult" and

[40] http://theurbantechnologist.com/2013/06/17/how-to-build-a-smarter-city-23-design-principles-for-digital-urbanism/ How to build a smarter city, 23 design principles for digital urbanism, 17 June 2013.

[41] Anthony Townsend, at Economist debate about „smart cities" 13 February 2014. http://www.smartcitiesbook.com/

[42] These two approaches are discussed in: Judith Ryser, 2013, Eco-cities in Action, sustainable development in Europe: lessons for and from China? To be published by the „EU-Asia Dialogue, shaping a common future for Europe and Asia, at the East Asia Institute National University of Singapore.

[43] Judith Ryser. 2013. Asian Eco-Cities, a critique. In: FuturArc, the voice of green architecture in Asia, march-April 2013, I Volume 29.

[44] http://inhabitat.com/songdo-ibd-south-koreas-new-eco-city/

[45] Jonathan Thorpe, CIO for Gale International. Quoted on BBC News, Technology, Lucy Williamson, 020913.

[46] http://www.london.gov.uk/priorities/business-economy/vision-and-strategy/smart-london/smart-london-vision

[47] Ricky Burdett, director of LSE Cities, professor of urban studies and co-editor of The Endless City, the urban age project by the London School of Economics and Deutsche Bank's Alfred Herrhausen Society. Phaedon 2007

[48] https://www.london.gov.uk/sites/default/files/smart_london_plan.pdf, chaired by David Gann, Imperial College London

[49] http://data.london.gov.uk/. It also includes maps which shows the spatial distribution of London characteristics.

„iCity Programme“ and setting up a „Smart London Innovation Network“. Various programmes aim to support SMEs and a „Smart London Platform“ should enable Londoners to provide feedback on their „smart city“ experience. Much is made of the 2012 Olympic legacy, but the Wellcome Trust, a pioneer in „smart“ health research was turned down for relocation on the Olympic site.

While Songdo can factor in infrastructure needs for its longer term future at the outset, something the Victorians did for London, retrofitting a city which has lived of the foresight of its forefathers for a long time is a much greater challenge, especially as it is expected to be financed by the private sector.

5 CRITIQUE OF “SMART CITY”

It is not surprising that the „smart city“ notion has its critics.

„The whole smart city concept… well, it is marketing, you know. There is the actual worry that cities are becoming unsustainable in all sense, so academics are worried about it; then politicians add that worry to their discourse, in order to get votes, and then companies go after them trying to sell them new solutions for cities to become „smarter”…”[50]

The divisive issue is an economic-technological approach as opposed to fostering social, cultural and political plurality and diversity of cities and city life. Traditionally, information was used in the city for the purpose of city living characterised by production, concentration and exchange of information. This amounts to top down centrally controlled information aiming at „city efficiency“, as opposed to bottom up diversity and fuzziness as fertile ground for creative activities, including low-tech „smart“ solutions. Top-down techno-interventions are a far cry from Patrick Geddes“ conservatory surgery to heal cities. In today’s circumstances the decentralised autonomous initiatives are also taking advantage of ICT, albeit in terms of crowd sourcing and social networks.

5.1 Greenfield site requirements and central controls

A specific worry is that the „ideal type“ of „smart city“ models requires building on greenfield sites. This in itself can be seen as an unsustainable direction of urban development with drastic implications for future spatial policies and land use. This is particularly critical as the „smart city“ industry is less sanguine about much more costly retrofitting of existing cities where the majority of people live at present.

Another preoccupation is that owing to their „digital city“ innovations „smart cities“ lend themselves to centralised remote controls from where various urban systems could be digitally lined-up and coordinated into an overarching information system which may eventually fall into a handful of global ICT corporations. Such loss of control over urban management may not be welcome by all planning authorities. Naturally, the alternative bottom-up ecological movements contest this „big brother“ prospect and object even to new centrally controlled public safety networks proposed for existing cities like New York. For them, the ubiquitous approach to urban design and planning which aims to turn cities into „smart cities“ or to create „smart cities“ on greenfields, contrasts with the organic evolution of cities, their local specificity and dynamic diversification often manifesting themselves despite top down planning, but which in their view makes them fit for ever changing purposes driven by human activities. They reckon that just to call cities „smart“ does not make them „smart“.

5.2 The Economist debate

The recent debate organised by the Economist[51] asking „Are Smart Cities an Empty Hype?” reflects some of these controversies. Although its tenor was mainstream techno-neo-liberal, expressed by Ludwig Siegele, the moderator in his remarks that while cities generate the world’s wealth, novelty and human interaction, they also produce a vast amount of data which needs to be put to use. Integrated systems of collecting, processing and acting on this data are seen to equate with a „second electrification“.

Supporting the motion, Anthony Townsend, director of the Institute for the Future states that

„…the quest to centralise the distributed and messy yet highly resilient intelligence of existing cities within a single network or piece of software appears quixotic at best…”

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[50] Peter Madden, Chief Executive, Future Cities Catapult, https://futurecities.catapult.org.uk/. Open Data Synchronisation for the City of Manchester, etc.

[51] http://economist.com/debate/days/view/1044

He sees a role though in the new utopia of „smart cities“ for bottom-up start-ups, NGOs, civic hackers, etc. who come up with innovative „smart city“ services.

Irving Wladawsky-Berger, VP Emeritus and IBM strategic adviser of Citygroup at the Harvard Business School counters that with the view that:

„…platforms are software frameworks designed to make it easier to develop, run and integrate applications of all kinds and will play a major role in the evolution of smart cities. „

His view about bottom-up protagonists is to balance their contribution with top-down actions, something the web, the internet and Linux have succeeded in doing. Not surprisingly, the debate remained inconclusive, but offered an opportunity for views to be aired from all walks of life.

Negative effects of „smart cities“ which were addressed in the response to the economist debate and elsewhere[52] focus on the intrusion into personal privacy, excessive surveillance, no personal control over personal information, as well as the threat of hacking into „smart“ systems which control appliances in the home and on-line public urban services. For Adam Greenfield,[53] a city’s logic is based on chaos and diversity. Thus, subjecting „smart“ citizens to the logic of algorithm could amount to authoritarianism rather than freedom. More generally, ICT controlled dependency makes for self-absorbed, self centred people trapped in epistemic bubbles, unable to communicate meaningfully with others, or acknowledge other’s ideas. He also criticises quantification of „smart cities“ which cannot be neutral and opposes the „smart city“ model to the „open city“, which uses information gathering and sharing to empower citizens and inform political debate to improve the city by resorting to a decentralised structure of autonomous local collectives.

6 “SMART CITY” OR JUST “CITY”?

How many smart cities are there compared with (self-appointed) sustainable, liveable, resilient or other „adjectified“ cities? How many overlaps do exist between „adjectified“ cities which use several of them together?

Must crucially, what distinguishes „smart cities“ from „ordinary“ cities? It is hard to imagine a city and its protagonists who would want to be „unsmart“ in their ambitions for their city, its management and its future. Does the notion of „smart city“ vary with geography, culture, stage of development? Not much information exists on the emergence of „smartness“ from this broad perspective.

Most of the technological innovations and measures which „make“ „smart cities“ are adopted by many cities. An operational question is whether „smart cities“ generate greater „quality of life“ than incorporating technological innovation in different shapes and forms into ordinary planning measures.[54] Where „smart cities may differ from just „cities“ is in how these digital controls are operated: where, by whom, at what cost and to whom? Some cities may wish to offer greater transparency, accountability and decentralisation of such powers than what seems to be on offer by „smart cities“ currently.

What may be symptomatic, and not universally welcome about the notion of „smart cities“ - and other „adjectified“ cities before them - is the relentless generation of alternative „adjectified city“ models aiming to impose frameworks for „quality of life“, together with the inordinate efforts of industry to appropriate these „ideal type models“ for its own aims. This tension between the „adjectified cities“ and the „refuseniks“ may well point to a profound (if not paradigmatic) change, expressed in the refusal, at least by a part of society, to have their „quality of life“ slotted into a binary existential contradiction, a choice between backward poverty and material wealth. The cities are the place where these contradictions are being played out. No longer either-or, the solutions point to and-and, and-or, or-or and something else altogether.

This refusal of being compressed into a binary model emerges all over the globe. The uprisings are no longer between two opposing parties, two ideologies, probably since the end of the cold war. Today they are driven by a wide range of aspirations which need to be accommodated in what can only be a new model of

[52] http://io9.com/the-dark-side-of-the-smart-city-1512608758

[53] Adam Greenfield, 2013, Against the Smart City (the city is here for you to use, e-book, Amazon, Do projects, New York City

[54] see IMPP, International Manual of Planning Practice, 2008, Judith Ryser and Teresa Franchini (eds) Isocarp, to be updated in 2015.

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governance and by extension in a different urban environment enabling a wide range of urban living and „quality of life“.

One manifestation of this are the „slow cities”[55] whose inhabitants are in favour of an alternative mode of living. They aim to reduce the ecological footprint of cities to contribute to sustainable planetary living. For such alternative movements the only hope for „cracks”[56] in the trend towards monopolistic domination of urban everyday life by the global corporate ICT industries and their investors is for them to fail in their effort to create a unique system with unique standards which would enable them to dominate the global „smart city“ market.

Finally, are „smart cities“ improving the quality of life of city users, smart of not, inclusively and equitably? From the above discussion it is clear that the jury is still out on this.

[55] Cittaslow, started this movement in Italy in 1999 inspired by the slow food organisation. Interestingly, Cittaslow which accepts only cities with less than 50,000 inhabitants is also asserting accreditation.

[56] See, for example, John Holloway, 2010, Crack Capitalism, Pluto, and John Holloway, (2002), 2005, Change the World Without Taking Power, Pluto.

Note: all the cited websites have been accessed January/February 2014.

reviewed paper

Quality of Time Spent Matters!

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1 ABSTRACT

The paper discusses an innovative approach towards addressing and measuring quality of living environments. It introduces the model which talks about quality of living environments via quality of time spent in user's daily routine. It examines relationships between characteristic profiles, their activities and the environments they are involved in, analysing three key parameters: time balance, financial balance and time-quality balance. Time balance shows how comfortable the time is offered to the user by his/her living environments. Economic balance is a category which represents user's incomes and expenses for necessary and optional activities. It represents a financial frame within which the user is flexible to be able to perform its activity in a certain environment. Time-quality balance is the final measure of quality provided with the proposed model. It classifies time spent regarding the activity and the environment in which the activity is taking place as well or badly spent time. Time-quality is expressed by time-quality coefficient KTQ. The model shows whether a segment of population can live in certain area and how comfortable.

2 INTRODUCTION

A general standpoint of this paper is that quality of living of any society begins with the quality of living for individuals. Therefore, one must bear in mind that any intervention in the environment must serve its user(s) well. This also means that when aiming for some (new) development, it is necessary to know this user, his/her habits, expectations and most of all the abilities to achieve well-being and consume the offer of the area he/she lives in fully (Goličnik Marušić, 2011; Goličnik Marušić and Marušić, 2012). A specific standpoint of the paper is that it is crucial to achieve well-being especially via optimisation of consumption of time, optimisation of services and reduction of costs. The paper addresses a spatial interaction model which assesses quality of space for certain use (activity) and certain user (profile) via analysis of quality of time spent for that activity in a particular space or sequences of spaces. It is based on temporal evaluation of places and is able to assess effectiveness of human environments for living. The motive is how to come to real life in certain area, real people, real economic frames as well as spatial characteristics as close as possible, and set up a time-place oriented approach (Marušić and Goličnik Marušić, 2014). The challenge is in searching for the approach which may address quality of living quite directly and describe it with simple everyday measures which are shaping our daily routines and which reflect on actual living situations as much as possible.

Quality of living is reflected in a notion of quality of life (e.g. Allen and Gibson, 1987; Norris, 2001). Approaches for modelling quality of life have been developing for some decades (e.g. Albouy et al., 2013; Lora and Powell, 2011; Baker and Palmer, 2006; Blomquist, 2006; Gabriel and Roshental 2004). Literature review shows that although quality of life is recognised as a general concern, there is little consensus of a definition of quality of life or the factors/ predictors of an individual's quality of life (e.g. Bramston et al., 2002; Michalos, 2003). There is still a lack of focus on detailed, actual, local level aspects, despite of the fact that many strategic documents as fundamental objectives for smart, sustainable and inclusive growth put the importance of local development towards quality of place and well-being of people. However, actual implementation of such objectives into real life situations, in scale 1:1, is often vaguely realised.

The paper introduces the prototype of the model and shows how the model can work. It debates basic initial ideas and conceptualises the model for simulation and valuation of quality of living based on measures of quality of time spent at daily routines of representative profiles in selected environment. Key indicators to calculate possibility and comfort of living in the given environment are time balance, financial balance and time-quality balance.

3 CONCEPT

Many approaches for assessing or measuring quality of living aim for comprehensive concept of quality of life, referring to social, spatial and economic aspects (e.g. Diener and Suh, 1997). However, in finalisation

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focuses on some priority aspects and actual comprehensiveness are a bit lost. Also, none of them suggests any universal measure which can be equally applicable wherever. Our model suggests time as the universal expression and measure of quality of living.

The assumption is:

- Quality of time spent indicates quality of living environments.

Further assumption is:

- Quality of time spent depends on that what a person can afford.
- A common denominator for evaluation of quality of living environments is a measure of good/bad time.

This calls attention to introduction of time-distance units and time as a quantification of quality for basic measure in the model. The real issue is in examining and measuring a temporal distance; a consumption of time over certain distance between two places, defined by the means of transport and the type of way and regime applied upon it. Such idea is not new. However, this time issue in spatial planning has not been sufficiently transformed into wider frame, over the transportation studies, towards a measure for quality of living. The aim is to address quality of living via quality of time spent within peoples' daily routines.

Paying attention to users' daily routines in their environments as much as possible reflects a bottom-up approach. As a method and evaluation tool for quality of place in relation to its usage behavioural mapping is valid, where GIS behaviour maps extract behavioural evidence into layers of spatial information to give a better understanding of the individual and collective patterns of use that emerge in a place (e.g. Goličnik Marušić 2011; Goličnik Marušić and Marušić, 2012). Besides, to get as thorough insights about people and places as possible, field work analysis, focus groups interviews and analysis of publicly accessible databases as well as available planning documents are proposed to be analysed.

Model development process represents a set of necessary steps where the first are characteristic for their descriptive nature, while further and final steps are characteristic for the decision-making character. They are:

- Provision of adequate database (e.g. demographic, socio-economic data)
- Identification of the profile(s) (e.g. users)
- Definition of the scenario for each studied profile (e.g. minimal and optimal scenarios for each selected profile)
- Valuation of the location

3.1 Quality of space via quality of time spent

There is no absolute measure of quality of living space. Quality of one space may be defined in relation to another known or defined quality. Parameters of quality depend on purpose of space (urban amenities) and/or space user(s). Something that is important for one user may not be as important for another or may not apply for other user at all.

User's time spent in certain space is valuated as good (the best), bad (the worst), or something in between. Accordingly, satisfaction with time is valuated with scale from -100% satisfaction (complete dissatisfaction) to +100% satisfaction (complete satisfaction), where 0% satisfaction would mean that user is indifferent to time spent in certain space. In such valuation positively signed percentage of satisfaction is transformed into "good time"; negatively signed percentage into "bad time"; the rest is "indifferent time".

3.2 Schedules and users' characteristics

As the model aims to address real life situations as much as possible, the smallest possible unit must be defined for the scale studied. To be able to simulate behaviour of population, behaviour of individuals needs to be known. In this model behaviour is defined by three significant situations: daily routine, weekly routine and extraordinary routine. Those routines are described in relation to individual's needs, obligations and desires. In a personal level (e.g. home) control over the relationships between realised desires, needs and offer is manageable and liveable places in relations to wishes and expectations are often achieved. In bigger scales and more complex environments, where to achieve liveable environments, needs and expectations of many individuals are in question. The smallest common denominators about qualities of living environments must be found.

On the basis of individuals' profiles it is possible to define limits of population of the studied area and edge conditions of/for such population within the area. An average profile does not help to understand the population, its needs, expectations or obligations. It is necessary to define some characteristic individual profiles which can help to describe the population in the studied area. Such profiles are set up from available statistical data or any other relevant source (e.g. questionnaire) regarding demographic and social parameters such as: age, gender, family status, education, occupation, income, and the like. Based on crucial boundary characteristics all possible variations of individual profiles, which are assumed to be realistic, are defined. Realistic profiles are designed by logical filters or on the basis of known data about the population of the area of interest. Having defined possible real boundary profiles of the population, the assumption (for further development of the model) is, if those boundary profiles are satisfied, all profiles within the studied segment of population are covered.

To get as thorough insight as possible into a segment of population daily routines of boundary profiles are important. There are as many routines as there are boundary profiles. However, there can be less different routines as there are profiles, as some profiles can have the same daily routine.

3.3 Properties of place

There are two basic types of properties of places: programmes in places and communications between them. Necessary programmes are, for example, dwelling, working, attending to the basic services. Other activities within a daily routine are classified as optional or desired, such as leisure, recreation (e.g. sport, culture) and other services (e.g. hairdressing). Each such spatial component - programmes based in the building or in an open space and the communication between them - has its basic purpose. Places are evaluated against their prime purpose as well as to any other potential activity they might stimulate. Thus two components of the place are taken into consideration:

- what a person is doing in a place and,
- in what kind of environment the activity is taking place.

Both components are valuated with quality of time spent. Final suitability of the location for one ore more activities is valuated with quality of activity component of time (FQAC), i.e. quality of time involved in action as such, and quality of spatial component of time (FQSC), i.e. quality of time spent in a certain environment. There is a third parameter which links these two components of time (activity component FQAC, spatial component FQSC) by weight (FWAC, FWSC), i.e. how much of an influence has each of the components on quality of time spent in a place for this certain activity. This ponder depends on profile's preferences. Final results are measured in coefficient of time-quality and quality time balance (see KTQ and TQ in Table 1).

3.4 Time-people-place notion-base of the model

The assumption "quality of time spent indicates quality of living environments" can be paraphrased into: Less time spent for commuting (e.g. to work, to recreation or other services) and more time to have for any kind of leisure (e.g. theatre, recreation), better quality of life can a person live. What a person can afford depends on what is available and for what price. This is of course limited by person's budget. Nevertheless, budget is only the frame within which a person can manipulate his/her choices and appoint the amount of money for a desired activity. Proposed concepts and ideas are illustrated with two simple examples.

In the first example, there are two different valuations of the same time by two different recreational swimmers (S1, S2): Each of them pre pays time-tabled hour of swim (6 EUR). They are both running late for 5 minutes. S1 does not want to loose any minute of swimming and takes a taxi to the swimming pool. He arrives on time. S2 walks to the swimming pool along the nice neighbourhood and arrives 10 minutes late. As they both have to finish swimming at fixed time, S1 has been swimming for 60 minutes, S2 for 50 minutes. However, S2 considered his walk as valuable as swimming; so, S2 does not feel he lost 10 minutes of recreation. Moreover, S2 might even feel he gained 5 minutes of recreation. S2 did not spend any extra money. S1 completed his 60 minutes of recreation and spent some extra money for a taxi.

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To sum up, S1 paid 6 EUR for swimming pool and 6 EUR for a taxi to enjoy 60 minutes of swimming. The price was 12 EUR for 60 minutes of recreation. S2 spent money only for swimming pool. The price was 6 EUR for 65 minutes of recreation (50 minutes of swimming + 15 minutes for walking). They both spent 65 minutes for both activities commuting to the pool and swimming in the pool, but they were willing to pay different price for the same thing (swimming). S1 paid 12 EUR for 60 minutes of swimming (20 cents/ 1 min of swimming); S2 paid 6 EUR for 50 minutes of swimming (12 cents/ 1 min of swimming). Time spent in the swimming poll as well as time spent for commuting to the pool they valuated differently.

When addressing quality of living, quality of time spent for recreation matters. Let's illustrate further. Both persons earn the same per working hour (e.g. 12 EUR). As shown above, S1 had 60 minutes of good time (recreation), S2 had 65 minutes of good time (recreation). Speaking in time-dimensions, for these 60 minutes of good time, S1 consumed one working hour and 5 minutes of taxi driving, i.e. 65 minutes of bad time (time spent for working is considered as a bad time). S2 spent 65 minutes of good time and consumed for that only half working hour, i.e. 30 minutes of bad time. The value of and the price for time spent differ very much. S2 gets higher value for lower price.

In the second example, there are two persons (P1, P2) with different incomes who go for 60 minutes of swimming. There are three time corpuses which matters: time for swimming, time for going there, and time of work in which a person earns enough to be able to swim and go to swimming. P1 earns 72 EUR/h, P2 earns 12 EUR/h (P1earns 6xP2). Swimming hour costs 6 EUR. If P2 is walking to the swimming pool for 10 minutes and swimming for 60 minutes he/she must work for that commodity for 30 minutes, as the only cost is the entrance to the swimming pool (6 EUR). So, for 60 minutes of swimming (good time) P2 has to invest in total 40 minutes of commuting and working (bad time). If P2 takes a taxi to the swimming pool it costs 6 EUR and takes 5 minutes. In such case P2's time balance is as follows: for 60 minutes of swimming (good time), P2 invests 5 minutes of commuting and 60 minutes of work (30 minutes to pay a swimming pool and 30 minutes to pay a taxi). In total, for P2 the bad time (65 minutes) prevails the good time (60 minutes). So, to keep living good in the area P2 cannot afford to take a taxi to the swimming pool.

On the contrary, for 60 minutes of swimming and going there by foot, in time measures P1 spent 10 minutes for walking and 5 minutes of working hour for the entrance. So, for 60 minutes of a good time (swimming) P1 invests 15 minutes of bad time. In case that P1 takes a taxi, situation in terms of time-quality balance is the same: for 60 minutes of swimming P1 invests 5 minutes of commuting by a taxi and 10 minutes of work (5 minutes for paying a taxi, 6 EUR; 5 minutes for paying the swimming pool, 6 EUR). In the case of the person who earns more money (P1) the price in bad time for the unit of good time is the same in both arrangements. For such a profile it is irrelevant which way of transport to the swimming pool the person chose, while the other person makes his/her quality of living much worse. If chose to go by taxi the total balance is 5 minutes of bad time and 0 minutes of good time.

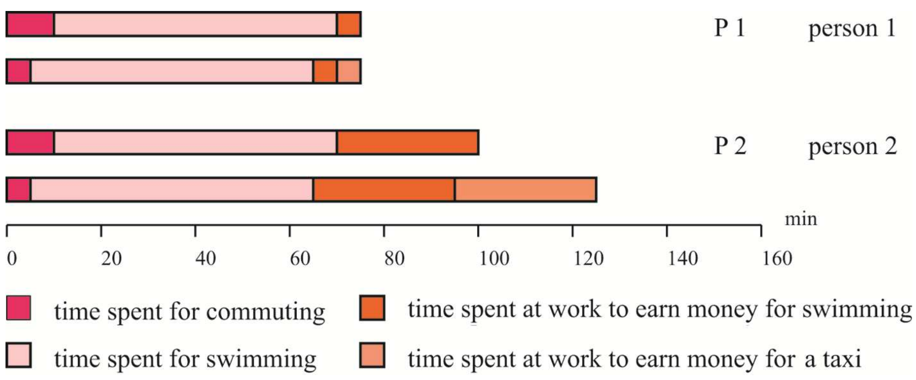

Fig. 1: Time spent for direct involvement in recreation related activities and time spent for investment in recreation related activities.

4 MODELLING: ITERATION PROCESS

Having behavioural patterns and peoples' daily routines in mind, the main points of departure for the modelling process reflect aspects grounded at the beginning of the paper:

- For quality of living, quality of consumption of time matters.
- Quality of living of a person reflects in how well he/she can spend and is spending his/her time.

- Various environments enable various quality of living, i.e. various quality of consumption of the available time.

Translating it into model iteration process there are three key analyses to be followed:

- time balance,
- financial balance and
- time-quality balance.

Time balance shows how a chosen routine is manageable for an individual in the available time. It shows if a person can achieve necessary and optional activities within an available limited time frame (e.g. 24 h/day). Financial balance shows if these selected activities can be afforded per person within a household. This is that incomes and expenses of a household per person enable these activities to be fulfilled. When financial situation allows the activities can happen, then time-quality balance shows how well the time needed for them has been spent in total; i.e. how much of the entire time taken for all the activities per day is considered as being good quality and how much of bad quality. This balance shows final quality of time spent within a routine and reflects on quality of living environment one lives. The sections below show some examples.

4.1 Time balance

Time spent for each action should be shorter or equal to available time for that action:

$$T_{Rqi} \leq T_{Avi}$$

where

TRqi = time required for action i

TAvi = time available for action i

Sometimes one does not manage that, so the person is late. However, the minimum required condition, jet not always sufficient, is to do everything that is required in the whole available time (e.g. to do all daily routines in 24 hours):

$$\sum_i T_{Rqi} \leq \sum_i T_{Avi} \rightarrow T_{Rq} \leq T_{Av}$$

Time balance analysis shows balance of necessary and optional activities. The assumption is if the profile is not able to fulfil necessary activities, the neighbourhood is not suitable for such profile. If the profile is not able to fulfil optional activities, optional activities must be re-organised against a new priority list.

4.2 Financial balance

When discussing financial balance, the basic information addressed is household's incomes and expenses for necessary activities and optional activities. Expenses of a household should not exceed the incomes:

$$\sum_i M_{Rqi} \leq \sum_j M_{Avj} \rightarrow M_{Rq} \leq M_{Av}$$

where

M_{Rqi} = money required for expense *i*

M_{Avi} = money available from the source *j*

Accordingly, incomes are classified as regular (e.g. salary earned in working time every working day); other regular (e.g. pension, rent); and irregular (e.g. property selling). If the model assesses suitability of location for permanent living, then certain location suits its user if this user manages to live at the location with the regular incomes. This means that for his/her permanent living at the location, the person should not use any savings. Final important information is how much money is left after all necessary expenses and what a representative of the profile can do for that money.

Expenses are classified as residential expenses; basic basket expenses (e.g. food, clothes); other necessary expenses (e.g. nursery, school); other optional expenses; and travel expenses for commuting at daily routine. Residential expenses depend on location, but vary at the location regarding the profile. This means that more levels can be recognised, e.g. basic, medium, and high. Similarly, basic basket expenses can vary regarding the prices different individuals are willing to pay for basic goods. Choosing medium or high level may represent optional expenses for residential expenses and expenses for basic goods. Savings are usually also important component of financial security of household and consequently influence satisfaction. Therefore the ability of household to make some savings in given environment is not negligible.

4.3 Time-quality balance

The point of this stage of the model is to extract the time spent for any activity into the good or the bad portion. The rest of the time not classified as good or bad is considered as indifferent portion of time. Time-quality balance may be expressed with time-quality coefficient:

$$K_{TQ} = \frac{T_Q}{T_{Sp}} = \frac{\sum_i T_{Qi}}{\sum_i T_{Spi}} = \frac{\sum_{ij} T_{Spi} \times F_{Qij} \times F_{Wij}}{\sum_i T_{Spi}} \quad \text{where} \quad \sum_j F_{Wij} = 1 \quad \text{and} \quad -1 \le F_{Qij} \le 1$$

where:

K_{TQ} = time-quality coefficient

T_Q = evaluated portion of time (positively signed – good time; negatively signed – bad time)

T_{Qi} = evaluated portion of time within the time interval *i*

T_{Sp} = time spent

T_{Spi} = time spent within the time interval *i*

F_{Qij} = quality of the quality component *j* within the time interval *i*

F_{Wij} = influence (weight) of the quality component *j* within the time interval *i*

In the examples in this paper at least two time-quality components are proposed:

AC = activity component

SC = space component

therefore:

$$j \in \{AC, SC\} \;\Rightarrow\; F_{Wi,SC} = 1 - F_{Wi,AC}$$

The activity component (AC) evaluates potential or most probable satisfaction with the activity within a given time interval, e.g. desired recreation or relaxation would be assigned +100%, driving a car ±0%, while compulsory hard labour -100%. The space component (SC) evaluates potential or most probable satisfaction with the place where activity is taking place for given activity within a given time interval, e.g. very suitable and stimulative place for certain activity would be assigned +100%, a very inappropriate and destimulative place -100%. The weight of each quality component (F_{WAC}, F_{WSC}) describes how much each component contributes to potential quality of time, e.g. potential satisfaction with the time spent in the given place.

Table 1 presents the examples of variation of daily routines of two persons (P1 and P2) when commuting by bicycle (P1b, P2b) or by car (P1c, P2c). They are neighbours living in the city. However P1 works closer to his residence than P2. Within the city centre travelling by bicycle is faster than by car due to hard traffic and parking problems, while for longer distances outside the city car is faster which reflects in time spent (T_{Sp}). From the activity a person is involved in point of view, it is assumed that time spent on a bicycle is more favourable than time spent in a car (F_{QAC}) and in this case also due to environment where this activity is performed (F_{QSC}). Cycle tracks in this city are more pleasant than busy city streets. Further, an influence rate (weight) of each component on the impression of the quality of spent time is assessed (F_{WAC}, F_{WSC}). With time-quality coefficient (K_{TQ}) quality of time spent within different routines and subroutines is compared. Perhaps is easier to understand this balance in the form of amount of quality time per routine or subroutine (T_Q). The negative balance means that performing a given activity in the considered environment is unpleasant for considered profile (i.e. user).

Simulating time-quality balance for the same profile, with exactly the same daily routine, living in the same neighbourhood, but at the other side, close to the heavy traffic road and railway line, would show that quality time balance would decrease, especially as quality of spatial component of time for sleeping, which in the previous case represents a great portion of good quality of time (8 hours), is considered as bad. In such case instead of having 12h 2’ of a good quality of time per day (example P1c in Table 1) the person has 9h 26’ of a good quality of time per day (K_{TQ} = 0.39).

		home	home	by bicycle/car	nursery/school	by bicycle/car	work	by bicycle/car	nursery/school	by bicycle/car	shop	by bicycle/car	by bicycle/car	gym	by bicycle/car	home	home	
		sleeping	preparation for go to work	going to nursery	dropping off children	going to work	working	going from work, to pick up children	picking up children	going from work, to do shopping	daily shopping and services	going home	going to recreation	recreation	coming from recreation	dinner preparation + dinner	home with a family	
P1b	T_{Sp}	8h 0'	30'	10'	5'	15'	8h 0'	15'	5'	10'	20'	10'	10'	2h 0'	10'	30'	3h 10'	24h 0'
	F_{QAC}	100	0	50	0	50	-20	50	0	50	0	50	50	100	50	100	100	
	F_{QSC}	80	80	-20	-10	-10	0	-10	-10	-20	20	-20	20	80	20	80	80	
	F_{WAC}	50	40	40	40	40	50	40	40	40	20	40	40	60	40	50	50	
	F_{WSC}	50	60	60	60	60	50	60	60	60	80	60	60	40	60	50	50	
	K_{TQ}	0.90	0.48	0.08	-0.06	0.14	-0.10	0.14	-0.06	0.08	0.16	0.08	0.32	0.92	0.32	0.90	0.90	0.50
	T_Q	7h 12'	14'	1'	0'	2'	-48'	2'	0'	1'	3'	1'	3'	1h 50'	3'	27'	2h 51'	12h 2'
P2b	T_{Sp}	8h 0'	30'	10'	5'	25'	8h 0'	25'	5'	10'	20'	10'	10'	2h 0'	10'	30'	2h 50'	24h 0'
	F_{QAC}	100	0	50	0	50	-20	50	0	50	0	50	50	100	50	100	100	
	F_{QSC}	80	80	-20	-10	-10	0	-10	-10	-20	20	-20	20	80	20	80	80	
	F_{WAC}	50	40	60	40	60	50	60	40	60	20	60	40	60	40	50	50	
	F_{WSC}	50	60	40	60	40	50	40	60	40	80	40	60	40	60	50	50	
	K_{TQ}	0.90	0.48	0.22	-0.06	0.26	-0.10	0.26	-0.06	0.22	0.16	0.22	0.32	0.92	0.32	0.90	0.90	0.50
	T_Q	7h 12'	14'	2'	0'	7'	-48'	7'	0'	2'	3'	2'	3'	1h 50'	3'	27'	2h 33'	11h 57'
P1c	T_{Sp}	8h 0'	30'	15’	5'	15'	8h 0'	15'	5'	10'	20'	15'	10'	2h 0'	10'	30'	3h 0'	24h 0'
	F_{QAC}	100	0	0	0	0	-20	0	0	0	0	0	0	100	0	100	100	
	F_{QSC}	80	80	-50	-10	-10	0	-10	-10	-50	20	-50	-50	80	-50	80	80	
	F_{WAC}	50	40	60	40	60	50	60	40	60	20	60	60	60	60	50	50	
	F_{WSC}	50	60	40	60	40	50	40	60	40	80	40	40	40	40	50	50	
	K_{TQ}	0.90	0.48	-0.20	-0.06	-0.04	-0.10	-0.04	-0.06	-0.20	0.16	-0.20	-0.20	0.92	-0.20	0.90	0.90	0.48
	T_Q	7h 12'	14'	-3'	0'	-1'	-48'	-1'	0'	-2'	3'	-3'	-2'	1h 50'	-2'	27'	2h 42'	11h 27'
P2c	T_{Sp}	8h 0'	30'	15'	5'	20'	8h 0'	20'	5'	10'	20'	15'	10'	2h 0'	10'	30'	2h 50'	24h 0'
	F_{QAC}	100	0	0	0	0	-20	0	0	0	0	0	0	100	0	100	100	
	F_{QSC}	80	80	-50	-10	-10	0	-10	-10	-50	20	-50	-50	80	-50	80	80	
	F_{WAC}	50	40	60	40	60	50	60	40	60	20	60	60	60	60	50	50	
	F_{WSC}	50	60	40	60	40	50	40	60	40	80	40	40	40	40	50	50	
	K_{TQ}	0.90	0.48	-0.20	-0.06	-0.04	-0.10	-0.04	-0.06	-0.20	0.16	-0.20	-0.20	0.92	-0.20	0.90	0.90	0.47
	T_Q	7h 12'	14'	-3'	0'	-1'	-48'	-1'	0'	-2'	3'	-3'	-2'	1h 50'	-2'	27'	2h 33'	11h 18'

T_{Sp} time spent (hours, minutes)
F_{QAC} quality of activity component of time (%)
F_{QSC} quality of spatial component of time (%)
F_{WAC} influence of activity component of time (%)
F_{WSC} influence of spatial component of time (%)
K_{TQ} coefficient of time-quality
T_Q quality time (hours, minutes)

by car (incl. walking and parking time)
by bicycle (incl. walking and parking time)

hour h
minute '

Table 1: Quality time balance for total daily routine for variations of P1 and P2, when commuting by bicycle or by car.

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5 PRACTICAL RELEVANCE

The main issue of the paper is reflected in the notion that quality of life is closely linked to the quality of place and quality of time spent in this place and its surrounding. Therefore, the capital challenge was to set up a time-place oriented approach for measuring quality of living environments. Why is this important? Why such approach seems to have the future? When addressing any local change spatial conditions for that change its related activities and quality of time spent in relation to that activity, matters! Complex development at local level which may suit their users best is hardly ever questioned.

Giving local scale, i.e. micro data, a bigger value and accepting cross-scales analysis enable gaining well informed knowledge about relationships between various elements and quality of living in local areas and their influential environments. Such notion represents an important starting point of developing of the model for valuation and simulation of quality of living environments, debated within this paper. However, reasoning further in terms of how to actually measure this quality of living environments represents the intriguing question which was addressed. As other known approaches (e.g. Blomquist, 2006; Baker and Palmer, 2006), the proposed model also addresses comprehensive aspects of quality of life (e.g. social, economic, spatial), but the novelty of the approach is in the way these aspects are linked together and finally translated into a universal measure: time. Basic outputs of the model are calculations of time balance, economic balance and time-quality balance.

Such calculated data are linked to locations and user profiles and are useful for:

- comparison of profiles within different locations of the area,
- judgement about suitability of certain location in the area for various profiles.

In the proposed model, understanding and defining boundary profiles is of key importance. They are defined as profiles bordering on two or more segments, depending on numbers of parameters used for defining boundaries. Analysis of the results for any studied segment of population show acceptability and quality of places for a particular segment of population. This enables to examine how well does a certain place suit this group of users and how well does it enable their co-habitation. Accordingly, examination of suitability of location for the weakest profiles can show which profile can reach the minimum satisfaction at certain location in the area. There can be different profiles recognised as the weakest at different locations within the studied area.

Basically, the model works as a tool for simulation of spatial polycentric development at different scales, from local to regional and for various subjects of interests. In the paper quite straight forward subject was addressed to discuss the model (individual living). However, by the analogy the subject can be any kind of entity which can have its specific characteristics and needs and can be described with significant routines and behaviour. This means that the model can be applied also upon business subjects as such, employees, customers and the like. To illustrate, there is an example what can be the most usual unit of examination at each specific scale. Basic unit of examination at the local scale is individual profile, defined either as a person, as exemplified and discussed in the paper, or as a local business or service. At the level of urban agglomeration the basic unit of examination is a community profile, a small group of individuals, e.g. creative industry unit profile. Taking into account broader and more influential area, let say sub regional level, settlement profile represented by medium group of people becomes in focus, e.g. public service profile. Talking about regional level, relations between urban centres and their influential areas become in focus. It addresses large group of people, most typically mobility issues.

The model itself exemplifies a development of new knowledge and innovation in the interchange of fields of urban planning, spatial development and territorial governance. It reflects an innovation via synergy of basic urban planning and design knowledge, creativity and mathematical modelling. It is designed as a tool that can help to simulate, direct and monitor spatial development and economy integration at the interface of regional and local levels. Its applications and use will show more practical advantages and disadvantages. Having rich database including GIS spatial, socio – economic and other derived time-related data can be presented on the maps. Such result can be a profile’s suitability map. When more profiles are involved, suitability map of a community would be recognised as a final output of the model. In terms of knowledge and innovation, the future challenge is in upgrading it as a web-tool to be used for simulation of placement of activities in places and assessing the suitability of social, physical and business environment for the tested activity. Therefore future challenges are in testing it at as many subjects and cases as possible.

6 CONCLUSION

Based on the notion of this paper, people-friendly cities and from this point of view smart cities are cities with minimum time waste for their users. They represent places where residents and other users are able to qualitatively spend their time. Furthermore, such cities must enable as broad spectrum of users as possible (e.g. considering peoples' age, socio-economic situations, ethnic groups, impaired people, etc.) to fully fulfil their needs and expectations.

Accordingly, time balance is a category which is place and user dependent, i.e. it is possible to be established when having defined a profile and the belonging space. Time balance is the initial result of the model representing the main tool for evaluation of suitability of the place for someone or something. It shows how comfortable the time is offered to the user by his/her (living) environments. Economic balance is a category which represents subject's incomes and expenses for necessary and optional activities. It represents a financial frame within which the subject is flexible to be able to perform its activity in a certain environment. Time-quality balance is the final measure of quality provided with the proposed model. Based on spatial characteristics, taking in to account the character of the activity and economic situation of the subject involved in the activity, it classifies time spent regarding the activity as such as well as the environment in which the activity is taking place as well or badly spent time. This time-quality balance must be examined for at least in three significant situations: satisfaction of/for crucial subjects, average satisfaction, and minimum satisfaction, i.e. satisfaction of the weakest profile. Finally, the quality is expressed by time-quality coefficient KTQ.

The applicable value of the model is in showing suitability of a certain location for a chosen profile in comparison with some other location for the same profile; or in showing suitability of a location for one profile in comparison to another. This is especially important when the aim is to simulate a community with certain characteristics represented via bunch of profiles, or at least with a boundary profile and the most common profile. Thus, the model can be applied for setting new development in a place, searching for measures for improvements, comparison of different locations for one particular use, and comparison for various measures in a certain location. When the subject in focus is a service or business, it is important, to understand that time balance and financial balance are analysed in terms of the subject of businesses or services as such, and that time-quality balance is analysed also regarding the employees there as well as regarding the customers.

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🏆 *reviewed paper*

Recycling Architecture: the Redefinition of Recycling Principles in the Context of Sustainable Architectural Design

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1 ABSTRACT

The sustainable management of city resources (land, infrastructure, suprastructure) is one of the crucial urban processes to which the ‘smart cities’ concept should be addressed. In other words, resource conservation is highly important question nowadays. Namely, only a small percentage of the total building stock is made up of new works. This inevitably means that the general refurbishment and adaptive reuse will significantly benefit the sustainability agenda in the next twenty years, which will, further, make our cities smarter. Since most buildings are physically suitable to various uses, flexibility and ‘long life – loose fit’ should be a guiding principle behind most design briefs. The recycling of existing buildings has several benefits, such as: decreasing the pressure on new land, preserving the embodied energy of building materials, saving new materials form being used, cutting the associated environmental impacts of producing and transporting new materials, and, finally, involvment the lesser generation of residues in relation to a totally new construction. Thus, the subject of this research relates to the definition of recycling principles for sustainable architectural design. According to this, contemporary literature on recycling in architecture has been evaluated, compared and analysed. It is hypothesised that in order to produce least environmental damage the recycling intervention should use as much of the original building’s material as possible. Thus, physical characteristics of the original building define which design principle is most adequate for its recycling. Such an literature overview enabled the creation of so-called recycling model, which establishes a link between the physical characteristics of underused buildings, on the one hand, and the design principle most environmentally sustainable for its recycling, on the other. This model provides a fresh understanding of how an extensive range of physical characteristics of building can be considered in a systematic way in order to choose the most suitable design principle in the recycling process. Its elaboration is the focus of the research.

2 SUSTAINABLE DEVELOPMENT AND CONSTRUCTION INDUSTRY

The influence of human activity on numerous subtle changes in the environment over time is becoming increasingly clear, from the bleaching of coral reefs and the polluting of oceans by regular oil spills, to the damage of human health caused by harmful processes, materials and buildings (Bragança & Cuchí, 2007). Out of all resources consumed across the planet fifty per cent are used in construction, which makes it one of the least sustainable industries in the world. However, contemporary human civilization depends on buildings for its continued shelter and existence even though our planet cannot support the current level of resource consumption (Edwards, 2005).

The definition of the sustainable development coined in the “Brundtland report” (1987) has spawned a series of sub-definitions to meet particular sector needs. Typical of these is that used by the practice of Foster and Partners, which defines the sustainable design as creating buildings which are energy-efficient, healthy, comfortable, flexible in use and designed for long life (Edwards, 2005). The Buildings Service Research and Information Association (BSRIA) has defined sustainable construction as the creation and management of healthy buildings based upon resource efficient and ecological principles (Edwards, 2005).

The Earth Summit (1992), United Nations Conference on Environment and Development (UNCED), included environmental degradation and resource depletion into their agenda. The discourse was broadened in “Agenda 21” and the “Rio Declaration” in which the principles of sustainable development were laid down. With the “Declaration of Interdependence for a sustainable future” at the Chicago Congress of the International Union of Architects (IUA) in 1993, architecture also joined the movement, and many national bodies and institutions of architecture began producing energy and environmental policies (Szokolay, 2004). The timeline of main environmental agreements is briefly shown in the Figure 1.

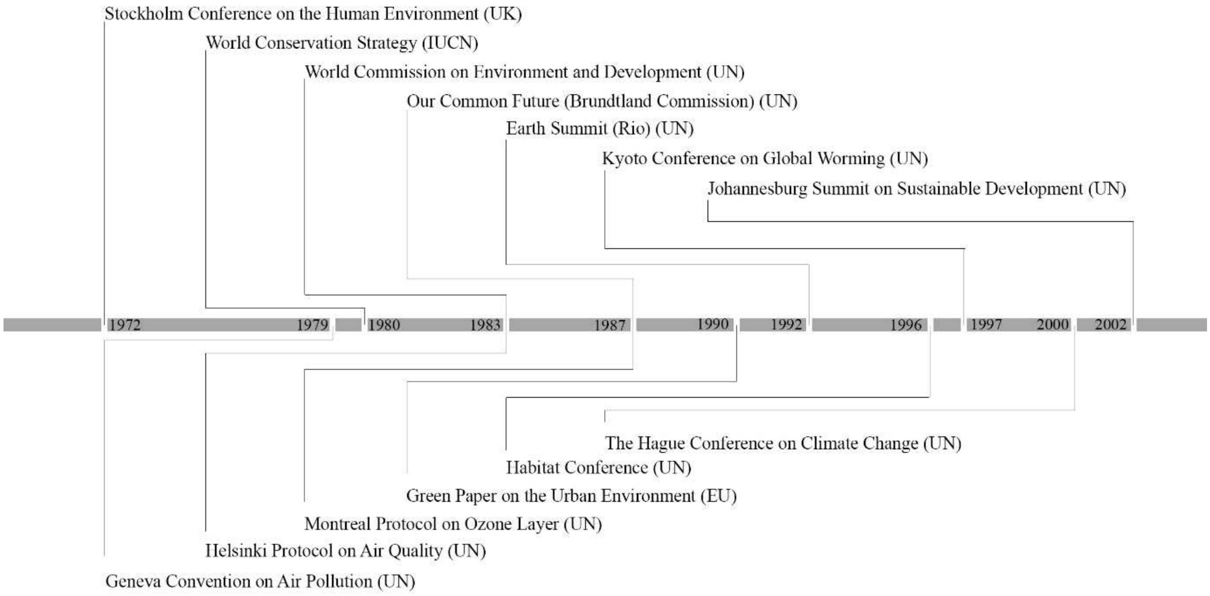

Fig. 1: Major global environmental agreements (Source: Author according to Edwards, 2005).

Unquestionably buildings are big users of raw materials. The environmental capital locked in buildings is enormous, as is the waste footprint, making them one of the biggest users of raw material. The waste produced from the construction and demolition activities constitute one of the biggest waste streams produces in Europe (Bragança & Cuchí, 2007).

It is not enough to develop principles for a sustainable design only for the new projects. The existing buildings must also be taken into account as structural issues are usually not the reason why buildings come to their end-of life, but rather the shift of the building’s original purpose, making the existing building unsuitable for new roles and functions (Lee, Trcka & Hensen, 2011). Existing buildings are crutial to any strategy for carbon-emission reduction. Buildings are durable goods which can reach 100 years of useful life or more and building renewal can extend the use of the existing buildings with diverse benefits, such as the exploitation of the existing urban infrastructure (with no need for new site development) and the lesser generation of residues in relation to a totally new construction (Bragança & Cuchí, 2007).

3 RECYCLING DESIGN PRINCIPLES

All major global environmental agreements state that recycling our building stock is one of the most effective strategies in reducing carbon footprint and environmental degradation in general. A number of publications have been written on what is considered ‘good practice’ of recycling architecture in general and of architectural design of an intervention on existing buildings. These publications are usually in the form of a catalogue, where projects are divided into several categories, usually depending on the intensity of the intervention, or in other words, the relationship between the old and the new. In contemporary literature dealing with reconversion of existing buildings projects are divided into three categories, where the alterations to existing fabric are of low, medium and high intensity.

The comparative analysis of four sources and their categorization of recycling prnciples, Brooker & Stone (Intervention–Insertion–Installation), Feireiss & Klanten (Add-On, Inside-Out, Change Clothes), Jäger (Addition–Transformation–Conversion) and Rogic (Coexistence–Imposition–Fusion), is conducted with the aim of understanding the logic behind the definition of these design principles.

3.1 Intervention, Insertion, Installation

The design concepts of Intervention, Insertion and Installation defined by Brooker & Stone (2004) are determined by the relationship between the existing and the new building, the host and the intruder. Depending on the level of the autonomy of the new elements, the recycling project gethered in their study fall into one of the described categories. This autonomy is represented both in structural terms, as the extent to which the new structure is dependant on the old, and formal-spatial terms, as the level to which the original building’s form and spatial organization influenced new design.

Intervention is defined as a process which transforms the host building, but new and old elements become completely dependent upon each other. Through this process the original building may be changed but Brooker & Stone explain that all the changes are informed by the original building, its volume, scale, geometry and in this process old and new become one. Yet in one of the projects selected as the representative of this design principle, Museum Küppersmühle by Herzog and de Meuron, it is clear that the intervention executed on the façade of the building disrups the symmetry of the host building and changes its appearance. Inside of the building, a number of floors were removed to provide space for large art pieces. A new element was added in front of the building, staircase, in a form of a prismatic tower which introduces new architectural vocabulary into the scene. It is not clear to which extent the original building can be changed and still fall into this category but it is evident that all the changes were influenced by the character and physical characteristics of the old building. In material terms all new elements are executed in materials clearly distinguishable from the old. In structural terms new elements depend on the host building.

Insertion is defined as a process through which a building accommodates new elements, build to fit, but stays very much unchanged. Its exterior remains largely intact but interior space is subjected to substantial change. Just like in the previous category, the new elements depend on the particular qualities of the host building, yet they have a much greater level of independency and can be even confrontational. The most obvious difference is in material expression as this design principle implies a clearest possible distinction between the old and new. Structurally the inserted elements can rely on the old building for its support, but can also be structurally independent, without touching the existing structure.

Installation implies complete separation of old and new, they simply exist together and very little rapport is established between them. Like with the design principle of Insertion, new elements can be structurally dependent or independent to the host building. In material terms new and old are completely at odds, and have their own formal logic independent form the original building. Jet the scale and dimensions of the new elements depend on the host building as these elements are usually installed into the old buildings space.

It can be concluded that the design principle of Intervention, even though it allows for a substantial change and disruption of the old building, implies the predominance of the old building as all the characteristics of the new elements depend on the character of the host building. Second design principle, Insertion, preserves the image of the old building but changes substantially its inner spaces, making both old and new equality present and dominant. The third design concept, Installation, implies the highest autonomy of the new elements, both materially and structurally, even though its scale and dimensions depend on the old building's physical characteristics.

3.2 Add-On, Inside-Out, Change Clothes

Just like in the Brooker & Stone's "Re-Reading", the relationship between the old and the new was the leading criteria in determining the design principles of recycling in Feireiss & Klanten's study "Build-On converted architecture and transformed buildings".

The design principle of *Add-On* includes all types of additions that can be executed upon the existing structure. This category is very broad as it contains both projects that simply restore the original structure by adding elements that follow the formal logic of the old, and also projects that almost completely change the face of the original building. One of the projects selected as representative of this design concept, CaixaForum in Madrid, shows that completely different architectural vocabulary was used for the new addition, both in material, formal and structural terms. The interior of the old building was also substantially changed. Compared to Brooker & Stone's principle of Intervention, the principle of Add-on allows for a much more aggressive approach to the host building's exterior and interior.

The second category, *Inside-out*, presents projects that change fundamentally old building's interior, but leave its exterior and appearance intact. The original image of the building stays almost unaltered just as in Brooker & Stone's principle of Insertion. However, in one of the selected projects for this category, Haworth Tompkins's Temporary Theatre, it is clear that the new intervention was completely governed by the old buildings spatial logic. New elements were simply placed in the open space of the derelict power station. New auditorium was made by following the spatial organization of the old building. Therefore it can be concluded that this design principle implies minimal change to the building's exterior. If any changes are made, they are always informed by the old building itself. Since this design concept follows a change of function of the host building a greater degree of alteration can be executed in buildings interior. New elements can be both structurally independent form the old building, following its own spatial logic or dependant on it, respecting the host building disposition of spaces. Nevertheless, as the new intervention is conducted within the host building, its scope, dimensions, rhythm and scale is completely dependent on the physical characteristic of the host building.

The third design principle, *Change Clothes*, implies the predominance of the new structure. The level of autonomy of the new element is the highest here, as in Brooker & Stone’s Installation category. This concept implies change not only to the building’s interior but exterior as well, changing it appearance completely. However, unlike the principle of Installation, which confines the change mainly to the building interior, this principle allows for the new element to break the formal logic of the host building’s exterior as well. The selected project for this category, Jægersborg Water Tower, clearly shows that, in order to gain more space, apartments units were allowed to protrude from the old building’s envelope. Even though this design principle should entirely change the face of the original building, it this project it is clear that the importance of the host building was recognised and its landmark qualities and appearance preserved.

It can be concluded that as in the Brooker & Stone’s classification the relationship between the old and the new was the leading criterion for the definition of design principles of intervening with the existing buildings. Yet here, it cannot be said that the dominance of the new elements rises from first to the last principle. New elements are executed in materials clearly distinguishable from the old in all three design concepts. The main difference between the first two concepts is the localization of change. The design principle of Inside-out confines the change within the old building leaving its interior unchanged while the concept of Add-on implies substantial change to the building interior as well. The third design concept, Change Clothes, just like the first one allows the change of the building’s formal logic as well, but should imply the higher level of alteration of the building fabric. There is no clear difference in structural dependence of the old and the new between these design principles.

3.3 Addition, Transformation, Conversion

According to Jäger (2010), the main criterion for the classification of selected projects in his study named „Old & New: Design manual for revitalizing existing buildings” was the architectural quality and maturity of the treatment of the existing building. Like in previously analysed cases, three categories have been established, Addition–Transformation–Conversion, each one corresponding to a different level of independency of the new elements.

Jäger’s first category *Addition*, just like Feireiss & Klanten’s category Add-On, implies a multitude of architectural actions that change the original building, but are always informed by the host building itself. In material terms new and old can be strictly divided, as seen in the selected example for this category, Cafeteria in the Zeughouse ruin. Exterior of the original building was preserved and changes were made only in its interior. Structurally new and old are separated in this project, though other projects in this same category show structural dependence on the old building. Examples in this category also show that different architectural vocabulary could be used, forms which follow its own logic, but can also be influenced by the host building. In general it can be said that this category gathers projects where both the old and new have the same presence and importance and are coexisting.

The second design principle, *Transformation*, implies more aggressive approach, and the change to the old building’s structure as well. In the first category there is usually clear distinction between the old and new, and according to Jäger, the principle of Transformation dissolves the boundary between the old and new. The selected example, Punta della Dogana, shows that just like in the previous example, no changes have been made to the building exterior, preserving its appearance completely. New elements are executed in materials different form the host building and the spatial logic of the interior spaces was mostly followed. Other examples in this category show that the change was usually constrained to old building interior where it is clearly recognizable and can both follow or alter the host building’s spatial logic. This design principle implies more invasive approach than the previous one.

The third category, *Conversion*, also includes wide variety of examples that change the old building function, from projects that add elements, to ones which alter only the host building’s interior. The selected example, the Fahle Building, shows that new addition is conceived in material which separates it clearly form the old building, and is structurally independent. Examples in this category are to great extent influenced by the original building's formal and spatial logic. It can be concluded that somewhat abstract criteria were used to separate these design principles and that there is a rather blurry line which separates one form the other.

3.4 Coexistence, Imposition, Fusion

Rogic (2009) went a step further in her PhD thesis, "Converted Industrial Buildings: Where Past and Present Live in Formal Unity". She extracts three design principles, Coexistence–Imposition–Fusion, from the six proposals (David Chipperfield, Renzo Piano, OMA, Herzog & de Meuron, Tadao Ando and Jose Rafael Moneo) shortlisted for the second stage of the competition for the reactivation of the Bankside Power Station and analyses them on two levels, building tectonics and spatial-formal composition.

Coexistence is defined as parallel existence of the old and new. And all projects shortlisted for the second phase of the competition clearly distinguish between the old material, brick and steel, and the new introduced materials, usually concrete and glass. However, she explains that the interventions differ in the level of rendering visible the coexistence of old and new materials. By detaching new and old materials one form the other in terms of their structural and environmental behaviour, Chipperfield and Piano, demonstrated transparently the principle of coexistence, whereas in the other four interventions (OMA, Ando, H&dM and Moneo) there is no divided role between old and new materials (Rogic, 2009).

The concept of *Imposition* implies the predominance of the new element introduced to the host building. It also means that the original building's characteristic were not taken into account while designing the new intervention. OMA's (Office for Metropolitan Architecture) intervention proposes the insertion of three blocks into the building's interior and one addition in front of the eastern part of the northern elevation (Rogic, 2009). On the outside, the old building's symmetry was broken not only by the placement of windows but also by the addition of the sixth level which created a new asymmetrical composition.

If old and new structure and materials could not be recognised, are dependent on each other and work together then the concept of *Fusion* is at play. The spatial composition of the intervention derives from the physical characteristics of the host building. New and old structure work together.

Rogic analyses these three principles, established by the architects themselves, on two levels. The first level of the analysis is the building tectonics. Here Rogic refers to building material and its structure, and to what extent is the original tectonics changed and new intervention governed by the old building. The second level of the analysis is the spatial-formal composition, which she divides in two categories, building interior and exterior. The extent to which the spatial organisation of the old building influences and governs the new intervention was examined. Based on this analysis Rogic defines four new concepts: *Tectonic fusion* if new and old structure and materials are completely interwoven; *Tectonic coexistence* when new and old structure and materials work separately and are clearly distinguishable; *Spatial composition conservation* if the old spatial organisation was preserved and influenced the new intervention; *Spatial composition transformation* if the old spatial organisation was altered.

4 REDEFINITION OF RECYCLING DESIGN PRINCIPLES – RECYCLING MODEL

It can be concluded that a general criteria for the definition of design principles of recycling in all above mentioned examples, was the relationship between the host building and the new intervention, i.e. the level of independency of newly introduced elements. Thus, in all cases one design principle was presented which implies obedience to the host building and minimal change to its appearance. The original building governs the intervention and decides how it is going to be changed. All characteristic of the new elements derive from the physical characteristics of the host building.

The second design principle implies higher level of autonomy of the new elements. The new intervention is influenced by the host building, their characteristics can derive from the original building itself, but the 'new' speaks equality loud as the 'old'. The substantial change to the original building can be done, but always following the spatial logic of the old building. Its volumetric composition, rhythm and scale are the elements which should be respected and which define the new intervention.

The third design principle implies the highest level of the autonomy of the new elements. New intervention and the host building speak different languages. The physical characteristics of the old building are not factors that define the new intervention. These new elements are dominant and follow their own spatial logic.

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Some of the abowe analysed design principles limit the recycling intervention almost exclusively to the host building´s interior, as Inside-Out and Insertion.

Yet due to a rather abstract criteria for the definition of these design principles, there is no clear and direct distinction between them, and example from one category can easily fall into another one. This problem calls for a systematization of existing principles and formulation of a clear set of criteria which would define design principles of recycling.

The criteria for the analysis of the chosen design principle were material relationship and structural dependence on one hand, formal disruption and change of spatial organisation on the other. Table 1 confirms that there is a rather blurry line which defines and separates these principles. In order to redefine design principles and make the distinction between them clearer, a clarification and more precise definition of criteria should be established.

	Materials		Structure		Form		Inner special organization	
	Clear distinction	Interwoven	Dependent	Independent	Changed	Preserved	Changed	Preserved
Intervention	x		x			x		x
Insertion	x		x	x		x		x
Installation	x			x		x		x
Add-On	x		x	x	x		x	
Inside-Out	x			x		x	x	
Change Clothes	x		x	x	x		x	
Addition	x		x	x	x	x		x
Transformation	x		x			x		x
Conversion	x			x	x		x	
Coexistence	x			x		x		x
Imposition	x			x	x		x	
Fusion		x	x		x	x	x	x

Table 1: Analysis of all four groups of design principles

Criteria for the analysis of the intervention:

Structure

- Old structure retained, no new structure added.
- Old structure retained and upgraded.
- New structure added, independent from the old structure.
- New structure added, dependent from the old structure.
- Old structure completely replaced.

Materials

Exterior

- Old and new materials are completely interwoven.
- Clear division between the old and new material which form a harmonious union.
- Clear division between the old and new material which are confrontational.

Interior

- Old and new materials are completely interwoven.
- Clear division between the old and new material which form a harmonious union.
- Clear division between the old and new material which are confrontational.

Form

- Formal logic of the old building (volumetric composition, symmetry) is respected and unchanged, no new elements are added.
- New elements are added respecting the old building's formal logic.
- Formal logic of the old building is disrupted.

Spatial organization

- Spatial logic of the interior spaces is preserved and unaltered.
- Spatial logic of the host building's interior spaces is altered but the size and the position of the new elements depend on the physical characteristics of the host building (its size, volume, organisation).
- Spatial logic of the host building's interior spaces is altered.

On the other hand, in order for the recycling intervention to be as environmentally sustainable as possible, a range of existing building's physical characteristics has to be taken in consideration. The level of the environmental sustainability of the intervention can be measured by the amount of the old building materials used (the use of existing material minimizes pollution and energy waste related to excavation, production, transportation), and the level of change imposed to the old building (the less change, the less energy and material waste). Thus it can be concluded that the most environmentally sustainable recycling intervention will be one which fully exploits the host building, inducing as minimal change as possible, given that the condition of the host building allow it.

Hence, the first step in planning the recycling intervention and deciding which design principle is most adequate/environmentally sustainable for a given building the following set of its physical characteristics has to be taken into account.

Criteria for the analysis of the existing building:

Structural characteristics:

- Foundations condition
- Vertical load bearing structures condition
- Horizontal load bearing structures condition
- Roof structure condition
- Internal partitions condition

Material characteristics:

- Façade condition
- Cladding system and fenestration
- Internal surfaces condition
- Floor coverings condition
- Wall and ceiling coverings condition

Therefore, according to the above described criteria for the analysis of both existing building and the intervention a recycling model, which implies a new set of redefined design principles of recycling (3S classification: Subjection–Symbiosis–Subversion), can be proposed. This model links the physical state of the host building and the most environmentally sustainable design approach for its recycling. Which of these design principles should be used depend entirely on the state in which the host building is found, i.e. its physical characteristics.

4.1 Subjection

Longman dictionary of English language and culture defines the term as: the act of bringing under firm control; not allow to have free expression; contingent or dependent. This design principle implies the subjection of the new intervention to the old buildings. In structural terms, the new intervention will retain the existing structure and upgrade it if necessary. If new structure is added it is dependent on the old one, relies on it for its support, they work together. Material-wise the exterior of the building is left unchanged. If any reparation work has to be done to the building's façade (e.g. material replacement, crack repairs, patching, cleaning and painting), they will preserve and reveal it's aesthetic and historic value and will be based on respect for original material. All new interventions to the building's interior will be executed in materials which follow the aesthetic logic of the old, thus the new and old will be interwoven, or in materials which are distinguishable from the original but integrated harmoniously with the whole.

The form of the building stays untacked. Its volumetric composition, fenestration rhythm and proportion are preserved in its totality. No additions are executed to the building envelope. If some parts of the building are in state beyond repair, selective demolition can be applied but this process will not change the building's character and appearance. All newly introduced elements will follow the host building's spatial logic. The division of spaces within the building, its organisation, is preserved and governs the new intervention. New elements are defined by host building's physical characteristics, its dimensions, scale and disposition of spaces. The character of the old building's interior will not be changed by the intervention.The original building is dominant, fully governs the new intervention, and decides how it is going to be recycled.

If the host building is found in an excelent state, both structuraly and materialy, and can be used 'as found' and only a negligible physical change is required the design principle of Subjection should be applied, given that this design concept implies the predominance of the old and the maximum use of its material.

4.2 Symbiosis

Heinrich Anton de Bary coined the term symbiosis (from Ancient Greek σύν – together, and βίωσις – living) in 1879 to explain an internal, mutually beneficial partnership between two organisms. This term defines a relationship in which one symbiont lives within the tissues of the other, either within the cells or extracellularly and it also refers to any relationship in which the symbiont lives on the body surface of the host, including the inner surface (Paracer & Ahmadjian, 2000). Oxford dictionary defines the term as: interaction between two different organisms living in close physical association, typically to the advantage of both. Organisms living in a symbiotic relationship have different physiognomy, jet together they form a harmonious, mutually beneficial, union.

The new intervention will retain and upgrade, if necessary, the existing structure. If new structural elements are introduced, they can both be dependent or independent on the existing structure, according to the scope of the intervention. If new structural elements are self-sufficient they are certainly conditioned by the pure physical characteristics of a host building, its size and disposition of its structural elements. The positioning, size and rhythm of new structure depends entirely on the old building's organization.

In many cases the building's exterior, its envelope, façade will be preserved, or if necessary, restored to the original state, preserving its appearance and integrity. Yet this design principle implies greater degree of change to the buildings fabric than the previous one. Additions, can be made to the host's building volume, and they will always be executed in materials clearly distinguishable form the old, yet carefully chosen to create a harmonious relationship with the existing materials. Even though new and old are not interwoven, they form a union. All the changes done in the old building's interior are executed in materials different form the old. There is a clear distinction between what is new and what was already there. The form of the old building, the balance of its composition, is not altered by new intervention. Elements which are added to the buildings envelope follow the formal logic of the old building, its symmetry and relationship between its parts. New follows the old but is equally present and dominant.

New intervention is governed by the old building's inner space distribution. Building's interior organization influences the design of the new intervention. This influence is limited to new intervention's dimension, not character. There is a clear distinction between what belongs to the old and what was newly introduced, both in material and formal terms. Compared to design principle of Subjection, Symbiosis creates more dynamic relationship with the old. Additions and alterations of the old building can be executed, jet buildings spatial and formal logic will not be jeopardised by this act. In most cases the alterations are restricted to building's interior. Whereas in Subjection old dominates and fully conditions the new, in Symbiosis old and new are equally present but speak different languages.

When a host building is found in a relatively good state, structurally and materially, and requires only minor physical change, upgrading of its structure or replacements of certain parts, the design principle of Symbiosis should be applied, given that this concept implies preservation of all usable elements of the old and yet leaves space for equally powerful new intervention.

4.3 Subversion

Subversion (lat. *subvertere* – overthrow) refers to a process by which the values and principles of a system in place, are contradicted or reversed (Blackstock, 1964). Through this act the established system is changed or damaged. This concept involves infiltrating, penetrating and manipulating existing system.

This design principle, is structural terms, implies introduction of new structure independent form the old, and in some cases complete replacement of the old structure. The positioning and size of the new structural elements depend entirely on the new intervention and does not follow the structural logic of the old building. Additions, and alterations to the host building's fabric are executed in materials clearly distinguishable from the old, and even confrontational. Newly introduced materials do not pretend to form a harmonious union with the old but follow completely different material logic, defined by the new intervention entirely. In the host building's interior the clear separation of old and new materials is also at play. The clash between existing and newly introduced materials produces dynamic and very intense relationship between old and new.

The form of the existing building is substantially changed by this design principle. The balance of its composition, symmetry, and fenestration are broken and altered by new intervention. New volumes will be added following its own formal logic, confrontational with the old. Host building can endure substantial subtractions as well, which can change its appearance. New elements belong to a clearly different style, the style which is defined by the commissioned architect.

This intense relationship extends to the building's interior as well, where new intervention changes the spatial composition of the old building. The logic of interior spaces in altered and the character of the host building completely changed. New intervention is fully governed by its own formal and spatial logic, independent from the existing one.

This design principle implies the highest level of change to the original building. Compared to Subjection, where the old building has the predominance, and Symbiosis, where both new and old are equally present and powerful, the design principle of Subversion implies complete obedience of the old building to the new intervention, new overpowers the old. If significant physical change, reconfiguration and reconstruction are required for the host building to be usable once again the design concept of *Subversion* can be applied. As only small part of the original building can be used, overpowering new intervention, composed of entirely new stricture, materials and space logic is entirely justified.

5 CONCLUSION

The global concept of sustainable development is imposed as a general context for all urban questions in the last few decades. This concept implies the integration of various aspects of urban development, which affects the modification of the contemporary design principles.

Adaptation of the design principles to the demands of sustainable development concept has great potentials, reflected in increasing quality of land as a non-renewable resource. During this and the past decade, sustainability in construction industry, represented a central theme of the most important international conferences. Further, our existing building stock plays a fundamental role in our society. It contains large quantities of embodied energy, materials and resources and contributes to the streetscape, character and embodied memory of our communities. When buildings no longer meet expectations, demolition is frequently employed, contributing to the building industry as the single largest consumer of resources and the single largest contributor to the waste stream.

Thus, recycling architecture has many historic, environmental, social and economic benefits, all of which make it an essential component of sustainable development. By analysing recommendation in most important international documents regarding sustainable development and by analysing design concepts used in contemporary practice of recycling architecture a recycling model has been created. It fully exploits the host building, by analysing its structural and material state and characteristic and assigning the most environmentally sustainable design principle for its recycling accordingly. In this way the embodied energy of host building's materials is preserved and energy necessary for excavation, manufacturing and transportation saved.

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Resilient and Smart Public Spaces: the Div@ter Digital Platform

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1 ABSTRACT

Terms such as smart and resilient seem nowadays to have captured the scientific literature in different fields: from urban design and planning to technology from economy to sociology. The sustainability adjective does not help to circumscribe the question and may contribute to the vagueness of the argument. One of the possibility is represented by the process to become "smart" in a sustainable meanning, with particular attention to the ecological, as well as social and economic sense.

As regards, the paper aims at presenting the Div@ter digital platform, in course of development. Div@ter is a dynamic and interactive platform for the complex-sensitive management of the qualitative data of a territory. The project is financed by POR FESR Lazio Region 2007/2013 Axis 1- Activity 1.1. The synthesis of the Market Street case study in San Francisco (CA) - interested by two considerable earhquackes, carried out using the Div@ter platform, will conclude the paper.

The objective of this case study was to identify the place identity and provide for interventions able to restore the identity of Market Street as a whole and make it smart and more resilient to possible future period of crisis.

2 RESILIENT AND SMART PUBLIC SPACE

Terms such as smart (Duany et al, 2010; Townsend, 2013) and resilient (Eraydin, Taşan-Kok, 2013) seem nowadays to have captured the scientific literature in different fields: from urban design and planning to technology from economy to sociology. The sustainability adjective does not help to circumscribe the question and may contribute to the vagueness of the argument.

What is correct is that territories need to be able to respond to situation of crisis, so to be adaptive, recomposing their balance. One of the possibility is represented by the process to become "smart" in a sustainable meanning, with particular attention to the ecological, as well as social and economic sense.

As regards, in the last years, the public space topic is become a central theme both in the literature and in the practice field, because is not anymore considered the last step of an urban project, but as a part of a transformation process. Indeed the quality of an urban transformation project is more and more measured with respect to the quality of public space (Bain et Al, 2012; Cabe, Detr, 2000; Carmona et Al., 2010; Friedmann, 2010; Gehl, 2010; Kent, 2008; Madanipour, 2003; Oc et Al. 1997; Sepe, 2013a).

Accordingly, the design of smart and resilient public spaces could represent a factor of success for the whole operation of transformation.

Starting from these premises aim of this paper is to present the Div@ter digital platform, in course of development (www.divater.it). Div@ter is a dynamic and interactive platform for the complex-sensitive management of the qualitative data of a territory. The project is financed by POR FESR Lazio Region 2007/2013 Axis 1- Activity 1.1. The synthesis of the Market Street case study in San Francisco (CA) carried out using the Div@ter platform will conclude the paper.

The San Francisco post-seismic reconstruction, which has seen many earthquake including those of 1906 and 1989, was carried out in different stages. The Community Safety Element identified specific objectives and relative policies. With respect to the topics of the Market street case study, Objective 2 states: "reduce structural and non-structural hazards to life safety, minimize property damage and resulting social, cultural and economic dislocations resulting from future disasters: Most earthquake-related deaths and injuries will result from the failure of buildings and other structures as a result of shaking or ground failure. Damage to structures results in substantial economic losses and severe social, cultural and economic dislocations. In addition to the characteristics of the earthquake and of the site, a structure's performance will depend on structural type, materials, design, age and quality of construction and maintenance. (...) The Policy 2.8 reads: "Preserve, consistent with life safety considerations, the architectural character of buildings and structures important to the unique visual image of San Francisco, and increase the likelihood that architecturally and historically valuable structures will survive future earthquakes" (http://www.sfgov.org)

Market Street was subject to reconstruction which has mainly privileged the part including the financial district, leaving the other parts in a slow decline, apart from the Castro area. Furthermore, even though present buildings of historical interest are well maintained, the stretch between Embarcadero and Powell is mainly used by workers and less lively during weekends.

This is the only street of San Francisco which for its position is related to many parts of the city and is recognised by residents as an emblematic axis. Thus, the objective of this case study was to identify the place identity and provide for interventions able to restore the identity of Market Street as a whole, connecting public spaces and cultural resources in a smart way, and make it more resilient to possible future period of crisis.

3 THE DIV@TER DIGITAL PLATFORM

The Open Source platform allows to import tangible and intangible spatial data from different sources, integrate them with information provided by the users, calculate indicators and represent the information in interactive and immediately understandable maps. It collects the main data using the PlaceMaker method (figg. 1-2), already experimented in many public spaces and contexts - including Europe, Usa, China and Japan (Mazzoleni, Sepe, 2005; Sepe, 2006, 2007, 2009, 2010, 2013a-b, 2014; Sepe, Pitt, 2013, 2014) -, integrating them with structured data and enabling the development of new services based on them. PlaceMaker, through a both rigid and flexible protocol constituted by surveys - nominal, perceptual, graphic, photographic, video -, questionnaires administered to place users, analysis of traditional maps, allows the identification of the identity resources of places (Lynch, 1960) and of appropriate project interventions for their protection and sustainable enhancement.

PHASE	OBJECTIVES	ACTIONS	PRODUCTS
0	Construction of the analysis grid	Choice of categories Choice of parameters Choice of significant days Choice of time slices	Database grid
1	Anticipatory analysis	Preliminary observations made prior to the first inspection of the place	Map of the preliminary ideas of the place
2	Perceptive and denominative description of the elements	Denominative survey	Map visualizing the results obtained from the survey
		Perceptive survey	
		Graphical survey	
		Photographic survey	
		Video survey	
3	Identification with traditional cartography of the elements required for area description	Analysis of traditional planimetry at urban scale	Map with the components of the site deduced from analysis of traditional maps
		Analysis of traditional planimetry at territorial scale	
4	Identification of place elements perceived by users of places	Questionnaire for visitors to the place	Map visualizing the results of the questionnaire
5	Processing the collected information	Overlay of the maps with the different elements observed from the anticipatory and effective analysis	Graphic system construction
		Check of the different elements observed from different analysis tools	Complex map of analysis
6	Identification of identity resources	identification of the identity potential identification of identity problems identification of identity qualities	Map of identity resources
7	Identification of identity resources by users of places	Questionnaire for visitors to the place	Map visualizing the results of the questionnaire
8	Identification of the project proposal	Overlay and elaboration of data collected	Graphic system construction
		Definition and localization of design intervention	Complex map of identity project

Fig. 1: PlaceMaker method scheme

Div@ter is a Geographical Business Intelligence tool, devoted to the re-design of the territory and its public spaces, which is conceived as a unique platform with different entry points, both private and public: for local authorities, professionals and citizens (fig. 3). The product consists in two "complex" maps - one of analysis and one of design - with the identification of cultural resources of a place and enhancement intervention. Unlike other urban methodological approaches which study only one aspect of the site (perceptive, urban, etc.) or multidisciplinary approaches which collect a lot of data but find difficulty collating it, this considers the places from all points of view and with different but compatible tools of relief. This method assembles, elaborates and reconstructs data from surveys based on physical reconnaissance, sensory perceptions, graphical elaboration, photographic and video records, and sets these data against those provided by an overview of expectations, an analysis based on traditional cartography and two questionnaires administered to local inhabitants. The main products are two final complex maps, one of analysis and one of design, which represent place identity and project interventions in order both to establish a dialogue with local people and support planners and administrators in sustainable urban construction and conversion. Div@ter platform allows the collection and management of these data using an only one tool, the multimedia phone or tablet, allowing a quick updating of the information.

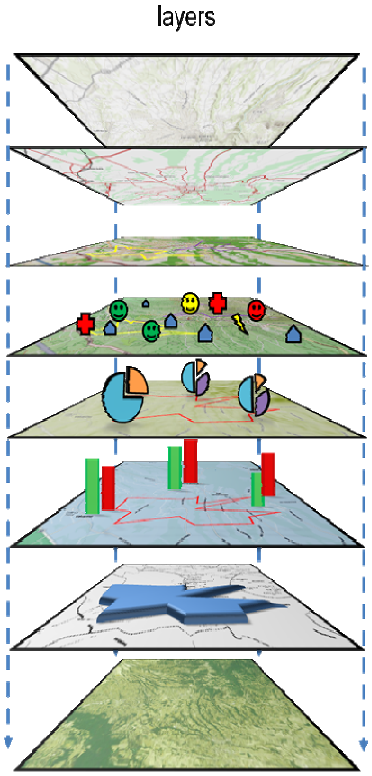

Fig. 2: Div@ter system of layers for the complex maps (image by F.Fagnini, Lynx)

The multimedia map are created by inserting symbols and elements into the maps connected to multimedia schedules that can be continuously updated. The complex-sensitive contents of the maps are navigable by using tablets and smart phones, contributing to deep and smart understanding of places and favouring participative actions.

One of the main use is identifying and enhancing a network of public spaces, of a territory meant as important factor for its resilience.

In the case study which will be shown in this paper, Market street in San Francisco, the platform is particularly useful because the questions related to the current identity of public spaces are complex and require the identification of different kinds of identity resources from many points of view.

4 THE CASE OF MARKET STREET

Market Street is the main thoroughfare of San Francisco (Jacobs, 1971). As Fred Kent (2008) pointed out: "Although many began as people-friendly streets that could be shared comfortably by pedestrians and motorists, most have evolved to accommodate an ever-increasing number of cars and trucks. While streets have become wider, sidewalks have become narrower. But no matter how much any street has been widened, it is never wide enough. Every time word gets out that a street has more room for cars, new traffic keeps coming until it's filled up again".

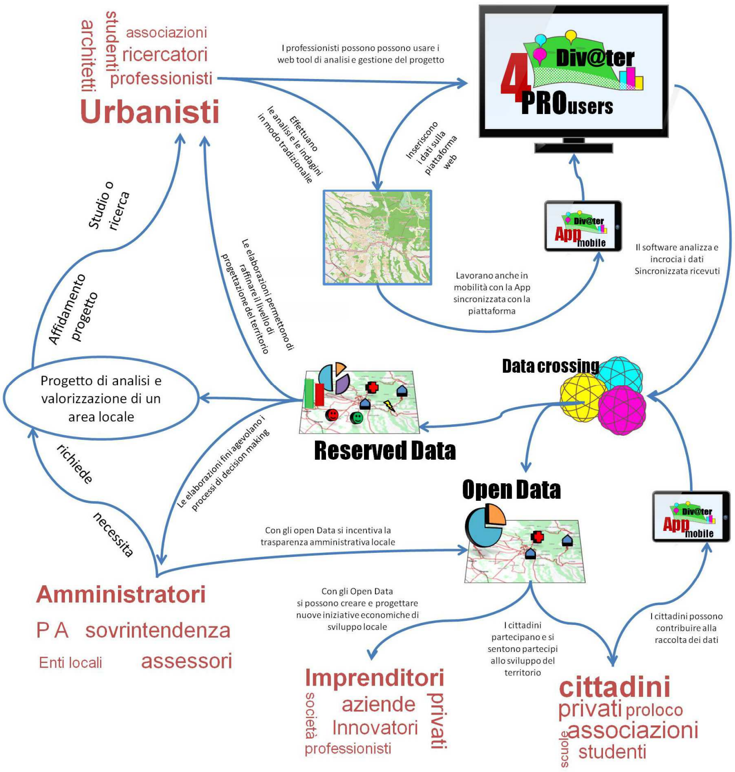

Fig. 3: Div@ter use cases (image by F.Fagnini, Lynx)

Indeed streets are space in their own right and have an important role in the public realm (Appleyard, 1981). They have to be considered in their three-dimensional characteristics. "Streets are not just a flat plane on which to travel, but a volume of space, a kind of large "outdoor room", in which the surface of the street serves as a "floor", and the surrounding buildings serve as the "walls". (...) James Kunstler notes that "whether in garden at home, or on Main street, people like to feel sheltered and protected. We're attracted to arbours, pergolas, street arcades, even awnings". "We enjoy spaces that are scaled appropriately for use by people, interpreting then as cozy, intimate, or safe. We feel invited to spend time there. When streets have poorly defined edges, large empty spaces, and are sized for cars and trucks instead of people, the space instead become isolating, intimidating, and even dangerous, encouraging us to move through it and leave it quickly, just as the vehicles are doing. Quality, safety, convenience, and interesting destinations are among the factors that determine how people choose to move around the city" (Bain et Al, 2012).

In this specific case the street present two distinct parts which makes it non-resilient and create a sense of discontinuity. In the following the case study will be summarized with particular attention to the tree phases of design carried out with PlaceMaker method.

4.1 The identity resources

Identity resources were identified through observation of identity potential, problems and quality reported in the complex map of analysis.

One of the main problems of Market Street highlighted by our analysis carried out with PlaceMaker is its lack of continuity. Notably, the stretch from Powell to Embarcadero is very different from that from Powell to Castro (figg. 4-5). The reconstruction that followed the earthquake of 1906 focused especially on the Powell-Embarcadero stretch, where the historical buildings were restored or rebuilt, new buildings, including skyscrapers, were erected, and several public spaces were created. In the Powell-Castro stretch, instead, several buildings are in a state of insufficient maintenance, and some are defaced by non-decorative graffiti. The discontinuity between these two stretches of Market Street is accentuated by the wide street crossings found along the Powell-Castro stretch, which undermine the sense of continuity and axis.

Another issue is the scarcity of public spaces in the Powell-Castro stretch, which does not allow people to use it as actively as they could. The presence of many closed stores in some parts of this stretch, as well as several empty spaces covered with uncultivated vegetation or dirt-floored, give it an aura of neglect that draws several homeless people.

Not least is the problem of vehicle traffic, which is quite intense in some parts, producing annoying levels of noise.

Finally, the most critical issue of Market Street is probably its lack of a strong identity capable of making it as attractive to locals and tourists alike as other places in San Francisco.

As to the potential of Market Street, our analysis highlighted several aspects. It is a broad street with wide sidewalks, except in its final part towards Castro, where it narrows down. The Powell-Embarcadero stretch is much used because of the presence there of the Financial District, the Ferry Building and the Embarcadero, as well as some large department stores.

The square in front of the Ferry Building is very large, but several parts of it are not used or used for stands sometimes arranged in a chaotic fashion.

In a way, the Embarcadero Plaza and the Hallidie Plaza are entrance gates to Market Street. The former has a primary role in providing access from the sea to the hillside. Although broad, it does not appear to be well designed, in spite of being graced by exquisite sculptures and fountains, benches and trees. It is mainly a transit place, occupied by street peddlers with their stands, which also extend into the stretch of Market Street between Drumm and Davis Street. The Hallidie Plaza is most frequented at the intersection with Powell Street, where street artists and peddlers gather.

The Powell-Embarcadero stretch has many other public spaces besides the just mentioned ones. Most, however, are underused, either for the lack of benches or because they are in shade most of the day, or because they do not afford interesting views.

There are several monuments that seem to go unnoticed and are susceptible of enhancement. These include Lotta's Fountain, the Plaque to Robert Frost, and the Liberty Bell Slot Machine plaque.

Crossings and empty spaces on the one hand constitute a problem, but on the other could become the public spaces that are presently lacking in the Powell-Castro stretch.

Various views, including some very striking ones, could be exploited to better advantage. The skyscrapers, the Flatiron and the historical buildings are certainly interesting features in the urban landscape. The views of the Ferry Building on one side and the hill on the other are also remarkable. In the Powell-Castro stretch, too, there are agreeable views, such as that of the Hibernia Bank, that are not enhanced as much as they could be. The proximity of Market Street to several places, such as City Hall, is an important resource, which, if used wisely, would increase the attractiveness and utilization of the street.

In the Powell-Castro stretch there are several interesting historical buildings that are presently underused and poorly maintained.

Finally, our PlaceMaker analysis highlighted many qualities. First of all, the central position of the Market Street axis, which intersects many other axes of the San Francisco grid plan. Then there is the fact that Market Street is the only street in San Francisco connecting the sea to the hills. Furthermore, the street affords easy vehicle transit.

On both sides of the street are well maintained historical buildings included in the lists of the historical sites and landmarks of San Francisco. These lists also include the monuments and fountains. Besides, there are historical buildings and Victorian houses not included in the lists, but which are nevertheless of historical interest. The Ferry Building has been well renovated and is well used, with restaurants and typical stores. Its space facing the sea provides a fine view of the surroundings.

As to the street itself, especially in the Powell-Embarcadero stretch it is constructed with good-quality materials and has mostly well-designed public spaces. Furthermore, Market Street is treed along its whole length and there are several green spots. Some stretches have bicycle lanes. Besides, there are two stops of the historical cable car, one on Powell, where the cable car turntable is, the other in California Street. These stops, besides allowing use of this traditional means of transportation, attract many people.

There are traditional shoe-shiners in the Powell-Embarcadero stretch who give it local colour. In Van Ness-Castro there are stores with special products and various novelties, and international restaurants. If these were incorporated in a more welcoming context for pedestrians, they could increase the street's attractiveness. Finally, there are some museums and theatres.

Fig. 4-5: Two stretches of Market street

4.2 The design questionnaire

The design questionnaire which we administered consists of a 10-point questionnaire concerning possible actions to be undertaken.

0) Nationality, age

Passing through the study area:

1)Why do you come to this street?

2)What do you think about the quality of this place?

3)What do you think about the overall perception of Market Street as an axis?

4)What do you think about restoring historical buildings in Powell-Castro area?

5)Have you noticed the historical buildings, the fountains and plaques, and the Victorian houses?

6) What about enhancing different characters of the street?

7)Did you feel threatened at any point?

8)What about creating new urban spaces and introducing more green spaces?

9)What do you think about designing new urban furniture in the Powell-Castro stretch in continuity with Powell-Embarcadero?

10) What do you think about improving pedestrian and cyclist mobility and circulation?

The interviewees (approximately 30 in number) were passers-by in Market Street aged 30 to 60. Their countries of origin were the USA and Mexico. The language used for the interviews was English.

To the first question – “Why do you come to this street?" – most interviewees replied that they came for work. This was the answer given by over half of the interviewees, independently of age or nationality. The rest answered for shopping or simply for a stroll. A small number said they were there to visit the city.

As to the question regarding the quality of Market Street, the answer was unanimous. All interviewees answered that the quality of the Powell-Embarcadero stretch is good, while that of the Powell-Castro stretch is generally not. Many of the interviewees, however, added that in the Powell-Castro stretch there are many interesting buildings, stores and restaurants.

To the question about the perception of Market Street as an axis, almost all gave a positive answer, especially the interviewees who worked on Market Street or had come there to shop. Some of the answers indicated an awareness of the historical value of the Market Street axis. A smaller percentage was not aware of how long the street actually is, and thought that the name Market Street only applied to the stretch of the street they were on.

To the question “Have you noticed the historical buildings, the fountains and plaques, and the Victorian houses”, the interviewees gave rather different answers. While a significant percentage answered that they had noticed the presence of historical buildings, only very few had noticed the fountains, the sculptures and the Victorian houses on the Powell-Castro stretch.

To the question about whether it would have been worth enhancing certain characters of the street, the interviewees mostly gave an affirmative answer. Some, especially those who had taken less notice of the street's monuments, replied that they did had no answer.

To the question whether they felt threatened anywhere in the street, most of the people answered that they only felt threatened in the Powell-Castro stretch. A few answered that they also felt threatened in the other stretch, especially on holidays.

All the interviewees agreed that it would be desirable to create new public spaces and introduce more green. Most of the interviewees added that what they especially would have liked is more public benches.

To the question regarding the designing of new urban furniture in the Powell-Castro area in continuity with Powell-Embarcadero, all the interviewees expressed their agreement.

Finally, all the interviewees found that it would have been a good idea to create a bicycle lane for the whole length of the street and improve pedestrian circulation. Many added that motor vehicle traffic should be reduced.

4.3 The design interventions

The last phase of our PlaceMaker analysis consisted in merging the data collected during the previous three phases (V,VI,VII phase) and drafting a project proposal (fig. 6).

Possible actions to be taken include: Reinforcing Axis Continuity; Designing new Urban Characters, Enhancing Identity; Creating Connections; Creating and Enhancing Public Spaces; Improving green; Improving Mobility.

The first action is Reinforcing Axis Continuity. Market Street is one of the axes that place the strongest stamp on the urban fabric of San Francisco. Walking on Market Street today, while in the Powell-Embarcadero stretch one observes axis continuity, in the Powell-Castro stretch this continuity is lost, to the point that in some places it is very difficult to understand that we are still on the same street.

The first step to be taken to address this issue is to create a continuous design of urban elements, sculptures etc. along the whole length of Market Street. The second step is to design illumination to highlight the axis from different angles and perspectives. The third step is to plan ways to diminish street-crossing distances at intersections in the Powell-Castro stretch and, wherever possible, to widen its sidewalks to the same width as those in the Powell-Embarcadero stretch.

The second action is Designing new Urban Characters. Although axis continuity must be conceived from the perspective of the street, certain features are susceptible of being further enhanced to add to the character of some stretches of Market Street, especially between Mid Market and Castro. Among these are some cultural features such as art galleries and antique furniture shops.

The first step is thus to create aggregations of functions and design new features for Market Street to allow frequenters and visitors to use this thoroughfare more often. The features we singled out with the PlaceMaker method, starting from Embarcadero, include: the sea and the piers, business centres and museums, stores for young people, art and antique shops, civic and cultural centre, and the Victorian centre.

The second step is to complete existing functions with new elements and integrate them with the new functions.The third action is the Enhancing of Identity. Market Street has several identitarian elements, and only some of these receive adequate attention, such as the Flatiron, Phelan, Food and Ferry Buildings.

Of these, only the last induces people to protract their stay in Market Street. The first step is thus to promote monuments, historical buildings, and historical trades. These include Lotta's Fountain, the Plaque to Robert Frost, the Liberty Bell Slot Machine, the Victorian houses, and the shoe-shiners in the Powell-Embarcadero stretch.

Besides, there are many historical buildings in the Powell-Castro stretch that are poorly maintained or not adequately promoted, such as the Carpet and Furniture Building – the second step .

The sea and the hill constitute two strong identitarian elements of Market Street, but are only really perceivable near the Embarcadero and Castro. Besides enhancing their actual visual perception – the third step – the sense of the vicinity of the sea and the hill can be reinforced by making them into a theme evoked in public spaces and by urban furniture.

The second step is to provide for the maintenance of historical and cultural monuments and buildings, in order to both safeguard their recognisability and beauty, and their rooted in the memory of citizens and visitors.

The third step is to enhance visual perceptions. These constitute a part of the urban landscape of Market Street and hence need to be recovered and promoted as much as buildings and monuments. These perceptions include views of the Transamerican Building, the Ferry Building, the hill from the intersection with Powell Street as well as several other spots, the Main Bridge and the sea, City Hall, and the skyscrapers. Other views to be recreated are to be found especially in the Powell-Castro stretch, whose discontinuity and gaps detract from its identitarian potential.

The fourth action is Creating Connections. The different orientations of the streets intersecting Market Street offer a strong potential for development.

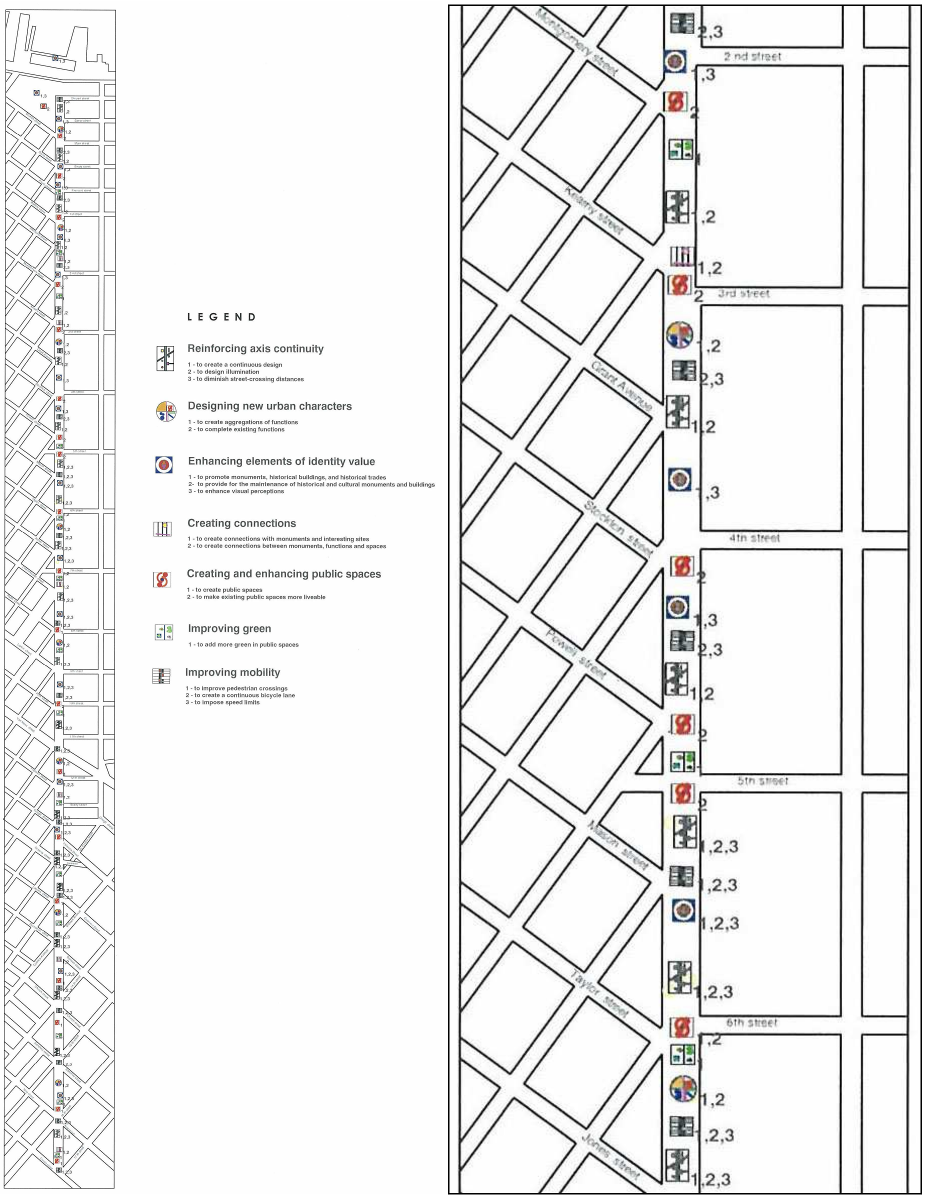

Fig.6: Market street, details of the complex map of design

The first step is to use the many intersections to create connections with monuments and interesting sites which are actually close by but not perceived as such, as in the case of City Hall.

The second step is to create connections between monuments, buildings, functions and spaces in the Powell-Castro and Powell-Embarcadero stretches.

The fifth action is Creating and Enhancing Public Spaces. Here the first step is to create public spaces, especially in the Powell-Castro stretch, where they would help to improve walkability.

The second step is to make existing public spaces more liveable by adding benches and other structures to facilitate stops and the enjoyment of natural resources, such as natural light, or cultural ones, such as monuments or views of historical monuments or buildings, or of the cable car.

The sixth action is Improving green. To add more green in public spaces is an important improvement in order to balance the strong presence of buildings in the area and thus make the thoroughfare more liveable.

The seventh action is Improving Mobility. The width of the street and sidewalks allows an adequate mobility project. The first step is to improve pedestrian crossings near bus stops, which are presently not receiving sufficient attention. Furthermore, to create adequate pedestrian crossings in the stretches with double street crossings, and at the freeway entrance

The second step is to create a continuous bicycle lane to spare cyclists difficult driving amidst cars and other vehicles. The third step, finally, is to impose speed limits to reduce the acoustic pollution of the street.

5 CONCLUSIONS

Market Street is one of the main axes of San Francisco, and as such is especially interesting for its connection with various parts of the city. Important questions of marginality and unsafeness, related to the Powell-Castro stretch, require specific attention to this axis to be resolved in a sustainable way.

The fact that it is the only city street directly connecting the hill to the sea surely constitutes a huge potential, to be taken into account in enhancement works. The actions proposed in the present study are: Reinforcing Axis Continuity, Designing "characters", Enhancing Identity-Related Aspects, and Creating Connections Creating and Enhancing Public Spaces; Improving Mobility.

We have taken special account of the consequences of the 1906 earthquake and the subsequent rebuilding and development of Market Street. These actions were not aimed at rebuilding the axis as a whole according to a strong and distinctive plan, but only parts of it. Both our careful observation of the street and the questionnaires we administered bear witness to this. People mainly use Market Street in connection with their job or business. Only a minority uses it as a place for strolling, shopping and visiting interesting buildings.

In the Powell-Embarcadero stretch, in spite of the presence of public spaces, one observes a certain monotony, although it is livened up by views of historical and more recent buildings. In the Powell-Castro stretch, places are, as it were, “on hold”. There are empty spaces, unused stores and buildings, and a certain discontinuity in state of maintenance, architectural styles, buildings height, and functions. This discontinuity is toned down only in the last stretch, approaching Castro, where the presence of Victorian houses and quality stores and bars makes the spot mostly agreeable and livable.

In our study of the whole axis, several features emerged that make Market Street suitable for specialization in different sectors, which would be better enhanced by the multimedia maps created by the Div@ter digital platform, navigable on tablets and smart phones. Starting from Embarcadero, we singled out the sea and the piers, the business centres and the museums, the stores selling articles for young people, the art and antique shops, the civic and cultural centres, and the Victorian centre. These places reflect specializations already present in Market Street or the adjoining streets, but unconnected or not clearly defined. For example, from the Financial District, Third and Fourth Street provide easy access one to several museums, including the Moma, as well as the Yerba Buena gardens. In any case, we see the promotion of specialization as part of a plan to reinforce Market Street’ role as a single axis. Indeed, one of the nodal points is that of continuity, which is clear and perceivable in the Embarcadero-Powell stretch, but almost completely lost as one goes on towards Powell-Castro. This loss of axis continuity depends especially on the many intersections with other streets. The information identified with PlaceMaker, using Div@ter, could be connected with those already existing, creating a smart connection between public spaces and cultural resources and events of the place, improving the use of Market street by citizens, visitors and tourist.

Indeed, the above-mentioned actions are meant to restore the coherence of an urban fabric impacted by a significant seismic event, where the ensuing reconstruction, although it did not disrupt it, took little account of place identity. The actions we propose share the intent of making place identity the driving force in the promotion of Market Street, complementing the development actions currently under way in this thoroughfare sustainably (BetterMarketStreet:).

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Rethinking the Strategic Dimensions of Smart Cities in China's Industrial Park Developments: the Experience of Suzhou Industrial Park, Suzhou, China

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1 ABSTRACT

Although smart cities have been widely recognised as a new tool to transform the industrial parks in China, planners have faced the complex challenge of how to translate the concept of smart cities into reality. While great emphasis has been put on the applicability of information and communication technologies (ICT) to smart city projects, there has been little analysis or evaluation in such planning process of smart cities. This is mainly because smart cities employ rather unclear definition and work scope. This research draws attention to the 'strategic dimensions' of smart cities in planning practice, which need to be considered in the transformation of industrial parks in China. The research uses a case study of smart city development in Suzhou Industrial Park (SIP), Suzhou, China, which is widely acknowledged as one of the successful industrial park developments in China. SIP is in transition, and accommodating manufacturing industries is no longer the primary function of SIP. The research found that it is necessary to redirect the smart city strategy of SIP by mirroring the needs of the workers and local residents in SIP. It requires a transformation of traditional compartmentalised planning practices and the engagement of a wider range of players including those who were not previously involved in traditional practice.

2 INDUSTRIAL PARK DEVELOPMENTS IN CHINA

Since the 1970s, the development model of industrial park has become a major feature of urban development in China. This may be closely associated with planning activities driven by the public sector that has seen this as a 'new hope' for their cities to boost local economy by attracting foreign investment. The Chinese government has established many preferential policies to embrace foreign companies and attract foreign investments. With state-led development strategies and its cheap labour, China National Bureau of Statistics (2011) reported that over 7,000 industrial parks were established in China by 2004, and they have been accounted for 11.1% of China's GDP and 29.8% of China's exports. Industrial parks in China were initially started as a development tool to organise manufacturing industries more effectively, then become a popular method of accelerating urbanisation in China. Consequently, the function of industrial parks has been no longer limited in accommodating industrial uses, and rather they have been developed as a fully functioning urban area. Living environments of local residents in industrial parks have become more significant, as the industrial parks were needed to serve its population. These good and newly-built living environments have also attracted the middle to high income-households to move into the industrial parks from the city's existing urban areas. Industrial parks in China, however, have faced a challenge to transform the nature of their industrial parks economically, socially and spatially. This became more significant to the earlier industrial parks that were based on manufacturing industries as market competitiveness has been diminishing due to decreasing tax benefits from governments and increasing labour costs. This doubtable investment climate has raised issues on the need of rethinking development strategy for industrial parks in China. There are many prior studies on the transformation strategic models for the industrial park development not only in China but also throughout the world. These models were primarily twofold.

The first transformation strategic model aims to change the industrial structure of the industrial parks from manufacturing to service industries. This is to encourage the manufacturing-based enterprises, which have originally been located in the industrial parks, to extend their business scope to the service sector industry with the supports from local governments. It is also described as the 'circular economy' approach by means of reorganising economic activities in the notion of loop-closing process in using resources, consuming energy, and managing supply chains (Yuan et al., 2006). This transformation strategy engages a more sustainable approach in developing and operating industrial parks. Suzhou Industrial Park (SIP) has employed this transformation approach. The second transformation model is to apply the concept of the 'eco-industrial park'. This developing model is to combine manufacturing and service industries with the consideration of environmental, economic and social issues with an emphasis on the environmental friendly

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approach in its development and operation (Tudor et al., 2007). However, ironically, it had been criticised that a lack of attention on environmental issues and guidelines had caused the operational problems of eco-industrial parks in China (Geng et al., 2007).

3 SMART CITIES AS TRANSFORMATION STRATEGIES

The changing social-political environments have forced industrial parks to reform their industrial structure to be more knowledge-based and eco-friendly. In this context, the concept of smart cities has been increasingly emphasised, as it is obvious that smart cities are connected to industries related to information communication technologies (ICT) that can act as a catalyst to transform economic and social environments of the industrial parks. Additionally, the language of 'smart' and 'intelligent' was also appealing to politicians and developers to promote the economic and political values of the industrial parks with positive images of the technology-led innovation. This research, therefore, aims to investigate the 'strategic dimensions' of smart cities in the transformation process of industrial parks in China by focusing on different views between service provider (public sector), industrial users (enterprises), and end-users (workers and residents) of the smart city. The research draws on the results of the questionnaire survey with 120 workers and local residents and five structured email interviews with enterprises located in a particular industrial park in China.

3.1 Development Strategies of Smart Cities in China

A smart city is a new urban form integrating between urban development and ICT to make urban infrastructure and living environment more intelligent, efficient, safe, and interactive. This approach enables an innovative city management by improving the efficiency of city operations, the quality of urban public services and promotes the integrated development of industrialisation and urbanisation of cities (Feng, 2011). Wang and Gu (2012) argue that the development of smart city has improved the city's competitiveness potentially, and at the same time, affected China's economy in relation to issues of labour, social and environment. There are five core strategies in the development of smart cities in China: (1) improving the city's creative capability; (2) developing smart industries; (3) promoting smart management and service; (4) applying smart technologies and facilities; and, (5) spreading smart life. While the China's smart city strategies are rather similar to those applied around the world, the practice of smart cities in China has developed their own empirical ways to apply the concept of smart cities to the practice of urban development in order to reflect the city's economic, political, cultural environments. Some cities like Nanjing and Shenzhen have integrated their smart city strategies with the overall urban development in the city to promote the innovative and creative images of the city. Other cities have preferred a piecemeal approached by developing individual intelligent systems targeting certain urban issues.

3.2 Smart City Transformation Strategies for Industrial Parks in China

The change in market conditions has brought major economic and political concerns in the development of industrial parks in China. Transformation strategies of industrial parks must be established in line with the changes in political, economic and social environments in China. As discussed earlier, the fundamental changes that are apparent in relation to transformation strategies of industrial parks are the industrial network restructure and the creation of eco-friendly environments. Bearing this in mind, transformation strategies of industrial parks by applying the concept of smart cities can be summarised in two aspects.

Firstly, the development of smart cities in industrial parks should consider restructuring of industrial network by attracting diverse types of industries. A considerable number of industrial parks in China are willing to attract high-tech and knowledge-based industrial sectors to facilitate the transformation of the industrial structure. This is because there is a widespread acknowledgement that 'high-tech' and 'service-based' industries may increase the competitiveness of the industrial park by enabling high value-added economic activities. Additionally, high-tech industrials are seen as environmentally friendly industries comparing with traditional manufacturing industries. As the leadership of local government wants to change the industrial structure of industrial parks gradually, the development of smart cities has been considered as a marketing tool to promote the innovative image of industrial parks to attract technology-led industries to their parks. Secondly, with the concept of the ecologically friendly development, smart cities should be able to add the sustainable values to urban environments and improve the quality of living environment for their inhabitants.

The changes of industrial structure have also forced to improve the quality of living environments in the industrial parks. As the industrial structure changes from manufacturing industries to high-tech industries, the industrial parks are needed to accommodate higher-income entrepreneurs who require better living environments than lower-income labour workers in a manufacturing factories. From the above two perspectives, the smart city approach, bringing together urban planning and ICT, needs to consider a transformation process of both industrial structure and residential settlements in the practice of industrial park development.

4 CASE STUDY: SUZHOU INDUSTRIAL PARK, CHINA

Although the smart city approach has been emphasised in the field of urban development in China, little is known about its implementation in a real-life context. It is evident that there is a need of investigating the development strategies of smart cities in a concrete example to identify operational difficulties and to make recommendations that will ultimately lead to better strategic dimensions of smart cities in the transformation process of industrial parks in China. The case study in this research, the Suzhou Industrial Park, Suzhou, China, has been selected to illustrate this point.

4.1 Development of the Suzhou Industrial Park

The Suzhou Industrial Park (SIP) is the most well-known project in the Chinese history of the industrial park development and often described as a ‘premium’ industrial estate in China (Pereira, 2007). SIP is located in the east of Suzhou and has been developed as new industrial, commercial and residential centres of the Suzhou city (Figure 1). SIP was implemented by a joint venture between the Chinese and Singaporean governments starting from 1994. It was recognised as the largest and most ambitious development project of regional industrial parks that had been implemented by Singapore government, and it was designed to cover 70 square kilometres by 2014 with the estimated development cost of 30 million USD (Tan, 1994). In 2013, SIP's GDP has reached to 31.35 billion USD, and 1.96 billion USD of the foreign capital and the 80.46 billion USD of import and export have been reported (SIPAC, 2014). The development strategy of SIP is based on three pillar industries and five creative industries. Those can be categorised as follows:

- three pillar industries including electronic information industry, machinery manufacturing industry and service industry; and,
- five creative industries including biomedical industry, animation industry, eco- protection industry, communication convergence industry, and nanotechnology industry.

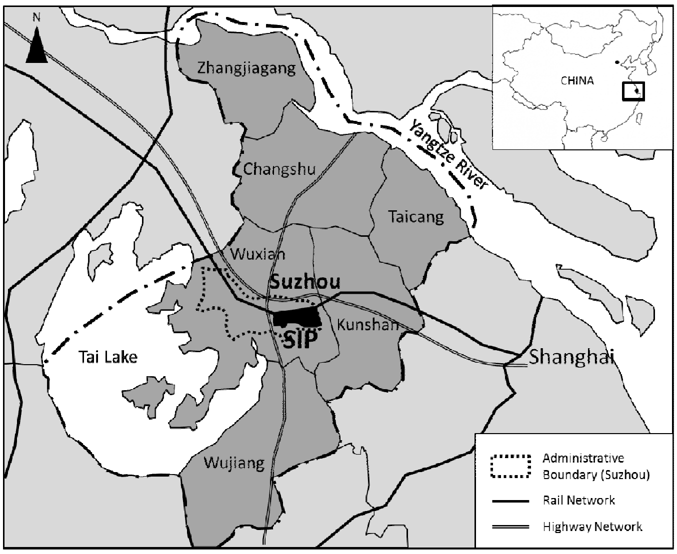

Fig. 1: Location of the Suzhou Industrial Park.

Apart from the above industries, industries related to property development have also played a significant role in the development process of SIP. Delivering high-quality housing to the property market, in particular, has led demographic and social changes in the Park. Since 2006, SIP has gradually reformed its industrial structure, and a transformation strategy called the ‘Ecological Optimisation’ programme was introduced in 2009. This strategic programme outlines a shift in focus from traditional manufacturing industries to high

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technology-based industries, and reflects the importance of the industrial structure transformation. Under this transformation strategy, IBM has invested in constructing Suzhou National Science Data Centre located in SIP. This data centre was a kind of flagship development to attract other ICT-related industries to the Park. Moreover, it was expected to provide a basis for the future development of the smart city in SIP.

4.2 Smart City Approach of the Suzhou Industrial Park

In 2013, the Ministry of Housing and Urban-Rural Development announced that SIP has been chosen as one of the first pilot smart cities in China. Under the umbrella of smart city development, SIP has developed: GIS data with 660 layers of geospatial information; intelligent transportation system including traffic signal control and bus information systems; e-administration system for demographic and medical records; and, smart public bicycle system (Z. H. Studio, 2013). Recently, SIP signed a memorandum of understanding for the strategic collaboration on the smart city development with Singaporean government.

The importance of collaboration between ICT and urban development has been emphasised over last decade in the China's planning legislation based on its five-year plans. The 11th Five Year Plan (2006-2010) raised issues of developing ICT infrastructure to improve the quality of public services in the fields of government administration, public facilities, social welfare and enterprise supporting services. The following 12th Five Year Plan (2011-2015) has also stressed a holistic approach between ICT and urbanisation, and to become a foundation of establishing urban and industrial development strategies of the Suzhou city in association with the ICT industries. Mirroring this, the Suzhou Industrial Park has developed a smart city strategy: (1) to implement smart solutions integrating diverse databases; (2) to operate intelligent management of the industrial park; and, (3) to transform the industrial structure with ICT industries (Department of Information for SIPAC, 2013). Yang Zhiping (quoted in Li, 2013), the Chairperson of SIP Administrative Committee, explains the '3-3-4-9' smart city strategy of SIP. This includes the development of three service portals, three databases, four dimensions of the strategy, and nine information hubs (Figure 2).

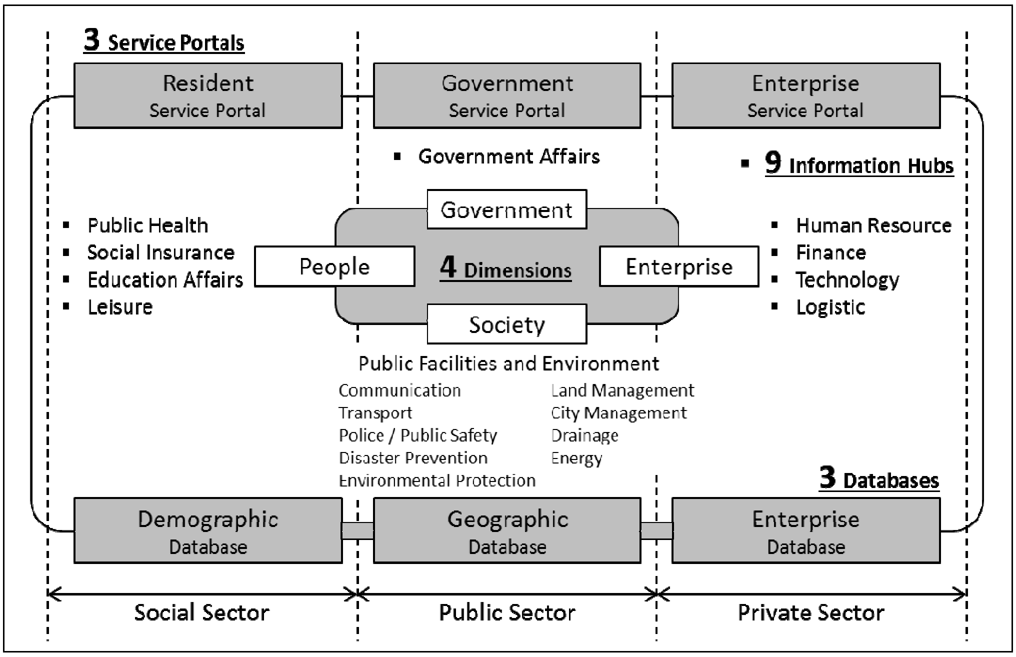

Fig. 2: Smart City Development Strategy of the Suzhou Industrial Park. (Source: modified from Department of Information for SIPAC, 2013)

Three services portals are to establish citizen-centric government by integrating three services portals for residents, government and enterprises. Three databases refer to geographic information, demographic information, and enterprise information as a foundation of the smart city development. It took nineteen years to develop a full set of geographic information as the primary database. Four dimensions represent the four key elements of the smart city strategy reflecting society, people, government and enterprise. Although the development of smart cities in SIP is government-led, the holistic approach among the four elements has been emphasised to create innovative public services and urban environments. Nine information hubs are to provide terminal platforms to share information in particular areas, such as government affairs, public health, social insurance, educational affairs, leisure, human resource, finance, technology, and logistics.

As illustrated in Figure 2, the key feature of the SIP's development strategy on smart cities could be seen in three categories representing public, private and social sectors. While the smart city projects widely practiced around the world have emphasised on issues of the urban infrastructure and public services of the city that governments provide for inhabitants (Bélissent, 2010), the development strategy of SIP is unique in its focus on private sector development. This shows that the smart city strategy of SIP echoes a notion of the industrial park where there is the need of providing better business environments for industries. Although credit could be given to the development of the strategy by engaging local issues, it is still arguable how a role of ICT could contribute to 'real' solutions in supplying suitable workforce, providing financial supports, and reducing the cost of logistics. It is also a challenge how the smart city strategy can serve the 'real' demands of local communities, and can be delivered in practice.

5 ANALYSING SMART CITY DEVELOPMENT OF THE SUZHOU INDUSTRIAL PARK

Viewed from the two common transformation strategies of China's industrial parks, industrial restructure and eco-friendly environments, the smart city approach is needed to cope with issues arising from transformation processes. In carrying out the case study, email interviews and questionnaire survey were the two methods used to investigate the views and needs from different stakeholders in SIP. As ARUP (2013a) argues, smart cities are no longer deliverable from a top-down approach by the public sector alone. The development of smart cities should represent the needs and capabilities of diverse stakeholders in the area including local communities and enterprises. Considering the fact that the current smart city strategies of SIP were mainly provided by public sectors, the results of two analytical methods may lead to an evaluation of the strategies from the wider views of stakeholders (enterprises, local residents, and workers) in the Park.

Email interviews were undertaken by two authors with five senior executives in a various range of corporations in SIP. The interviews were semi-structured to investigate the entrepreneurial benefits and limitations of industries located in SIP. In parallel with email interviews, the questionnaire survey targeting local residents and workers in SIP was conducted by five field surveyors who were trained professionally for this research. The questionnaire survey was conducted with 120 responders in order to identify the issues and applicability of the smart city approach in urban environments of SIP. From 120 questionnaires collected in 2012, 108 were valid for the analysis. Considering the age groups, 96.2% of the responders are the economically active population. 75.9% of the participants both live and work in SIP while 13.9% of them only either live or work in SIP. These indicate that the questionnaire survey represents the view of local communities in SIP. The questionnaire design was twofold. Firstly, respondents were asked to evaluate current living environments of SIP in seven categories of education, transportation, retail, healthcare, public safety, environment, and energy and water. Secondly, the survey participants were asked to mark the degrees of their preferences in the proposed smart solutions in each category that may apply to SIP in the near future. The seven categories and proposed smart solutions were chosen based on the author's 7-year experience as a practitioner[1] in the development of smart cities, and considered as most common areas that the smart city approach has been applied in the urban development practice.

In general, among the seven categories, the result of the questionnaire survey indicates that importance of three issues including retail, healthcare, and energy/water is particularly emphasised in relation to living environments of SIP from the perspective of local communities (Figure 3). Respondents have selected those three issues as the areas that needed to be improved and were less satisfied in SIP. While the result has indicated the local needs from various aspects, they can also be considered as the prioritised areas for the smart city development in SIP. Taking into account that the development of smart cities employs a considerable amount of time, efforts and resources, it needs to address what matters most in a particular practice with considerations of the political priorities and resource allocation (Kim, 2013). In the case of SIP, it seems that the 'healthcare' issue is the most significant area that needs attentions among the seven categories. Either intentionally or accidently, the local government of SIP has initiated a project to develop an integrated system to improve healthcare services in SIP under the development strategy of smart cities. This 'Digital Livelihood Programme' is an online e-administration system to allow citizens to access all public information available with a single login by integrating information of citizen card, medical insurance, provident fund, bank account, and so on (Suzhou Daily, 2011). With this system, in an ideal scenario,

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patients can make online appointments for outpatient service, doctors can access the digital medical records of the patients, the pharmacy can access to the prescriptions through a digital hospital system, and the provident fund managers can deal with integrative medical insurance information. Then, another question needs to be asked. What if the actual need of local communities in healthcare is not about the information system integration, but local residents need more numbers of clinics and hospitals in the area? In approaching the development of smart cities, therefore, there is the need of a concerted effort to develop a holistic strategy with considerations from diverse areas related to urban planning and development.

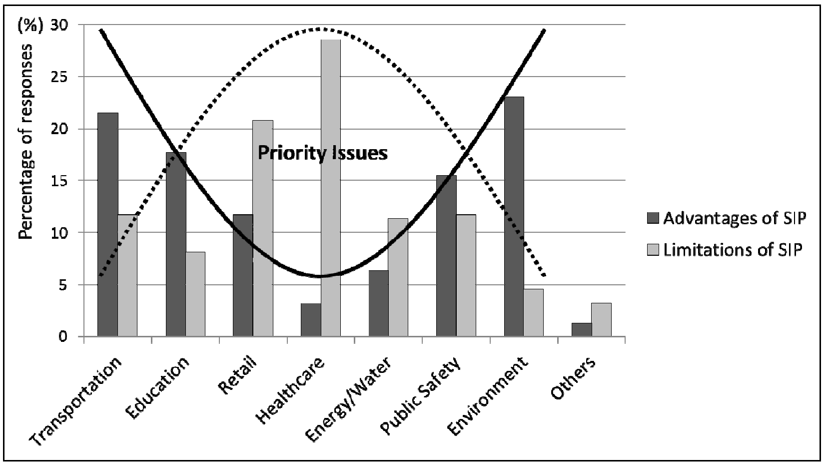

Fig. 3: Advantages and Limitations of SIP from the View of Local Communities. (Source: Author)

6 STRATEGIC DIMENSIONS OF SMART CITIES

The concept of smart cities is now firmly on the agenda of the transformation strategy of industrial parks in China. The practice of smart cities requires a collaborative strategic approach involving not only the ICT perspective but also political, economic and social aspects. The research findings could be summarised in three dimensions of the smart city strategy: (1) developing smart city strategies under the changing physical and economic environments; (2) recognising the need of local communities in the development of smart cities; and (3) delivering the integration of smart city services. These three dimensions demonstrate how an empirical framework can be developed in order to apply the ICT concept of smart cities to planning practice of the industrial park transformation in China.

6.1 Developing smart city strategies under the changing physical and economic environments

The Suzhou Industrial Park as elsewhere in China faces a challenge of coping with the changing economic, social, and political environments. Enterprises in SIP have reported that there are benefits and supports from the local government of the area. The results of email interviews have suggested that policies on tax reduction settlement and subsidised rent agreement are primary advantages of being located in SIP. This was the view from several senior managers of multinational corporations located in SIP. One of interviewees in a foreign enterprise in manufacturing industries pointed out that:

"[In SIP] there is a tax-free period for two years since the first day of profit-making, then fifty percentage of tax reduction for further three years. Those tax benefits and cheaper rents are certainly one of the advantages when we consider the factory development in SIP. Additionally, SIP is a fully functioning city and the local government offers a 'one-stop' service to the corporations. It [one-stop service] makes the administrative works easier comparing with other industrial parks in China. … There is still no problem in terms of the labour supply, but there is an issue about the labour cost as it increases every year continuously. Moreover, the tax benefits will finish soon. These are the main reasons why we cannot make a plan for further extension of factories in SIP."

Throughout the interviews, it is clear that the critical concerns of enterprises located in SIP are about more direct benefits such as tax and rent reductions. However, speaking from the smart city aspects, the development of the one-stop service centre with the integration of administrative information may be helpful to attract industries, especially in China where administrative process is relevantly complicated for foreign firms. This argument has also suggested that the development of smart solutions for industries such as the one-stop service centre should be seen as a value-added approach, as it cannot stimulate a primary motivation in determining the location of their corporations in a particular industrial park. From a long-term perspective, it seems that SIP is needed to prepare an exit strategy from the notion of industrial park in accordance with the changes of surrounding environments. The urban environment of SIP is transforming as a new urban area of the Suzhou city, and the characteristics of industrial parks are fading away. There is a need of consideration on how SIP can be restructured after the major manufacturing industries move out.

At the initial stage of the development of industrial parks, it was necessary to emphasise the aspects of the private sector in the development of smart cities. This might facilitate the integration of the administrative information in relation to industrial activities to provide effective governmental supports and services to the enterprises located in the industrial park. As SIP's smart city strategy states, smart transport solution for a better logistics system could also be another added-value for supporting local enterprises. However, industrial parks are moving forward to industrial restructure focusing on technology and service-based industries from manufacturing ones. The smart city development is also needed to refocus on living environments of the industrial parks. High-tech industries require highly educated professionals as main resources of the industries, while manufacturing industries at the initial stage of the development needed the cheap labour force. To attract technology-based industries to the industrial park during the transition period, the quality of living environments in surrounding areas should also be transformed to meet the need for the professional employees for those industries. The development of the smart city for the industrial parks should consider not only the local needs of public, private and social sectors at the development stage but also the transformation in a long-term perspective. In the development of smart cities for industrial parks, it is important to identify the critical elements that are needed in both short-term and long-term strategies. This is particularly important to the design of ICT infrastructure in the industrial parks, which is a long-lasting element in the city development. The ICT infrastructure should be developed in consideration of the uses to support both industries in short-term and local residents in longer-term.

6.2 Recognising the need of local communities in the development of smart cities

In order to investigate the need and preference of smart solutions in SIP, two sets of questions were asked in the questionnaire survey. The first question was to investigate the need of local communities in details, and the second one was about the people's preference on proposed smart solutions. Respondents were required to express their satisfactions and preferences in the five-ranking scale (Figure 4 and 5). From the previous analysis, the three aspects of retails, healthcare, and energy/water are the most significant in relation to the improvement of living environments of SIP. These three categories are reviewed and discussed in this section.

Firstly, for issues related to retails in SIP, people strongly agreed in the satisfaction of physical environments in the retail areas, despite the fact that they are less satisfied in a variety of goods and shopping experiences (Figure 4). This has influenced the question on their preference of smart solutions in the retail category, although the differences were less significant. It seemed that intelligent car park systems and way-finding solutions are desirable for the development of smart cities in SIP (Figure 5).

Secondly, in the healthcare category in Figure 4, the results have shown that local communities were not satisfied in both quantity and quality of healthcare services in SIP. They demanded the increased number of healthcare facilities and better quality of healthcare services in SIP. Analysing their preference of smart solutions, respondents demanded more to have intelligent medical services in hospital to reduce waiting time and improve administrative process. This was also the issue which the SIP government identified, and an integrated information system for medical services is currently under development. However, respondents preferred less in the remote monitoring system for home healthcare services.

Thirdly, for the energy/water category, Figure 4 indicates that local communities are generally satisfied in the water and energy supply services in SIP, although they are less satisfied in the cost of energy. This might lead to a conclusion that the development of smart cities in SIP should focus on effective use of energy to save energy consumption and the cost of energy uses, and the current intelligent energy and water management systems of SIP operate in a reasonable level. However, Figure 5 shows the opposite result. The preference of an underground facility management system was slightly higher than a smart home solution for energy monitoring. This might be because people tend to consider the development of smart cities is the responsibility of the government, especially, if it is related to public services.

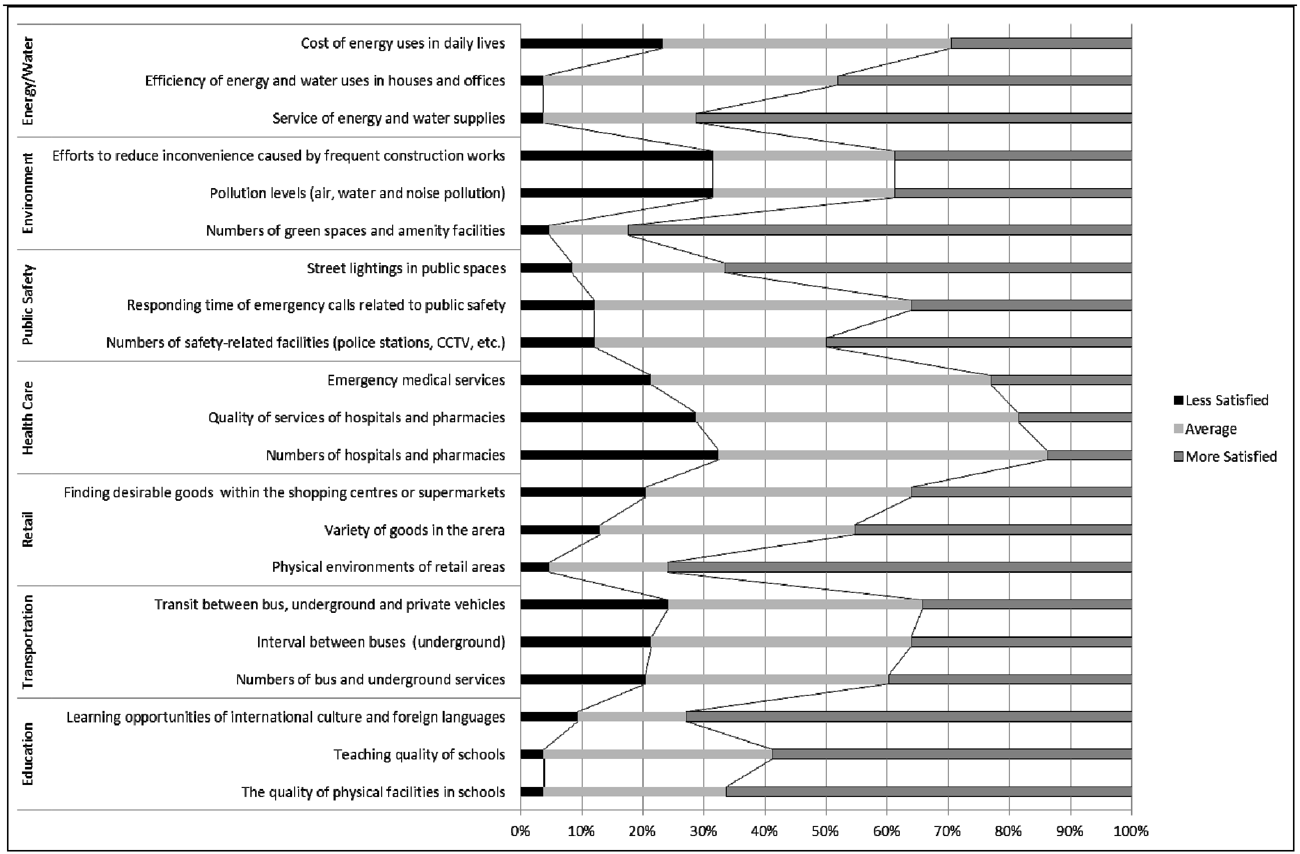

Fig. 4: Satisfactions on Living Environments in SIP. (Source: Author)

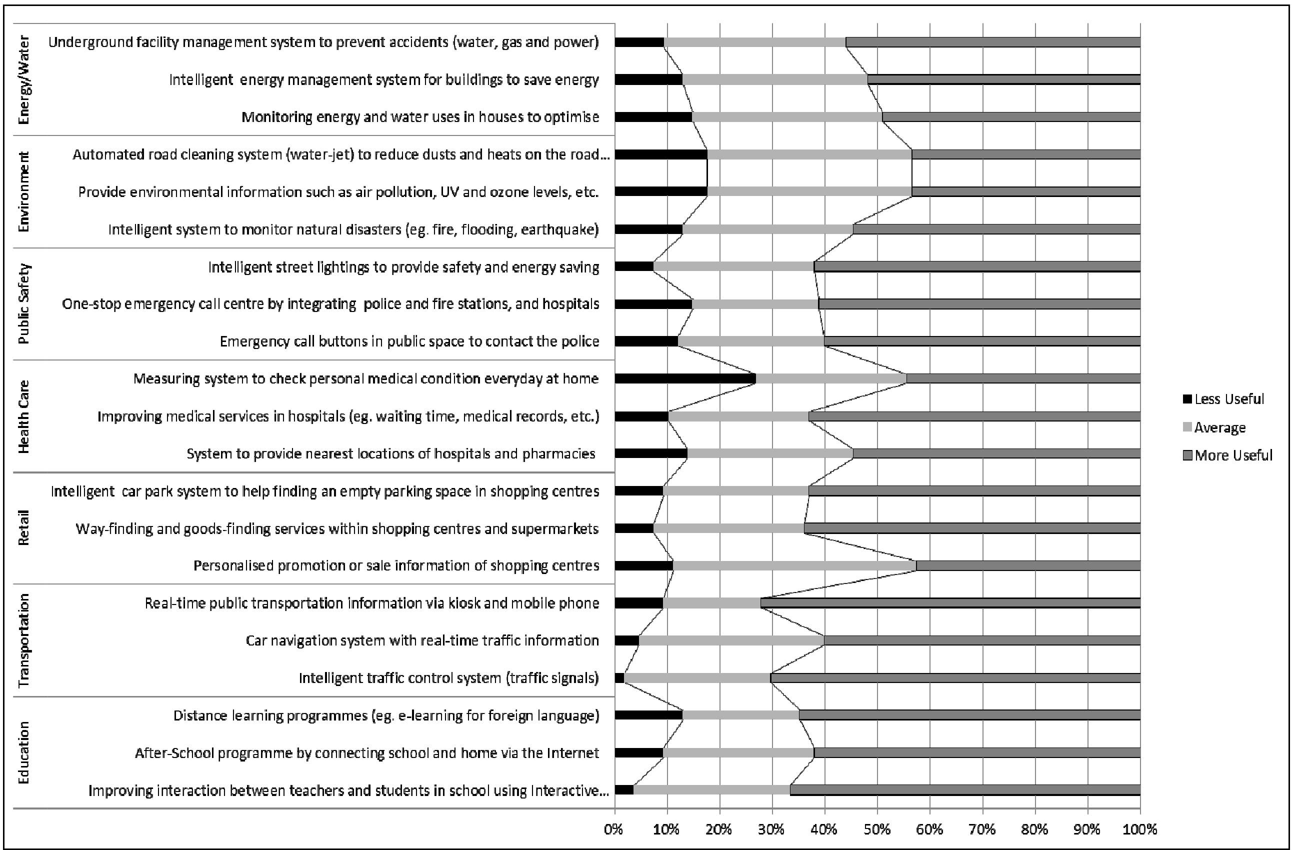

Fig. 5: Preferences on the Proposed Smart Solutions in SIP. (Source: Author)

The results of the questionnaire survey has also indicated that local communities demanded the most of all proposed smart solutions in the questionnaire survey with a perception of 'more is better'. This argument suggested that the development of the smart city strategy should not be decided by a single interest group, neither the government nor the local community. It should be a result of collaborative actions between various stakeholders including experts in the field of smart cities. Another lesson from this survey is that the development of smart cities should not be isolated in the ICT development. The need of local communities should be investigated in diverse interests in association with the urban planning practice.

6.3 Delivering the integration of smart city services

The development of smart cities should take a holistic approach by integrating different sectors and organisations in cities. One of the most significant barriers of the collaborative actions in smart cities is because public resources including those described in the above seven categories have traditionally considered and managed separately without much interaction between them (ARUP, 2013b). This partial approach exists in the development of smart cities in SIP. There is a realisation that public administrative information needs to be integrated for efficient, effective and accountable services for citizens in the case of 'Digital Livelihood Programme', discussed before. However, this is initiated from a top-down approach and limited to integration of governmental systems. There are less cross-sectoral attentions in developing other smart solutions in SIP such as intelligent transport systems and smart public bicycle services.

The fragmental approach was also seen in the evaluation framework of the smart city development. There are twelve indicators in measuring the level of the ICT development in Suzhou that become a guideline to the development of smart cities in SIP (Table 1). The indicator framework plays an important role by evaluating effectiveness of the development outcomes and guiding the future plans and development strategies. The twelve indicators, however, represent measurements on either the development of ICT infrastructure such as the Internet diffusion rate and speed, or the system integration within the single sector rather than across public, private and social sectors. It is understandable that the indicators were originally developed to measure the levels of information and communication services in the city, particularly targeting government-led projects. In considering the development of smart cities can yield the most benefit when it makes synergies from the interactions between various stakeholders, the system of smart cities in SIP is required be 'more' interconnected and interactive. As Kim (2013) argues, integration of smart solutions has operational difficulties and requires the changing of existing working process. In this context, the development of evaluation indicators reflecting integrations between diverse parties may facilitate them to work together to make collaborative efforts in the development of smart cities. The certain geographical boundary of the industrial park is also an advantage in this perspective because there are fewer stakeholders and less conflicts comparing with larger administrative areas.

Twelve Indicators of Suzhou's Informationisation		2010 status	2015 targets
Indicator 1	access rate of the administrative system on database platform	60%	90%
Indicator 2	reporting rate of the online open approval enterprises	50%	70%
Indicator 3	visit records of the government websites	3,800,000	10,000,000
Indicator 4	number of WIFI hotspots in public spaces	450	2000
Indicator 5	number of Internet users per thousand residents	950	1500
Indicator 6	average Internet bandwidth	4M	20M
Indicator 7	coverage of the digitalised health records of local residents	0	80%
Indicator 8	percentage of computerised operations in community services	80%	100%
Indicator 9	online rate of government public services	40%	90%
Indicator 10	number of enterprises using cloud-computing platform	1,000	2,000
Indicator 11	number of public service platforms for enterprises	6	10 or above
Indicator 12	number of people receiving ICT-related training courses	10,000	15,000

Table 1: Twelve Indicators of the Suzhou's Informationisation (Source: SIPAC, 2012).

7 CONCLUSION

The development of smart cities in China's industrial parks faces challenges due to the change of economic, political and social environments. It is evident that the smart city development of industrial parks should be closely associated with the process of urban planning practice in its transformations. This research is not an attempt to solve all the problems that smart cities face in practice. It has provided a framework for more manageable approach in developing the smart city strategy for industrial parks in China. This paper explored the three strategic dimensions of smart cities to investigate how smart cities could be delivered to cope with the transformation process of the industrial parks. The research shows that the smart city strategy should be a part of the transformation plan for the industrial park. The development of smart cities is needed to echo the needs of the local residents and enterprises before and after the transformation of the industrial park. This is especially true in relation to the development of urban infrastructure. Smart cities are also required to reflect local needs from various aspects and involve multiple actors in its value chain. This is because smart cities cannot be isolated from political, economic, environmental and social aspects of urbanisation. As the integration of systems and services is critical in the development of smart cities, a measuring framework on smart service integrations could act as a catalyst to motivate collaborative actions from a wider range of players including those who were not previously involved in traditional practice.

8 ACKNOWLEDGEMENT

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reviewed paper

Scenario Approach for Image Processing in Smart City

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1 ABSTRACT

Modern city is described by fast change of a situations and large volume of available data about it. One of principal data types are images (satellite pictures, video from surveillance cameras, etc.). Fast manual analysis of such data is often complicated or impossible. Widespread practice is development of analysis system for each separate problem (for example identification of car identification numbers or QR-codes) that leads to a number of difficulties; in particular, it is difficult to integrate and modify such systems. In article the structure of raster image analysis system (both single images and a video stream) is proposed. The system is developed taking into account peculiarities of input data and requirements imposed by the smart city. As a basis of system the set of algorithms, that implements all image analysis stages (preliminary processing, construction of feature space and classification) is proposed. That algorithms are elements of data processing scenarios. Usage of scenario approach, based on subject domain ontology, allows to significantly simplify adaptation of image processing system to the peculiarities of subject domain without limitation of allowed algorithms set. A example of application of the developed system for real-world problem is given.

2 BASIC CONCEPTS

“In the future, cities will account for nearly 90% of global population growth, 80% of wealth creation, and 60% of total energy consumption“ (MIT). In addition, widespread use of surveillance systems recovers the problem of processing heterogeneous data. This data almost always has geospatial part. The idea of IGIS (Popovich, Voronin, 2005) forms a theoretical base for analysis this big heterogeneous data. Significant part of the data are videos and still images. Smart cities make demands on image analysis systems, because they are characterized by:

- Different problems and demands of analysis speed and accuracy.
- Considerable volume of heterogeneous data.
- Distributed analysis.
- Inequality of demands.

This data can be later processed by more complicated and deeper analysis for different purposes, but this problem isn't described in this paper.

The problem of image analysis is reviewed below. We consider that analysis problems have 3 objected included to it:

- Recognized image — set of images that need to be detected.
- Training set — set of objects (instances) with its classes, that’s should be selected on images.
- Recognition — set of operations, running on recognized image and training set. These operations set a class for every pixel or group of image’s pixels.

Today there's no solid theory of digital image analysis, therefore analysis system should include wide set of d processing methods, based on different properties of objects of interest (Gonzales, Woods, 2007).

Every analysis system that works with digital images includes different set of operations of image processing. Most part of these operations can be divided in next classes:

- Image preprocessing.
- Selecting informative features — segments, contours, points and etc.
- Creation of description space (usually— feature space) (Potapov, 2007).
- Classification of the description space elements.

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Every step of analysis can use different set of algorithms and entire process can be presented as these algorithms sequence. We discuss more detailed description of basic concepts of the scenario approach in section 3, classification of the analysis algorithms in section 4, and set of used algorithms in section 5.

3 BASICS OF SCENARIO APPROACH

The scenario can be defined formally as sequence of stages and decisions (Popovich and others, 2013). The stage is a set of the elementary actions which are carried out insequence or in parallel. The decision represents a point in which the process can change the direction depending of some conditions which take place in this moment.

The elements, corresponding to actions, can represent both separate algorithms and the nested scenarios. Elements of the decision include one or several logical rules which are used for a choice of process's branch in the presence of several possible options. Usage of both strict and fuzzy logic is allowed.

Usage of scenario approach allows:

- to describe difficult, hardly formalizable or even not formalizable spatial processes, which assumes interaction of a large number of technical and natural objects;
- to specify descriptions of processes just before the beginning of their execution and during their execution without restarting;
- to have vivid graphical representation of described processes;
- to carry out parallel data processing. Some possible alternatives of parallel processing can be considered: parallel performance of various stages of processing for various data sets, application of the parallel computing algorithms, parallel processing of separate fragments of one data set.

As a rule, work with scenarios assumes:

- development of scenarios using knowledge of experts from different subjects domains;
- formalized description of the created scenarios;
- definition of conditions under which scenarios can be applied;
- implementation of scenarios;
- qualitative and quantitative evaluation of the data, obtained as a result of whole scenarios execution or execution of their separate fragments.

For development of scenarios specialized graphic tools, which allow to describe the general structure of scenarios and their separate elements are used. Such tools also provide means for debugging the scenarios, allowing revealing and eliminating possible errors.

The formalized description of scenarios assumes that:

- All concepts, used for description of processes (types of objects, types of actions, etc.) are defined in the dictionary of subject domain;
- The format of the scenarios description conforms to standards (for example, BPEL(Web Services Business Process Execution Language));
- The logical rules, that are set for elements of decisions elements, aren't inconsistent;

Descriptions of the restrictions, imposed on use of scenarios, and also conditions of scenarios application are intended for end users in subjects domains and are used for scenarios choice. The developed scenarios are stored arranged in the library of scenarios which is as an element of domain's model description. Execution of scenarios requires three principal components:

- The engine of processes execution - provides execution of actions according to the given sequence;
- The inference engine - allows to make decisions in the presence of alternative options of processes execution;
- The graphic interface - allows to display processes, described scenarios and to control the flow of their execution;

The assessment of results of scenarios execution is based on of an assessment of results of operation of separate algorithms. If the received results not meet requirements, the cycle of scenarios execution can be repeated partially or completely.

In case of scenarios creation for image processing it is necessary to define:

- list of algorithms for each processing stage;
- sequence of algorithms execution for each stage;
- list of the computing procedures applied in algorithms;
- parameters of execution for each algorithm;
- the criteria, applied for an assessment of algorithms results.

The heterogeneous structure of input data and tasks at hand, and also presence of various factors which can have impact on output data, result in need to develop a large number of scenarios. Besides, it is often needed to delete earlier created scenarios, and also develop of some new.

This problem is solved due to use of the generalized scenarios which describe general processing stages. Detailing of scenarios takes place during the execution of tasks, after necessary additional information is available. As a rule, context-dependent information is part of additional information. For example, on the basis of a signal / noise ratio assessment can be defined the filter, used at preliminary preocessing stage or temporal and frequency scales at which image processing is carried out.

For setup of scenarios to the solution of tasks in different conditions it is necessary to have possibility to specify the boundary values applied in logical rules. For example, in case of processing of seabed images, obtained from unmanned underwater vehicle (Zhukova, Pankin, 2013) boundary values of such properties as average brightness depends from a relief of a seabed and can significantly differ. In some cases, for calculation of boundary values additional computation can be demanded, and for specification of boundary conditions the results of statistical processing of historical data can be used.

During a execution of scenarios the set of the used software modules, that implements algorithms, is defined by a set of available services, and also computing resources. The composition of services and resources, as a rule, changes dynamically. As such, the choice of algorithms implementation is carried out before execution of scenarios. The description of scenarios contain names of algorithms according to the nomenclator and the description of their parameters; explicit links to algorithms libraries in scenarios should not be specified.

Thus, for the solution of image processing tasks in the applications developed for Smart Cities it is desirable to use the generalized scenarios formalized in the form of templates which are detailed and set up before the solution of application-oriented tasks.

It is necessary to mention that use of scenario approach for data processing also allows:

- to create new algorithms on the basis of a combination the exsisting algorithms;
- to execute different variants of data processing and - on their basis - create final decisions.

For a long time scenario approach is successfully used in intellectual geoinformation systems - IGIS (Popovich and others, 2013). Using IGIS for working with scenarios gives a set of important advantages - first of all, IGIS collect actual data about the environment, secondly, provides GIS interface, convenient for the end user, in the third, artificial intelligence techniques are integrated into IGIS, in particular, the inference engine and the expert system, used for implementation of scenario approach.

4 CLASSIFICATION OF DATA ANALYSUS ALGORITHMS

It is needed to develop onotology of image analysis algorithms for using algorithms of remote sensing in term of scenario approach. The basic to this ontology is classification of the subject domain by its main features. There are list of objects, that are subjects of this classification:

- Data processing and analysis algorithms.
- Variants of formal description of raw, intermediate and output data.
- Data and algorithms' results estimation.
- Tarfget objects.

Analysis algorithms classification is the most important part, because these algorithms are used to analysis sequence of data. Data analysis algorithms can be classified by next features:

Feature 1. General analysis process step. According to this algorithms can be divided as shown in table 1.

Feature 2. For algorithms of 1 and 2 classes - image type, which can be used by these algorithms (multispectral, hiperspectral, binary). It is important to expand the scope of application of the algorithms, that requires their generalization to process hyperspectral images, which is a non-trivial task.

Feature 3. For algorithms of class 2 – type of objects, which can be extracted by algorithm, such as points, contours and segments (see table 1).

No.	Algorithm class	Subclass	Input	Output	Settings	Examples
1	Preprocessing	Spatial processing methods	Raster image	Raster image	Level of image approximation, etc.	Median filtration, brights average, etc.
		Frequency domain methods	Raster image	Raster image	Level of image approximation, etc.	
2	Extracting infomative features	Segmentation	Raster image	Image model (result of image partitioning)	Level of image approximation, etc.	Statisical Region merging (Nock, Nielsen, 2004), flood fill, Full-Lambda schedule (Robinson, Redding, Crisp, 2002), etc.
		Points selection	Raster image	Image model (set of points and its properties).	Algorithm-specific.	SIFT / SURF descriptors
		Edge detection	Raster image	Image model as a set of contours.	Algorithm-specific.	Canny edge detector
3	Features space construction	-	Image model	Descrition space (Potapov, 2007)	Algorithm-specific, frecuently absent.	Calculation of segment properties–geometrical, bright, contextual, etc.
4	Classification	-	Descrition space, training set	Classes tags for model elements.	Algorithm-specific.	Nearest neighborhood.

Table 1. Algorithm classification by analysis process step.

Origin data (images) can be classified by next features:

Feature 1. For remote sensing — spatial resolution (meter per pixel or pixel per meter).

Feature 2. Image size in pixels.

Feature 3. Spectral band.

Feature 4. Color depth (radiometric resolution), defined by bits per pixel for one spectral band of image.

Feature 5. Capturing time and geospatial data.

Feature 6. Images can be divided to static and dynamic (videos).

Feature 7. Data format. They can be divided to lossy (jpeg, jpeg2000, etc.) and lossless (png, bmp, etc.) compression.

Feature 8. File size.

Also there are some specific videostream features (bit rate and others).

Formalized representation of data is different depending on data type. Raw (input) image can be represented by sequences of matrices (two-dimension array) with non-negative values. Value of array element is visualized as pixel brightness.

Types of image's model storage can differ essentially (see table 2). In case of segmented image, when it’s pixels are arranged to group (segments), dynamic trees can be used as data structure for storage (Sleator, Tarjan, 1985; Tarjan, 1975). In this case if levels of segmenation in different levels of approximation compose strict hierarchy, then this hierarchy can be stored in indexed tree (Kharinov, 2006). It store different levels of hierarchy with low memory usage. In cases when object of image cannot be presented as solid segment “marked segments” can be used for selection instead. Marked segments are specific for each class objects; extract such segments is equal to extracting whole object. Contours of image can be presented as pixels set, i. e. segments. It is needed to keep in mind, that image segment shouldn’t be coherenced. Some points can be stored in one-dimension array, where index is their linear coordinates. The formulas for mapping two-dimensional pixels coordinates to ine-dimensional array are evident.

Objects class	Subclass	Type of formalized representation	Advantages	Disadvantages
Single-band image	Raw image	Array of integer numbers	No accumulation of errors for many operations	The need to check errors accumulation for many operations
		Array of real numbers	Can be used as a temporary representation for many operations	Cannot be visualized directly
	Segmented image (one level of segmentation)	Assosiative array (key – coordintae of pixel, value – pixel bright)	Memory saving due to store only meningful pixels.	Slow segments union operations.
		Disjoint-set data structure	High speeed of segments union and enumeration operations.	Complex software implementation.
	Segmented image (multi-level hierachic segmentation)	Multi-dimensional assosiative array	Simplicity of software implementation.	High memory consumption
		Ierarchic tree	High speeed of segments union and enumeration operations.	Complex software implementation.
Feature space	Explicit representation	Two-dimensional array of properties	Can be used for analisys of relations between properties	Computationaly constly.
	Implicit representation	One-dimensional array (indexed tree)	Economy of computaional resources.	Low classification accuracy.

Table 2. Image representation at different stages of analisys.

Types of formalized representation of feature space are classification algroithm-specific. Volume of training set is often less than the number of image pixels, that lowers demands to data structure. In most cases using matrices of features vectors is smart choice. These matrices are stored as two-dimensional array where real numbers are values. Using indexed trees for storage segments features (contours) on some level of hierarchy is another option. Numbers of elements in features vectors in training set is equal to number of image pixels (in the worst case), and dimension of each feature vector is production of spectral band number by number of features, calculated for each band. If classification algorithm, during training process, works with each dimension of the feature space one-by-one, then we can reduce demands to CPU, because we don not need to storage the whole training set. But algorithms of these type often demonstrate worse classification results than algorithms that analyse features correlation.

There are many books about estimatione criterias for input data, for example the classic book (Pratt, 1978). Result of algorithms estimation is calculated twice:

- directly after algrorithm stops
- on next steps of processing and analysis.

Method of algorithm result estimation is iterative. When analysis can not be done, the algorithm returns to previous step of processing. We use following methods in case of direct analysis:

- comparison of given results with actual information,
- comparison with results, calculated by different methods,
- comparison with result of historical data processing,
- comparison with results of combinated analsysis methods,
- expert estimate (can be given automaticly with rules, that expert forumated); calculation of estimate by total calculated criterias.

The data sources can be classified by multiple parameters, for example:

- an area of basing (earth, air, space),
- a volume of transmitted data,
- noise-immunity (Verba and others, 2010), etc.

Desired objects can be classified by different features. The simplest classification is dividing object to natural and artificial. Extracting of artificial objects are more complicate, however for smart cities purposes they are more interesting. While analysis of remote sensing data we can divide objects to (Verba and others, 2010):

- Dotted objects (less than 1 pixel),
- Group objects (is around 1 pixel),
- Distributive object (more than 1 pixel).

This classification is base of ontology, that provides capability of developing image analysis scenarios without using algorithms restrictions.

5 BASIC SET OF ALGORITHMS

For the user of developed system the most important parameter is set of using analysis algorithma. We selecting algrothims for system prototype based on the following criterias:

- High speed of analysis is nessesary condition for videostream analysis and huge remote sensing data volumes.
- For preprocessing algorithms - no “bluring” of the image, adjustable level of noise reduction and possibility of light inequality compensation.
- For algorithms of feature extracting (primarily segmentation):
  - Hierarchy segmentation (lets us to use the dynamic trees).
  - Monochrome and color image segmenation.
  - High quality of the segmenation, estimated directly or by system work results.
- For algorithms of feature calculation:
  - Use of different segment features: geometry, brightness, spectral, context, etc.

  - Using dynamic trees as form of storage feature values.
  - Possibility of image analysis with arbitrary number of spectral intervals.
- For classification algorithms:
  - Possibility of analysis feature vector with high dimension.
  - Possibility one-by-one feature analysis or including interrelations.
  - Adjustable accruacity of analysis.

According to this set of criteria for developed prototype following algorithms were chosen:

- Median filtration, set of histogram changing algorithms, including invariant image representation (Kharinov, 2006).
- Segmentation algorithms: Statistical region merging (Nock, Nielsen, 2004), «Flood fill», Zero Lambda Schedule – modification of Full-Lambda Schedule with λ= 0 (Robinson, Redding, Crisp, 2002).
- Algorithms of properties calculation - (dozens of algorithms), including, but not limited to: average bright, perimeter, square, compactness (Gonzales, Woods, 2007), variance of brights, axis moment (Shapiro, Stockman, 2001), etc.
- Classification algorithms: one-dimensional linear classifier (threshold processing), nearest neighborhood, SVD-classifier (Galiano, 2010), «naive» Bayes classifier (Duda, Hart, Stork, 2001), etc.

Based on this approach a prototype of image processing system based on an intelligent GIS was developed.

6 CASE STUDY

6.1 Ships detection

One of tasks which can be solved by means of the analysis of Remote Sensing Data with high resolution is selection of the objects on water surface (vessels). Data at hand are characterized by the big size (in pixels), however requirements to analysis speed here are rather insignificant. The task of vessel selection, rather simple in a case when the vessel is in open water, becomes much more difficult if the vessel is at the mooring.

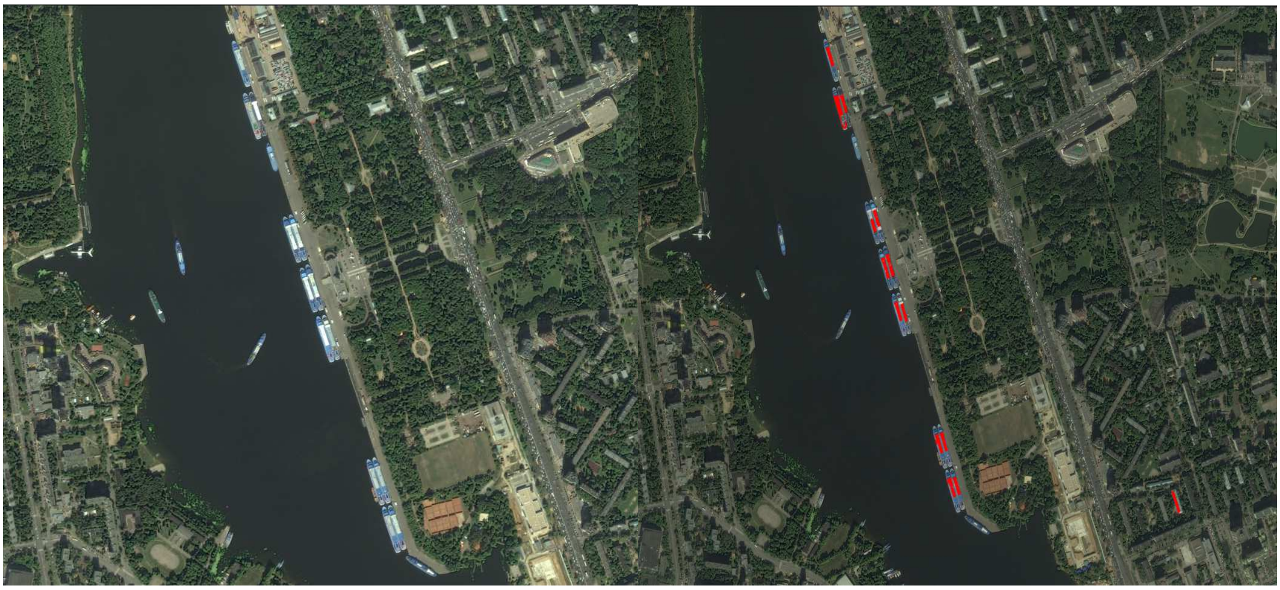

Fig. 1. The source image (at the left) and the result of its analysis (on the right) – selection of vessels of the given type on Remote sensing Data provided by the SCANEX (SCANEX Research and Development Center). In the picture the Krasnogorsk city is showed. The handle segments of the found objects are marked with red color.

However, for certain ships classes this task can be solved using a combination of standard analysis algorithms, as shown below. The purpose of the analysis was selection of vessels with big size which are at the mooring. As an algorithm of preliminary processing median filtering was used, for segmentation we use

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SRM, for classification – simple linear classificator. For speed-up the recognition (but not training) we use single-level segmentation, where value of segmentation level was defined as an arithmetic average of all levels at which the object was selected during training. As "object markers" we use segments, uniq for this ships class. The list of segment properties, used for classification, includes the area and segment perimeter (in pixels), average brightness of a segment and dispersion of brightness, and also a segment inertia moment round the principal axis (Shapiro, Stockman, 2001). Total time of the analysis using normal PC is about one one minute for one color image about 10 megapixels in size (see fig. 1). In the right lower part an false ship is detected; this result can be improved using cartographical information.

6.2 Realtime selection of region of initerest based on unmanned aerial vehicles

Other task of considerable interests is selection of region of interest on video stream, taking into account the spectral band of video. In particular, a unmanned aerial vehicles (UAV) video, see a figure 2, can be used as data sources. When processing a video stream high requirements to analysis speed are imposed, that restricts the possibilities of use computationally costly algorithms. However, use of indexed dynamic trees (Kharinov, 2006) allows to quickly analyse image at several levels of segmentation that permits to receive satisfactory analysis results.

The analysis was made for video received only in an infrared range. The analysis of video impose high requirements to the processing speed, however a separate frame it is significantly smaller, than tipical Remote Sensing Data (720 × 576 pixels, in this example). As algorithm of segmentation the modified algorithm of "flood fill" was used. It was modified by creation of the minimum spanning tree, and it gives the possibility to achieve essential increase in speed of segmentation (Galiano and others, 2013). The small feature set of a segment (average brightness and the square) was used; and as algorithm of classification simple linear classsificatir was used. Recognition take place in the RGB color space; before the analysis median filtering was executed and the linear normalization of the histogram to all range of brightness [0; 255] was performed. In the stage of recognition one level of segmentation was used. For training stage a set of supply algorithms was developed which are creating the training set and performing selection of algorithms parameters on the basis of the image classified by the expert. For analysis of one image the normal personal computer was used, and the analisys takes from 200 milliseconds to 1 second, depending on a used feature set. For an assessment of algorithm's accuracy part of a video stream was partitioned into separate images. The assessment of accuracy is given in table 3.

Parameter	Value
Total number of images	1931
Total number of opixels	800824320
Absolute number of correctly classified pixels	770279811
Absolute number of false positives	29340306
Absolute number of false negatives	1204203
Fractional number of correctly classified pixels	0.9618586645820147
Fractional number of false positives	0.03663763108493009
Fractional number of false negatives	0.00150370433305522
Variance of right classificated pixels	1.9063211494840804E-4
Standart deviation of right classificated pixels	0.013806958931944719
Total time of teaching and recognition, milliseconds	1515482

Table 3. Assessment of objects detection accuracy, measured for pixels.

7 CONCLUSION

The framework, offered in article, allows to create analysis systems for single images and video data rather easily. We outline that program implementation of processing algorithms can be replaced by arbitrary, while saving interfaces that allows to use third-party libraries, in particular – widely known library OpenCV (OpenCV). The received results can be applied in development of image and video processing systems of and video for smart cities. Further development of the offered prototype requires development of full ontology, including the expanded description of subject data (Turusova, 2007), in particular processing of sound information (for voice recognition) and geospatial information.

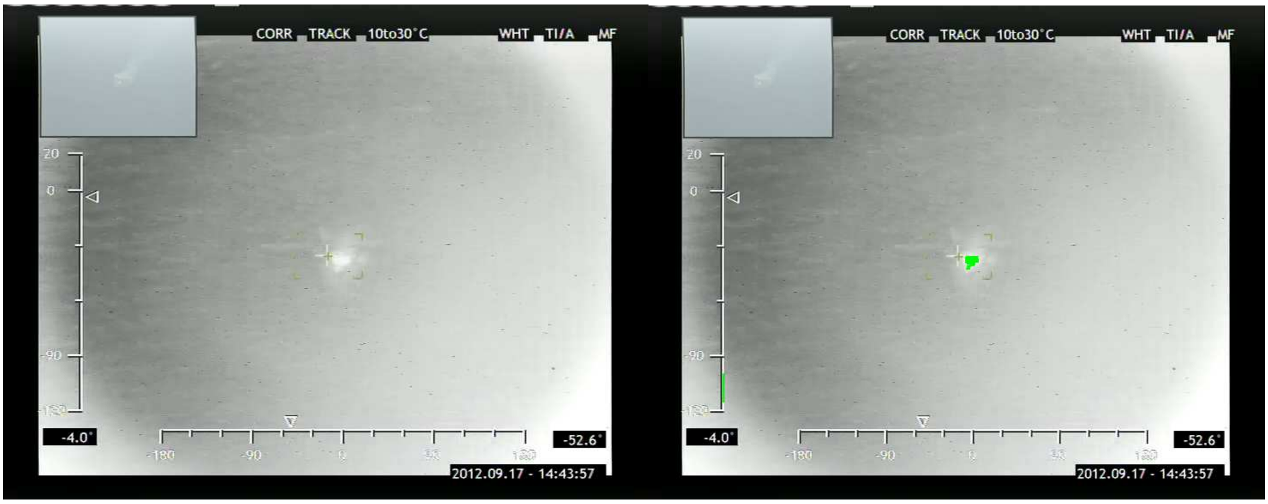

Fig 2. Analysis of data from the Camcopter S-100 UAV. At the left – input data, on the right – result of selection of marker segments (they are marked by green). Despite poor quality of a picture the required object is selected with an accuracy of 98%. False operation in the lower left corner is caused by presence of additional technical information and can easily be removed, if necessary.

In addition, an important direction for further development of the proposed approach and the prototype is the usage of inference engine for creating a chain of analysis algorithms. When operating in this mode for train the system to recognize a certain class of objects one need to set only their formalized description and the sequence of steps for objects detection will be generated automatically. The proposed approach allows to implement the idea of a "strong learning" where the learning process consist not only in changing the number values (weights of elements, training samples representation, etc.), but the structure of the system (Potapov, 2007). This opens up opportunities for the use of the system in various subject domains in fully automated mode.

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reviewed paper

Scientific and Practical Understandings of Smart Cities

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1 ABSTRACT

Cities are key agents in the transformation of energy systems, since the majority of the world population lives in cities and most energy is consumed in urban areas. In recent times, the concept of smart cities has raised the attention of both scientists and practitioners in different fields. Smart cities are envisioned to link different fields of action such as mobility; energy production, distribution, and consumption; buildings; governance and stakeholder processes; and urban planning. Information and communication technologies are seen as key to these interconnections. The overall goal of a smart city is to save energy and simultaneously to increase the quality of life for inhabitants.

Although a broad variety of descriptions of smart cities have been developed, the concept itself appears to be rather fuzzy and hard to grasp. A clear-cut, common definition of smart cities is still lacking. The goal of this paper is to better understand what a smart city constitutes and what it means from the perspective of science, as well as from a practical point of view.

In a thorough literature analysis, we identify different i) definitions, ii) approaches, iii) fields of actions and iv) technologies associated with smart cities. Our analysis is based on interdisciplinary scientific literature, as well as on practical documents (e.g. websites of pilot projects). In a subsequent step, we compare the different understandings of smart cities. In so doing, we focus on similarities and differences between scientific and practical approaches. In a final step, we identify opportunities and challenges arising from the identified similarities and differences.

Recognising these challenges and potentials is of particular interest for so-called transdisciplinary research in urban development, where scientists and practitioners work closely together. Differences between science and practice might on the one hand inform research on smart cities concerning practical implications and experiences. On the other hand, they can also inform practitioners about scientific innovation in urban development (e.g. cloud computing assessing sensor data in real time).

2 INTRODUCTION

Cities will be important agents of change in the upcoming energy transition. In 2010, it was observed that most people worldwide (52%) live in cities; this share is expected to grow to 67% by the year 2050 (United Nations, 2014). Furthermore, cities are responsible for as much as 75% of the global energy consumption (United Nations, 2011). This indicates a huge potential for energy efficiency improvements at the city level. In science and practice, the growing importance of cities in the energy transition has been recognised. Cities can be role models in the energy transition (e.g., by increasing energy efficiency of public buildings), and at the same time governing change by implementing national policies, setting legislation, providing infrastructure, and informing and empowering citizens. Furthermore, cities can disseminate their experiences, and in so doing, influence energy transition policies (Jollands, Kenihan, & Wescott, 2008).

In Switzerland, communities and cities are encouraged to promote energy savings in different domains such as developmental and spatial planning (e.g. a city's mission statement), public buildings and infrastructure (e.g. refurbishment of public buildings), energy supply and waste management, communication and cooperation (e.g. events, marketing), internal organisation (e.g. further education) and mobility (e.g. promotion of public transport; Horbaty, 2013). By November 2013, as many as 345 Swiss communities had received the 'Energiestadt' label (Swiss label corresponding to the European Energy Award; Energiestadt, 2013). This label acknowledges the engagement of cities in promoting energy efficiency in the mentioned domains. However, in order to go one step further to promote energy efficiency, cities need to link their activities in the mentioned fields. This means no piecemeal solutions; instead, integrated solutions are required.

In recent times, the concept of 'smart cities' has gained the attention of scientists and practitioners. Smart cities are supposed to link different fields of action such as mobility, energy, buildings, governance,

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stakeholder processes and urban planning (Smart City Schweiz, 2014b). Information and communication technology (ICT) is seen as key to these interconnections. The aim of a smart city is to reduce energy consumption while at the same time maintaining or even enhancing the quality of life of inhabitants.

2.1 Scientific definitions of smart cities

A multitude of different understandings of smart cities are evident, and there is no commonly accepted definition in the literature. Nam and Pardo's (2011) paper provides an overview of different definitions which have been developed. Here, we briefly review some key characteristics of smart cities as identified by Nam and Pardo (2011):

Smart cities

- adapt to the changing needs of users (Mars-Maestre, Lopez-Carmona, Velasco, & Navarro, 2008);
- use smart technologies that monitor and integrate infrastructure (e.g., ICT such as connected mobile terminals, sensors, and actuators; Hall, 2000);
- link smart economy (competitiveness), smart people (social and human capital), smart governance (participation), smart mobility (transport and ICT), smart environment (natural resources) and smart living (quality of life; Giffinger & Haindlmaier, 2010); and
- empower inhabitants to participate in decisions and to shape smart cities (Partridge, 2004).

These different perspectives are reflected in an operational definition by Caragliu, Del Bo and Nijkamp (2011): "We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance" (p. 70).

2.2 Practical understandings of smart cities

In addition to these scientific definitions, it is interesting to consider the practical perspective. We reviewed exemplary practice perspectives in three different countries which currently promote smart cities, namely, Switzerland, Germany and Austria. All countries also collaborate in a so-called D-A-CH project to exchange smart city experiences (D-A-CH Energieeffizienze Stadt, 2014) and provide rich databases on implemented, ongoing and planned projects.

In Switzerland, a smart city is understood to be a city which provides the maximum available quality of life at minimal use of resources thanks to intelligent connections of infrastructure (transport, energy, communication) at different hierarchical levels (building, quarter, city; Smart City Schweiz, 2014a). A smart city links topics such as urban energy master planning, smart buildings, smart grids and supply technologies, smart mobility, good governance and stakeholder processes (see Fig. 1).

Fig. 1: Understanding of smart cities in Switzerland (Smart City Schweiz, 2014b).

In Germany, the term 'energy efficient city' is used rather than 'smart city'. The overall goal of an energy efficient city is to integrate different innovative technologies in order to promote the energy efficiency of cities. Integrative planning is a key issue (EnEff:Stadt, 2014).

Finally, in Austria, smart cities are understood as cities which i) consider the balance of greenhouse gases, ii) use innovative technologies that are highly resource and energy efficient, iii) provide systemic solutions for optimising energy systems, iv) promote public transport and soft mobility, v) promote social and organisational innovation through participatory processes, vi) promote early inclusion of investors and vii) contribute to environmental sustainability (Smart Cities Austria, 2014).

2.3 Goal and research questions of the study

Scrutinising the understandings of a smart city in science and in practice reveals that there are similarities and differences within and between the scientific and practical perspectives. The goal of this paper is to better understand what constitutes a smart city and what it means from the perspective of science in relation to practice. The following research questions form the core of our study:

- How can the term smart city be characterised from both the scientific and practical perspectives?
- What are the similarities and differences between the two perspectives?

2.4 A two-dimensional grid: level of integration and socio-technical embedding

The backbone of our analysis is a two-dimensional grid on which scientific studies and practical projects are placed. The two dimensions have been deduced from our review on scientific definitions and practical understandings of smart cities (see above). The first dimension is *level of integration*. Integration is a key characteristic of a smart city, both in scientific definitions and practical understandings. This dimension refers to the extent to which a study or project integrates different technologies and topics (e.g. integrating retrofitting of buildings, connection of different buildings, energy supply and a mobility concept in a city quarter). Correspondingly, the two poles of this dimension are termed ‘single focus on topic/technology’ and ‘integrated approach’. The second dimension is *socio-technical embedding*. Many scientific definitions and practical understandings stress that a smart city should be built on participatory decisions. This means that smart cities should provide participatory processes and platforms where citizens and stakeholders can express their needs and opinions regarding city development, technological decisions and so on (Carabias, Moser, Wilhelmer, Kubeczko, & Nelson, under review). Hence, citizens and stakeholders should be encouraged and empowered to actively shape their smart city. This dimension refers to the extent to which a study or project takes a socio-technical perspective, that is, a coupled perspective on technologies and people. Correspondingly, the two poles of this dimension are referred to as the ‘purely technical perspective’ and the ‘socio-technical perspective’.

Our research approach includes a literature review of scientific papers on smart city issues, as well as a review of concrete projects that have been carried out under the umbrella of the smart city concept. These studies and projects are characterised and compared according to the identified analysis grid.

3 METHOD

The basis of our analysis comprises a literature review of scientific studies on smart cities and practical projects carried out under the umbrella of the smart city project.

3.1 Literature review of scientific studies

We searched research databases such as ‘Web of Science’ and ‘SpringerLink’ to find scientific articles, papers, book chapters and books on smart cities. As a keyword, the term ‘smart city’ was used. Identified matches were handpicked to select only those papers which provide an overview on the concept of smart cities and discuss the researchers’ understanding or give a definition of smart cities. Papers were carefully read and relevant information, including the following characteristics, was transferred to an Excel database: article information, (title, date, author, type, etc.), abstract, keywords, definition of ‘smart city’, topics, perspective (science or practice), technologies, country/region and project status. We experienced a certain saturation point at the end phase of article collection (a moment when further collection of data no longer provided additional contributions). In total, $N = 27$ research papers were included in the analysis.

3.2 Literature review of practical projects

We searched for practical projects carried out under the umbrella of the smart city concept in three online project databases provided by Switzerland, Austria and Germany. All databases are connected to official

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smart city websites or energy-efficient cities in the case of Germany[1]. The Swiss database contains 77 Swiss projects (58 concepts, 13 pilot projects and 6 implemented projects), the Austrian database contains 34 projects (25 projects that are getting started and 9 implemented projects) and the German database contains 22 projects. For practical reasons, we selected the 19 implemented and pilot projects in Switzerland, the 9 implemented projects in Austria and the 22 German projects. In total $N = 50$ projects were included in the analysis. All databases provide detailed descriptions of projects, contexts and related websites or documents. Project descriptions were carefully read and relevant information was transferred to the same Excel file as for the scientific studies.

3.3 Characterisation of scientific studies and practical projects

All identified studies and projects were located on the 'level of integration/socio-technical embedding' grid described above. This allocation was carried out qualitatively and rather intuitively, based on descriptions of studies and projects. This means that for each project or study, a decision was made as to whether it describes one specific topic or technology or takes an integrated perspective on several issues (dimension: level of integration). Furthermore, it was determined whether the project or study describes purely technical approaches or integrates people (dimension: socio-technical embedding).

As a first step, scientific studies and practical projects are characterised separately. For some quadrants, a few examples of studies and projects are described for illustrative purposes. In a second step, both approaches are compared.

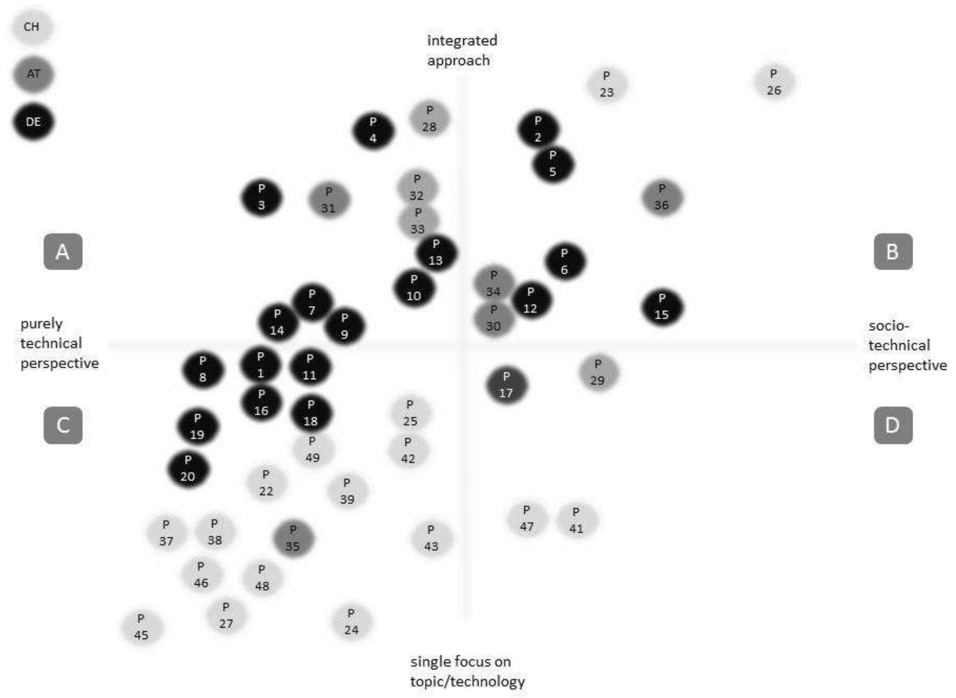

Fig. 3: Characterisation of practical smart city projects (pilot and implemented projects, $N = 46$ projects[2]). Black dots represent projects from Germany, dark grey dots represent projects from Austria and light grey dots represent projects from Switzerland. Numbers in circles represent numbers assigned to projects.

4 RESULTS

4.1 How can the term smart city be characterised from both the scientific and practical perspectives?

The allocation of the analysed scientific studies on the 'level of integration/socio-technical embedding' grid is displayed in Fig. 2. This indicates that almost all analysed research studies take an integrative perspective.

[1] Switzerland: http://ds1.dreifels.ch/smartcity/wprlist.aspx?LA=de (24.02.2014),
Austria: http://www.smartcities.at/stadt-projekte/smart-cities/ (24.02.2014),
and Germany: http://www.eneff-stadt.info/de/pilotprojekte/ (24.02.2014)

[2] Four projects could not be assigned to the grid, since they are accompanying research projects.

That is, they do not discuss single technologies in the context of smart cities (e.g. single focus on smart metering), but rather combine and link different topics and technologies (e.g. coupled perspective on building retrofitting and energy supply). Of course, this has to do with our literature research strategy, since we only included articles providing an overview on the smart city concept in our analysis. Many studies assign a key role to ICT in this integration endeavour (see, for example, Piro, Cianci, Grieco, Boggia, & Camarda, 2014; Ronay & Egger, 2014; Yovanof & Hazapis, 2009).

The analysed scientific studies seem to differ with respect to their degree of integrating societal issues. While about one-third of the analysed articles focus purely on integrated technologies, about two-thirds also consider the integration of people as an important characteristic of a smart city.

Table 2 provides examples of practical studies to illustrate different projects in all four quadrants. Typical examples of integrative projects are city quarter development projects which link topics such as buildings and their use, energy supply and mobility. The examples in Table 2 also indicate some key technologies of a smart city, such as e-mobility, ICT (for communication, monitoring and steering processes, as well as linking different systems), smart electricity grids, smart metering, district heating systems and so on.

ID, quadrant	**Name & keywords**	**Technologies**	**Level of integration**	**Socio-technical embedding**
P41, D	**E-cars** Pilot project, test of a series of e-cars; joint learning process and evaluation including all involved stakeholders	E-cars	Focus on one technology (e-mobility)	Project takes users' perspectives into consideration
P39, C	**Smart metering** Pilot project, installation of 1000 smart meters in a Swiss community	Smart metering, smart grid	Focus on distribution of electricity (smart metering and smart grids)	Households take part in pilot study by having a smart meter, no participatory processes described
P31, A	**Smart city quarter in Austria** Refurbishment of heritage protected buildings, realisation of a smart grid, establishment of car sharing infrastructure/e-mobility, district heating system, city-wide communication and information system	District heating, ICT, smart grid, refurbishment of buildings	Highly integrated (buildings, mobility, energy supply)	Rather technical focus, no participatory processes described
P15, B	**Net zero energy quarter** Links buildings and technical appliances, potential influences on electricity grid, analysis of user behaviour and raising awareness amongst users	Insulation, heat pumps, geothermal, monitoring technologies, ICT	Integrates buildings and energy supply without e.g. mobility	Includes user perspectives in project

Table 2: Illustration of practical projects.

4.2 What are the similarities and differences between the two perspectives?

When comparing the scientific understanding of smart cities and concrete implemented projects (i.e. comparing Fig. 2 and Fig. 3) in the context of smart cities in Switzerland, Germany and Austria, it becomes evident that the scientific and practical understandings have both similarities and differences. One similarity is that both understandings barely include projects which are singular and at the same time participatory (quadrant D). It also becomes clear that many of the analysed studies and projects in science as well as practice neglect participatory approaches, instead taking a rather technical perspective. Issues such as stakeholder processes, participation and integrating users' needs are often not at the core of the analysed studies and projects, although some definitions of smart cities stress these aspects (such as Caragliu et al., 2011).

There are also some differences between the analysed scientific and practical approaches: While from a scientific perspective, almost all analysed articles take an integrated perspective, this is not the case for the analysed implemented projects. There are many projects under the umbrella of smart cities (or energy-

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efficient cities in Germany) that take a rather narrow perspective on singular aspects or technologies (e.g., on smart grids, e-mobility, or ICT). Many analysed projects take a semi-integrated perspective. By this, we mean that they integrate topics such as buildings and energy supply but exclude, for example, the topic of mobility.

5 DISCUSSION AND CONCLUSIONS

The goal of this article is to better understand what a smart city constitutes and how this term is understood in scientific studies and concrete practice projects. We identified relevant overview research articles, as well as a number of concrete projects carried out in Switzerland, Germany and Austria. Based on a thorough literature review, two important dimensions characterising smart cities have been identified: *level of integration* and *socio-technical embedding*. All identified scientific studies and practice projects were characterised on a grid composed of these two dimensions.

Our analysis indicates that the scientific understanding of smart cities in the analysed studies is very integrative with respect to technologies and topics. However, not all analysed scientific studies integrate people as well. Only some take a so-called socio-technical perspective on smart cities, and thus, a coupled perspective including technologies and participatory processes for stakeholders and inhabitants. In contrast to scientific approaches, the analysed practical projects more often consider single technical approaches under the umbrella of a smart city. In general, the practical projects seem to have a narrower focus compared to the analysed scientific studies.

5.1 Critical reflections

The outcomes of our analyses are, of course, strongly dependent on the choice of research studies and practical projects. By only taking into account research studies that provide an overview on the smart city concept, research projects focusing on singular technologies of smart cities (e.g. smart grids) have been excluded. Since one of the goals of this paper was to better understand what a smart city constitutes in science in a general sense, this literature selection strategy seems appropriate. However, we need to be aware that including research articles covering specific single technologies of a smart city would probably alter the identified patterns illustrated in Fig. 2.

These considerations also apply to the practical projects. We decided to analyse three European countries which share experiences regarding smart cities (D-A-CH Energieeffiziente Stadt, 2014) and used their databases to select projects. These databases differ with respect to their structure, as well as the number and scope of included projects. For example, the Swiss database includes a greater number of projects than the German and Austrian databases. This, of course, makes comparisons between countries difficult. One possible explanation for the differing patterns of countries in Fig. 3 is that the Swiss database also includes projects which are related to single smart city technologies (such as e-cars, smart metering and smart grids), while the Austrian and German databases tend to include projects on city and quarter development, exhibiting a more integrative perspective.

5.2 Need for further research

Since all the analysed projects have been planned or implemented in Central Europe, a more international perspective could potentially offer important insights into the smart city concept as implemented in other regions of Europe and on other continents. It would also be interesting to consider the timelines of projects to better understand the interplay between research approaches and practical implementation. For example, one could analyse how the call for more integrative smart city approaches in science is reflected in practical projects, as well as how experiences in practical projects shape scientific ambitions.

Another line of future research could more systematically analyse and structure the technologies being used to realise smart cities. Such a structure could help in elucidating how different technologies are linked to connect infrastructures on different hierarchical levels (e.g. building, city quarter, city).

5.3 Implications of the findings

As mentioned above, integration of technologies and socio-technical embedding are key aspects of a smart city (Caragliu et al., 2011). In order to reach integration of technologies and people, many projects discuss the important role of ICT (Piro et al., 2014, Ronay & Egger, 2014, Yovanof & Hazapis, 2009). One can even say that ICT represents a backbone of smart cities. Such technologies allow connections between different types of infrastructure, monitoring and steering processes and the promotion of communication between people. They may also be used to promote participation of inhabitants and stakeholders in shaping decisions (e.g. e-governance). However, city administrations need to be aware that not all inhabitants are able or willing to use ICT. Successful participation strategies should therefore be appropriate to bridge the 'digital divide' amongst people (Hospers, 2012; Partridge, 2004). It is of vital importance that such alternative, complementary strategies for participation be developed in the process of becoming a smart city. In other words, ICT alone does not make a city smart.

The identified similarities and differences between science and practice bear challenges, but also opportunities. The analysed scientific studies ask for integrated approaches, while many analysed projects focus on specific technologies or topics. This difference represents a challenge and at the same time an opportunity for both science and practice. For practical projects, our findings may indicate that there is a need for more integration from the beginning of planning a smart city initiative, both with respect to technologies and topics and the involvement of people. The idea of a smart city is not one of piecemeal, topic-related solutions, but instead of integrated solutions which link infrastructure, ICT and people. This means that project teams should be composed of people with different backgrounds (in energy, mobility, city development, business, planning, architecture, social work, etc.). For scientific projects, our findings may indicate that more concrete ideas and methodological approaches are needed to reach the asked levels of integration. Concrete projects might also inform research studies on the practical feasibility of technical options, as well as on social conflicts (e.g. due to lack of acceptance of specific technologies) in projects. Moreover, research holds tremendous potential for interdisciplinary collaboration to develop integration methods jointly. The field of smart cities represents an interesting field for so-called transdisciplinary research (Häberli et al., 2001; Hirsch-Hadorn et al., 2008; Stauffacher, 2011), where science and practice collaborate closely to jointly develop technically sound and socially acceptable solutions for smart cities.

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Share it – Don’t Own it: Space Sharing as a Smart Solution for Cities and Regions?

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1 ABSTRACT

According to Time magazine the sharing economy is one of the ten ideas that will change the world (Walsh 2011). But does this concept also apply to space? Is sharing a concept for resource efficient spatial planning? Resource efficiency planning means using the limited resources – and this means also space – in a sustainable manner while minimising impacts on the environment. The overall goal is to create more with less and to deliver greater value with less input.

“Have space you don't fully use? Offer for people to rent it. Make some money.“ (uniiverse 2013) With this slogan, the Platform uniiverse advertises their internet service to share private spaces – from couch, rooms and apartments, offices, storage, gymnasiums, parking lots to all kinds of rooms.

After times of seemingly limitless growth and endless consumption, the scarcity of resources is obvious and requires resource friendly and saving planning concepts. Concepts like Smart City and Smart Region have a strong focus on technological solutions and newly built structures. How to handle the existing settlements and housing stock? Are only newly built neighbourhoods smart cities? In any case, there is need for smart spatial concepts and smart approaches for existing structures.

One possibility of smart development in the existing structures is the sharing of space and infrastructure. In the field of mobility diffenent sharing models are common. Starting with the shared space (an urban design approach which seeks to minimise demarcations between vehicle traffic and pedestrians) und to the traditional public transport. Car sharing is also offered by private sector as the project Sharoo (powered by Migros subsidiary m-way AG with participation of the Swiss Mobiliar Holding AG, successfully shows (sharoo AG 2013).

With exchange platforms like Napster the idea of shared economy became mainstream. But the real benefit of collaborative consumption and sharing turns out to be social. In an era of individualism, the peer-to-peer sharing "involves the re-emergence of community," says Rachel Botsman (2010) and is therefore very important in bottom-up planning process, because people learn to trust each other (ibid).

Seoul adopted the "Sharing City, Seoul" strategy in 2012 and has been promoting and supporting the shared economy my and their start- ups specifically, but also focuses on the sharing and more intense use of infrastructure. Did this idea already spread? Are there other cities and regions following this exciting way? Which smart sharing models can contribute to spatial planning and development?

2 WHAT’S SMART SHARING?

Smart Sharing combines two different concepts: the principle of sharing and the Smart City/Region.

Sharing is the joint use of a resources or space and also includes in a broad sense the collaborative consumption of goods and services. By sharing instead of possessing resources are saved. The possibilities for common use (eg, vehicles , apartments , programs , homes, gardens , services, etc.) are manifold and not new. “New” technologies e.g. smartphones, however, multiply the opportunities for sharing . The actual time spirit and lifestyle makes the "we" more attractive and pushes the need for personal ownership more and more into the background. By sharing on the one hand natural and spatial resources are saved and on the other hand personal time and financial cost are reduced. For example, the laundry room revival - historicly arosen from infrastructural needs, now rediscovered as a resource-saving service facility. Sharing and renting is reinvented by innovative technologies.

The so called commons refer to the cultural and natural resources accessible for everybody, including natural materials such as air, water, and earth. There are freely available to all potential buyers and is therefore also used and shared together. By definition, public goods can be provided by the State or by private providers (e.g. Wikipedia). Public goods and common goods are public goods by non- excludability property. The concept of "collaborative consumption" was published in 1978 (Felson/Spaeth). With the book "What 's

Mine is Yours " by Botsman/Rogers (2010) it rose in popularity, expecially in the US. " *Sharing is ... Connectivity Connectivity is progress ... It's not how smart you are ... but how connected you are!* " writes the communication scientist Dominik Haller and outlines the "post -ownership" movement, currently led by innovative thinking "digital bohemians", which focus on sustainability and are not waiting for politicians and companies to change (Haller, 2013). This new attitude of "sharing instead of owning" reflects milieu bound trends, their impact on the spatial development have hardly been explored. The main effects of sharing are described as follows:

- **Resources:** Sharing helps to use resourecs more efficient and to adapt to a world with fewer resources. Botsman (2010) points out that sharing might help to achieve sustainability goals by reducing waste and pollution as well as extending the life-cycles of products. Fewer assets bought and sold means that there is more value taken from the same environmental resources as well. There is no doubt that the emergent paradigm of sharing resources will expand and flourish in future, especially in the face of continuing economic recession, government austerity and environmental concerns.
- **Social innovation and trust:** Various forms of sharing amongst residents, neighbours and colleagues can strengthen communities and builds trust into the society which leads to greater resilience in times of economic and environmental stress. Even with the growing individualisation of lifestyles sharing helps to keep society values be strengthening of neighborhood community relationships in both urban and suburban areas.
- **Economy**: Sharing leads to lower sales and in the long run possibly to a shift in production and employment structures. Some worry that sharing creates an informal economy, which lacks the safety nets of social security, health insurance, anti-discrimination, and taxation. These are aspects to be tackeld with this "new" economy and sharing also creates new kinds of demand.
- **Technical Innovation:** The introduction of new technologies (smartphones, apps and websites) in the past years enables more opportunities for sharing and renting. A lot of innovation and development made the sharing-coordination possible through modern technology.
- **Urban development**: At the moment cities and agglomerations are the hubs of sharing economy. The impact of "space" sharing and sharing in general on the spatial development have hardly been research.

The Smart City/Region is defined by the City of Vienna as an intelligent, sustainable city – responding to the challenges of a changing energy , mobility and economic system that aims to ensure the quality of life of citizens in the long term" (Magistrat der Stadt Wien, 2014) . In recent years, numerous Smart City research projects have been carried out in Austria, a special funding programm was created (Klima und Energiefonds, 2014), EU initiatives have been provided with substantial funds to accelerate the use of efficiency-enhancing technologies in Europe Smart Cities. As a result of this a lot of cities call themselv "Smart City" nowadays, although or because it is not clearly defined yet.

The climate scientist Boyd Cohen has developed a worldwide "Smart City Index " (Cohen, 2014), which is updated annually and is based mainly on quantitative data (Cohen, 2013). Looking at the indicators of the Smart City Index, the spatial development is not included. Most Smart City put technological innovations and approaches at the forefront, such as civil engineering, traffic engineering, network engineering or information and communication technology solutions. When its about the urban envirionment, the Smart City Concept appears especially in development areas, e.g. in Vienna the Car-free model housing, Bike City, Marx box or the Seestadt Aspern (Magistrat der Stadt Wien, 2014). The Smart City aims to use resources in an intelligent and sustainable way. The new construction rate of buildings in Austria as well as in Germany is less than 1% per year, most of the today and future living, working and leisure space is already built. Use the existing stock, continue to build on the stock , organizing the existing stock resource efficiently - these are key challenges for the Smart City designed for smart urban development and smart renewal processes. One possible approach is the common use and sharing of resources.

3 POTENTIAL SHARING GOODS

The service platform Task Rabbit (Task Rabbit, 2014), especially available in American cities, has developed a sophisticated system. Based on the principle of neighbourly help, Task Rabbit offers help for supermarket shopping, assembling of furniture or small repairs locate in the neighborhood. Task Rabbit is based on trust between the a people, which is built up by background checks, personal profiles as well as ratings and reviews. Unlike traditional barthering circles, for example in a number of regions in Austria work with their own currency or time accounts, the Task Rabbit is paid after the task is fulfilled online by credit card.

This model allows easy neighborhood assistance and inspires trust, but without dependence and fits indidvidual lifestyles. Tje task rabbits develop a develop a virtual trust value by the ratings and reviews over time - similar to online shops. The experiences of Task Rabbit show that employees with high trust levels are booked more often. According to Botsman/Rogers (2010) , this trust value could be similar to the credit rating in the future and uses as an integral part of a personal portfolio, if it's provided platform independent.

4 POTENTIAL SHARING AND DEVELOPMENT OF KNOWLEDGE

A small revolution in the field of software development was started by open source programs. The Internet community develops - jointly and transparently - different software applications that are available for free. Start -ups discovered the possibility of crowdfunding and crowdsourcing for innovative projects, which become financed through many small amounts. This offers a new dimension for innovations as probably these projects whould not have been financed by banks.

Crowdsourcing of spatial data in planning processes - the entering, updating of data and collections of ideas – gets more and more popular. The number of applications of online-based participation tools grows increasingly. In Vienna 8,500 people discussed about – their wishes, concerns, needs and ideas - "Living togeter in Vienna" in 651 Charter groups. The results were put together in the "Vienna Charter" (Wiener Charta, 2013). On www.muenchen- mitdenken.de citizens were involved in the revision of urban development plan ("Perspektive München"). www.muenchen- mitdenken.de was viewed more than 180,000 times within the period of three months. On www.schau.auf.linz.at anyone reports on problems, deficiencies and opportunities for improvement on site using an online portal. The following informations is available fo everybody: when a message was delivered and how long did it take until the defect has been fixed (Stadt Linz, 2014).

Crowdfunding is also used for secure and design open spaces. The association Bodenfreiheit in Vorarlberg is looking for people who are willing to spend each month, an amount of at least 10 euros to buy open spaces which are already dedicated residential areas. When these areas are bought, the will not be built up and are made accessible by the public (Bodenfreiheit, 2014).

The "Power Sleep" app from Samsung uses sleeping smartphones for research (Samsung, 2014). The basic idea is: the processing power of smart phones is inactive at night and is therefore availalbe to use it for creating a database. The processing power is used to compare protein sequences stored a research database (SIMAP database). This SIMAP evaluations support scientists in disciplines like genetics, biochemistry and molecular biology as well as cancer research and was initiated by the University of Vienna. In general, the potential is great, because in Austria there are about seven million smartphones, which could be used for such projects, thereby saving resources.

5 POTENTIAL SHARING SPACE

The possibilities to share space are manifold such as living space, working spaces, gardens, sports facilities, meeting halls, parking lots, garages, storage rooms, courtyards, streets and squares.

The so-calles "shared space" is a planning approach to to minimise demarcations between differnet modes of transport by removing features such as curbs, road surface markings, traffic signs and regulations (FGM , 2014). The principle behind this is quite simpl: all road users feel fundamentally insecure and therefore the attention is increased massively. Experiences and surveys show that this leads to a reduction of road accidents and an increase of use as well as quality of public space.

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Fig. 1: VIENNA, Mariahilfer Straße rendering: In a citizen survey in March 2014 (with a stake of almost 80% of the voters) the inhabitants of the neighbouring districts were in favour of the traffic calming Mariahilfer Straße with 53.2%. Shared space or pedestrian zone covering a distance of 1.6 km. Picture Credits: APA/STADT WIEN/ B+B ORSO.PITRO.

Not only in the public space but also in the private space, there are numerous examples of common usage, especially for touristic use. Examples are: couchsurfing, an Internet- based guest network for the exchange of accommodation with 7 million members in more than 100,000 towns (couchsurfing, 2014) worldwide, private renting of rooms like Airbnb, founded in August 2008 with headquarters in San Francisco, another worldwide community for private accommodation (Airbnb , 2014) or houses and home exchange. One exhange of living space in Vorarberg – announced by the exchange platform of Radio Vorarberg - has become a pilot project in the country of Vorarlberg (ORF, 2013). A young family of five people from Wolfurt had offered their too small apartment in exchange for a house and the change was successfully completed.

Particularly in the age group 50 + there are innovative examples, when it comes to share living space. On the one hand, the costs are reduced by sharing and on the other hand it is more possible to stay in the communiy. Nevertheless the focus is again projects with new constructions. However, many older people live in large flats over 100 m², the general these units could be easily converted to residential communities, corresponding individual and communal areas. This has tow effects: more exchange of the inhabitants and resources saving (space, energy , heating, ...). The combination with thermal renovation this community housing projects causes a higher energy efficiency than thermal renovation alone. Increasing only the higher occupation density brings an energy-saving effect (Brandl, 2012, P. 111). Moreover mobile services are organized easier and more cost –efficient, if needed. There is variety of models possible - from small apartments including bathroom in a shared large apartment up to a family house with common areas. This ensures privacy and takes advantage of the common facilities . But do these forms of housing really have a chance? Is this too much social romanticism?

In summer 2011 the project "Living for Help " was started in Erlangen (Amt für Soziales, Arbeit und Wohnen, 2014). The basic idea is to provide assistance in everyday life for the provided living space. The project is aimed primarily at residential partnerships between seniors/families/singles and students. The additional costs of living are paid and the assistance such as help with housework, gardening, shopping, walks together, tuition for kids, babysitting are arranged individually. Only any kind of care services are excluded. The city proposes one hour assistance per month in exchange of one m² living space (Ibid). The number of students interested in this project is very high in Erlangen, because affordable housing is hardly available. The website of the Amt für Soziales, Arbeit und Wohnen brings is the link to establish the residential partnerships (mitwohnen.org is a search engine for housing providers and housing seekers). It is particularly interesting that in this example the city itself is active in shared living. This "public" support the offer is very trustworthy and speaks out to thus users, which might not have considered such a flat model in other circumstances.

Urban Gardening is a popular trend for several years where people join together for gardening. The organization forms are very different. Partially located on public or private space, organized with access restriction or simply accessible for all, such as on tree slices and green stripes in the road space or flower beds in the park. Urban Farming , also known as "City Farming", in neighborhood gardens ("Community Gardens") in a public space, to semi-public or private green on buffer stripes and on former agricultural and fallow land (incl. Brownfields) increased the diversity of green features in the city. It allowes a "Do it yourself" urban nature experience and strenghens the relation to food production. The City of Vienna promotes neighborhood gardens. The Municipal Department 42 lists 20 supported garden projects (February 2014), more gardens are in the planning stage. Urban Gardening seems to be optimal entry into the sharing of space.

6 SHARING AS AN INTEGRATIVE DEVELOPMENT MODEL?

Cities and regions wolrdwide increasingly recognize the potential of sharing. In Europe, Amsterdam wants the first European Shared City and has decided at least not to ban shared economy such as Airbnb (Share NL, 2014), Urban Gardening is funded by municipalities or at least initiatives such as Bodenfreiheit (see Chapter 4) for the preservation of open spaces are less hindered. Overall, the debate in Europe is still at the beginning.

The South Korean capital Seoul has declared itself a shared city in 2012 (Johnson, 2013). As one of the global megacities Seoul is facing extraordinary challenges in terms of population and mobility development, environmental impact, etc.. Seoul has begun to promote shared economy companies and sets sharing initiatives. A mission statement for the " common use" has been adopted and includes the following objectives and measures:

- A label for selected sharing services to establish trust
- To promote sharing companies to strengthen their perception in public and funding of 10 sharing companies with € 180,000 to build or improve their services and also to support 20-share-startups (counseling, subsidy and provision of office space) with innovative ideas and thinkers.
- establishment of the "Shared Seoul Promotion Committee " consisting of actors of different sectors (e.g., science, law, media , transportation) to disseminate the Shared City idea in all policy
- International branding of Seoul as a Shared City and as a future-oriented innovation center. Organization of an international conference on the Shared City to exchange know-how.
- The communication between the administration and the economy should be improved through shared data and the Department of Social Innovation acts as a focal point for the Shared City Seoul.
- In addition, Seoul offers 492 carsharing vehicles, opens the parking of governmental and municipal buildings outside of work hours to the public, supports common living of senior citizens and student , openes common tool boxes and bookshelves throughout the city and much more. With support of the city companies like Woozoo, a company that remodels the old houses into the shared living or SOCAR - a car-sharing company, a children's clothes exchange or even a food sharing platform impfove their services. The Creative Commons Korea (CCK) platform is the official partner of the city to share information and resources via an online platform.
- The Shareable Cities Resolution was adopted by the US Conference of Mayors[1] in June 2013 (Collaborative Consumption, 2013). This resolution, supported by 15 mayors (including San Francisco and New York City), "*states that mayors resolve to make their cities more shareable, encourage better understanding of the sharing economy, and create local task forces to review and address regulations that may hinder participation in the sharing economy*" (ibid).

[1] The United States Conference of Mayors (USCM) is the official non-partisan organization of cities with populations of 30,000 or more. There are 1,393 such cities in the USA today. Each city is represented in the Conference by its chief elected official, the mayor.

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7 WHAT ARE THE BENEFITS?

The saving potential of space, energy and resources through shared residential, green space and mobility for the city is obvious, though still little quantitatively and qualitatively studied. In addition, the potential of indirect savings through reduced costs for development of infrastructure, concentration of the services or greater efficiency in their use.

Brandl has estimated the potential of the residential communities for the Viennese generation 60 + in her dissertation and comes to an estimated annual savings of heating load of 366 GWh for Vienna, when in 2035 just 10% of the population aged 60-85 live in residential community housing projects. This corresponds to a reduction of the heating demand (individual) of 77 % (Brandl, 2012, P. 117). In addition, Brandl states that the spatial saving potential is enormous, as if 2035 probalby 60.000 elderly live in residential Communities. If they live there on olny 50 m² instead of 100 m², a savings of 3 million m² is possible (Ibid., P. 118). This scenario describes only the potential of space savings projected for the generation 60 +, whose share of the population in the future will dynamicly grow. The attempt to reallocate the model on the general potential of the City of Vienna, leads to the following potential assessment.

The number of one-person households has been rising for decades continuously. The proportion was 45.6 % in 2013. Statistics Austria expects the following developments: the number of single households will continue to rise above average. In 2030 there will 1.56 million single households in Austria (+17.4 %, 1.33 million in 2011). The main reason for this trend is the aging society and related to a strong increase of single housholds after the death of the partner or divorce (Statistik Austria, 2013a). In Vienna an increase of 12.8 % (up to 445 086 people) in 2030 is expected (Statistik Austria, 2012). Also the average living space per person is growing constantly up to 41,2 m² (2001 : 38 m2) in 2011. The average apartment size in Vienna is between 68.8 m² and 78.4 m,2 (2011). The savings potential through smart sharing is related to the apartment size - the larger the apartment the better the apartment is suitable for sharing. Based on the existing housing stock 2011 in Vienna the following saving potential is calculated (see Table 1):

	up to 45 m²	45 up to 60 m²	60 up to 90 m²	90 up to 130 m²	more than 130 m²	Total
Single households Vienna 2011	93.358,00	102.236,00	133.028,00	40.150,00	10.995,00	379.767,00
Assumption share of residential communities in %	0,00	1,00	6,00	11,00	15,00	
Saved apartments by smart sharing	0,00	511,18	3.990,84	2.208,25	824,63	7.534,90

Table 1: Potential saving of apartments with smart sharing in Vienna. Source: STATcube – Statistische Datenbank von STATISTIK AUSTRIA, Registerzählung 2011.

These estimates demonstrate that in Vienna around 2,500 apartments larger than 90 m² could be obtained immediately from the stock if 10% of the single housholds share an apartment – and this is only the potential of the already existing single-person households in 2011. Based on the average living space of 41,2 m² (Statistik Austria, 2013b) it is additionally also possible also to share apartments in the category 60 m² up to 90 m² without degrading the quality of life eventough the potential here is more limited. It is the same with the apartments with 45 m² up to 60 m². So already with the single households in 2011 7,500 homes could be made available only through smart sharing immideately.

Based on the population projection 2030 - with a further increase in single households in Vienna – 50.368 new single person households are expected (Statistik Austria, 2012) and thus increases even the potential of saving apartements (see Table 2).

	up to 45 m²	45 up to 60 m²	60 up to 90 m²	90 up to 130 m²	more than 130 m²	Total
Share single houshold/apartment size 2011 in %	24,6	27	35	10,5	2,9	100
New single households Vienna 2030	12.391,51	13.600,44	17.630,20	5.289,06	1.460,79	50.372,00
Assumption share of residential communities in %	0,00	1,00	6,00	11,00	15,00	
Saved apartments by smart sharing	0,00	68,00	528,91	290,90	109,56	997,37

Table 2: Potential saving of new single apartments in 2030 with smart sharing in Vienna. Source: STATISTIK AUSTRIA, Haushaltsprognose 2012, Registerzählung 2011.

The total number of saved apartments through smart sharing corresponds to the planned final development of the largest urban development area in Vienna with 8.500 apartments, Seestadt Aspern a former airfield. Of course, to move only a few percent of single households in residential communities requires a large-scale activation and participation process. In general, the potential savings through smart sharing are larger in agglomerations than in rural areas, on the one hand due to the social mix and the other by the low proportion of single-family house. Nevertheless, smart sharing is also an option for small and medium-sized cities. The main benefits of sharing in spatial/urban development are described as follows:

- **Less consumption** of space, energy and resources by smart sharing in the existing housing stock.
- Indirect savings through **reduced costs** for development of infrastructure and more efficiency by the concentration of services.
- More efficient use of space and existing infrastructure e. g. gardens, sports facilities, meeting halls, parking lots, garages, storage rooms, courtyards, streets and squares.
- The social dimension of space sharing leads to social innovation in spatial/urban development.
- Transparent planning processes, online **participation** and open source data opens up new perspectives in spatial/urban development thought they have to be reasonably used.

8 WHAT'S NEEDED?

The sustainalbe use of space and resources is a fundamental principle of spatial planning and legally anchored at all levels – European spatial development, the Austrian Spatial Development Perspective, spatial laws of the provinces, urban development plans and regional and local development concept. Traditionally spatial planning attempts to minimize conficts by the spatial separation and compatible mix of uses as well as moderate densities. Sharing as a principle for spatial planning means a paradigm shift. Space is not distributed anymore but commonly shared and used. The balancing of private interests (land ownership and individual use) and public interests (regulatory and development planning) needs participatory and negotiation-based planning processes focused on this new common perspective. Sharing is done by individuals, companies, ad-hoc groups or associations, often in variable, rapidly changing forms of organization and involved parties. Within this system the “users” of planning are a fuzzy, moving, a more or less loose community, so the participant's circle (e.g. by voting rights) is not conventionally clearly identified or defined anymore.

Sharing is facilitated and support by the hype of online tools providing more capacity of self-organization. The apps give the advantage of omnipresent access. Possessing, hoarding and collecting of space and objects are not so much in the foreground of a successful lifestyle anymore.

For some sharing seems to be antiquated and socially romantic - it is reminiscent of commune, cooperative and clubs. Others fear "forced" sharing and therefore a limitation of personal freedom. However, experience shows that this is hardly the case. On the contrary, the social profit is in the foreground, which also coincides with the individual profit.. “The reduction of ownership brings us more access: to people , to experiences and to stuff. And that makes us happy and makes us more sense,.."explains Lena Sönnichsen, Head of PR & Social Media by Airbnb (quoted in Haller, 2013). Money loses significance, personal relationship are built up and trust strengthens the community. The environmental impact is reduced due to the lower production and disposal of goods and resources.

Far too little recognized and researched is the potential of the house and apartment sharing. Advice in social processes is needed, such as in revitalization of single familiyhouse settlements (abdondand becaouse of the generation change), community use large apartments especially in “Gründerzeitgebäuden” and the reuse and conversion of commercial estates. Knowledge could be obtained from experience of building communities (see Noack, 2013) - the experience in jointly planned and built settlements and houses. Housing subsidies should be available not only for construction, but rather on the efficient use and reuse of the existing building stock .

For models of the space sharing trust is an essential core value among stakeholders. In particular by sharing between strangers on the Internet through P2P platforms (peer -to-peer , such as the above-mentioned services platform Task Rabbit) as well as sharing F2F, in which the users face-to-face their immediate circle, such as a neighborhood garden, a house or share an apartment. A masterthesis in the Department of Spatial Planning at the TU Vienna developed proposals for a platform to share of vacant or under -used private garage spaces in the densely built-up urban area to enlarge public space (Stoeger , 2013).

9 CONCLUSION

To sum sharing has great potential for an economically, socially and environmentally sustainable urban and regional development. Even if sharing has already reached a certain level of popularity and can be seen as hype for small parts of the population (about carsharing, couchsurfing, urban Gardening), it needs encouragement of civil society and economic efforts through a bunch of incentives. A successful implementation of the sharing model therefore includes the anchoring in strategy papers and planning instruments of provinces, cities and communities. The local level (the community, the village, the quater) need expert support, motivation and promotion as well as first-hand experiences and knowledge "on the spot", which should be integrated in the strategic approachon the higher level (Zech et al. 2011 P. 17).

Sharing is promoted by smart communication as well as supported by smart technologies in construction and reconstruction of settlements, buildings, open spaces and transport infrastructure. However, the primary challenge is not the technical solution, but the smart combination of technical and social innovations. This includes planning- and process-know-how to raise awareness and participation, steering and cooperation skills within smart governance of diverse stakeholders from economy, civil society and policy.

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Simulation Game for Future Mobility – Support Tool for the Discussion Process about Scenarios of Future Mobility in SUMP Processes

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1 ABSTRACT

In order to work out and draw up smart and sustainable mobility strategies, it is essential to predict the development of transport demand. This development depends on many factors so an estimation is quite complex. Therefore transport models are often used as a basis for the decision-making- and planning-process. There is a wide range of expected developments, so in order to describe future transport developments, it is helpful to work with various basic development scenarios in these models to calculate future developments. The respective topics for future mobility scenarios are often highly complex and the stakeholders as participants of the planning process have different experiences considering these topics. For this discussion the Institute for Urban and Transport Planning of RWTH Aachen University has developed the simulation game for future mobility as a guide, which uses numerous factors to illustrate the expected developments of transport demand. This game aims to involve all stakeholders in the development of future mobility scenarios through an interactive game. The goal is firstly to illustrate different influential parameters for mobility and transport demand and their possible developments as well as to evaluate the results by identifying accordance and differences in the different expectations of the stakeholders. Then, on the basis of systematical analysis of the individual results of the game, it is possible to pre-structure scenarios for the use in transport models and guide the process.

The basis of the simulation game is a schematical illustration of a city, consisting of 11 areas. Each area represents a functional part of a city (e. g. industry) or a mobility and transport offer (e. g. public transport) and ist equipped with one or two question marks. Each question mark corresponds with one mobility-related issue. In the context of this game, the following three categories are considered more closely: general conditions, lifestyle and mobility/transport offers. In these different categories, general conditions and discussed measures are represented. The general conditions with influence on transport behavior in 2050 deal with the population's development, population structure and the development of the job market. Considering changing lifestyles, the handling of Social Media and its possible effects on activity behavior, as well as the influence of online commerce on shopping behavior are outlined in the area lifestyle. In the category of mobility and transport offers, possible developments in the field of electric mobility, the changes of transport costs and a stronger interlinking of different transport modes are introduced. For each of the 15 issues within the areas the game presents two or three different theses as possible developments of the respective issue in the future. One area after the other, the player can choose the thesis, which, he thinks, is most likely and plausible. In the context of a planning process as for example when drawing up a SUMP, the introduced simulation game makes it possible to create a basis for all participants at the beginning of the scenario development. At the same time, the discussion process can be guided based on the evaluation of the game by, for example extracting those theses with the greatest deviation for further discussion and eventually rating them in different scenarios according to their effects, and on the other hand using the theses which are seen equally between the different stakeholders as basis for several scenarios. Through this game the access to the complex topic of transport forecast can be simplified for stakeholders with different background so a better understanding of the scenario circumstances can be reached and through that a higher acceptance.

2 INTRODUCTION AND BACKGROUND

The promotion and development of sustainable mobility concepts in the „StädteRegion Aachen" (association of municipalities) is currently the focal point of several initiatives and projects. The creation of a long-term framework includes, amongst other projects, the restructuring of transport development planning in Aachen, with special attention to the basic principles of sustainable mobility. In this context, current developments on the European level (Sustainable Urban Mobility Plans (SUMP)) have also been integrated. This leads to the realization of a new transport development plan in the city of Aachen within the context of an extensive integrative process and a SUMP for the whole region of Aachen which is drawn up as part of the project CIVITAS-DYN@MO supported by the European Committee.

In order to work out and draw up smart and sustainable mobility strategies, it is essential to predict the development of transport demand. This development depends on many factors so an estimation is quite complex. Therefore transport models are often used as a basis for the decision-making- and planning-process. There is often a wide range of expected developments, so in order to describe future transport developments, it is helpful to work with various basic development scenarios and calculate various future scenarios. The respective topics are often highly complex and each participant has different experiences considering these topics. As a result, drawing up these scenarios and including all relevant participants often leads to lengthy discussions. In order to provide guidance for this discussion and include all relevant topics, the Institute for Urban and Transport Planning of RWTH Aachen University has developed the simulation game for future mobility. This has been done in the context of the SUMP-process for the region of Aachen. The goal is firstly to identify different influential parameters for mobility and transport demand as well as their possible developments. Then, on the basis of systematical analysis of the individual results, it is possible to pre-structure scenarios for the use in transport models at a later point in time.

3 SUMP-PROCESS IN THE REGION OF AACHEN

The process of transport development planning for the city of Aachen started in 2011. The latest transport development plan was published in 1995 and the latest Masterplan Mobility in 2000. These plans mainly included a sectoral view for different modes of transport. An up-to-date integral examination of the entire urban transport development for a medium- to long-term time span of 15 to 20 years is currently missing. Furthermore, there are currently no planning principals which could be used for certain modified general conditions. The development of the SUMP is based on a joint work effort in thematical teams. In these teams, the administration works together with external specialists on different topics. (Langweg, Nacken 2012)

Transport and especially environmental problems caused by traffic, e.g. noise and air pollution, cannot be solved simply on city level. Therefore, as of this year, this process has been extended to the whole region supported by the European Union's Civitas Programme. This means that parallel to the process for the city of Aachen, another process for a regional SUMP within the context of the project „CIVITAS DYN@MO" has begun. Latter process is being controlled by "StädteRegion Aachen" and will orientate itself to the structure of Aachen's SUMP. (CIVITAS-DYN@MO 2011). Both planning processes are used as motivation for the voluntary task of sustainable transport development planning. Therefore, this plans can be classified as a Sustainable Urban Mobility Plan (SUMP).

4 GOAL AND CONTENT OF THE SIMULATION GAME

The goal of the simulation game for future mobility is to introduce the different participants in the context of the SUMP-process to the complexity of forecasts and the development of underlying scenarios. This is of such great importance, because all participants come from different work backgrounds and thus have different points of view and affinities to the subject of transport forecasts. With the help of the game, all participants are supposed to gain a deeper understanding for the development of scenarios and also the integration of complex influential parameters into the scenarios will be increased. Accordingly, not only the integration of the results which come from the transport forecasts based on these scenarios is simplified, but also the use of these results in the planning processes e.g. when drawing up the SUMP.

In the context of this game, the following three categories are considered more closely: general conditions, lifestyle and mobility/transport offers. These categories have already been researched in scientific studies. The handling of such studies and their partly also contrary results is an important foundation for the development of scenarios. In connection with the political processes when drawing up a SUMP, the participants are often overwhelmed. Reasons are the great amount of studies and the difficulty to evaluate their relevance for the respective scenario development, because several different methods have been used in these studies. In addition, such an evaluation would be a very time-consuming task. Here, the simulation game is supposed to serve as an introduction to the discussion of different development possibilities. That is why the development possibilities given as options in the game have been derived, completed and generalized based on results of various studies.

5 STRUCTURE OF THE SIMULATION GAME

Basis of the simulation game is a schematical illustration of a city (see fig. 1), consisting of 10 areas. Each area represents a functional part of a city (e. g. industry) or a mobility and transport offer (e. g. public transport) and ist equipped with one or two question marks. Each question mark corresponds with one mobility-related issue.

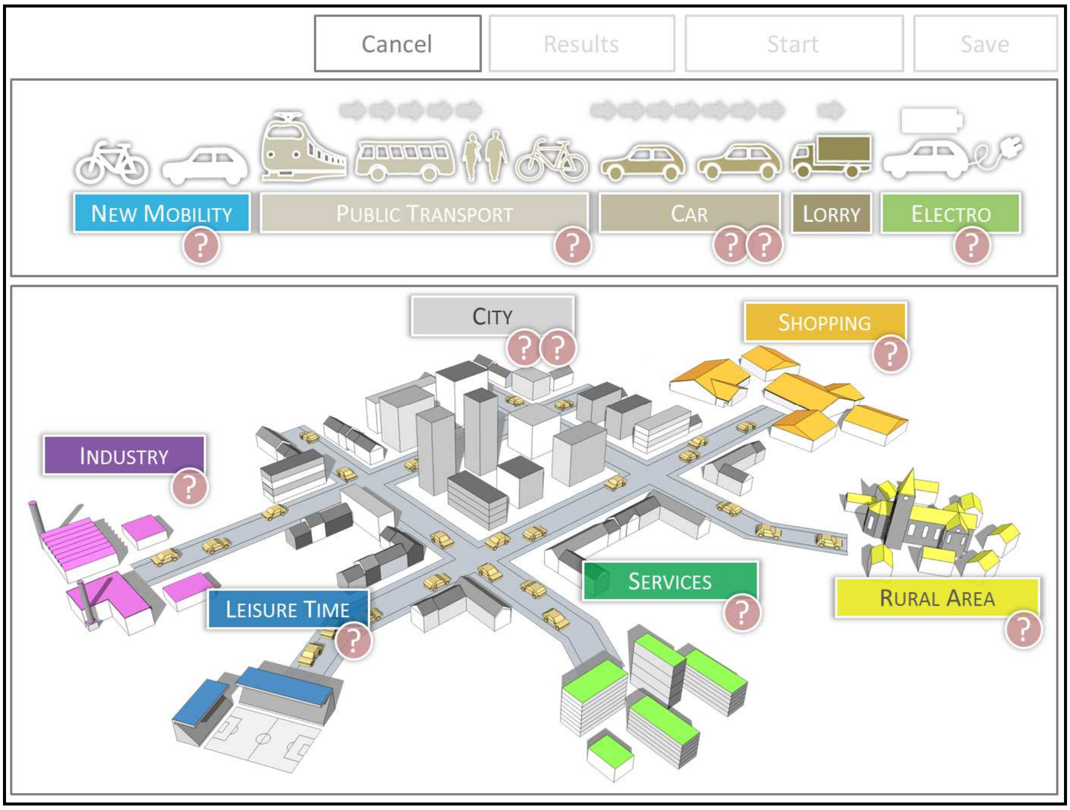

Fig.1 Graphic from the start of the simulation game

Areas and issues within the simulation game	
Area	***Issue***
Functional part of the city	
City	Population development
	Life expectancy
Shopping	Importance of online commerce
Industry	Transnational outsourcing
Leisure Time	Importance of social media
Services	Jobs in service sector
Rural Area	Suburbanisation
Mobility and transport offers	
New Mobility	Importance of new mobility services
	Combination of mobility services
Public Transport	Financing of public transport
Car	Invention of traffic toll
	Development of fuel costs
Electro	Distribution of electric vehicles
	Range of electric vehicles

Tab. 1 10 Areas and 14 issues within the simulation game

The 14 issues within the game are summerized in table 2 (see tab. 2) and represent circumstances as well as discussed measures. Circumstances cannot or can only be marginally influenced (e.g. the demographic change) and are therefore easier to predict. Discussed measures can be influenced by political decisions and

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are therefore difficult to predict (e.g. car tolls). Both factors are of great importance for the future development of mobility and transport demand, which is why they are included in the simulation game. In contrast to the general conditions of the population’s development, the general conditions of the category „mobility and transport offers“ is very closely connected to political actions, so here the predictability still has its limits. Nevertheless, in order to develop scenarios it is necessary to make certain assumptions. It is all the more important that participants of the planning process know which general conditions are given in each scenario and that they also support these conditions. Only then, the results, which base on the respective scenarios and were included into the development process, can be evaluated and be taken into account appropriately.

The general conditions with influence on transport behavior in 2050 deal with the population’s development as well as population structure and the development of the job market. Considering changing lifestyles, the handling of Social Media and its possible effects on activity behavior, as well as the influence of online commerce on shopping behavior are outlined in the area lifestyle. In the category of mobility and transport offers, possible developments in the field of electric mobility , the changes of transport costs and a stronger interlinking of different transport modes are introduced.

For each of the 14 issues within the areas the game presents two or three different theses as possible developments of the respective issue in the future. One issue after the other, the player can choose the thesis, which, he thinks, is most likely and plausible. Considering the subject of the population’s development, the demographic change and its consequences for the development of transport demand are of great importance. These consequences can be changes in traffic volumes, but also new user needs e.g. because the number of elderly travellers increases. With regard to the development of the job market there are studies (IZA, FIT, 2007; Bartsch, K. 2009; Fuchs, J., Söhnlein, D., & Weber, B., 2011) which show that all in all and in a long-term perspective, the number of employees in Germany is expected to decline. At the same time, an increasing number of female and elderly employees leads to a rising employment rate and therefore to a reduction of the development mentioned before. Depending on migration and changes of the employment rate, studies show different developments up until 2050. Apart from that, the subject of job market development also includes other factors such as the possible introduction of flexible working hours, the influence of telecommuting and/or the type of jobs. Will there be a rising number of jobs in the service sector while at the same time the number of jobs in the manufacturing industry declines, as predicted for Germany by the study (IZA, FIT 2007). The influence of the settlement structure and of the activity distribution throughout the area on transport demand is exemplarily represented in the game by possible changes in peoples’ and businesses’ choice of location (Suburbanisation or reurbanisation? Which effects will the current problem of rising costs of living in urban areas have?).

The importance of Social Media is included in the game by taking into account its possible effects on leisure activities. Respective this issue, the player can choose between the following three theses: (see Fig.2):

- The influence of social media over leisure activities increases, increasing time spent at home. Traffic towards leisure areas decreases.
- The influence of social media over leisure activities increases, but they do not influence leisure areas. Traffic towards leisure areas stays roughly the same as today.
- Social media simplify the coordination of spontaneous meetings. Traffic towards leisure areas increases.

These theses illustrate three possible effects of Social Media on leisure activities and qualitatively describe the consequential effects on leisure traffic volume.

Another main part of the total traffic volume, apart from trips toward leisure areas (32% of all trips (MiD 2008)), are trips toward shopping facilities. These trips make out 21% of the whole trip volume (MiD 2008). When predicting shopping traffic, demographic development should always be taken into account. Although in this case, not the development of the population itself, but the population structure is decisive. In the past, shopping traffic increased because of the growing concentration and the generation of new business types in retail trade. Furthermore the increase of leisure time, which was also used for shopping trips, led to an increase in shopping traffic. In addition, there has been a strong increase of online commerce in the past few years. Concerning future transport development, the question is if a further increase in online commerce will reduce the shopping traffic volume. The study (ITB, BVU, 2007) assumes that online commerce will partly replace the errands which used to be done in person. In this case there would be a shift of passenger to freight transport. In doing so, the study comes to the conclusion that these developments will compensate each other which means that the total shopping traffic (including non-motorised individual transport (NMIT)) only slightly decreases. In comparison, the the study predicts an incrase of trip lengths due to the development of settlement structures (Suburbanisation) and the tendency towards large-scale business types in retail trade. Based on this statement, the study forcasts an increase of about 4.1 % in transport for shopping purposes until 2025. (ITB, BVU, 2007)

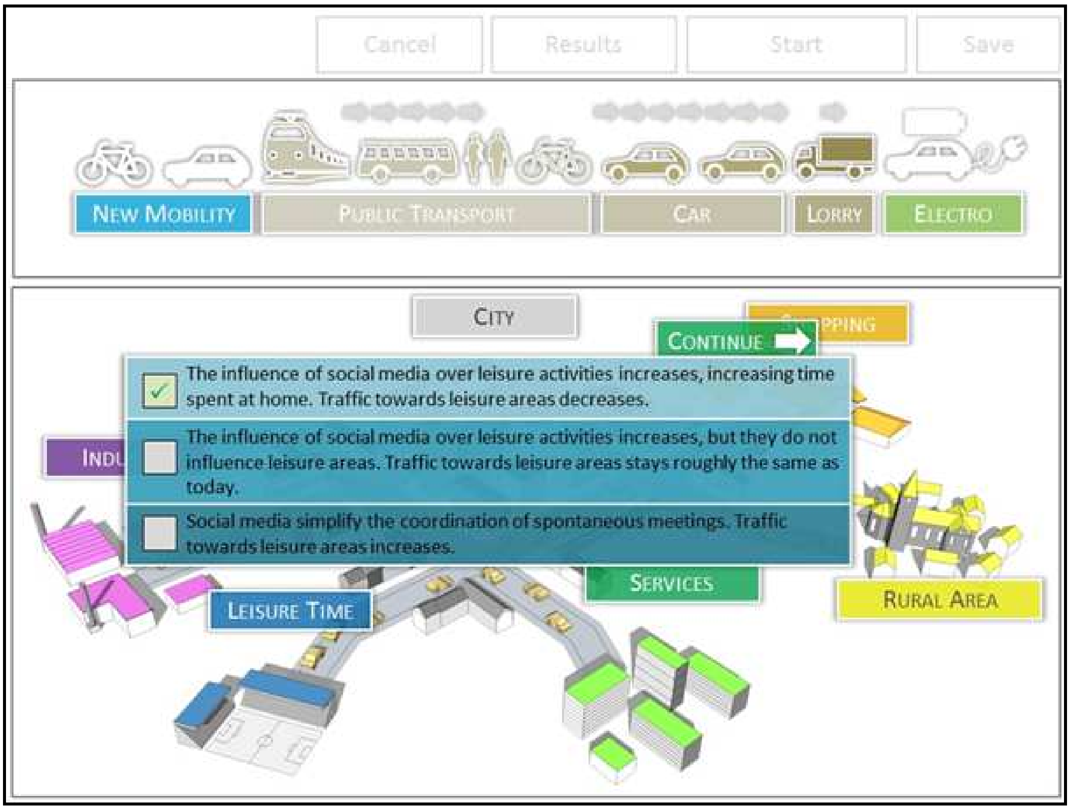

Fig.2: Selection of the possible effects of social media on leisure activities in the simulation game

In this issue, the player can choose from the following options:

- The popularity of online commerce continues to increase. In response to this increase, freight transport throughout the city also increases. Private shopping traffic decreases.
- The popularity of online commerce does not increase. Freight and private shopping traffic stay roughly the same.
- The popularity of online commerce increases. Customers, however, still travel to shop. Freight and private shopping traffic increase.

A subject concerning mobility and transport offers which has been discussed very often are the transport cost trends. These factors have already been included in many forecasts. Based on the predicted oil price development, the German Institute for Economic Research in Berlin has derived the possible development of fuel costs up until the year of 2025. (DIW, 2008, p.18) In contrast there is the development of fuel consumption, where the study predicts a decline down to 5.2 l/100 km for 2025. The Shell Forecast (Shell Deutschland Oil GmbH, 2009) from the year of 2009 assumes that fuel consumption will continue to decline in the years to come. Depending on the scenario, the average prediction are approximately 6 to 6,5 liters/100 km for 2025. All in all this would mean further rising costs in motorised individual transport (MIT). The cost trend in public transport is mainly influenced by staff (40 %) and material costs (30 %). Here, the development of energy prices is not of great importance. Nevertheless, studies also predict significantly rising costs for public transport. The study (DIW, 2008) expects an increase of about 1,5 % per year, due to declining subventions in the public sector. According to the study (DIW, 2008) and the general conditions it bases on, the transport costs will increase more strongly up until 2025 than the general price development.

The study's assumptions also lead to the fact that costs for users of public transport will increase more strongly than for average users of private (car) transport. (DIW, 2008, p. 62 f.) In another study (TRAMP, Difu, IWH, 2006), the transport cost development is seen as the main influential parameter for future travel behaviour. Depending on the scenario, the increase can be more or less strong, but the share of transport costs in the total budget is assumed to be relatively constant because of further price increases. (TRAMP, Difu, IWH, 2006, p. 73 f.) In the context of the simulation game, this subject is represented in theses on the development of fuel costs, the potential implementation of car tolls as well as the development of public transport (service improvement or service reduction because of insufficient financial aids).

Apart from the development of transport costs, the subject of electric mobility has also been discussed to a great deal. The promotion of electric transport is a main goal worldwide. In order to push ahead the distribution of electric vehicles different options are being used such as tax incentives, subventions or privileges (Randelhoff 2012). Therefore the game shows different theses on the distribution of electric vehicles and on the development of these vehicles (range of batteries, charger-infrastructure).

At the same time, changing mobility options due to electric passenger cars and E-bikes as well as the integration of electromobile services will offer new fields of application. Electric mobility can in this case also be seen as a possibility to develop new, innovative transport offers. The progress of this development can have a decisive influence on travel behavior as a whole. Since getting information has become increasingly easier and data is more and more connected, route and mode choice as well as access to services has also become much easier for users. Especially the distribution of smartphones (and similar devices) has made it possible to plan transport use in a timely and spatial flexible way. Another resulting advantage are new information offers (often in real-time) which also improve this planning. Further increase of these possibilities (real-time information, e-tickets, interlinking of different transport offers) can lead to a reduction of accessibility barriers e.g. for public transport. The effects cannot yet be estimated today. The effects of improving individualized public transport modes such as car-sharing and bike rentals by e.g. offering simpler information and booking systems are difficult to predict. Lenz 2011 claims that the linkage between information and communication technology and travel behavior is very complex. This subject is represented in the game by theses on the development and interlinking of transport services. In this issue, the following theses are shown as options:

- The importance of mobility as a service and renting out bikes and cars (Car-sharing) increases. Car traffic decreases.
- Mobility as a service and renting out bikes and cars are not accepted very well by the population. Car traffic stays roughly the same as today.

According to the combination of the player's chosen options, he receives a result which displays a changed image of the city with all changes basing on the chosen developments. At the same time the development choices of all players can be saved and evaluated, enabling the integration of these results into the SUMP process as "majority-scenarios" and also encouraging further discussion of these scenarios.

6 CONCLUSION AND PERSPECTIVE

In the context of a planning process as for example when drawing up a SUMP, the introduced simulation game makes it possible to create a base for all participants at the beginning of the scenario development. This common foundation includes general conditions which need to be taken into consideration. At the same time, the discussion process can be guided based on the evaluation of the varying individual forecasts. This can be done by, for example extracting those theses with the greatest deviation in the game for further discussion and eventually rating them in different scenarios according to their effects, and on the other hand using the theses which are seen equally between the different stakeholders as basis for several scenarios.

The purpose of the simulation is not to analyze future developments, but to encourage the discussion process, to illustrate the complexity of developing and simulating different scenarios for transport development and to make these tasks comprehensible. Therefore it is not possible to include all influential parameters – this would make the game too long-drawn. Therefore, the chosen theses can only represent a small part of the wide range of possible developments and cannot include all the details relevant for each issue. But, since the goal of the game is to introduce participants with different backgrounds to the complexity of transport forecasts and the underlying scenarios, this much detail is not necessary.

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Smart Cities and ICT – Insights from the Morgenstadt project

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1 ABSTRACT

According to the United Nations, 60% of the world's population will live in urban areas by 2030 (United Nations 2012). While many cities around the world are growing and expanding, at the same time, a big number of cities in the northern hemisphere is facing reverse trends, e.g. caused by the demographic change. As a result of these trends and the comprehensive globalization, cities are competing within a global market for companies and well educated inhabitants. As an additional challenge, the climate change revealed his powerful forces during the last decades as seen in hurricanes Katrina and Sandy in 2005 respectively 2012 or typhoon Haiyan in 2013.

In this context, cities are facing an extremely difficult assignment: an innovative sustainable development of the city, including ecologic, economic and social dimensions. This task includes two central requirements, making the city livable on the one hand and resilient against external factors as natural disasters or other crises on the other. This paper outlines innovative approaches of cities all over the world, in order to achieve the goal of a sustainable city of tomorrow, concentrating on the contribution of innovative information and communication technologies (ICT).

The paper is based on an interdisciplinary long-term research project called "Morgenstadt: City Insights" (m:ci), which analyzed innovative and sustainable solutions and projects of the city sectors mobility, water infrastructure, production and logistics, governance, buildings, energy, security and ICT in six leading cities around the world in order to identify common characteristics and structures of success stories.

Therefore, the paper first presents the research methodology of the m:ci project, followed by an overview of the examined sectors, projects and cities. Subsequently the key findings regarding the ICT sector will be presented and the role of ICT for an innovative and sustainable city development will be outlined. In this context it will be elaborated for instance how ICT enables innovative solutions of other sectors and to which extent the collection and procession of urban data contributes to a sustainable development. Finally, the paper discusses the transferability of the identified approaches and tries to illustrate possible strategies to implement such innovative and sustainable solutions.

2 MORGENSTADT: CITY INSIGHTS PROJECT

This chapter provides a brief introduction into the m:ci project. At first the underlying idea for the project is outlined, followed by the developed and applied research methodology.

2.1 Idea

The urban knowledge economy is facing a tremendous transformation that will affect the society technologically, organisationally and systemically. Individual technological sectors, such as energy or mobility, will be affected. But since these sectors are highly cross linked, especially in cities and urban regions, the change in one sector will affect all others and the urban system itself as well. To understand the interdependent links between the urban sectors the Fraunhofer Society launched the innovation network m:ci. For this system research initiative, 12 Fraunhofer institutes work together to investigate innovative solutions for a sustainable city. To achieve this goal a holistic research approach was developed in order to analyze the city system in its interdependent structure (Kalisch et al. 2013).

The main goal of the first period (2012-2013) of the m:ci project was to identify the status quo and establish a starting point for the research and development of innovations for urban systems. Based on the findings of the first period and the systemic understanding of urban areas, the second period (2014-2015) will focus on discovering and implementing systemic approaches that successfully respond to the increasing problems of the selected technology fields in leading cities. By detecting and analyzing innovative but already field-tested approaches, their feasibility for other complex environments and demands for an urban future will be evaluated. To verify this expertise will be pooled to develop smart and individually customized strategies

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together with our network partners from industries and cities, aiming at the future requirements for further concepts' efficient implementation.

2.2 Methodology

The m:ci project follows a transdisciplinary research approach, its first phase has been divided in seven phases (see Figure 1). At first more than 270 global good practicees in more than 250 cities around the world that were applicable to bring the city forward towards a liveable, resilient, zero-waste and CO2 free city were studied. The examples were ranked by researchers from the corresponding field by innovative technologies, business models, forms of organization used, and the transferability to other cities. Based upon this assessment 80 solutions were defined as best practices. All 80 best practices were evaluated in a systemic way which included assessment of core sustainability indicators on social, economic and environmental impact and a cross-sectoral analysis of systemic interfaces with other sectors.

The amount of identified best practices per city served as reference for the city ranking. Further, a meta-analysis of cities that appeared in different indices lists was conducted. Based on this list a meta-ranking of the cities was compiled that reflect their overall performance. The final ranking was realized by integrating the best practice-ranking (70%) and the global meta-ranking (30%) into one list of inspiring and leading global cities on the field of urban sustainability. The first 24 cities of the final ranking were taken as base items for defining the top 12 list. This was done by referring to the preferences of project partners, to a fair regional distribution and to a good distribution of sector-specific best practices. Based on the top 12 list the project partners choosed six cities (Berlin, Coppenhagen, Freiburg im Breisgau, New York, Singapure and Tokyo) that were studied on-site (phase 1 and 2 in Figure 1).

Prior the two-week research visit the mayors offices were contacted and asked to support the fieldwork with a letter of recommendation and support. Aditionally several other locally based institutions like universities, German associations etc. were also contacted in advance to request support in lining up interviews with the persons that were responsible for the studied best practice examples. The m:ci project team defined 15-65 indicators with the associated data for each sector in the given city and saved this information in a relational database that was developed for this project. The same was done with information and data that were collected from each studied practice example in the city.

Prepared with the results of this desktop research, a group of Fraunhofer researchers stayed in each of the six cities for two weeks and mainly conducted narrative interviews with relevant actors within each practice example. The interviews, typically 1.5 hours in duration, were conducted on the basis of a part standardized questionnaire which was adapted to each interview. The interviews were recorded, when permitted, and later analyzed.

The practice examples were, whenever possible, viewed and visited, in order to gain a personal impression. Each night the involved researchers came together to share the insights they gained this day. This step was not done for a group dynamic reason only but to gain transdisciplinary insights from the other researchers. By sharing and discussing the experiences the researchers were challanged to view the studied example from their own sector from another perspective and also to rethink the projects of other sectors from ones own perspective (Roehl et al. 2012; Bojer et al. 2008).

Additionally, all actors that were involved in the city's key projects were invited to an evening event during which the project, as well as the researcher's first impressions of the city, were presented. The city's sustainability initiatives were discussed during a panel discussion and a subsequent reception. The feedback of the participants was incorporated in the analysis and accounted in the following interviews. During the so-called "Morgenstadt: City Labs" several hypotheses relating the examined practice examples were developed following a defined methology and discussed with the m:ci project partners. The discussions served to help the researchers recognize inherent patterns in the implementation of projects and solution approaches (phase 3 and 4 in Figure 1).

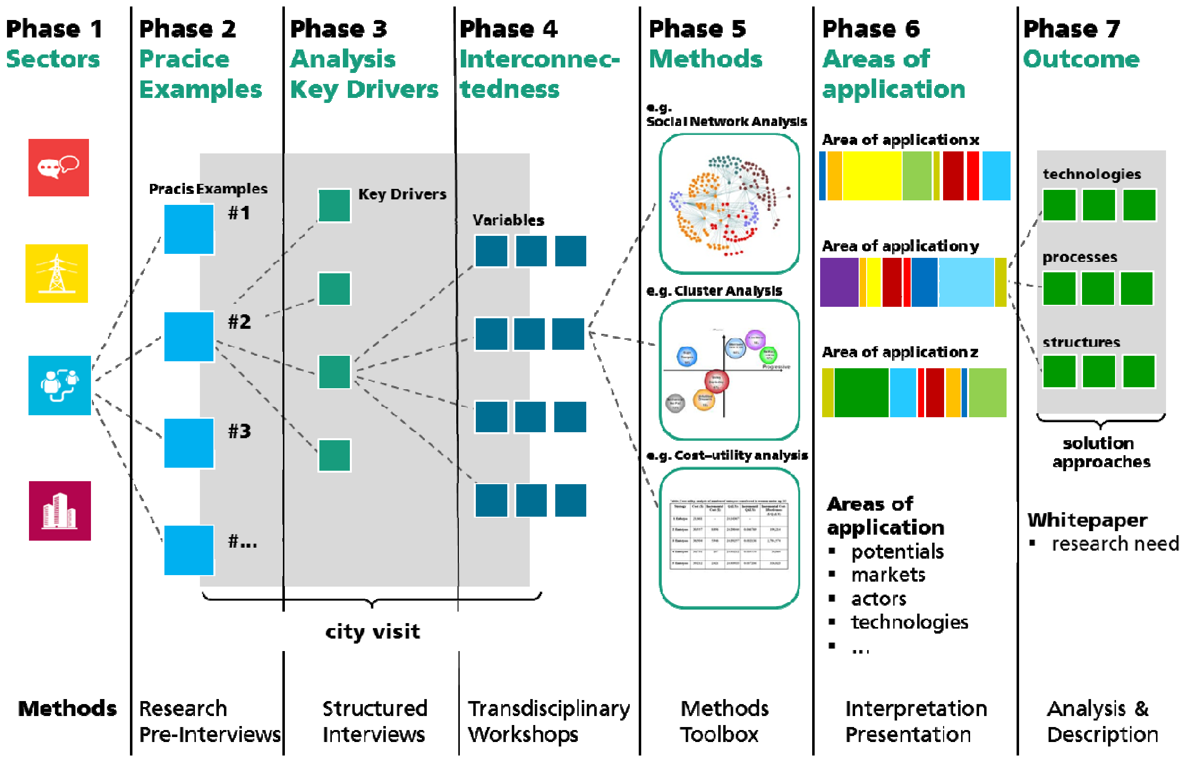

Figure 1: Overview of the research process from sectors to areas of application (Kalisch et al. 2013)

Based on the qualitative interviews and available quantitative data, impact factors for certain processes were indentified. The analysis of impact factors uncovers why a certain progress happens in a particular way in a specific urban system. Accordingly they describe general forces that push or hinder the process of sustainable development on many different levels. The identification of impact factors is complex and requires a transdisciplinary reflection by the researchers. The researchers therefore reflected every day the identified drivers and framework conditions. One important tool to do this were collaborative mind-maps to structure the identified factors. Further, a mixed methods approach was applied, utilizing social network analysis and cluster analysis (phase 5 and 6 in Figure 1).

Starting from a three-level-approach (indicators, impact factors and action fields) of urban systems analysis the m:ci research network developed a first generic model for sustainable urban development (see Figure 2).

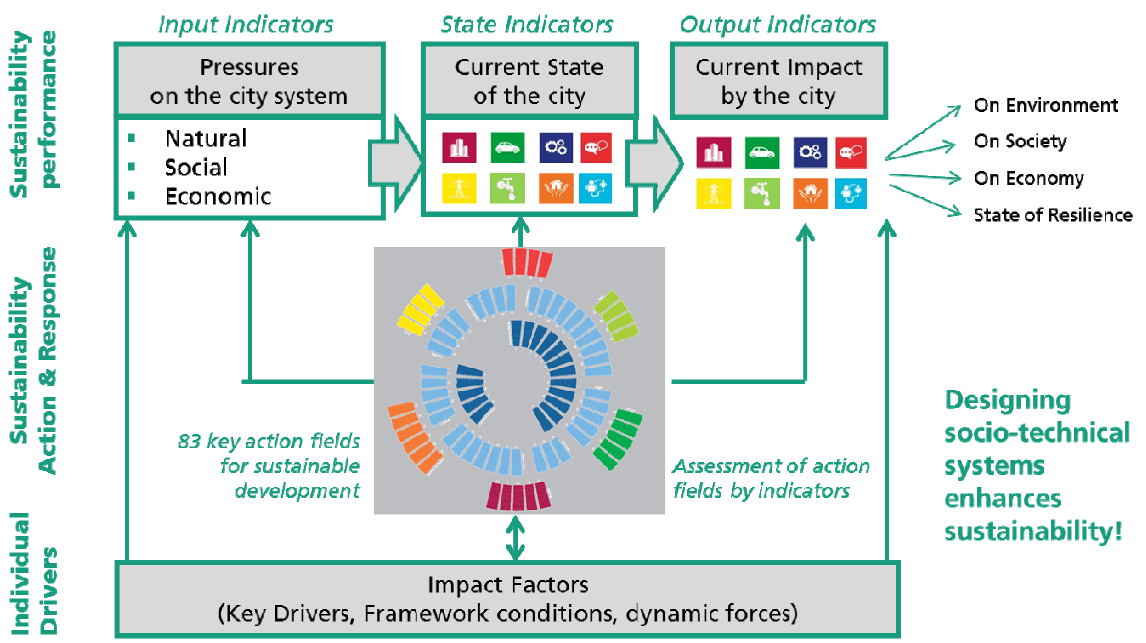

Figure 2: Morgenstadt model for sustainable urban development

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After the on-site research visitis, all prior defined indicators had been evaluated. The assessment showed that most variables are only available in some cities and therefore not usefull for general city comparisons. A revision of the m:ci indicators provided a set of less than 100 urban indicators that define the state of sustainability of a city. This indicators are listed in the final project report (Fraunhofer-Gesellschaft 2013).

The 83 defined key action fields for sustainable development represent the core of the Morgenstadt model. This action fields describe the sustainable actions and responses of the cities. They can be related to indicators and allow the m:ci researchers to assess whether a response of a city is in line with existing pressures or state conditions and therefore really helps optimizing outputs for enhanced sustainability. The key action fields were further assessed by the participating researchers. They rated the impact of each key action field to each other based on their field of expertise. This so called cross-impact matrix of key action fields was subsequently evaluated by the sum of active and passive ratings. By plotting the sums of each key action field, three groups of action fields could be seperated that have a significant relevance for sustainable development of a city (see Figure 3).

- The “drivers” were key action fields that bring ideas and initiatives forward.
- The “enabler” enables the city to perform certain actions.
- The “levers” amplify given actions.

The cross impact of each key action field to each other is also dynamicly visualized and accessible through the project website.

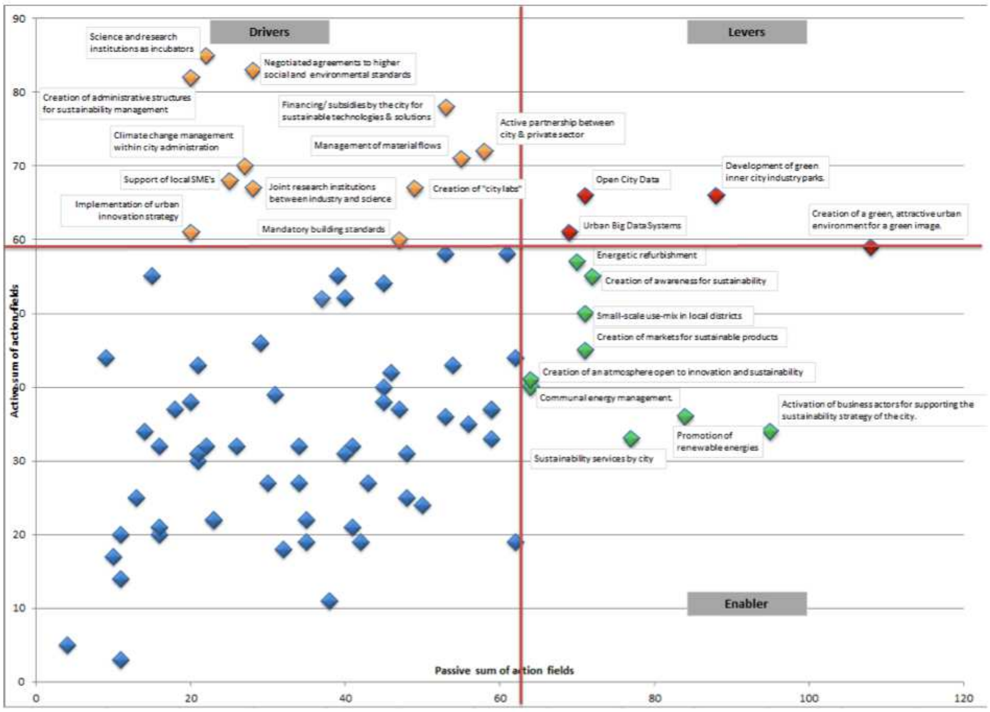

Figure 3: Cross-impact analysis of key action fields

3 THE ROLE OF ICT IN THE SMART CITY (OF TOMORROW)

In this context, the following chapter will concentrate on the ICT sector and its role for the sustainable and smart development of cities. Therefore the argumentation will follow the m:ci methodology, first providing an overview of the analysed best practices and subsequently deriving consitent impact factors as well as coherencies. Finally four key action fields and one central key insight for the ICT sector will be presented, including a discussion regarding the transferability of such solutions.

3.1 ICT best practices

As Table 1 lines out, the m:ci project analysed thirteen ICT best practices in four different cities. It can be stated that the thematic scope of those thirteen projects was extraordinarily broad. Thus the themes range from traffic management or ICT assisted security approaches to ICT tools for public participation. This broad range is a first indication of the profound relevance of ICT solutions for the smart and sustainable development of city systems and their subsystems. On this basis chapter 3.2.2 provides a more detailed insight into the influence of the ICT sector vis-à-vis other sectors, such as mobility, water infrastructure, production and logistics, governance, buildings, energy and security.

Best practice	**Description**
New York, United States of America	
Open Data Initiative*	Urban data analysis for evidence based city planning and management
Smart Public Safety*	ICT assisted security (trend analysis and hot spot projection)
Berlin, Germany	
Capital Cloud	Open data approach (cloud networking for regional companies)
infreSt	Open data approach (pipeline network information)
Open-Data-Plattform*	Open data approach for community information and services
Verkehrsinformationszentrale*	ICT assisted traffic management
Vernetzte Sicherheit*	ICT assisted security
Smart Grids und Smart Metering Berlin-Brandenburg*	ICT assisted energy grid management
Tokyo, Japan	
Mobile Spatial Statistics*	Mobile data analysis to understand citizen's movement patterns (field of application e.g. urban planning and crisis management)
Interoperable Electronic Ticketing*	ICT assisted ticketing system for public transportation
Freiburg im Breisgau, Germany	
GRID2Smart*	ICT assisted energy grid management
Beteiligungshaushalt	ICT assisted participation platform for city budgeting
Baulückenbörse	Open data platform to manage the gap site market

Table 1: Analysed ICT best practices

All projects marked with an asterisk within Table 1 are based on one main idea: the smart use of already existing urban data. Moreover, the remaining four projects are basically providing new types of digital data, by collecting information and making it available digitally. Summarizing, innovative ICT solutions try to make cities smart by using and providing city data in a new, creative and analytical manner.

3.2 Results of the ICT sector

In the next sections the results of the ICT sector are outlined. First the identified impact factors are described. Then it will be discussed how ICT can be an enabler for sustainable and smart development of other sectors. Finally, key action fields and key insights are presented.

3.2.1 Impact factors

As explained earlier, the m:ci project tried to identify consistent impact factors within all best practices. With the help of detected success factors it should be possible to increase the chances of success for upcoming innovative project ideas. All analysed ICT projects revealed specific impact factors corresponding to local political, social and economic circumstances. Nevertheless, several impact factors were identified as substantial for numerous best practices.

The impact factor "existing networks of innovative actors" has been relevant in six of the best practices projects (out of 13) and is therefore the most important factor for the ICT sector. Cooperation between research institutes and other actors was an impact factor for three of these projects. However, other projects like the Open Data Initiative of New York also includes universities or research institutes as project partners, without depending on those networks upfront.

The political will of the city government to implement innovative ICT strategies and techniques was designated as an impact factor for 5 of the 13 ICT best practices. Among other things, this factor is of great importance, because the financial support of ICT projects depends on political decisions. Additionally, financial funding respectively funding programs were named as central impact factors for three of the ICT best practices. Accordingly, a municipality that wants to support a smart city approach should be dedicated to technological innovations and should support and initiate networks of innovative actors of the ICT sector.

On the other side, looking at obstructive impact factors, the intensive use of digital data depends strongly on legal regulations and the societal awareness regarding privacy issues. Especially during the last years the public awareness raised due to massive data collection of companies and organizations. Cities that want to use personal data of inhabitants need to communicate the dimension of the data collection and processing transparently, further clarifying the benefits for each citizen and the society as a whole.

3.2.2 ICT as an enabler for sustainable and smart development of other sectors

Since innovative ICT solutions support a broad spectrum of city related themes and projects, not one single ICT best practice project is limited exclusively to the ICT sector but connected to other sectors. Exemplary the Interoperable Electronic Ticketing project in Tokyo as well as the Verkehrsinformationszentrale in Berlin have to be considered as projects of the mobility sector, benefitting from a "smart" usage of data with the help of ICT. Moreover, the Smart Grid projects of Berlin or Freiburg im Breisgau could be assigned to the Energy sector, the Beteiligungshaushalt is also aiming at the governance sector and the projects Vernetzte Sicherheit and Smart Public Safety can be seen as parts of the security sector.

The level of impact of the ICT sector for other sectors is shown in Figure 4, which describes the dependences between all defined key action fields with those of the ICT sector (The more bars in the middle rings the higher is the relation). This figure, which is based on expert ratings, illustrates the extraordinary interdependencies between the sectors ICT and mobility as well as ICT and security. Nevertheless, it can be noted that all sectors are affected from ICT key action fields to a certain point.

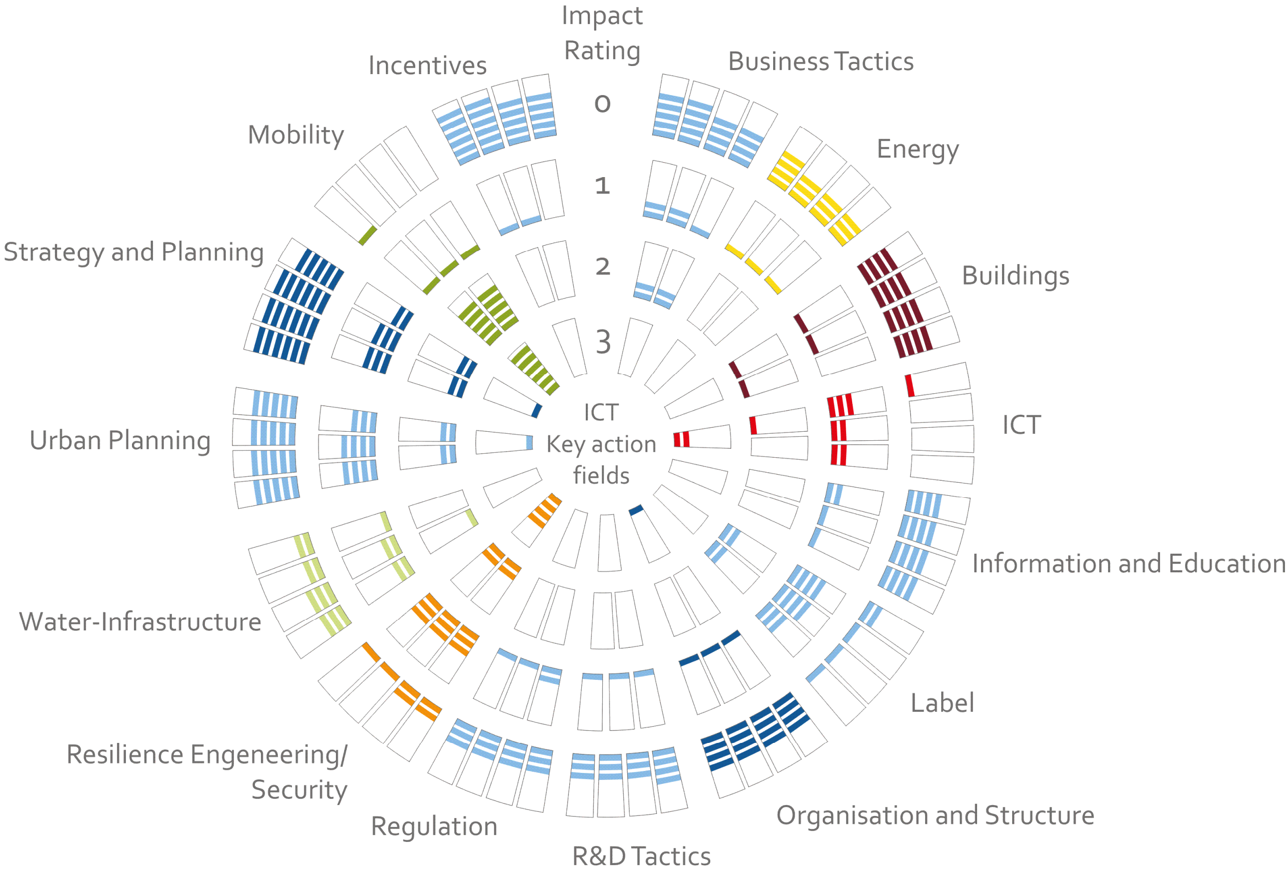

Figure 4: Impact of ICT key action fields

All these best practice projects used ICT in order to achieve one or several of the following three main goals:

Efficiency

Usually ICT solutions are implemented in order to optimize processes. This optimization includes approaches regarding higher efficiency, evidence based decision making, improved target group addressing and much more. Exemplary project: GRID2Smart in Freiburg im Breisgau.

Promising opportunities of technologies

In various cases ICT solutions were adopted because they allowed addressing existing problems with completely new approaches. In fact, sometimes they are able to uncover so far unknown problems and offer possible solutions to deal with them. Exemplary project: Open Data Initiative in New York.

Emerging demands

Moreover, the digitalization of cities includes societal changes too. Like Montgomery et. al. (2004) already discussed, new generations of digital citizens evolved during the past decades. These highly connected inhabitants demand for new products and solutions in order to organize and live their lives. Exemplary project: Interoperable Electronic Ticketing in Tokyo.

3.2.3 Key action fields

As also outlined in chapter 2.2, sector specific key action fields were identified during the city visits in order to highlight recent innovative developments which have proven positive impact on entire city systems. In this context, four key action fields can be named for the ICT sector.

Open Data Systems

The core idea is to provide municipal data for citizens and local companies in order to ensure transparency and enable inhabitants to control their authorities. This key action field consists of various best practices as for example the Open Data Platform and infreSt in Berlin or the Beteiligungshaushalt of Freiburg im Breisgau.

Urban Smart Data Systems

Such systems are applied in order to gather and process the increasing amount of emerging city data to optimize municipal processes and to provide a foundation for evidence-based decision making. Like the previous key action field, “Urban Smart Data Systems” combines different best practices, like the Open Data Initiative in New York or the implemented Smart Grid solutions in Freiburg im Breisgau and Berlin.

Intelligent traffic management based on real time information

A system of receiving units collects real time traffic data from the city’s streets. An operation terminal collects the information and calculates optimal traffic flows. The results are used for traffic management. Driver information is provided by real time street displays or directly to navigation devices. Related practice examples are the Verkehrsinformationszentrale in Berlin or Tokyo’s Vehicle Information Communication System (VICS) which was analysed by the mobility sector experts of the m:ci project, collaborating with ICT specialists.

Interoperable electronic ticketing systems in public transport

Optimally such an approach will be implemented with a single card or device that allows passengers to use all public transport vehicles (e.g. subways, buses or taxis) within a city. These systems have to meet the following three main criteria: (1) optimal usability for passengers, (2) interoperability within means of transport and operating transport companies and (3) cross-domain applicability (versatile payment methods in the city).

The four presented key action fields have not only shown their positive impact for the analysed best practice projects and cities, rather they represent the central four ICT key approaches that should be considered by cities all over the world in order to become smart, sustainable and resilient. Other urban areas of the world already started to implement comparable approaches, as for example in Hong Kong or the Netherlands, were chip cards exist that cover various means of transport from local ferries up to regional trains.

Additionally, a fifth aspect has to be considered as a future ICT key action field, although first approaches are just beginning to develop. Digital self-helping structures for the society will become more and more important worldwide within the next years. This development was, among others, observable during the last few years in the context of natural disasters. National and global non-profit organizations are trying to involve citizens in data collection processes during natural catastrophes with the help of smart phone applications (Meier 2013). Citizens are also initiating and organizing their engagement on social media platforms, as occurred, for example, during the 2013 flood in the German city of Dresden (Ulbig 2013). With the help of social media platforms (e.g. Facebook and Twitter) that are deeply grounded within societies,

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inhabitants get the chance to be proactive regarding all kinds of social, economic, environmental hazards. Cities should engage citizens to strengthen the resilience of local communities and to foster their sustainable development with the help of such self-organized smart community solutions.

3.2.4 Key insight

It can be concluded that a wide provision of urban data and their intelligent use can enable cities to achieve a smart and sustainable development. Nine out of thirteen ICT-oriented best practice projects were based on the same main idea of knowledge acquisition through use of urban data. Further, the four remaining projects are producing data sets that could also be consulted for such projects. The previously named ICT key action fields correspond to this outcome, concentrating on the use and provision of digital city data for all fields of application. With this background, one ICT key insight can be derived: the intelligent use of data in urban systems.

Cities can use existing or new (with the help of new sensor systems) data sets in order to optimize municipal processes and take evidence-based decisions. Cities that apply data analysis processes are able to get deeper insights into the living conditions of inhabitants. They are capable to identify emerging problems faster and will be empowered to cope with them independently. Such cities could be efficient working holistic systems that are connected via data streams of all kinds of application fields.

3.3 Transferability

In general, the transferability of the presented ICT solutions is not limited to specific external circumstances as for example geographic or demographic characteristics. Nevertheless, the transferability is dependent on the presented impact factors such as the political will, legal regulations and the societal acceptance.

With a view to the presented findings, one question regarding the transferability remains: What steps and measures are necessary to implement comparable solutions within a city? Concerning this, the following main tasks have to be adressed.

- Identifying relevant data sets respecting the intended field of application and privacy considerations.
- Collecting data automatically as well as developing and implementing of sensor systems.
- Analysing smart data with high performance analysis tools, including the development of additional tools in order to make data operational.
- Defining knowledge processes in order to base specific decisions on obtained results.
- Designing dissemination processes for public information.

In order to accomplish these complex tasks, cities will need help from different partners. Therefore research institutions as well as industrial partners could offer know-how (e.g. big data analysis) and technologies (e.g. sensors). Further, long-term collaborations between these actors should be established in order to act on the basis of a common strategy and to achieve optimal results. Jointly developed local ICT strategies are the first important step to integrate innovative ICT solutions within city projects and processes and to promote a sustainable smart city development in all fields of application.

Moreover, the second period of the m:ci project (2014-15) concentrates as initially intended on the implementation of successful approaches and solutions for other cities. In this context, city partners as well as industrial partners are working together with Fraunhofer experts to adapt identified promising solutions to the specific needs of the partner cities.

4 CONCLUSION

The substantial insights that were generated with m:ci illustrate the value of the project and the developed method. The interdisciplinary approach revealed a profound understanding for best practices and their impact factors, allowing the researches to identify yet hidden connections and commonalities between projects of all sectors.

Regarding the ICT sector the m:ci project has shown that:

(1) Innovative ICT solutions are able to support the sustainable and smart development of urban systems and all their sub-systems/sectors, and

(2) The smart use of already existing digital city data is a powerfull as well as realizable first step in order to make a city smart, sustainable and resilient.

In order to exploit the full potential of the presented ICT solutions and to make a city innovative and smart, cities should establish collaborations with local research instutions as well as to partners of the private sector. Nevertheless, cities need to meet their responsibilty towards the society by applying transparent processes, both during the implementation phase as well as while using urban data for specific purposes.

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Smart Cities between Ethics and Aesthetics

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1 ABSTRACT

Smart cities are systems of knowledge. If on the one hand they maintain an identity that prevents repetition - given the uniqueness of their historical-evolutionary path – on the other hand they can be classified according to the criteria of representation adopted for interaction with the urban reality. However, rather than adhering to a single paradigm (modernity, postmodernism or complexity), it may be useful to develop an "eclectic" perspective, in order to identify the conceptual intersections that show the existence of areas in which it is important to intervene, regardless of the diversity of paradigms.

In this context, researchers and practitioners can help in establishing a link between the development of collective identities and activities of public institutions interested in activating participatory decision-making processes. Thus, it is possible to appreciate geographical scales and elements of scarse interest at an institutional level, which, however, may prove to be of great value in citizens' individual background. Citizens become "daily life explorers" who can communicate with the institutions or share contents with them on the web. Instead, geographers and institutions have the task of integrating the individual opinions in order to produce "ethical frameworks" which are responsive to the living experience of people that animate everyday life.

On the basis of these premises, the aim of this work is to research an equitable and sustainable pattern of development, in the ambivalent tension between ethics and aesthetics of the urban contexts, "mediated" by the system of knowledge that characterises the smart cities.

2 INTRODUCTION

We all like to live in a more united, more intelligent and environmentally friendly world, making use of all that modern technology has to offer: school resources available remotely to students, health services more suited for retirees, safe cycle lanes for commuters and a fast broadband widely used for home workers. But in a time characterised by unprecedented pressures both on public finances and on urban landscapes, how can our cities reach such "intelligence" for their citizens? What should the partnerships between local authorities and the private sector consist in to work effectively, or in other words how do the institutions themselves need to become "smart" in order to make the city smarter for everyone? Can these changes be made in the short term with small incremental movements, or can they only be achieved through a long-term strategic vision? The answer to these questions is not unique as the concept of a "Smart City" contains many visions, often competing and variously articulated and codified internationally: sustainable mobility, nearly zero-energy buildings, smart living, green economy, e-health, e-participation, e-government, social innovation, public-private partnership and much more. Despite this uncertainty, the idea of the Smart City earns consensus on the political and industrial agenda and is poised to become one of the central issues around which planning efforts can be articulated and organized not only of the main Italian and European cities, but also of many other forms of territorial aggregation. This trend is already being enacted in a multitude of initiatives designed to transform millions of people's lives, from simple projects that improve digital access to public services (such as the use of smart phones to benefit of a wide range of goods and services), up to innovative infrastructure to recycle waste water or for heating. However, apart from being a set of technology solutions, the smart city is both the product of social needs on an urban scale, and the concrete manifestation of the need for a new generation of innovation policies regarding different levels of government. The basic idea is that the capacity of connection and processing of information offered by the ICT can contribute to building a much more cooperative model of community than in the past, and therefore more "clever", able to pursue efficient, i.e. more competitive and more inclusive, solutions. This idea, however, implies a radical change of often consolidated habits, and the removal of barriers between roles and responsibilities. The challenge is to combine urban environmental protection, energy efficiency and

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economic sustainability in a single model, with the goal of improving the quality of life of residents and of creating new services for the citizens and for the city-users, at the same time reflecting the multiplicity of the needs of the population without imposing a general structure. It is important that cities are not smart in themselves but for the people who live in them. According to this smart approach, the relationship between the landscape, understood as the set of physical, social and cultural components of a given urban context, and the city users assumes particular importance. Considering this vision, the paper is organised as follows: in paragraph 2, starting from the difference between an ethic and an aesthetic approach to the city, we highlight the need of innovative forms of governance; in paragraph 3 the elements useful to implement a participated process at territorial level are discussed; finally in paragraph 4 the concluding remarks are presented.

3 IMPLEMENTATION OF SMART TRANSFORMATION POLICIES

The European Landscape Convention[1] states that every landscape should satisfy people's attitude to enjoying high quality landscapes and "to play an active part" in their development (Council of Europe, 2000). In doing so, landscape studies "contribute to the formation of local cultures", increasing "people's quality of life" (Council of Europe, 2000). On the other hand, landscape and cultural heritage (the "ethos" of a place) have often been considered in economic activities as important assets, that increase the added value of economic activities related to residential, cultural and recreational services. Therefore, it seems that the ethos of a place might depend both on what residents believe is ethic (their identity) and on what non-residents recognise as aesthetic during their stay (their perception).

In other words, the ethos of a place depends on concerns belonging both to internal and external perspectives. When an external perspective prevails, landscape reduces to an "icon" and people's quality of life might suffer significant decrements. On the other hand, when an internal perspective prevails, a place might develop a localistic attitude, that, even if it maintains citizens' quality of life, in the long run there is a significant loss in terms of welfare and well-being.

However, as it will be explained, activating participated processes at a territorial level is not straightforward, especially due to economic reasons related to the availability of human, financial and technological resources. Therefore, cooperation among local associations, territorial administrations and firms in endorsing government actions aimed at opening the decision-making and implementation processes to citizen's participation is of the utmost importance. In doing so, citizens might obtain an active role in territorial policies, and firms might obtain a higher added value for their goods and services (Salusti, 2013). Finally, local administrations might improve the level of welfare by contributing to the accumulation of social capital and by discovering additional cultural goods and practices in peripheral areas that are usually penalised in terms of visibility and accessibility.

In brief, a city that wants to be smart must be able to balance both an aesthetic and an ethical approach in order to make its landscape more attractive. In fact, the attractiveness of a landscape – with its territory, its habitat, and its cultural heritage – can contribute to an increase in its fruition. In this framework the quality of regulation plays a central role, regarding the right to have an active participation in the implementation of processes of landscape preservation, management and planning (Garau, et al., 2014). The complexity of the concept of smart - synonymous of sustainable, efficient, inclusive, technological - city must necessarily consider the dynamism produced by complex territorial geography, irreducible to the traditional political, administrative and hierarchical partition, in which the government at local, regional, sub-national levels needs to be integrated to the central or national one. This falls between the "living", "people" and "governance" factors that characterise the smart cities (Giffinger et al., 2007). They acquire a meaning only

[1] The European Landscape Convention aims to "promote landscape protection, management and planning" of all landscapes, through cooperative processes that should increase the awareness of the living landscapes (Council of Europe, 2000). The European Landscape Convention does not have an equivalent counterpart in the EU legislative framework, as landscape has been regulated indirectly, and legal protection has been accorded only to the environment and to the sustainable use of the exhaustible stocks of natural resources. A regulation focusing directly on landscape has been developed at national level by the EU member States. As regards Italy, landscape is considered mainly as a cultural good. Nevertheless, also in the Italian law (in particular with the coming into force of the L.D. 42/2004 - known as Code of the Cultural Heritage and Landscape) the concept of landscape is the result of all the natural and cultural elements observed, assessed in their individuality and in their interaction.

if they are planned in a development process that involves a broader area of which the city is the trigger factor (La Rocca, 2013).

In relation to these conditions and considering that it is difficult to generalise - because of the different characteristics of each city that cannot be transcended by the chronicity of the problems that over time may have taken a consistent dimension - the awareness of a lack of national urban policies integrated with a good local government, is shared. Smart or effective sustainable resolutions, projectable into the medium-long term, cannot exist except through strategies and objectives in line with local, national urban policies and European perspective on smart key (Mistretta et al., 2013). It is therefore necessary to look at new approaches and innovative forms of governance, which should be stronger and more radical. At the same time they should allow a joint action plan which optimizes the mobilization of local resources, care of the common goods, efficiency and reliability of the actors involved, trust in institutions and culture and cooperation in inclusive practices. Particular attention must also be paid to the process that will lead to the adaptation of the new competitive and territorial objectives. In other words, public action has to face new challenges and new directing tasks in which its role is not weakened or marginalised by the continuous change of the global system, but adapts to the changing city, taking on a leadership of law recognised by all parties involved. This objective can be pursued not only through innovative policies and regulatory cooperation negotiated between local authorities, representatives of groups, businesses, public companies, etc., but also through correspondence between what is said and what is done (Garau, 2013).

Therefore the actors involved, overall and in a participatory manner, must assume the responsibility to activate processes and strategic projects beyond the specific roles and interests. And if, on the one hand, it is asked that the public authorities reflect on the economic and social development, going beyond administrative skills, on the other hand, communities are asked to be more active in taking on new responsibilities with respect to the balance of social and environmental sustainability in the long run.

To avoid repeating frequent failures, it is therefore necessary to have systemic and predictive visions of future scenarios, accompanied by assessments on the effectiveness of interventions put into place. This approach does not necessarily imply a loss of the central role of more “progressive” policies, but a reacquisition of a project leadership and of a systemic vision. The latter cannot be reduced exclusively to the objective of protecting and producing goods and services, but mostly to governing this dense network with its overall territorial system.

Moreover, explicit attention should be paid to the lack of istitutional stability: the government should introduce new structures and / or functions dedicated to their consolidation, so as to progress and become a reference point for citizens. This process is also crucial in the formation of a common store of knowledge among the different stakeholders involved: it is necessary to define common lines of action through the sharing of (1) knowledge on the issues and needs; (2) common cultural parameters; (3) concrete constructive approaches to public goods, etc..

However, based on this reasoning, it is necessary to point out that there are strong institutions where there are strong communities. «The collaborative approach [...] is important, as is the motivation» (Innes et al., 2003, 14). Skills, responsibilities and relationships with the community characterise the new citizenship. Social capital is of fundamental importance because it enables an effective smart, sustainable and inclusive growth. This requires the courage to get out of the consensus as an end in itself, focusing on civic and institutional trust, supporting and enhancing forms of active citizenship.

A smart city must surely trust in the full involvement and in the ability of the community to perceive the local issues and to propose and develop solutions to resolve them (through bottom-up logics). These solutions, mostly marked by a technological nature, need to be supported from above through top-down logics, so as to perceive the landscape as an ecosystem of innovation open, free and user-driven, based on the continuous development of partnerships between governments, companies, researchers and groups of citizens (Living Lab). One of the challenges of smartness is to be able to govern the change effectively, characterised by the speed of the times of action for the urban context functioning, where this place-based context, in turn, depends on the intelligent coordination between physical and intellectual resources of the community.

4 ENHANCING PEOPLE'S PARTICIPATION: REGULATION, FINANCE AND CULTURAL HERITAGE

It is worth noticing how a network of stakeholders might facilitate the interaction between the institutions operating at a macroeconomic level and people's participation at a microeconomic level. In other words, the network might stimulate connections between the activities related to the accumulation of social capital in terms of a collective identity (within an ethic and aesthetic perspective) and the activities of the public institutions interested in developing participated processes of decision making at every geographical scale and economic sector. The contribution of the stakeholders is twofold: firstly, they can integrate the economic accountability with social and environmental issues; secondly, they can explore the landscape at a local level identifying meanings of collective relevance and stimulating people's involvement in landscape transformation processes, both at a decisional level and in the implementation phase.

However, the implementation of a participated process at territorial level is not an easy task. Specifically, it requires: an ad hoc regulation that enables the process; a set of tools able to incentivize the private involvement in the implementation processes of smart initiatives; a set of methodologies able to manage the complexity of the information collected and of the relations activated by the promoters. These three elements might facilitate the participation of the interested citizens in the development and implementation of landscape transformation policies. They might be considered as important as the Environmental Impact Assessment (EIA) at a political and economic (financial and real) level, and as complements to it in order to develop territorial and urban planning activities in coherence with the principle of equitable and sustainable welfare.

4.1 The Regulation Impact Analysis (RIA): a brief overview

The RIA was introduced for the first time at the beginning of the Seventies in the USA as a monitoring tool of the quality and quantity of regulation approved by the Regulatory Agencies. During the Eighties, the RIA was also adopted in Australia and in the United Kingdom, and, during the Nineties, the OECD, through the Public Management Committee (PUMA), promoted the spread of the RIA throughout the European Union and its Member States. At an EU level, the issues of simplification and of better regulation acquired a strategic relevance during the European Council of Edinburgh (1992) and with the White Paper on "Growth, Competitiveness and Employment" (1993). In 2000, the European Council of Lisbon asked the European Commission, the Council and the Member States to develop a coordinated strategy to simplify the regulatory framework and the public administration procedures at European and national level by 2001. A few years later, the European Council of Brussels (2003) asked the Commission to assess how the regulatory reform might contribute to the achievement of goals of the Lisbon Strategy. The European Council of Brussels also supported the implementation of the Action Plan "Simplifying and improving the regulatory environment", presented by the European Commission in 2002.[2]

In Italy, the RIA was introduced in Article 5 of the Law n. 50/1999, by which Parliament delegates the Government to define an experimental assessment of the impacts of regulation on the organization of public administration and on the activities of citizens and firms. The same Law attributes to the Parliamentary Commissions the faculty to require a RIA of the normative drafts and of the proposals of law of their competence. The Directive of the President of the Council of Ministries of March 27th 2000 finally introduced the RIA in the Italian legislative system as an experimental activity (Greco, 2003). In 2001, the Italian Government published the "Guida alla sperimentazione dell'analisi di impatto della regolamentazione (AIR)",[3] which illustrates the RIA procedure and highlights logical frameworks and methodological issues that might be used in the assessment activities. Finally, Article 2 of the Law n. 229/2003 delegates the Government adopt a Legislative Decree for the reform of the legal norms regarding the production, the simplification and the quality of regulation. In the same years, the Italian Independent Authorities developed autonomous procedures of regulation impact analysis, and enforced their diffusion among the other central and local public administrations in order to facilitate the existing coordination mechanisms and increase the quality of regulation.

[2] Specifically, the Action Plan aims to enforce the proposal of the Commission to support the most relevant regulatory proposals with a consultation of all the interested people and institutions, and with an overall assessment of the expected impacts (Greco, 2003).

[3] "A guide to the experimental use of the Regulation Impact analysis".

Two important activities promoted by the Independent authorities are the RIA on Competition developed by the Antitrust Authority and the on line consultations instituted by the CONSOB on regulatory projects related to the markets of capitals. Some applications of interest for the participation in landscape transformation policies are the Antitrust reports concerning the quality of regulation in the Toscana Region (AGCM, 2007) and the effects on competition of the regulation of the retail sector (AGCM, 2007), and the CONSOB online consultation concerning the adoption of a new regulation of the equity-based crowdfunding (CONSOB, 2013). More detailed information on the state-of-the-art of RIA in Italy is provided by the RIA Observatory.[4]

4.2 Crowdsourcing and crowdfunding in territorial policies

Participation in the implementation phase means taking part in the process both at a financial and at an economic level. Specifically, at a financial level people interested in participating in a project might be involved in the fund raising activities through the implementation of crowdfunding processes. As it has been pointed out by Ordanini, Miceli, Pizzetti and Parasuraman (OMPP), crowdfunding is "a collective effort of people who network and pool their money together […] to invest in and support efforts initiated by other people or organizations" (OMPP, 2011). Indeed, "the idea that some people may decide to pay for producing and promoting a product (instead of buying it), and run the risk associated with that decision, represents a step ahead in the evolution of consumers' roles, that involves a mix of entrepreneurship and social network participation" (OMPP, 2011). Following the authors, three kinds of players are involved in crowdfunding models. Firstly, "there are the actors that propose the ideas and the projects that need to be financed" (OMPP, 2011). Secondly, "there is a crowd of people that decide to invest in these projects", participating also in selecting and developing the goods or services they consider "to be most promising or interesting" (OMPP, 2011). Finally, a crowdfunding institution connects investors and producers (OMPP, 2011).

"Crowdfunding has been boosted by the new achievements of the Web 2.0", allowing consumers to participate actively in the development and creation of the project itself through social networks (OMPP, 2011). Even if crowdfunding has some features in common with charity and social cooperation, it is also true that "money is invested by consumers to obtain a return, mostly financial, but sometimes intangible", in terms of "status, social esteem, identification, etc." (OMPP, 2011). Crowdfunding models include elements of crowdsourcing, "a procedure that enables the members of a community to share ideas and efforts to solve a problem or to create favourable conditions for the community itself" (OMPP, 2011). Crowdsourcing might enable people's participation in the implementation of public projects. Specifically, people's participation in landscape transformation interventions might be enabled by fractioning a project, or a part of it, into elementary activities that might be devolved to the free or regulated implementation of the interested citizens and firms on a voluntary basis. As an example, in the management of a park several areas might be dedicated to the free use of people, who might decide to plant new trees, vegetation or flowers, or simply use it to relax and talk with other people. Similar processes might be planned also in the implementation of decorative structures in selected parts of a city or of a village.

Clearly, crowdsourcing should not refer only to landscape planning in a narrow sense, but to all those activities that might be of interest for the community that lives in the landscape (social and recreational activities, welfare services and immaterial infrastructures, economic activities, etc.). The promotion of crowdsourcing activities on a large scale might contribute to increasing people's sense of community, augmenting also the number and the quality of the dimensions involved in the definition of people's well-being. Specifically, the concept of individual well-being might be complemented by topics usually referring to a collective idea of well-being, legitimizing also at an individual level the choice of promoting social capital as a bridging value among private and public narratives, and landscape as an important determinant of people's quality of life.

Finally, at an economic level, the process of people's permanent involvement in landscape transformation activities might counterbalance the widespread diffusion of the illegal economy during recessions. Specifically, during crises the criminal economy constitutes a sort of buffer for the legal activities, and the main deterrent seems to be that of reviving growth even when it implies paying high social costs. Recently a team of World Bank practitioners proposed as an anticorruption measure, the empowerment of the local

[4] "Osservatorio AIR", http://www.osservatorioair.it

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communities, highlighting also how they suffer the major negative consequences from the increment of illegal activities (Recanatini, 2011). Consequently, living in the landscape and participating in the development of a collective identity can contribute to reducing the levels of corruption and crime, and redirecting the productive structure towards sectors of higher added value by transferring the risks associated with the investments.

4.3 Cultural heritage and ICT's for the territorial development

The problem of economic development is of particular significance in connection with the need to fill the gaps and socio-economic imbalances between different areas and social groups, with respect to the quality of life offered to their respective populations. Culture, in these situations - as a mix of tangible and intangible aspects - plays a critical role in the persistence or the overcoming of 'vicious' circles. This is due basically to the fact that, for cultural heritage, the use of culture is translated into the production of other culture, and this, in turn, into the best economic and social performance, contrary to what happens for normal economic goods, where consumption leads to the exhaustion the good consumed.

It is therefore crucial for cities, especially marginalised territories and communities to develop cultural projects in line with the preferences of its users (residents and tourists).

From an economic point of view culture appears as a concept that can be interpreted in two ways: the first refers to the beliefs, habits and customs of a social group, and the second refers to a range of human activities and their products that are concerned with the intellectual, moral and artistic aspects (Throsby, 2005). A marked presence of tangible and intangible aspects is highlighted especially in the goods that constitute the concrete explanation, the so-called artistic historical cultural heritages (AHCH). In them culture is reflected in the different forms in which value can manifest itself (eg, aesthetic, spiritual, social, symbolic, historical, authenticity, etc..). Due to their peculiar nature, another characteristic element of AHCH is the ability to produce private and collective benefits: the first are directly related to the experience of "consumption" of such goods by users (for instance the purchase of an artwork by a public or private subject), the latter are directly related to the number of effects and side effects, in terms of economic and social exchanges that are generated and spread throughout a community.

Positive externalities - such as the increase in employment levels - can then be added to these benefits.

For these reasons, several studies show that culture can have a decisive impact on economic performance on three main fronts: 1) efficiency - by reducing the so-called transaction costs – 2) equity - through a reorganization of moral rules or customs – 3) social goals - through the establishment of a new equilibrium with respect to the achievement of tangible and intangible benefits. In essence, it could be said that the consumption of culture is not limited to the time itself, but it produces - unlike with so-called normal goods - other culture and further consumption of all goods that are connected to it.

To sum up, the fruition of culture does not end in the moment itself. Instead, it generates – in opposition to what happens with other normal goods – more culture and additional consumption of all the goods that are culturally-related. Moreover, the AHCH can be significantly increased through Information and Communication Technology (ICTs), as they can generate powerful territorial attractors that push individuals (tourist operators, intellectuals, visitors and tourists etc.) to visit the places that host the AHCH so that they have a direct vision and perception of them.

Indeed new technologies allow the definition of networks of AHCH aimed at sharing and managing information, indicating, also in marginalised and disadvantaged places, nexus and linkages, that can define concepts such as "open museum" or "territorial museum" that otherwise would lack of any concrete meaning (Minucciani, 2005). Contemporary museums should not be intended as places involved in the preservation and contemplation of the artworks they contain, as they should, instead, restore the original circuit of communication; in other words, new AHCH fruition styles are emerging (Caputo, 2008), in which representation is not simply a box containing the information, but is a way to shape contents (Cirafici, 2010). Historically born in opposition to this function (a museum contains objects), the museum space has often been accused of decontextualising artworks (Antinucci, 2004). This problem persists and the museum cannot communicate, as its communicative function depends on fruition based on the mere contemplation of artworks, which cannot provide information on them (Monaci, 2005). The contribution that smart cities can provide to the development of a place must be contextualised in this scenario, and it consists of the shared use of resources according to a networking approach.

Specifically, we do not refer to those applications, created with the web 1.0, aimed at creating products for dissemination purposes, or to databases and online archives directed at proficient users. We refer, instead, to those solutions that draw linkages among AHCH belonging to different subjects – i.e. institutions that enable customised paths regarding different interests (cultural heritage, paintings, sculpture, etc.). This perspective is the product of a new culture of museums, coherent with the principles of the network economy (Grannoveter, 1973): the preservation goal evolves, overcoming the limit of the goods contained in the "containers of AHCH", and including the city and the connected urban landscape.

With this new focus for cultural heritage, a smart vocation of the city, towards the enhancement of all that constitutes the cultural heritage of its community, emerges. The reference principle is that knowledge is no longer seen as a mere storage of data, but rather as a process of exchange in which the AHCH value requires a new model for the organization and use of the cultural heritage, integrated with innovative service structures and communication networks, capable of orienting economic development processes. This is the perspective in which it is necessary to take into account a system of systems, or, in other words, a network which is a complex of services that enable the AHCH use, becoming a research laboratory and an incubator of new economies.

To implement those potentialities a smart city, cannot be separated from a governance system based on a network approach, that is able to systematise the various AHCH operators and all existing and potential users located in a landscape (with particular attention to social and / or urban marginalised areas) in order to encourage a revival of the development and growth of the territory, in accordance with the cultural identities that characterize it.

Instrumental to this purpose is:

(1) To strictly refer to the institutions that preserve and manage AHCH heritages. The choice is motivated by the fact that these institutions aim at saving goods with a high merit, that are able to generate not only economic value, but also social value, regarding the quantity and the quality of the net benefits perceived by direct and indirect consumers, future consumers and potential consumers.

(2) The empowerment of the ICT for experiencing the consumption of AHCH can always be more interactive and inclusive.

The accessibility and consumption of AHCH in a smart city environment must not be fragmented and contained by disconnected real and/or virtual contexts, but should be opened – through the adoption of technological innovations – to even more numerous and intense new connections. This dynamic must have a counterpart in the new kinds of interactions among artworks consumers, cultural contents providers and landscape, which should be able to generate multiple consumption patterns, in a flexible and adaptable framework. This need is due to the continuous evolution of and to the numerous opportunities offered by the ICTs to experiment different patterns of fruition of the historical-environmental heritage such as the implementation of alternative touristic routes (developed using a GIS), which can be easily observed using mobile devices. Consequently, the visiting patterns, usually made of audio-video contents (Garau et al., 2014), can be complemented with all the relevant information (street directions, restaurants, hotels…) for a complex experience of the city. By reducing the transaction costs of access and management of the AHCH a higher level of accessibility and knowledge is reached, but also more skills in the management of information are generated, and through them:

(1) a widespread diffusion of tangible and intangible benefits;

(2) a higher degree of dynamic efficiency in terms of better distributed welfare (also in terms of accessibility to cultural heritage);

(3) a higher level of intra-generational equity related to the opportunity for the current generation to have a access to AHCH associated to a higher level of preservation of cultural heritage.

5 CONCLUDING REMARKS

Managing policies with responsibility, reflecting on the international competition, involving the actors in a "common direction" by organizing collective action, mobilising resources in a cohesive way, also closer to

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the needs and resources of the community. They are among the many issues that we consider necessary and indispensable in implementing a smart city. First and foremost, it is necessary to be aware of what all this means, in terms not only of technical feasibility, but also of policy and human capital feasibility. In other words, is there the political will to move the axes of the reasoning that has so far characterised the government? The approach that public authorities must assume, is multidisciplinary, and governed by a "visionary leadership". Moreover, it implies shared values, concerted actions, mobilization of resources and more attention paid to communities.

Secondly, researchers and practitioners might contribute to facilitating the connections among the accumulation of social capital in terms of a collective identity and the activity of the public institutions interested in developing participated processes of decision. All the information collected can be integrated at macro level in an ethic vision of the landscape of interest. The issues that emerge from the narratives collected can be integrated with those which come from quantitative analyses and from regulation analyses with the aim of creating complete information available to the policy makers. A tool of analysis at political level that has been developed according to this integrated framework is the Regulation Impact Analysis. Crowdfunding and crowdsourcing, instead, are tools that might facilitate the participation of the interested citizens at the implementation phase.

Thirdly, people living and using the smart city can act as explorers at every geographical scale, contributing to reviving the narratives that animate daily life. Geographical scales and elements of scarce interest at institutional level (as an example, a neighbourhood, a square, a park, a street or even a block of flats) might emerge as the most relevant in many individual and small group narratives enforcing both the ethic and the aesthetic perspective.

By using an ad hoc analytical structure, all the information collected can be integrated at macro level obtaining as output an ethic vision of the landscape of interest. "Ethic" means the fact that the issues and the narratives collected express the view of the community that lives in it, and contribute to reinforcing its identity. The issues that emerge from these narratives can be integrated with those which come from quantitative analyses and from regulation analyses with the aim of creating complete information available for the policy makers.

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reviewed paper

Smart Cities Need Smart Citizens, but What About Smart Children?

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1 ABSTRACT

Citizens are a key component of the smart city concept. Understanding citizens allows creating sophisticated services and outcomes that are tailored to their needs. This refers also to children and the youth who are an equally important part of society. But, even though singular initiatives can be found that put interest on children and the youth, there exists a gap between knowledge required and knowledge existing on how young people act, move, and live in cities and which urban infrastructure, facilities, and services including ICT they consider important. This owes to the fact that the needs of children and the youth - as for instance outlined in literature - are determined mostly by adults, while the perspective of the youngsters themselves has been less considered. Thus, there are several open questions on smart cities regarding children and the youth: Why at all is it important for smart city initiatives to pay attention to children and the youth? What are relevant aspects to take into account by smart cities in order to become (more) child- and youth friendly? These questions are discussed based on experience gained by work done in the project Youth Map 5020.

2 INTRODUCTION AND RESEARCH QUESTION

The continuing urbanisation trend, the pressing need for sustainability, and their increasing level of complexity are great challenges for today's cities. At that, cities, i.e. due to their development, must meet the following demands (Meijer & Rodríguez Bolívar 2013): produce more wealth including other public values (e.g. solve environmental problems, guarantee safety), involve social issues (e.g. integrate growing populations from different ethnic, religious, and socio-economic backgrounds), trigger structural transformation in society (i.e. include stakeholders and citizens in urban governance), and foster cultural development (e.g. arts, museums, and education), to create a vibrant cultural climate.

In order to respond to these tasks, the smart city concept has been developed. Very roughly described, this concept is a strategy for working with cities supporting them to fulfil the objectives outlined above. For it, the needs of citizens are put first, whereas solutions not only base on intelligent management and active citizens participation, but also increasingly rely on the use of ICT (see e.g. URL 1).

Concerning detailed definitions on the smart city concept, it has to be underlined that different definitions exist. Furthermore, it is a fuzzy concept that is not used consistently and for to describe it similar terms such as intelligent cities, virtual cities, knowledge-based cities, digital cities, or information cities have emerged (Meijer & Rodríguez Bolívar 2013). Nevertheless, representative for others, two definitions are presented here:

Caragliu et al. (2011:70) consider a city smart " (…) when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.

Giffinger et al. (2007:11) define smart cities as "(...) a well performing city built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens." To identify and assess smart cities, he stresses a set of six characteristics (see Table 1): social and human capital, competiveness, participation, transportation & ICT, natural resources, quality of life.

	Characteristics of Smart Cities		
smart	people	Social/ Human Capital	Affinity for life-long learning; participation in public life; creativity & flexibility
	economy	Competiveness	Innovative Spirit; productivity; flexibility of labour market
	governance	Participation	Participation in decision-making; transport governance
	mobility	Transportation & ICT	Local accessibility; ICT infrastructure; sustainable, innovative, safe transport system
	environment	Natural Resources	Attractive natural conditions; environmental protection; sustainable resource management
	living	Quality of Life	Cultural facilities; health conditions; housing quality; Social cohesion

Table 1: Criteria of smart cities (adapted from Giffinger et al. 2007; URL 1)

Regardless the definition, citizens (the human capital) are highlighted as a key component for the concept of smart cities. Several authors such as Hemment & Townsend (2013) and Meijer & Rodríguez Bolívar (2013) argue that (smart) citizens are necessary to make smart cities. For developing smart cities they ask for putting people first: As our cities are becoming instrumented, interconnected and intelligent, and enabling to create new opportunities to improve the performance and efficiency of city systems, it requires, being fully aware of the citizens and their way of life which triggers certain needs and requirements. This refers, on the one hand, to city's endowment of urban infrastructure, facilities, and services, and, on the other hand, it encompasses the application of digital technology (i.e. ICT) to city systems (availability and quality of knowledge communication, information infrastructures etc.). Both are related to multiple key areas (as listed in Table 1) focusing on economy, mobility, environment, living, and governance.

So, to foster smart cities, understanding citizens and having information about their preferences and needs is considered reasonable (Tratz-Ryan 2013). Citizens, therefore, may be segmented by a myriad of different profile characteristics such as age, ethnicity, abilities or disabilities, gender, level of affluence and state of health. Also, ICT use variables should be taken into account to get a better picture. This includes for instance, information on interaction type referring e.g. to request for information, application for services, channel for the service request/transaction (e.g. telephone, face-to-face, web). Such profiling of citizens supports to create services and outcomes well-tailored to the needs of particular target groups (Thacker 2009). However, such knowledge, beside its relevance to smart city development, can impact city planning initiatives as well as design and development of information and communication infrastructure.

Even though, the smart city approach asks for considering everyone, some parts of society are still left behind. This is even truer for children and the youth (see e.g. Zeising & Katterfeldt 2013). Literature highlights the need to improve services and outcomes to fit the needs of children and the youth (URL 18).

But, even though singular initiatives (e.g. European Network Cities for Children: URL 19; Child & Youth Friend Strategy of the city of Surrey; URL 15), and projects (child health: URL 8; school and teaching: URL 20, Noling 2008) exist, which directly or indirectly provide some information on how children and the youth act, move, and live in today's cities and which urban infrastructure, facilities, and services including ICT they deem important, there is a gap between knowledge required and knowledge existing.

Among others, this owes to the fact that requirements of children and the youth rely mostly on what adults determine as such (e.g. society relevant aspects such as education, health), on insights gained by people observing their own children, on knowledge delivered by what others say, i.e. general assumptions on how kids and youngsters supposedly behave, and on what children (probably) consider relevant (URL 2; URL 5). Regarding the perspective of children and the youth themselves less attention has been paid until now. Hence, there are several open questions on smart cities concerning the very point of view of children and the youth: (i) Why is it at all relevant to pay attention to children and the youth when developing smart cities?, (ii) Which urban infrastructure, facilities, and services are used and regarded important by children and the youth?, (iii) What about the use of modern ICT infrastructure and services on the part of this user group?, and (iv) In a nutshell, what are relevant aspects to consider by smart cities in order to become (more) child- and youth friendly?

These questions are discussed based on experience and results gained from the project Youth Map 5020. Even though the project is still under way, work done until now, already produced a wide range of information on children and teenagers interesting also for smart city initiatives.

3 THE PROJECT YOUTH MAP 5020

Youth Map 5020 (http://www.youthmap5020.at) is a project funded by the Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT) in context with the FFG program "Talente Regional" (https://www.ffg.at/talente-regional). The project, which started in May 2013 and which will end in October 2014, aims at creating a dynamic, interactive web map for the city of Salzburg (zip code 5020) well-tailored to the requirements of children and the youth (user interface, map content, map design, range and properties of functions). The Youth Map 5020 will be implemented as ArcGIS online web map application. Moreover, based on the experience gained while designing and implementing the web map 'Youth Map 5020', recommendations will be elaborating providing support to others creating such web map applications. As this includes suggestions on map content focussing on urban infrastructure, facilities, and services, as well recommendations on ICT-related issues (device, user interface design, interaction mode etc.) results offer useful input for child- and youth-friendly (smart) city initiatives as well.

To gain such insight, the approach of participatory design is applied. Literature highlights participatory design as an approach specially valuable and useful when it comes to work with children and the youth, and to involve them in design processes (see e.g. Kaufman 2011; Muller & Druin 2012; Sanders 2002). In consequence, i.e. to be able to directly and actively involve kids in the web map development process, the Youth Map 5020 consortium includes adults plus children and teenagers. Hence, partners, besides coming from the scientific sector, public administration, and the business domain, are eight schools located in Salzburg. Table 2 outlines the tasks performed by the students within the development process of the web map application 'Youth Map 5020'.

Partner		Description on tasks and role
Scientific	IFFB-Z_GIS, University Salzburg	project leas, scientific support
Public administration	City of Salzburg, youth office	real-world project- and product connection (and dissemination)
Business	SynerGIS	technological support (ArcGIS online)
Schools	Handesakademie 2	development of the YouthMap 5020 web map application: requirements specification, data collection, processing, management, map design and implementation, testing and optimization
	Bundesrealgymnasium	
	Akademisches Gymnasium	
	ABZ St. Josef	
	Sonder-Pädagogisches Zentrum 1	
	PH Praxis-Volksschule	

Table 2: YouthMap 5020 project consortium

4 CITIES, CHILDREN AND THE YOUTHYOUTHMAP 5020

As already outlined above, (smart) citizens are central to the operation of smart cities (Hemment & Townsend 2013; Meijer & Rodríguez Bolívar 2013). While, the elderly has been getting a lot of attention lately (see e.g. Hennig et al. 2012; Tratz-Ryan 2013), a segment of society that too often has been left behind regarding the development of smart cities are children and the youth. But, this needs a change. This is further underlined by several authors who stress the relevance of children and teenagers for smart city conceptions:

"In view of the demographic changes taking place, policies designed to create a more conducive environment for children, young people and families should form the focus of municipal action if our cities are to be competitive and maintain their vitality in the future." (URL 19)

"(…) this year's Summit particularly focuses on the theme of 'Knowledge Cities for Future Generations'. (…) we believe that on the one hand, knowledge can be generated and then used for building a sustainable future for our children, and on the other, it can also be created by the involvement of our children." (Abdoullaec 2011)

Moreover, reasons, why situation and requirements of children and the youth should be known and beard in mind concerning the development of smart cities are numerous:

(1) children and the youth are an equally important part of society inhabiting our cities, using urban infrastructure, and transportation systems, needing natural resources such as water, air, energy etc., participating in public and economic life (UNICEF 19998; URL 15).

(2) In city planning, children and the youth are considered as one big part of social planning, since cities must be great places for children and youth to live, learn and play (URL 18).

(3) Youth culture works is a trendsetter, which refers primarily to three main topics: fun sports, music, and computer. Großegger (2006) points out: The zeitgeist is framed by youth culture! ('In der Jugendkultur formiert sich der Zeitgeist').

The relevance of integrating the needs of children and the youth in city development finds embodiment in numerous child- and youth-friendly city strategies. Determined characteristics presented in these strategies provide also a framework for integrating child- and youth related demands in smart city creation. Thus, for instance, UNICEF (1989) promotes the concept of a child- and youth-friendly city which guarantees the right of all young citizens to: (i) influence decisions about their city, (ii) express their opinion on the city they want, (iii) participate in family, community and social life, (iv) be an equal citizen of their city with access to every service, regardless of ethnic origin, religion, income, gender or disability, (v) receive basic services such as health care, education and shelter, (vi) drink safe water and have access to proper sanitation, (vii) be protected from exploitation, violence and abuse, (viii) walk safely in the streets on their own, (ix) meet friends and play, (x) have green spaces for plants and animals, (xi) live in an unpolluted environment, and (xii) participate in cultural and social events. While these aspects represent quite general, high-level criteria specified from adults, the question arises on what is missing with regard to the opinion of kids and youngsters.

Working with young people, it has to be emphasised that this target group is quite heterogeneous covering a wide age span, including children and teenagers from different development stages and with different levels of skills and knowledge. As several developmental leaps might occur during few months' time only, the target group is split into narrow age groups related to main development stages (URL 5; URL 6; URL 13):

- children in strict sense (3 – 12 years old) encompassing
    - young children (3-5 years old),
    - mid-range children (6-8years old),
    - older children (9-12 years old), and
- teenager (13-17 years old).

Due to children's different development stages, it is a very challenging task to fit their needs and requirements regarding urban infrastructure, facilities, and services as well as ICT. Nevertheless, because of reasons such as being allowed to move around cities independently, to use the Internet self-determined, and availability of own (mobile) devices, it seems to be reasonable, to primarily focus children being at least 12 years old (i.e. older children and teenager).

This is underlined by the following numbers and statements: Regarding the situation of owning a smartphone, statistics show that from the age of 12 years, percentage of children owning a smartphone is almost 100% (e.g. Germany for 2011; URL 16). Further, literature differs on the age from which children start using the Internet more or less self-determined: Some highlight that already five year old kids are fascinated by the Internet (Seltmann 2008; URL 2); others state that kids start using the Internet from the age of 7 (URL 10). But, since Internet use requires certain reading abilities as well as more skilled motoric capabilities for e.g. (fully) using mouse, keyboard etc. (URL 2), this puts certain age-related and development stage related constraints. It asks for children being at least 12-13 years old (secondary education equivalent age).

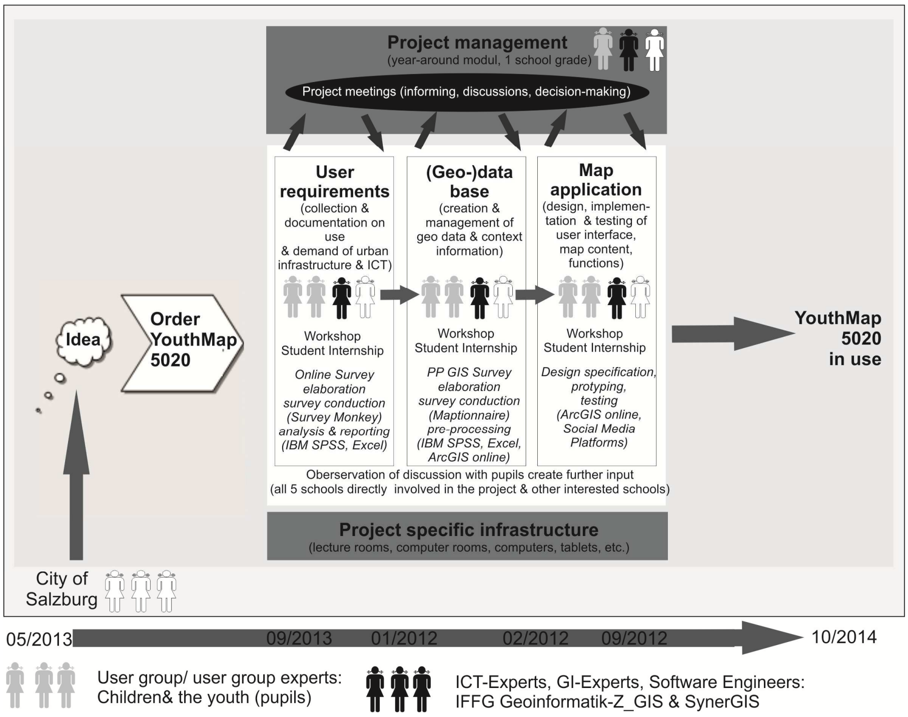

Fig. 1: Youth Map 5020 development process and applied methods and tools

5 METHODS APPLIED FOR THE DEVELOPMENT OF 'YOUTH MAP 5020'

Today, products and applications must be tailored to meet user requirements (see e.g. Tsou & Curran 2008). Well-grounded knowledge on the intended user groups and their requirements is asked therefore. This is even true for youth-centred products, i.e. applications, such as the web map application 'Youth map 5020'.

As literature highlights youth-centred design as a remedy to engage young people actively and directly in the design and development process (URL 2), the 'Youth Map 5020' development strategy relies on participatory design in line with well-known software development processes, whereas methods commonly used in both realms are applied (see Fig. 1).

5.1 Design and development strategies

5.1.1 Participatory design

By definition, participatory design is a form of user-centred design. It is a method which not only attempts to understand user needs but also encourages the direct participation of users in the entire design process. Involving users in assessing, designing, and developing a system, it tends to help ensuring that the product design meets the needs of the user group and is usable to them (URL 3; URL 4).

Regarding the involvement of children and the youth, the approach aims at engaging young people to take place in the design and development process of a project or product. This allows to inform program design and implementation as well as to guarantee that activities are responsive to the needs of young people and their on-the-ground reality (Kaufman 2011). This has been gaining interest in different domains. Thus, with the belief that more appropriate solutions can be found, researchers seek to give children a voice in the design of new technologies by using the participatory design approach (Muller & Druin 2012).

5.1.2 Software development process

Design and implementation of the web map application 'Youth Map 5020' follows well-known and broadly used state-of-the-art software development processes, which are broken down in several stages encompassing IT project management, conception, design, creation as well as implementation (Balzert 2000; Sommerville 2007). The dissection into separated phases provides the advantage that particular attention can be paid to identify, outline, and fully recognize user requirements. This is even more relevant since analysing users and their requirements is seen as a crucial issue for defining product characteristics in detail, and fosters to develop user-centric, i.e. usable software applications. At that, user requirements show effect on the entire development process and trigger on all further development steps. Methods to gather user requirements encompass e.g. user surveys, interviews, observation, running through scenarios of use, task analysis, studies and analyses of documents, and analogue methods (Nielsen 1994; Richter & Flückigner 2007).

5.2 Applied techniques and methods

In order to get to know the target group and to better understand how children and the youth act, move, and live in today's cities, from the wide range of methods available in the context of participatory design and software development (requirements engineering), several were applied. This was closely related to undertake workshops, meetings and pupil internships as presented in Fig. 1.

5.2.1 User questionnaires

Main information source for the 'Youth Map 5020' web map is a user surveys conducted in autumn and winter 2013/2014. The questionnaire was implemented as an online survey using the Internet survey tool SurveyMonkey (www.surveymonkey.com). It consisted of 26 questions that besides socio-demographic data (age, sex, school education, and place of residence) focused on relevance of urban sites, infrastructure, facilities, and services, as well as ICT related aspects such as application design, range and properties of functions.

The survey was not only created, but also spread by students (school partners) using numerous communication channels (face-to-face, email, Facebook, events etc.). The data collected was statistically analysed by the students (using MS Excel and IBM SPSS) and a report documenting the results was prepared by them.

The user questionnaire resulted in 502 valid responds, from which 35% were delivered from male and 65% from female persons. Concerning the age structure of the respondents 37,5% were 16 years old or older, 44,2 % were between 13 and 15 years old, and 18,3% younger than 10 years old.

Since the questionnaire was developed by the students, information on the target group and their requirements was on the one hand gained through the survey itself; on the other hand, the questionnaire elaboration process (discussions, comments, decision-making etc.) revealed several interesting aspects.

5.2.2 Literature review and analysis of analogues application

On web design and usability aimed at children, not abundant, but at least some literature exists. Information on children and the youth, their characteristics, abilities, and capabilities as well as on computer and Internet use behaviour, web design recommendations etc. is available. However, by analysing analogues software, i.e. web (map) applications tailored for children, additional information was found.

For it, we took into account 13 web maps from all over the world: Austria, Germany, Spain, EU, USA, and Argentina. This referred to web map applications found searching the Web for terms like ‘youth map’, ‘kids map’, ‘maps for children’ etc.

6 RESULTS USEFUL FOR (MORE) CHILD- AND YOUTH-FRIENDLY SMART CITIES

In the following we present a selection of results gained by literature review, analyses of analogue systems, and user questionnaire, as well as discussing with the target group during workshops, meetings, and internships.

Map content	Web map applications													
	Adult-made													Youth-made
	Salzburg (A)	Wien (A)	Heilbronn (GER)	USE-IT (EU)	New Haven (USA)	Vancouver (USA)	New Orleans (USA)	Magedeburg (GER)	Freiburg (GER)	Kaarst (GER)	Zaragoza (ES)	Buenos Aires (AR)	Hilden (GER)	Youth Map 5020
Consultation & Service														
Education & work														
Sport & fun (pools, crag, sports club etc.)														
Youth engagement & canters, boy scouts etc.														
Events & culture (cinema, theatre, library etc.)														
Child care														
Youth culture (traditions, dancing, music etc.)														
Shopping														
Organisations (church, nature, health, politics)														
Green space														
Go out for a meal														
Help (police, hospital)														
Going out/ night life/ party														
Sightseeing/ accommodation/ tourist info														
Youth specific meeting points														
Girls only														
Place of family excursion														
Transport (bus, taxi etc.)														
Areas of public Internet access														
Caution zones														
Service (cash machine, tobacconist etc.)														

Table 3: Categories of infrastructure and services provided by youth-centred maps (made by adults) and demanded by the youth, i.e. collected within the Youth Map 5020 project (A: Austria; GER: Germany; ES: Spain; EU: Europen Communiy; USA: United Straes of America, AR: Argentina)

6.1 Urban infrastructure, facilities, and services

As mentioned before, two perspectives on young people’s requirements and needs can be distinguished: On the one hand, there is the perspective that adults have on children and the youth; on the other hand, there is the perspective of children and the youth themselves. Based on different categories of urban infrastructure, facilities, and services, Table 3 gives insight in differences between what adults and what children and the youth consider relevant. It bases on elements, which are presented in child- or youth-centred web maps and/ or are identified by the research conducted in the Youth Map 5020 project.

Adults, primarily, see important for children and the youth features such consultations services (carer choice, family problems), schools and places of work, child care centres (incl. after school supervision), recreation sites (sports, play), centres for youth engagement, culture and events. Several of these aspects are also considered relevant by children and the youth. But, they also put focus on youth-specific meeting points, shopping facilities, location for going out and nightlife as well as areas of public Internet access.

Surprisingly, the youth shows high interest in knowing green areas, police stations and hospital, public transportation system including taxi ranks, banks and cash machines, as well as caution zones, i.e. indicating different levels of feeling of safety.

Ranking sites and infrastructure by relevance (done by the target group), the following situation was found: Children and the youth enjoy the most to stay at home (26,2% of the respondents), second and third most important are shopping malls (16,4%) and nature sites, i.e. parks (14,7%), a little bit less important are public sites (11,6%), Salzburg historic city centre (10,9%), inns including fast food restaurants (9,4%), and sports ground (8,1%).

Regarding mobility, the overwhelming majority of the target group (47,6%) uses public transportation system. Therefore, they consider especially important to have at their fingertips information on the actual schedule, location of the closest bus stops (distance) and how to get there the best. Surprisingly, few make use of bicycles (11,3%).

6.2 ICT use

ICT is a relevant aspect to smarter cities (Hoon Lee et al. 2013; Walravens 2012). Washburn et al. (20102) describe smart cities as the use of smart computing technologies to make urban infrastructure components and services (e.g. administration, education, healthcare, public safety, real estate, transportation, and utilities) more intelligent, interconnected, and efficient. A variety of ICT elements such as unified communication, digital services, green technologies, smart utilities, and security services are used to provide smart buildings, smart transport, and smart public service planning. Due to the rapid development of geospatial technology, the use of spatial data, geovisualisation and geocommunication plays an increasing role, too (Roche et al. 2012). Further, smart city applications claim for being developed as user-centric tools (see e.g. Thacker 2009). This means that they must be well-tailored to particular user groups regarding e.g. devices, application design as well as the range of functions.

Concerning the target group of children and teenager, little is still known about how they use ICT or how to design applications that will be easy for them to use. Most of the information available originates from a study done by the Nielson Usability Group (URL 5; URL 6). But, two facts are for sure: First, children and teenager use applications in a way different from how adults do, and, second, their requirements differ remarkably from those of growing up people (Friedrich 2000; URL 2; URL 5; URL 10).

6.2.1 Use of devices

Today, smart cities more and more use digital devices. In this context, the questionnaire results confirm - as outlined in literature (see .e.g. URL 16) - that the target group to almost 100% owns smartphones, whereas the majority has a Samsung HTC (54,3%).

Children labelled as “digital natives” or generation smartphone are keen to leverage ICT (IEB 2009). Thus, it is not surprising, that children and the youth as using these devices several times per day consider their use as supplementary acting in order to support them in all kinds of activities. Not per se they regard the use of smartphones or desktop-PCs as a particular activity they spend their time with like meeting friends, listing to music, making sports.

6.2.2 Applications design and range of functions

Kids and teenagers are described by specific characteristics, abilities and capabilities: This refers to (over)confident in their web and computer abilities, nut fully developed motor capability, long reaction time, reduced attention span, and insufficient reading skills, as well as less sophisticated research strategies. Moreover, being assessed as quite impatient, i.e. judging sites quickly and leaving a site immediately if no good without coming back again or having fun while using the application (URL 5; URL 6; URL 9), it is necessary to convince these users at first view. All this asks for a youth-centred design: providing simple and consistent application structure, clearly laid out and well-arranged design, and well-structured content.

Regarding the design, it is well-known that children and the youth like it colourful. This matches web design guidelines for children which highlight that kids like colours (bright, vivid colours) as well as images and pictures (URL 7; URL 11). This is underpinned by the user questionnaire, too. Despite the desire for a cool looking design and a “snappy” application look (deemed not boring by kids), it must be guaranteed that symbols are easy to understand and easy to identify (URL 2; URL 6; URL 14).

While pictures are highly desired, web links are less popular. This might owe to the fact, that children have difficulties to recognize links as such. For them, blue underlined text does not vary from other text (URL 2). Hence, information required should be presented in a more suitable way. Further, all textual information should by presented in understandable text, short sentences and abundant paragraphs not using too tiny font sizes (URL 2; URL 6; URL 12; URL 14).

6.2.3 Properties and range of devices

Implementing functionalities, one must be aware, that children and the youth prefer simple, straight forward processes such as point and click (URL 2). The mouse is the preferred device (URL 17).

Regardless the application domain or task, to call the interest of young people, the provision of social networking services is highly required. This conforms to findings on kids' Internet use: The target group like forms for providing feedback or asking questions, online voting, features for sharing pictures and stories, message boards (URL 6; URL 9). This is also confirmed by the questionnaire: 60% of the respondents consider the availability of social media functions, i.e. social networking services, as relevant or very relevant. Despite this, the youth does not like to create own profiles (growing awareness on security of personal data). This is a tendency also underlined in literature: Children do not want to register or create profiles as prerequisite for using applications.

7 CONCLUSION AND OUTLOOK

The Youth Map 5020 project is still in progress. But, work that has be done till now already delivered interesting results regarding use and design of web maps tailored to the needs of children and the youth. It also provides background valuable for smart city initiatives regarding (more) child- and youth-friendliness. Due to the method to actively and directly involve the target group in the design and development process of the "Youth Map 5020' application (participatory design), the project fully benefits from today's shift in attitude from designing for users to approaches which focus on designing with users (Sanders 2002).

As this approach pays particular attention to the perspective of children and the youth, instead of focussing on the perspective of adults with regard to urban infrastructure, facilities, and services including ICT, this can be considered as a starting point to allow developing smart child- and youth-friendly cities. This is outlined by two examples, which also indicate the need for further research:

(1) Regarding mobility, even though the bicycle has gained in importance as transportation means across society, this is not true for children and the youth. Reasons therefore still need to be investigated. To introduce children and the youth to use bicycles, it is might be interesting to provide a map application fitting the demands of children, i.e. particularly focusing on the mobility behaviour of children and the youth (e.g. including caution areas, areas with traffic risks) and also taking into account their demands related to ICT use.

(2) Children and the youth rank the existence of nature and green space and spending time their there as very important. However, due to the relevance of natural resources for smart cities, it might be an interesting aspect, based on the pivotal role nature plays for young people, to sensitize this target group – as tomorrow's decision-makers – for topics such as environmental protection, and sustainable resource management. But, which kind of suitable action to take, this requires for more research work. For sure leveraging mobile devices and the possibilities of social media what be helpful, to inspire children and the youth.

The work presented in this paper must be seen as a starting point to get to know how children and the youth act, move, and live in cities and which infrastructure, facilities, and services including ICT they consider important and how to design and implement sophisticated applications and service. However, more research on smart children and youth is needed to more integrate young people in smart city initiatives.

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reviewed paper

Smart City – a Quest for Innovation within the EPS Framework

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1 ABSTRACT

The paper presents the process of education and its results which addressed the issue of innovation in the field of Smart City technology. The project was realised within the framework of a European Project Semester (EPS) at Lodz University of Technology. The Project Based Learning methodology enhances collaboration and creativity in finding solutions to defined problems. The first phase of the project was assigned to define germane areas of research under the general umbrella of Smart Cities. Further, brainstorming allowed students to choose a detailed task to be performed. The implementation phase entailed work on an application of their choice and its reality check in the urban environment of Lodz city centre. The students developed a smart phone application which may serve as a social platform allowing citizens to express their opinion on various spots in the city. The functionality is based on crowd-sourcing. The app structure is open and flexible and may be subsequently extended with the addition of new layers of information.

2 INTRODUCTION

Creativity as defined by Landry (2008,xxi) is an applied imagination using qualities such as intelligence, inventiveness, and learning along the way. Original ideas result from initial curiosity and innovation and after a little lateral thinking they require a more convergent approach that takes them through a reality checker from which an innovation might emerge. The new approaches to the training of engineers based on Project Based Learning methodology not only allow a more efficient and useful learning process but also provide an excellent framework for shaping innovative ideas.

The project discussed in the current paper was done as a part of the European Project Semester (EPS) curriculum at Lodz University of Technology, International Faculty of Engineering. The team of five young people (aged 20 to 22), coming from various European countries (Spain, France and Poland) and representing a wide range of fields of engineering (computer science, biomedical engineering, management), worked together in a strongly collaborative environment.

The project topic was delineated in a very general way and provided a broad range of themes under the common umbrella of Smart Cities. After extended research aiming at pinpointing the actual meaning of the term and reviewing all its aspects, the team was asked to propose their specific project which might answer a need. The presented approach, which was a result of a brainstorming process, allowed the identification of problems which were genuinely identical to those discussed in current presentations by leaders in the field. The project proposed as a result of the investigations was a smartphone application with the functionalities of a social platform for collecting citizens' opinion on various spots in the city. The application uses crowd-sourcing methodology to gather data on urban places, covering both commercial and public locations, such as: cafes and restaurants, squares and parks. Its functionality also allows the gathering of information on historical and natural heritage. A section will be left for people's opinion.

The paper is organised as follows: after this introduction, the EPS learning methodology is briefly presented, which points out the necessity for changes in engineers' education as well as discussing the main methodological assumptions. Section 4 explores the Smart City topic and the four main areas of research in order to justify the project's decisions. Further, the details of the proposed application are presented. The concluding part returns to the project and discusses possible developments of the tool.

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3 EPS LEARNING METHODOLOGY

The European Project Semester is a programme offered at Lodz University of Technology (TUL), International Faculty of Engineering, to bachelor level students of various backgrounds who are in the third year of their studies as a minimum. It covers the whole semester workload (30ECTS) and is based on Project Based Learning (PBL) methodology. The method connects project organised or problem based learning and courses addressing design process organisation: Team Building and Project Management. It facilitates the acquistion of new skills and knowledge through an extended process of inquiry in response to a complex problem (Dym et al, 2005). The EPS gathers together students of various background, both in terms of ethnicity and professional field. At the moment there are 13 universities in 11 European countries which offer EPS as a part of their curriculum. The methodology enhances collaboration and creativity in finding solutions to defined problems, while at the same time providing an opportunity for authors to verify the results by presenting them in front of a large audience. The obligatory midterm and final presentations as well as the external review requirements assures the quality of the results.

The emphasis in the EPS is on team work, entrepreneurial skills and collaborative problem solving. There are four main stages of the project: (1) forming – getting to know each other, (2) storming - developing of shared understanding of the defined problem, adjustment and adaptation to the group environment (3) norming - deeper involvement of participants in the project, (4) performing - implementation, the stage of productive work (Andersen, 2009). The supplementary courses facilitate project organisation, giving students the opportunity to learn some presentation and communication skills. The differing background further enhances creativity.

The Smart City project used the Gantt diagram to plan the team activities. All meetings were carefully documented in minutes. The team defined its identity, adopting the name SmarTeam, where the single 'T' had an additional hidden meaning - it signified better connectivity. At the beginning of the project course meetings were conducted in different places to better integrate the team. Some supplementary activities were also performed like cooking national dishes together or visiting the city centre. The research itself was conducted with the use of multiple and complementary methods: internet and library queries, presence at various lectures and their own recognition of the actual requirements of city life. Among the lectures the one by Jan Gehl, performed in the University of Lodz, was particularly significant. Further work engaged brainstorming. The individual skills of team members were particularly useful in the last phase of the project as it meant it was possible to prepare both the Smartphone application and the whole necessary background including benchmarking, business plan, preliminary evaluation of the interface, etc. The work finished with the final report, which was further assessed by the appointed reviewer and presented for evaluation. The results were satisfactory.

4 SMART CITY AS A STUDY TOPIC - PROJECT IDEAS

The germane areas of research within the wide range of topics covered by Smart City initiatives were addressed in the first phase of the project. The assignment was to find out the meaning of the term Smart Cities and its possible implementations. A dictionary definition[1] of the term which is *"a developed urban area that creates sustainable economic development and high quality of life by excelling in multiple key areas; economy, mobility, environment, people, living, and government. Excelling in these key areas can be done so through strong human capital, social capital, and/or ICT infrastructure"* served as one of several starting points for establishing the group's own perspective. According to the definition by the European Commission: *"Smart Cities have been characterized and defined by a number of factors including sustainability, economic development and a high quality of life. Enhancing these factors can be achieved through infrastructure (physical capital), human capital, social capital and/or ICT infrastructure."*[2]. There is an enormous quantity of approaches to the topic which may be found. Among the most recognised ones there are such which emphasise the issues of governance and planning and the social participation and collaboration in defining the goals for future (Batty, 2012; Batty, 2013). The most comprehensive elaborations presume the impact of smart cities' phenomena on science, technology and competitiveness and on society itself (Batty et al, 2012). Other discuss *"revolution intervening in terms of a new infrastructure*

[1] Business dictionary, source: http://www.businessdictionary.com/definition/smart-city.html, accessed: 21.12.2013.
[2] Source: http://ec.europa.eu/digital-agenda/en/content/defining-smart-cities, accessed: 21.02.2014

and platform, made of both virtual and physical elements, enabling citizens, users and all different urban players to carry on activities and realize applications thanks to the opportunity allowed by improvements in technology and its widespread presence" (Borruso, Murgante, 2013). The popular understanding of how technology may enhance changes in urban life is expressed as *"the marrying of the city, in both its urban and suburban forms, to the telecommunications revolution signified by the silicon chip, the Internet, the fiber-optic line, and the wireless network."*[3] Although this is not the only one possible.

The students own perspective is outlined in the following considerations: *"So what is a Smart City? And how can we define it? As you can see in the previous parts, we tried to understand the main ideas and aspects of Smart Cites. How they should be. How people should feel in such cities. And we figured it out, that the really important thing is just to think smart! Think smart about how you can use new technologies and apply them in the city. How, in a smart way, you can make transportation in the city, easy, fast and comfortable. How not to waste energy but use it? How to make people feel safe and happy in their daily life. How to make them ACT smart."*

The important event which strongly influenced the students' views was their participation in the lecture by Jan Gehl on "Cities for People" in Lodz University's Faculty of Economics and Sociology, which took place on 21st October 2013. The lecture, connected with the promotion of the book of the same title, provided them with an insight into more contemporary theories on urbanism and city development. During numerous meetings with their supervisor many talks were watched and discussed, including ones by Saskia Sassen, Michael Batty, Carlo Ratti and others. Other important sources which influenced their perspective were the internet and library queries as well as their own understanding of the current situation, based on individual experiences in the various cities which participants come from or are familiar with, in this case: Lyon, Paris, Madrid and Bilbao. All these insights were contrasted with the local reality of the former 19th century textile industry centre and post-socialist city - Lodz. The project was focused on smart solutions required to improve human life in urban areas. The smartphone application has been developped as a tangible result, inscribing into a more general trend of development of easy and available tools facilitating everyday citizens' life (Townsed, 2013, pp.200-203). The implementation phase included a reality check in the urban environment of Lodz city centre.

4.1 Four fields of a Smart City

The research performed allowed the students to define key fields of urban and technology development and four potential areas of the project development were identified: (1) accessibility, with an emphasis on public transportation, (2) connectivity, including also the broader theme of improving the quality of interpersonal relations and building social capital, (3) green energy and environmental protection and, finally, a wide range of issues under a common name (4) *"culture and innovation"* Fig 1. (EPS Report, 2014).

4.1.1 City environment

Cities, even if sometimes considered separate from their environment, are ultimately supported by nature and are one of its inherent parts. Through bringing nature into the city, residents can enjoy, on their own doorsteps, some of the ecosystem services that nature provides. In the past, people did not care about building cities which took into account the environment. In addition, the simplification of urban landscape (uniform green areas and parks) could generate a loss of biodiversity. Nowadays, society is trying to respect and protect the environment inside the city, creating green areas, parks and using green energy in order to reduce the pollution of the atmosphere and prevent climate changes.

4.1.2 Communication and relationship

The environment of contemporary cities should enhance not only communication but also the ability to create relationships. One of definitions of communication explains it as *"the process by which information is passed between individuals and/or organizations by means of previously agreed symbols"*[4]. Technology enables effective circulation of information but on the other hand its speed may constrain the ability to build meaningful relationships, which require time and trust. In a Smart ity, effective communication should

[3] Source: http://www.metropolismag.com/February-2014/Big-Data-Big-Questions/ , accessed: 21.02.2014

[4] Definition by P. Little, source: (2012, 11). Mass Communication. *StudyMode.com*. Retrieved 11, 2012, from http://www.studymode.com/essays/Mass-Communication-1217118.html

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satisfy a citizen's requirements and anticipate it. It may use codes such as colours, light, sounds, signs, enhance mass collecting of information, i.e., crowd-sourcing, assists process organisation or just provides a communication platform (Hanzl, 2007).

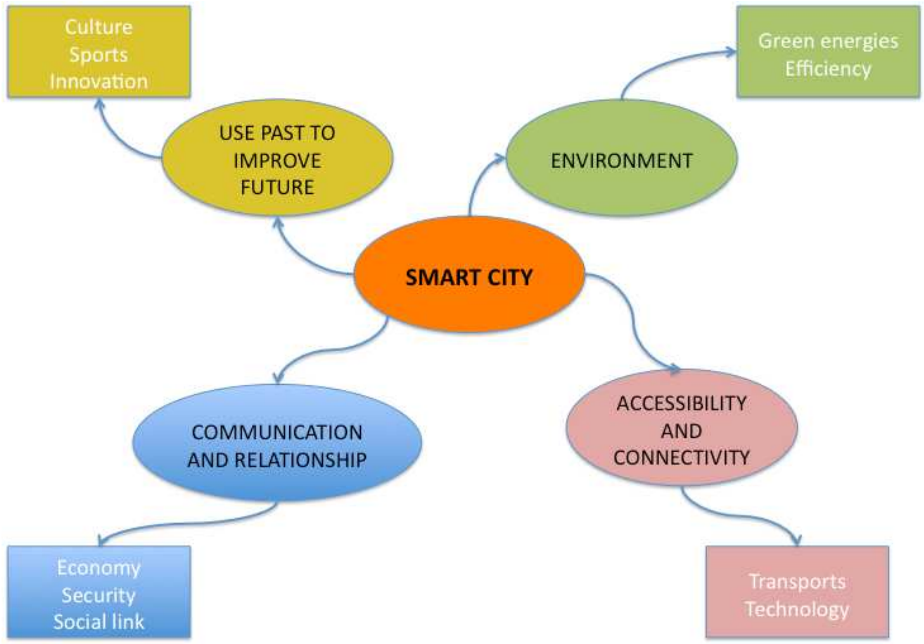

Fig. 1: Graphical representation of Smart City and its aspects. Source EPS Report 2014.

4.1.3 Culture and innovation

Since 2009, when the urban population overtook that outside the urban environment, the problems of urbanised areas have needed solving even more than before. Technology development and social innovations try to answer some of these issues. Although the list of challenges remains long and includes such issues as: promotion of employment and effective resources management. Cities compete to provide comfort, which requires satisfaction of more basic human needs, like: physiological ones, security and safety, education, etc.

The recognition of the city's own culture and history is indispensable as key values for knowledgeable and respectful development. Education services have a role to play with this regard, both with the usage of direct as well as remote communication and presentation methods. In fact every area of human activity may be in one way or another enhanced with the use of technology, whether its sports or musical and theatre spectacles taking place in any spot in a city, they may profit from some technological innovation. The constraints are creativity and organisation, the background is the adjustment to local culture.

4.1.4 Connectivity and accessibility

The transportation system influences both accessibility of goods and citizens' mobility. Both may be enhanced with the use of digital technology implemented for transportation management and organisation. The improvement of a transportation system may also eliminate the need to develop its physical infrastructure by allowing more flexible use of the existing one. Availability of interactive information may increase the comfort of commuters, thus significally improving travel conditions. Mixed uses and increased densities may make the role of pedestrian movement as a form of transportation more important. All this creates new requirements and opportunities for innovation to make circulating in urban spaces safe, effective and enjoyable. As Senett (2012) admits: *" (...) smart-smart urbanism should follow specific planning principles, privileging the complexity of ground-plane design, recognising the cognitive value of pedestrian experience."*

4.2 Definition and project ideas

The definition of the term 'Smart City', a a result of the former considerations is: *"A Smart City is a place where citizens interact with the city in order to satisfy their necessities (relationship, communication, green energy, economy, connectivity, accessibility, culture) and improve their quality of life using new technologies."* (EPS Report, 2014). The emphasis on social and cultural aspects of urban development is also expressed e.g. by Carlo Ratti in his talk 'Decalogue for a "SENSEable" City' (2013), where he talked *"not about technology, but about us"*.

Still, there are several crucial questions to be explored related to current technological development, Batty (2012) listing just a few of them: *"the implications of how the city is being wired, how it is generating new data, how this data might force new theories and models relevant to our understanding, how we might use our strategic models and intelligence to plan the city, building on this new understanding"*. We need to understand the internal structure of the acquired data and look for its efficient and useful applications.

At the same time severe critics of an approach favouring concentration on technology and infrastructure and overlooking the intelligence of citizens and human capacities, as leading to amounts of useless technological innovations, are becoming increasingly common (Boni, 2013). As Saskia Sassen (2012) asserts, cities tend to urbanise technologies. She asks how to implement intelligent systems enhancing urbanisation rather than deurbanising cities. The issue to answer is how to put the technology *"at the service of inhabitants, not the other way around: the inhabitants as incidental users."* Sassen underlines the need to "urbanise" technology which in her perspective means making it work in a particular urban context. This emphasises the difference between the determinative and the coordinative use of technology, which is similar to the one between closed and open systems. The first are fixed and thus oppressive, the second may be further developed and allow flexibility and take into account citizens' needs.

As a consequence of digital technology development, people satisfy their business and communication objectives using remote media. But this hasn't removed the need for direct social interaction, on the contrary, as *"the constrains of geography are lifted, people, businesses and ultimately cities aggregate even more"* (Offenhuber, Ratti, 2014). As William H. Whyte (2009) discerns *"what attracts people are first of all other people"*.

More and more people are interested by the Smart City concept and more and more initiatives try to be an innovative way of supporting local development: (1) to invent new means for consultation and conception of the city, (2) to enhance local resources and identities of a territory, (3) to experiment with new products and services on a digital city, (4) to study new urban uses and (5) to mobilize users, local stakeholders around the territorial project. All the above led the team to propose an application enhancing citizens social needs of direct presence and acquiring knowledge about the city.

5 APPLICATION OUTLINE

A Smartphone application named U-place has been proposed as an answer to the project requirements. It may serve as a social platform allowing citizens to express their opinion on various spots in the city. Its functionality uses crowd-sourcing methodology to gather data on urban places, covering both commercial and public locations, such as: cafes and restaurants, squares and parks. Its functionality also will allow comment on historical and natural heritage sites, where people will be able to evaluate the experience.

The application is intended to help people share their favourite places, thus providing a way to communicate, share opinion about places in the city and promote direct meetings. The places may be added by users along with geographical coordinates, type, photograph and, optionally, a description. Every spot may be assessed based on its quality and price range. Comments may also be added by users. The application is a map-based one and within the map, each place is represented by an icon based on its type or the logo of the enterprise. Upon a click, info on a spot is displayed, consisting of: a photo, evaluation, comments and two buttons for voting on either the quality or price of the place. When a user presses the photo, a description of the place is displayed. The search functionality is also covered. A user may look for a location using such criteria as: name, description, proximity, type and price range. There is also a feedback system, designed to include relevant characteristics of places that may also be used when searching.

The initial phase covered the analysis and design of the app. Further steps need resources to be completed and the estimated budget is included in the final project report. In order to test the application functionality data on various spots in the city centre of Lodz were collected following the chosen criteria. The geo-database was created with the use of Quantum GIS.

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Fig. 2: The exemplary screen of the U-Place application. Source EPS Report 2014.

5.1.1 Benchmarking

The final definition of functionality was possible after benchmarking covering existing applications of similar functionalities. The results of the benchmarking is included in Fig 2. It showed that the most similar functionality is offered by TripAdvisor. However it is more complicated and doesn't offer support for the handicapped and hints on transportation availability.

Name	Short description	Platform	Food	Bar	Culture	Profile	Hotel	Comment	Transport	Vote	Handicap
Tripadvisor	An application used all over the world to organise trips: visits, pubs, hotels, restaurants	Android, Apple	✔	✔	✔	✔	✔	✔	✗	✔	✗
Avabar	Social application used to meet people and join friends in bars and clubs all over the world	Android, Apple	✗	✔	✗	✔	✗	✔	✗	✗	✗
Foursquare	An application to find out what there is to do / going out	Android, Apple	✔	✔	✔	✔	✔	✔	✗	✔	✗
Ville de Lyon	An application used to go out (culture and gastronomy) find out everything that is taking place in this city.	Android, Apple	✔	✔	✔	✔	✔	✔	✔	✔	✗
PARISAPPS	A set of applications enabling visitors to go out, visit, use transport. Just one function performed by one application.	Android, Apple, Blackberry, Windows	✔	✔	✔	✔	✔	✔	✔	✔	✗
Insiders' Amsterdam	An application for visiting and finding out what is happening in Amsterdam. Dedicated to tourists.	Android, Apple	✔	✔	✔	✗	✔	✔	✔	✗	✗

Fig. 3: The key features of similar applications. Source EPS Report 2014.

5.1.2 The benefits

The U-place android application offers several technical benefits: (1) time-saving, (2) portability, (3) high availability, (4) flexibility and open architecture. In terms of economy there are a few groups of beneficiaries: (1) application users, (2) institutional stakeholders (restaurants, bars, museums, shops, etc), (3) application developers. The clients' benefits are the most obvious as they would not only be able to make a better, more knowledgeable choice, but they would also be offered better services thanks to the increased competition between establishments of the same sector. The group of institutional stakeholders may see increased sales due to the popularisation of the application. Social benefits are achieved thanks to the network of relations between consumers/citizens created along with the exchange of reviews, ratings and information on various spots. Increased information may enhance city life and attract more tourists and citizens to use various places and meet there.

5.2 The application analyses and functional requirements specification

The application will be composed of a server-side app and a client-side app. The client app, installed on mobile phones, will contain an interface to interact with the user and ask the server for the information the user requires. The server will store all the important data and will perform the most important processing tasks; including receiving client requests and sending it appropriate responses.

The following list contains all functional requirements to make it easier to get a general vision of the project:

- Adding Information
  - Add a new user
  - Add a new place
  - Add comments on one place
  - Modify place information
- Searching places
  - Location Search
  - User text input search
  - Limited search
  - Mixed search
- Voting for a place
- Displaying information on a place

A detailed description of the application is covered in the specification included in the project report.

5.3 The database structure

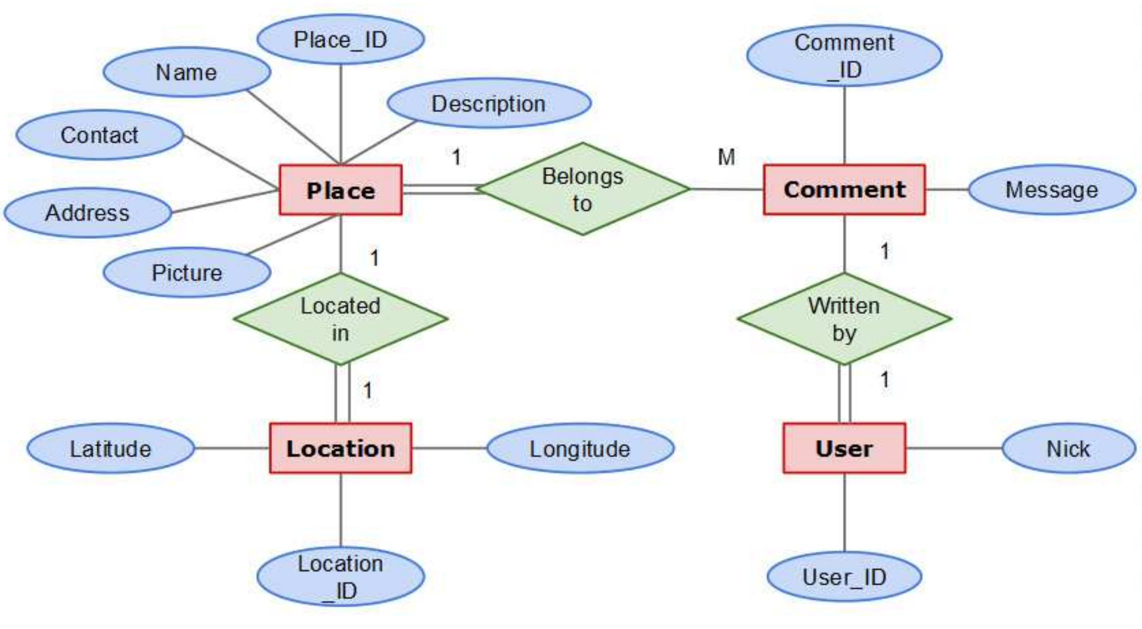

Fig. 4 Entity-relationship diagram

The diagram in Fig. 4 shows the structure of the database, the main entities composing it and their inner relationships in a technical view. Also the the general structure and division in modules of both apps, client and server has been developed. Both the client-side app module diagram and the server-side app module diagram have been defined.

5.4 Statement of the product

During the EPS, a complete analysis of the application was finished, including functional requirements, specification and interface design. Moreover, the most important stages of the design of the app have also been performed, including the architecture design, database design and a complete module design. To get the application finished, there are still some stages to be completed. First of all, the design process should be finished by making class diagrams for all the server code and most of the client code. The second step would be starting to implement the code. The last steps would be the testing and maintenance processes. The recommendation to do this is to use an incremental process, building a small functional prototype in the first instance and improving it with some iterations, using Scrum methodology. This way, testing could be done easily and the development process would be more precise.

6 CONCLUSIONS AND FUTURE DEVELOPMENT

The paper adressess the issue of innovation in education in the field of Smart City technology within the process of education. The project was realised within the framework of the European Project Semester (EPS) at Lodz University of Technology, International Faculty of Engineering, by a team consisting of 5 Bachelor level engineering students of various background, coming from three different European countries. The EPS methodology, concentrated on problem solving, emphasises the teamwork and entrepreneurship of the participants. The initial research on Smart Cities let students define four main areas of possible further activities: (1) accessibility with an emphasis on public transportation, (2) connectivity, including also the broader theme of improving the quality of interpersonal relations and building social capital, (3) green energy and environmental protection and finally a wide range of issues under a common name (4) *"culture and innovation"* (EPS Report, 2014). Their understanding of the topic, enriched with the knowledge coming from various lectures, library and internet queries and their own perspective, led them towards more citizen oriented solutions. As has been stated in the final report conclusions, *"the project was focused on smart solutions required to improve human life in urban areas"*. This approach is similar to the one presented by the chief researchers in the field, e.g. Ratti (2013) or Boni (2013).

The U-place Smartphone application has been the result of the project work and may serve as a social platform allowing citizens to express their opinion on various spots in the city. Its functionality uses crowd-sourcing methodology to gather data on urban places, covering both commercial and public locations, such as: cafes and restaurants, squares and parks. Its objective is to "help people to be connected with the city and other citizens". The main phases of the product design has been performed, which are: the functional requirements specification, interface design, architecture design, database design and a complete module design. The design stage was preceded by benchmarking, examining similar applications. Also the budget necessary for further steps has been estimated. The students' project was completed with the final report which was subject to review, and presentation in front of the evaluating commission, following the predefined EPS learning methodology.

The current functionality of the application is simple and easy to manipulate. It allows users to find a desired location, to comment on a place, to add new places and to modify existing ones. Also, the interface remains simple, which is done purposefully to keep it easy to use and attractive from the point of view of young people. The application architecture is conceived as open, so more options are planned if it is developed further, such as connection to a database on historical heritage and reading of QR codes fixed in historical or other important locations. The functionality has been verified with the data describing the neighbourhood of Piotrkowska street in Lodz city centre, collected with the use of Quantum GIS. Further development should also cover other locations. Besides this, users should be able to follow, both places and other users.

The educational process was successful as the EPS method is particularly useful for projects which assume a certain amount of creativity and innovation. The supplementary blocks on teambuilding and project management are very useful for supporting collaboration in a multicultural group. A high level of identification with the team and the project has been one of the outcomes. *"It was the opportunity (...) to* *meet people with another culture and way of working. Sometimes it was difficult for us to communicate and agree but we always found a solution to succeed. Living in another country, we learnt about ourselves too: punctuality, patience, responsibility and working in a team."*

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Smart Environment for Smart Cities: Assessing Urban Fabric Types and Microclimate Responses for Improved Urban Living Conditions

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1 ABSTRACT

Urban areas are particularly vulnerable to the impacts of climate change; they are also the chosen living environment of a significant majority of Europe‘s population. Global warming increasingly influences the urban climate and affects the future health and well-being of the urban population. The urban climate is mainly influenced by the urban form and the open space structure, which significantly modify the regional climatic conditions, and thereby directly affect the (thermal) comfort of the citizens. At the same time, urban open spaces are generally becoming more important as a result of their role in helping to support sustainable urban development from an ecological, social and economic point of view. Thus the future quality of life within cities is highly dependant on the "smart" treatment of its open space structure.

The objective of the present study within the ACRP 3rd call was to better understand the way in which the small scale structure of the urban fabric contributes differentially to heat island effects and other urban climate phenomena, and to use this information to develop specific strategies for counter-acting and mitigating these effects on a local basis. A major focus has been laid on the urban morphology and in particular the urban landscape, and on understanding its interaction with urban microclimate. The aim was to identify climate sensitive urban patterns – using the example of Vienna - and to suggest concrete open space design measures to counteract the overheating effect during hot summer days. On the basis of a grid used by Statistik Austria (quadrants of 500 m x 500 m) an urban fabric typology for the city of Vienna has been generated taking into account aspects of urban climate and urban structure with regard to terrain, open space and built structure, which influence the microclimatic conditions and parameters. The derived "urban fabric types" have been analysed, characterised, and a sample of the most critical types formed the basis for further investigation of potential open space design measures aimed at counteracting the overheating. This was undertaken using the microclimate simulation programme ENVI-met 4.0. The evaluation of the data generated has focused on thermal comfort and on its most relevant climate factors and has taken the form of maps, mean values and diurnal variations. Based on the evaluation of the simulation results and with regard to results of a previous project, a general catalogue of open space design measures has been compiled. Representative packages of measures have been defined for each sample quadrant, highlighting their specific conditions based on their open space patterns and climate sensitivity, and focused at obtaining the optimal influence on thermal comfort amelioration.

2 INTRODUCTION

Urban climate is generally embedded in regional climate conditions. But due to the built structure of the urban area and other anthropogenic influences, the urban climate can differ significantly from that of its surroundings (OKE 1987, ELIASSON 2000). A typical phenomena is the urban heat island effect caused amongst other things, by changed wind conditions due to building structure, by the use of building materials with a high thermal capacity, a high proportion of sealed surfaces and by increased air pollution exacerbating the greenhouse effect (KUTTLER 2009, WILBY 2007). The increased overheating has a direct influence on the health, well-being and thus the quality of life of the citizens (KEUL 1995). Besides aspects of usability and attractiveness of urban open space, there also exists a clear relationship between nocturnal heat stress, cardivascular deseases and the mortality rate (HUTTER et al. 2007). Against the background of global climate change, there is an urgent need for urban planning measures to ameliorate the local climate

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conditions and enhance thermal comfort, particularly within the densely populated city districts (MEEHL 2004, RAHMSTORF & SCHELLNHUBER 2007, HAGEN & STILES 2010).

The urban climate in general is made up of many local climates resulting from the individual small urban structures, which differ from each other with respect to their size, the surrounding built structure, surface materials, and the configuration of open space (GEIGER 1961, FEZER 1995). Thus the urban morphology – indeed the urban landscape as a whole – plays an essential role in influencing the urban climate in terms of counteracting the increasing overheating, as well as in adapting to the changing climate conditions (BROWN & GILLESPIE 1995, HAGEN 2011). The project lays the focus on this approach by classifying the whole city area of Vienna in specially generated urban fabric types, which influence the microclimatic conditions and parameters and integrate aspects of urban climate and urban morphology in terms of terrain, open space and built structure,

3 IDENTIFICATION OF CLIMATE-SENSITIVE URBAN FABRIC TYPES IN VIENNA

3.1 Generation of urban fabric typology

The generation of the urban fabric typology is based on a grid used by Statistik Austria which divides the whole city area into 500m x 500m quadrants. Data sets were compiled for each quadrant describing the above mentioned criteria urban climate, terrain, open space and built structure. In total around 250 indicators were extracted, 44 of which were selected to be used in the multivariate statistical analysis. The selection of the final indicators used was based on existing classification models, e.g. on the indicators used by ADOLPHE (2001) for his characterisation of urban structure for urban climate analysis and on the Stadtstrukturtypenansatz of PAULEIT (1998) with respect to urban open space patterns (Table 1).

Urban climate	Built space	Open space
	Density	**Surface condition**
air temperature	porosity	ratio of sealed surfaces
air humidity	occlusivity	capability and speed of infiltration
wind speed	compactity	soil moisture and water areas
wind direction	volume, surface/volume	heat absorption and retention capacity
precipitation	length of inner and outer fassades	surface temperature
global radiation	solar admittance	albedo
	contiguity	
Terrain		**Vegetation**
	Orientation	height of vegetation
absolute ground level elevation	sinuosity	density of vegetation
slope gradient	orientation of facades	cover ratio
slope orientation	orientation of streets	
positioning of summits and hollows		
	Rugosity	
	absolute rugosity	
	relative rugosity	
	wind shadow	

Table 1: Indicator groups and most important criteria considered for the generation of the urban fabric types

The four thematic groups were analysed using factor analysis in order to eliminate redundant information and to identify the most influential parameters. As a result, a certain number of factors for each group was selected to serve as “super variables”, containing the information of the entire indicator set. The data subset “urban climate” was represented by one factor, the data subset “terrain” by two factors and the last two subsets “open space” and “built structure” were represented by three factors respectively.

A „two-step“ cluster analysis was carried out to classify the quadrant and into urban fabric types (UFT) which reflect the overally variation of Vienna’s urban landscape on the basis of the criteria described above. The cluster analysis resulted in 9 urban fabric types, each representing a combination of physical morphology and climate sensitivity. The urban fabric types which appeared to have the most potential to be explored further were those represented by clusters 1 to 5 and 8 (see Fig. 1). These urban fabric types were more vulnerable to certain impacts of climate change (due to the high proportion of sealed surfaces, the low proportion of green open space, the high number of hot summer nights, etc.), and were therefore the most promising targets for future mitigation measures. Although the selected clusters characterising the city's urban fabric types generally presented a convincing representation of Vienna's urban morphology, a further attempt was made to see, if it were possible to resolve the urban structure in greater detail by further sub-dividing some of the more heterogenous classes – in particular urban fabric types 2 and 3, and type 6, the Danube river corridor. Further analysis of these clusters was therefore conducted, leading to the generation of another three 'sub-types' for each one. Figure 1 shows their distribution across the city.

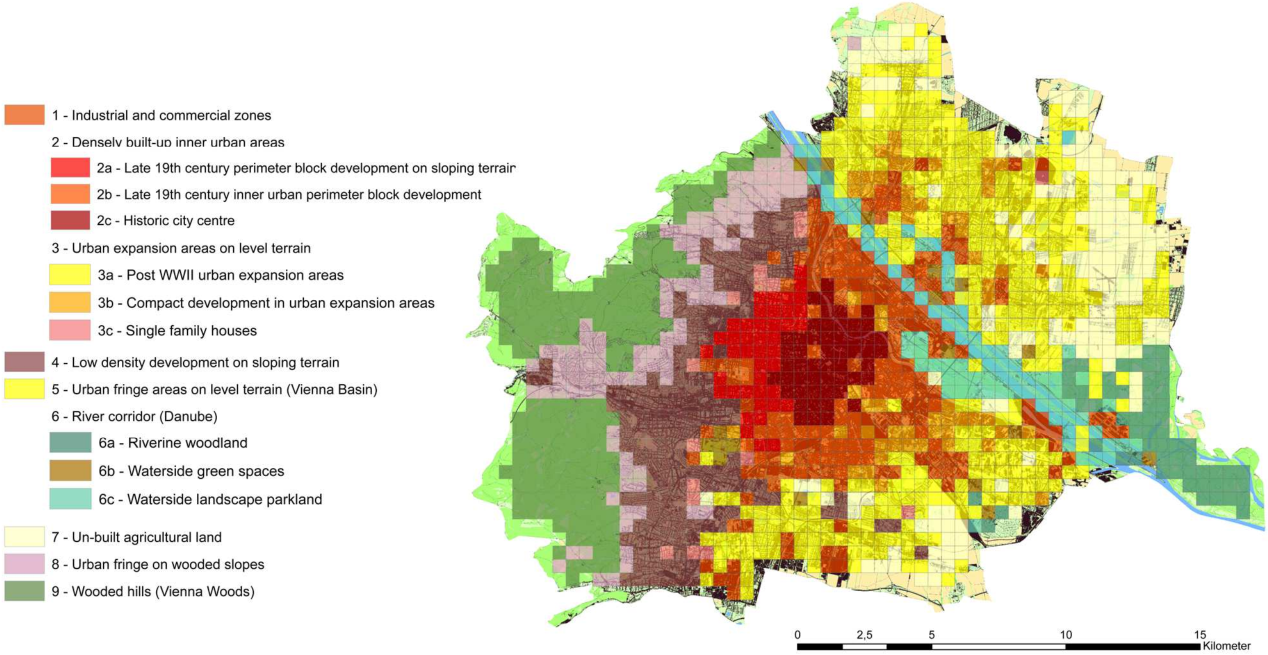

Fig. 1: Urban fabric types (UFT) for Vienna including the subclusters of UFT 2, 3 and 6.

3.2 Selection of urban fabric types for further investigation

For further investigation, the focus was laid on those urban fabric types and sub-types which were likely to be the most climate-sensitive, namely those within the dense inner urban areas and the main urban expansion areas northeast of the Danube:

UFT 1 - Industrial and commercial zones: marked by heterogenous building structure and a high percentage of sealed surfaces; dominated by perimeter block development and multi-storey linear housing; big industrial zones with generous areas of green space, and a strong influence of urban heat island phenomena.

UFT 2 - Densely built-up inner urban areas: with the highest percentage of sealed surfaces and the greatest building heights; historic building structure (especially perimeter block development) with a low proportion of green space; the highest number of hot nights and the warmest winters.

- 2a - Late 19th century perimeter block development on sloping terrain: marked by perimeter block structure and about 86% sealed surfaces; elevations in the terrain structure; low proportion of green space dominated by taller trees and grass areas; hot with highest amount of precipitation within the sub-types.
- 2b - Late 19th century inner urban perimeter block development: marked by perimeter block structure and high proportion of sealed surfaces; only small differences in elevation; green structure dominated by grass areas and small trees; hot, especially high number of hot summer nights.

UFT 3 - Urban expansion areas on level terrain: marked by heterogeneous building structure and a high proportion of grass areas and agricultural land; high amount of sealed surfaces on level terrain; a moderate amount of shrubs and small trees; highest number of hot summer days, but with cooler nights.

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- 3a - Post WW II urban expansion areas: marked by detached housing zones and an average building height of 6m; low building density; about 50% sealed surfaces; high proportion of grass areas (particularly agricultural areas) and low tree structure; hot days and warm nights.
- 3b - Compact development in urban expansion areas and old village centres: marked by heterogeneous building structure with an average building height of 11m; highest building density within the sub-types; high proportion of sealed surfaces; warm days and warm nights.

4 OPEN SPACE AND MICROCLIMATE CHARACTERISTICS

4.1 Selection of representative sample quadrants

A selection of sample quarter kilometre square quadrants within each of the selected urban fabric types was made in order to investigate their microclimatic characteristics as a function of their morphology. The quadrants were selected according to their climate sensitive open space patterns and as representatives of average indicator values for each of the respective urban fabric types. The final selection of sample quadrants took place in several steps (Fig. 2):

(a) statistical analysis was undertaken to obtain a significant number of samples representative of a particular urban fabric type. The number of samples chosen depended on the number and spread of quadrants within an urban fabric type;

(b) the selection of representative sample quadrants for each fabric type for further analysis and simulations. Here the main focus was on the identification of typical urban open space patterns, making use of information from the Grünraummonitoring (green space monitoring) and the Flächenmehrzweckkarte (digital map) databases, which were integrated using ArcGIS. The most representative quadrants were identified by making use of the spatial characteristics data, focussing on those categories covering at least 5% of the total quadrant area; and

(c) the comparison of aerial photos of the most representative quadrants for the final selection in order to assure the applicability of the simulation method (e.g. localisation of important open space patterns within sample quadrant and avoiding falsification of simulation results due to boundary effects).

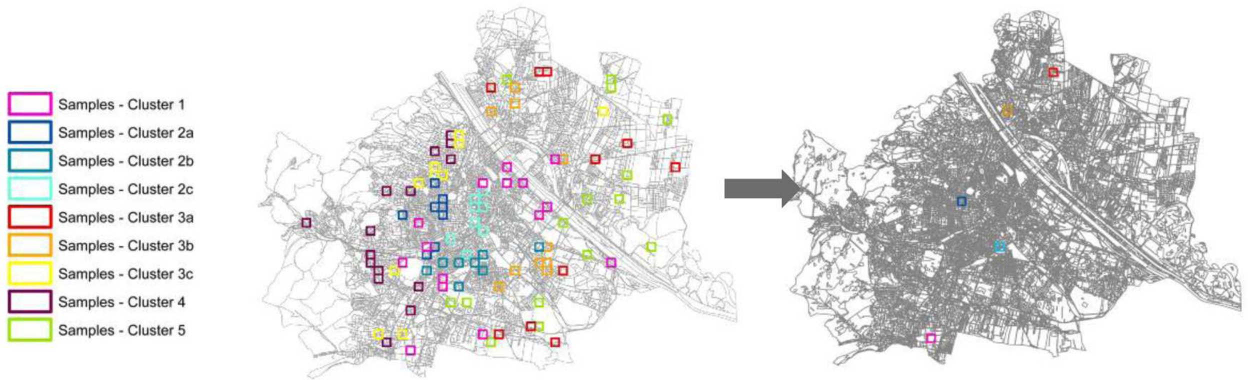

Fig. 2: Statistical random sample and final selection of sample quadrants for further investigation.

4.2 Analysis of open space structure and microclimate conditions

Typical urban open space patterns were identified for each urban fabric type as represented by the selected quadrant, by means of the analysis of rectified aerial photos, which were compared with the databases referred to above. This lead to a classification with respect to potential open space design measures in which the main categories were: road system (linear street area or widenings), courtyards (fragmented within block or entire block), green areas (fragmented, connected or extensive), squares (fragmented, connected or extensive), other areas (car parking, paved areas within industrial sites, rail tracks, waste land or agricultural land) and potential roof areas for greening. The open space structures identified were digitized for all the sample quadrants using ArcGIS, thereby making possible a quantative analysis of the percentage distribution characteristic of each urban fabric type. The keywords relating to the respective characterisation are presented in Table 2.

The microclimate conditions of the status-quo of each selected quadrant were simulated using the programme ENVI-met 4.0 (BRUSE 1998). ENVI-met is a three-dimensional computational model for analysing small scale interactions between urban structure and mircoclimate. The model combines the calculation of fluid dynamics parameters such as wind flow or turbulence with the thermodynamic processes taking place at the ground surface, on walls and roofs or in vegetation. A big advantage of this simulation programme is the possibility to present the results in form of maps and vertical sections, facilitating the understanding and explanation of climate issues for non-experts. The atmospheric input data used for the simulations referred to current extreme climate conditions using a hot summer day, measured in the inner city of Vienna, representing the 99th percentile of the daily maximum air temperature. Further simulations were conducted for projected future climate conditions for the year 2050, based on results from the regional climate model COSMO-CLM (LOIBL 2010). These showed that the current climate sensitivity will increase significantly, emphasising the urgency of taking counter-measures immediatly.

The simulation results were compared to the maps of open space structure and reviewed with regard to the typical and critical climate situations. Comparable open space patterns within the different quadrants which had been selected, demonstrated different climate sensitivity due, for example, to their particular proportions. Open spaces with sealed surfaces heat up strongly, while green open spaces with ground-cover vegetation and trees result in the lowest temperatures and the highest comfort values. However, even within green courtyards, sealed areas form hotspots, which result in clearly identifiable thermal discomfort zones especially during the afternoon. Critical areas within the dense urban structure could also be located, for example, in areas where the streets are wider and where there are junctions. Figure 3 is an example showing the open structure map (left) and the simulation map for the PMV (predicted mean vote) as a value representing thermal comfort (right) for sample quadrant 723, which lies on the border of the 16th and 8th districts of the city, and is representative for urban fabric type 2a. The areas of highest heat stress (magenta) are clearly located along the street areas and street widenings, particularly within west-east-orientated streets as well as on crossings and squares. The small and fragmented courtyards show lower heat stress (green) due to shading by the surrounding buildings. The lowest thermal load is to be found in entirely green courtyards and within the planted street areas with tall trees along the Gürtel (Fig.3).

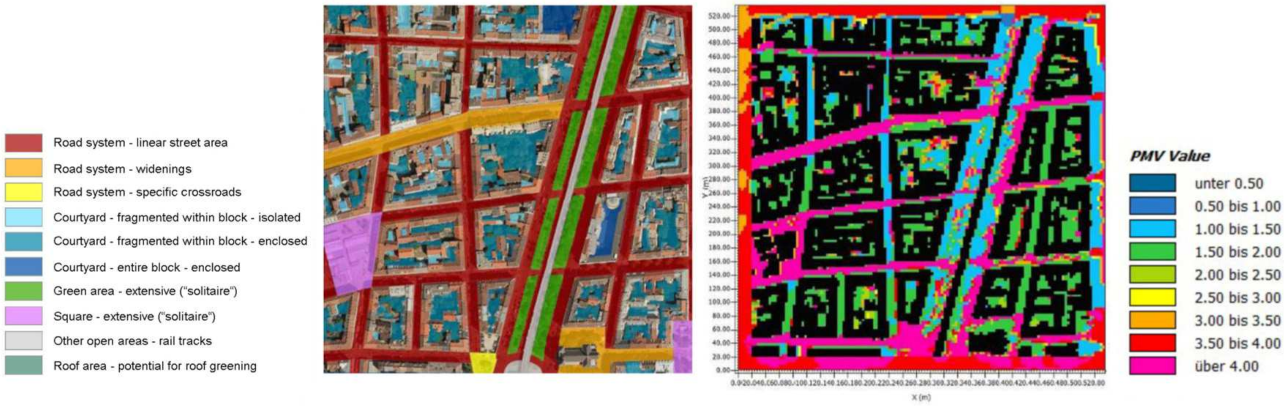

Fig. 3: Maps for open space structure and status-quo climate conditions for sample quadrant 723 (UFT 2a).

5 POTENTIAL OPEN SPACE DESIGN MEASURES

The characterisation of the sample quadrants led to adjusted design measures which were used in further simulations aimed at the amelioration of thermal stress, including tree planting, de-sealing of impermeable surfaces and roof planting where appropriate (based on the Gründachpotentialkataster). According to the specific conditions of each sample quadrant, the design variants were focused on different aspects such as street orientation and width, the influence of density and of adjacent areas, etc. The evaluation of the generated data has focused on thermal comfort and on the most relevant climate factors that influence it, in form of maps, mean values and diurnal variations.

5.1 Design measures

Based on the input files and results of the status quo simulations, different design variants were defined and modelled using ENVI-met 4.0 to investigate the respective microclimatic effects.

The modelled design variants were:

- different forms of tree planting with respect to appropriate measures for the identified critical climatic aspects within each open space type. The implementation of tree planting with regard to the type (deciduous), size (crown diameter 12m) and planting distance (canopy closure) was based on the results of a previous project (FREIRAUM UND MIKROKLIMA 2011).
- the de-sealing of paved surfaces within the affected open space types. This involves a simple change of surface material as well as potential structural changes e.g. the transformation of certain traffic lanes to public space.
- the implementation of extensive roof planting based on the data of the “Gründachpotentialkataster” (green roof potential map).

The design measures were simulated individually and in appropriate combinations, allowing conclusions to be drawn regarding specific open space situations, including an “optimal variant” over the entire area of the sample quadrant. According to the characteristics of each sample quadrant, the focus of the design measures was adapted correspondingly (Table 2).

SQ	UFT	Open space structure	Focus of design variants	Variants
555	1	characterised by extensive paved surfaces and parking areas, high potential for roof planting	de-sealing of ground surfaces in extensive paved areas as far as reasonable, de-sealing of ground surfaces together with tree planting along building sites and on parking areas, area-wide extensive roof planting	4
723	2a	characterised by orthogonal road system (N, W) and fragmented, partially connected courtyards	tree planting along the streets with focus on street orientation as well as on the respective street sides (facades)	5
919	2b	characterised by orthogonal road system with widenings (NW, NE), rail tracks and adjacent in-plant areas as well as all types of courtyards and extensive green area.	tree planting along the streets with focus on the south façade along the Gürtel-road, de-sealing of ground cover within street widenings and possible abandoning of street section along the Gürtel-road, de-sealing of parking and in-plant areas as far as reasonable, de-sealing and tree planting within larger-scaled courtyards	10
983	3a	characterised by linear street area with crossroad widenings, opened courtyards, connected green areas and parking area.	tree planting along the streets with focus on crossroad widenings, de-sealing and tree planting in possible abandoned street sections, de-sealing and tree planting within parking areas	9
1264	3b	characterised by linear street area, fragmented green area and agricultural land	tree planting along the streets with focus on street orientation as well as on the respective street sides (facades), de-sealing and tree planting within parking area	6

Table 2: Open space characteristics and measures focus on the microclimate simulations for the sample quadrants

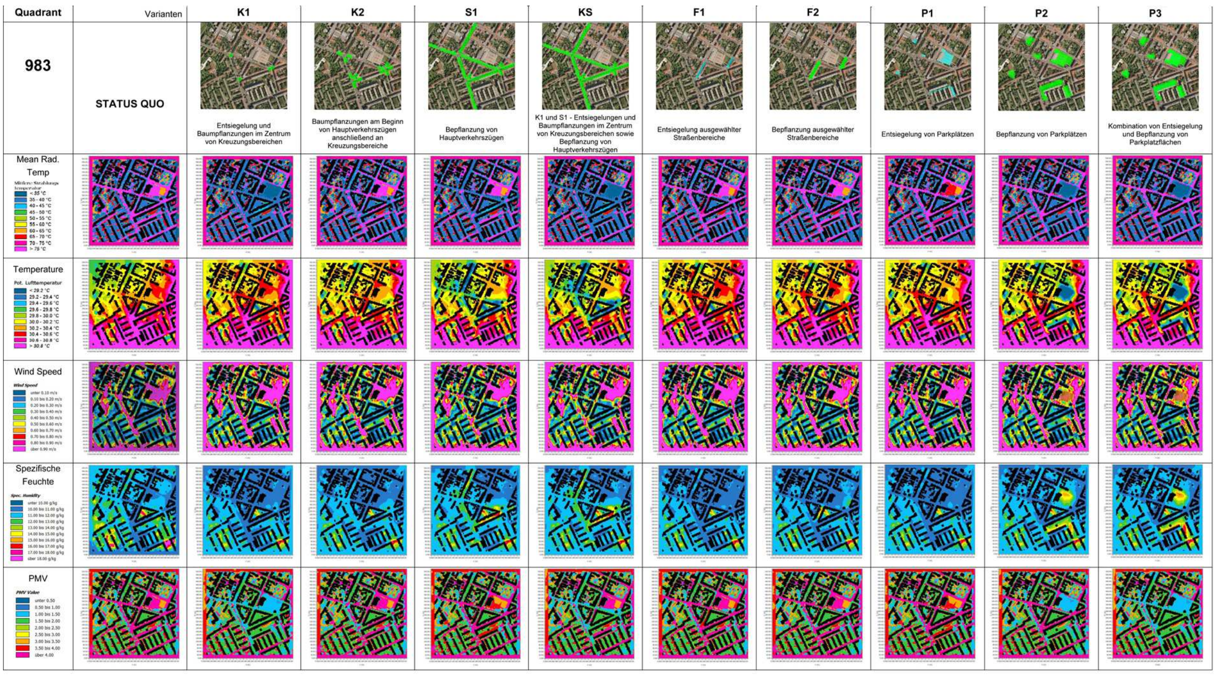

Fig. 4: Maps for open space structure and status-quo climate conditions for sample quadrant 983 (UFT 3b).

5.2 Simulation results

The simulations of the design variants were conducted using ENVI-met 4.0 under conditions identical to the status-quo simulations, involving 36 hour run time durations and focussing on hot cloud-free summer days with a high temperature amplitude. The resulting data was analysed using simulation maps, extracted mean values and diurnal variations. The focus was placed on the PMV value, which also takes into account effects of wind speed, mean radiant temperature, potential air temperature and humidity. Figure 4 provides an exemplary overview of the simulation maps generated for the different variants of sample quadrant 983 in the 21st Vienna district, and representing urban fabric type 3b. The focus of the design variants was laid on the tree planting along the main streets with special focus on road-junction widenings, de-sealing impermeable surfaces and tree planting in potential abandoned street sections, as well as de-sealing impermeable surfaces and tree planting within parking areas.

Simulation results for the design variants within the investigated sample quadrants can be summed up broadly as follows.

- Generally, tree planting shows the greatest effect on all design measures analysed, especially within the immediate area covered directly by the tree crown. The PMV value is reduced from "extreme hot conditions" to "slight warm conditions". A clear correlation can be observed with the specific pattern of tree distribution in relation to the adjacent open space structures and to the width and orientation of the respective open spaces. The simulations for sample quadrant 723, for example, highlight the importance of considering the street orientation, and show a much greater effect in reducing temperature values due to tree planting along the east-west oriented streets as compared to streets oriented north-south. For the same quadrant, the diurnal variations with regard to different microclimatic factors of the status-quo situation as compared to the design variant of street planting in the east-west orientated streets show a significant decrease in the mean radiant temperature, and a similarly significant increase in the specific humidity. Although the wind speed is slightly reduced, the air temperature can be reduced up to 1.5°C during the hottest period of the day and by 3°C at night.
- Just de-sealing the ground surface generally results in a slight reduction of the PMV value particularly during the hottest time of the day, around 3 p.m. This could be clearly observed in all sample quadrants especially in the case of the de-sealing of impermeable parking areas and industrial zones, for example within sample quadrant 919, which is located in the 4th Vienna district and marked by perimeter block buildings adjoining a vast area of sealed surfaces to the north, including the Gürtel, rail-tracks, parking and industrial areas. Looking at the respective differential maps of diurnal variation, further microclimatic effects become apparent. A significant cooling of the air temperature within the adjacent resident area to the north-west can be observed as a result of the south-easterly wind conditions.
- The roof planting generally has less direct influence at ground level. Looking at the vertical distribution of microclimatic data, the amelioration effect is highlighted. The vertical section of the potential air temperature for the design variant involving roof planting for quadrant 555 in the 23rd Vienna district, which is characterised by low, flat-roofed, industrial and commercial buildings illustrates a significant cooling effect at higher air levels and in the leeward direction from the buildings.

6 PLANNING RECOMMENDATIONS

The results of the simulations were evaluated with respect to the overall open space patterns, leading to general recommendations and to specific packages of measures for each sample quadrant and the corresponding urban fabric type.

The catalogue of general recommendations (Maßnahmenkatalog) was formulated according to the type of design measures concerned: tree planting, de-sealing of ground surfaces and roof planting. Additional information and recommendations are given based on a literature review and on the results of a previous project, dealing with aspects of tree size, species, distribution, distance of planting and different forms of de-sealing the ground surface (FREIRAUM UND MIKROKLIMA 2011).

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According to the characteristic open space structures within the respective sample quadrants, specific packages of measures (Maßnahmenpakete) were defined based on their effectiveness, thereby establishing a hierarchy of priorities. Each urban fabric type was briefly characterised in terms of its topography, the urban structure and climatic conditions. The respective sample quadrants were discussed in terms of their percentage area, of their existing open space patterns, and their representative status for the urban fabric type as a whole. Based on the general recommendations in the catalogue, specific packages of measures have been defined for the respective open space structures. These have been set out in the form of priorities that take account of, the climatic effect of the recommended measures (locally as well as on the nearby surroundings), their potential for implementation (with respect to limitation of adaptable surfaces due to logistic aspects, and to the degree of additional benefit to be expected, depending on the status-quo situation) and to the potential user intensity within the open space structures concerned. A second hierarchy was also developed with the additional consideration of the percentage distribution of the respective open space structures within each of the quadrants. This showed up interesting variations that enable alternative approaches to concrete implementation to be evaluated. Figure 5 provides an example of the percentage distribution of open space structures within sample quadrant 555 as representative of urban fabric type 1 (Industrial and commercial zones) leading to the package of recommendation in Table 3.

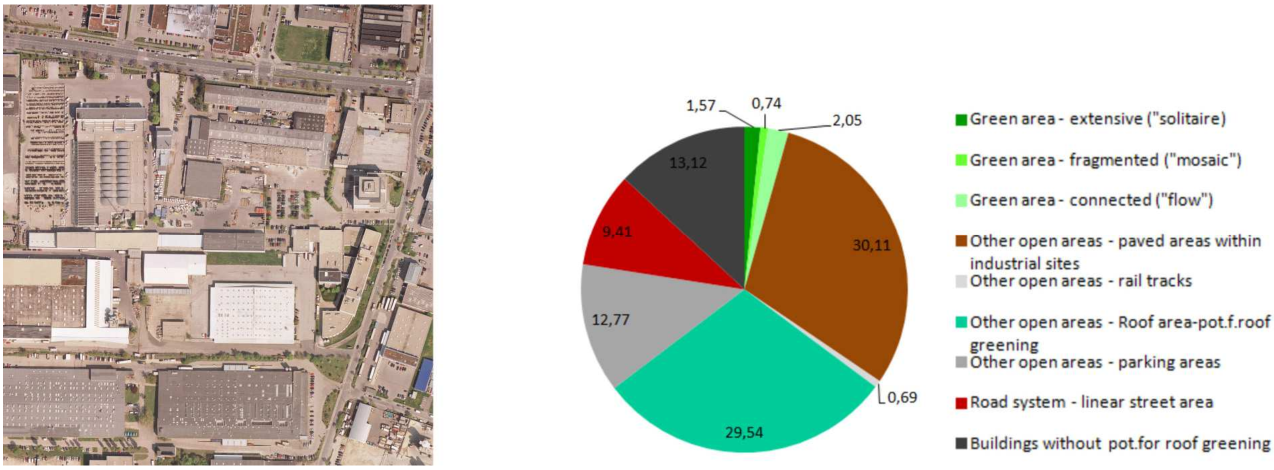

Fig. 5: Percentage distribution of open space patterns for sample quadrant 555.

Priority	Open space structure	Design measurement	Area	Priority*
1	**Parking areas** (grey)	**De-sealing and Tree planting** (area-wide)	13%	2
2	**Roof area with potential for roof planting** (green)	**Roof planting** (area-wide) Where statically and technically feasible preferably intensive roof planting as to its greater microclimatic effect and offering of aditional green space for workers and residents	30%	1
2	**Linear street area** (red)	**Tree planting** Focus on wide streets and on east-west orientated streets	9%	3
3	**Paved areas within industrial sites** (brown)	**De-sealing and Tree planting** (as far as posible) De-sealing area-wide except areas of stacking, heavy load and hazardous contaminant Tree planting particularly along the property lines and in front of buildings	30%	4

Table 3: Package of measurements for sample quadrant 555 as representative for UFT 1 in order of priority considering climatic effect, potential for implementation and potential user intensity (left column) resp. additionally percentage area (right column).

7 CONCLUSION

The urban space typology shows close agreement with similar city typologies addressing other criteria, as well as reflecting the relationships between urban structure and urban climate pattern. The characterization of different urban space types, on the basis of the sample quadrants investigated also illustrates the close interrelationship between open space structure and the local climate conditions. The analysis of the microclimate simulations demonstrates the effects of various design measures. Planting trees helps - in addition to the increase in transpiration - by enlarging the shaded area and thus reducing the extent of areas exposed to high mean radiant temperature. Taking into account the effects of all times of day, treeplanting causes a significant reduction in mean radiant temperature, but also in air temperature. The minimum, maximum and mean air temperature is reduced. The minimum air temperature occurs earlier than without tree plantings. De-sealing of large areas of impermeable surfaces can cool down the air temperature within neighouring dense city quarters downwind of the prevailing wind direction. Roof planting equally has a cooling effect downwind of the wind direction, particularly when implemented on lower buildings. Furthermore, in quadrants with similar open space characteristics, differences could be identified due to local variations in the urban fabric (orientation, height:width ratio, adjacent land or buildings, etc), leading to the recommendation of different priorities with regard to design measures. The results can serve as a planning guideline and to provide decision support for urban design and should create greater awareness of the need for climate sensitive open space design, given appropriate presentation of measures and impacts. The results have to be confirmed with regard to their replicability in other studies. But one can be optimistic that the study can serve as a basis and a model for further investigations in cities throughout Europe, with the aim of improving local thermal comfort. Additional work will be necessary to investigate the detailed costs and benefits of the proposed measures.

8 ACKNOWLEDGEMENTS

The paper presents the project “Urban fabric types and microclimate response - assessment and design improvement” within the ACRP 3rd call. The detailed results and the complete catalogue of recommendations can be found in the final report that is available for download on the official website www.urbanfabric.tuwien.ac.at (STILES et al. 2014). Project coordinator: Vienna University of Technology, Institute of Urban Design and Landscape Architecture (Prof. Richard Stiles, Dr. Katrin Hagen, Dipl.-Ing. Beatrix Gasienica-Wawrytko, Dipl.-Ing. Heidelinde Trimmel). Project partners: Austrian Institute of Technology, Energy Department (Dr. Wolfgang Loibl, Dr. Tanja Tötzer), TU München, Strategic Landscape Planning and Management (Prof. Stephan Pauleit). Special thanks to Mag. Mario Köstl (AIT) for the data processing and to Dr. Wolfgang Feilmayr (Vienna University of Technology) for the statistical assessment.

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Smart Kids Make Cities Smarter

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1 ABSTRACT

The aim of the paper is to highlight the potential of the involvement of children and kids in planning activities by understanding and giving voice to their distinctive language, in order to construct a non authoritarian concept of smart contemporary citizenship.

2 KIDS' RIGHT TO THE CITY

Even though children and kids are citizens to all intents and purposes (and with their own needs and rights), on the one hand, their mobility across the city – as non-drivers – is strongly reduced, so that their «right to the city» (Lefebvre, 1968) is denied in practice (see: Bozzo, 1998; Dolto, 2000; Moro, 1991); on the other hand, they usually are substantially excluded from decisions concerning the urban spaces of their daily life since they are considered as non-adults, "still-in-progress entities" having no voice. But its worth remembering that, after all, the well-known definition of sustainable development esplicitly refers to «future generations» (WCED, 1987). The exclusion of children from decision-making reveals the vagueness of such definition – «starting from how needs are to be defined and anticipated, and by whom» (Pellizzoni, 2012) – and, more generally speaking, the problematic character of sustainability itself.

Recent years have witnessed an increasing interest in planning processes based on the involvement of children in design activities (e.g.: within partecipatory workshops). Such involvement could be utilised as a sort of "litmus test" to evaluate the sustainable perspective of the project, as it gives voice to weak actors. Children's technical contribution (see: Tonucci, 1996; Paba, 1997) to planning and design activities can be particularly fruitful as not only they «bear specific needs» (Paba, 2001), but they are also provided with a "different sight", which means a specific "experienced knowledge" of urban spaces. Furthermore, they are also involved within the network of «weak ties» (Granowetter, 1983) of the neighbourhood level, where people are «within sights» (Mumford, 1968. p.35) and a «democracy of proximity» (Bracqué & Sintomer, 2002) may be possible. Finally, children's distinctive spatial behaviour tends to be subversive since it is able to resist the usual «production of urban space» (Lefebvre, 1974) of late capitalism, and this fits well with a different and more political claim for sustainability. Thus, children' sight "from below" can help planners in anchoring sustainable alternative visions to the local dimension of daily practices.

Especially if framed within and sustained by a learning path (e.g.: through workshops strictly inter-related with school programs, with particular reference to subjects such as geography, drawing and natuural science), their skilled involvement in planning activities can fruitfully contribute in re-imagining the city as an inter-active cognitive potential (see, e.g.: Sandercock, 2003) that lies within the daily social practices structuring urban spaces (De Certeau, 1990). In this sense, not only children's participation can force planners towards a more responsible approach to the resources and commons to be preserved for the future generations: their different sight can effectively help planners in placing «diversity as the cornerstone of their prescription for urban reform» (Talen, 2006a; see also: 2006b), i.e.: enabling diversity through planning and design.

The paper reports findings from a still on-going action-research concerning the involvement of children in planning and design activity.

3 THE SHIFTING MEANING OF PARTICIPATION

The broader "participative turn" of the recent decades has resulted in a wide range of very different practices aimed at involving the inhabitants in planning processes: «collaborative planning» (Healey, 1997; and many others), «deliberative democracy» (Forester, 1999; Elster, 1998; Friedmann, 1987; etc.), «communicative planning» (Sager, 1994; but also: Yftachel & Huxley, 2000), «community planning» (Wates, 1998), «community architecture» (Wates & Knevitt, 1987), and so on. Such a multiplicity of interpretation perhaps derives from the different meaning of the term. "Participation", in fact, is used to indicate two different behaviours: the first one concerns communication (i.e.: to make something known, to inform someone about something); the second refers to sharing interests, opinions, situations or experiences. Being «the action or

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fact of partaking, having or forming a part of», it could be «either transitive or intransitive; either moral, amoral or immoral; either forced or free; either manipulative or spontaneous. Transitive forms of participation are […] oriented towards a specific goal or target. […] in its intransitive forms, the subject lives the partking process without any predefined purpose» (Rahnema, 1992).

In Italy, the more recent decades witness an evolution of the meaning of the concept of "participation". Different phases can be distinguished (Giusti, 2000): the first one is political and ideological, wherein participation is a tool for social conflicts involving planners' politically-oriented "expert knowledge". This phase is strictly associated with the claims emerged during the '68's struggles and consists of the experiences of the "consigli di quartiere" ("neighbourhood councils") within the frame of both the crisis of traditional mass parties and the process of administrative decentralisation of the early 70s (see: Elia *et al*., 1977). A second phase (only apparently interrupted during the 80s) concerns the '77 movement, involving both the feminist (Friedmann, 1992b; Maggio, 1996; Massey, 1994; Sandercock & Forsyth, 1990) and the environmentalist movement and generating a multiplicity (Paba, 1996; 1998) of different self-organised and locally focused pathways – «thousands of tiny empowerments», as Sanderkock (1998) would say – aimed at occupying the empty space due to the loss of traditional mass parties in order to answer the emerging social demand.

The third phase of the 80s and 90s is characterised by the development of participatory techniques and methodologies aimed at the effectiveness of governance in order to face the complexity of the contemporary society by reducing ideological and social conflicts through a re-framing process, in which conflicting images are de-constructed and then re-constructed by highlighting possible shared visions, in order to prevent or at least to mitigate the inhabitants' resistence against public projects. Planners' role, therefore, changes, as they are intended as "facilitators" that are substantially not interested in substantive issues, being them mainly focused on procedures. From a theoretical point of view, such an approach can be intended as influenced by the Habermasian (1984) view of deliberative democracy that tends to overlook differences and to replace them with an idea of a rational actor following the principle of reasoned argumentation.

Not surprisingly, during this phase, participation often becomes a useful rethoric, a sort of «new tiranny» (Cooke & Kothari, 2001) and an «essentially contested concept» (Day, 1997). Not surprisingly, in fact, the comforting recipe of standardised and self-referential participatory "best practices" is often seen by spontaneous (and mistrustful) social movements (Scoppetta, 2013a) as corresponding to the first five – «manipulation», «therapy», «informing», «consultation», «placation» – of Arnstein's (1969) «ladder of citizens participation» since it supposes mainly cooperative interactive networks and denies the existence of conflicts. Thus, it is consequently interpreted as embedded in a «system maintaining» and not in a «system transforming» (Chawla & Heft, 2002) approach, revealing the «suspicious intentions» (De Carlo, 1980) of the rhetoric on civic engagement in planning processes. In this sense, it is worth highlighting that, despite the pervasive spread of participatory planning practices, in advanced countries exclusionary processes are more and more widening (Thomas, 1997; see also: Madanipour *et al*., 2000), as interactive forms of planning and governance can develop also through an exclusionary mechanism aimed at overcoming weak and not formally represented actors, while including a limited set of institutional or quasi-institutionals acknowledged interest groups, with a clear reduction of collective control on decision making (see: Forester, 1989).

The current phase is related to neo-liberal globalisation and the consequent need to a different and less contradictory development model (see: Sullo, 2002; Gerso & de Souza, 2002). Thus, on the background of the current crisis of representative democracy and the need of renewing it (Gross & Singh, 1986; see also: De Micheli *et al*., 2010; Magnaghi, 2002), the term "participation" tends more and more to coincide with "self-government" (see: Magnaghi, 2000; Ferraresi, 2002), by progressively shifting from conflicts to sustainable proposals, i.e.: by enlarging the content of participatory processes from specific local problems (such as the quality of life and common goods) to wider issues that involve a radical rethinking of the current pruduction processes, way of living and power relationships (see: Paba, 2002; see also: Harvey, 1999), by focusing on the empowerment of the inhabitants towards the construction of an active citizenship (see, e.g.: Paba & Perrone, 2003; Paba & Paloscia, 1999; Crosta, 2002; see also: Friedmann, 1987; 1992; 1999). Within such a frame, planners' distinctive "expert knowledge" consists of Forester's «critical listening» (Forester, 1989; see also: Giusti, 1995; Sclavi, 2000). On such a background, participation does not focus on rationality, but rather on building relationships (i.e.: face-to-face, body-to-body relationships) and, consequently, on truth, sharing, feelings and emotions, by including them into decision-making interaction (see: Forester, 1999). In short, participation implies «the intelligence of emotions» (Nussbaum, 2001).

4 INVOLVING KIDS IN PARTICIPATORY PRACTICES

On the background of the "participatory turn", recent years witness a multiplying of planning practices based on the involvement of children and kids (see: Hart, 1997), but too often such experiences are to be framed within top-down processes where children and kids play an "ornamental" role, as they cannot really modify the already established projects and interventions.

By contrast, the most interesting Italian experience are included in bottom-up practices that have been carried out in regions such as Tuscany or Emilia Romagna (see, e.g.: Paba, 2000), where the involvement of children and kids is not aimed at designing "bordered zones" for children only, but public urban spaces that are accesible for all, as kids' condition represent diversity, which is to be placed «as cornestone» of planners' «prescription for urban reform» (Talen, 2006a; see also: 2006b; Forester, 2009; Young, 1990; Low *et al*., 2005; Watson, 2006; Perrone, 2010a). In this sense, the aim of such projects goes beyond a mere physical transformation of places, being the major goal to construct a process in which children and kids are no longer seen by administrators as a "niche" sector, but rather as a relevant crossing issue, as it can methodologically turn useful for the involvement of further weak actors.

It is not a coincidence, however, that the most interesting experiences are carried out by public administrations that adhere to the "Charter for a new municipium"[1], where "new municipium" means the outcome of a process aimed at transforming local municipalities from bureaucratic administration offices towards self-government social workshops, as its first target consists of establishing a new relationship betwwen elected and voters, which are more and more dispossessed of any decision-making by the overriding power of economic reasons. This implies introducing alongside elective democracy institutes new decision-making "spaces" that are designed to include – going beyond the notion of long-term representatives, only elected every four or five years – the largest number of actors representing the local social-economic context, in order to build in plain and everyday language shared future scenarios and rules, thus enabling participation and extending it to actors that usually have no voice in institutional decisions through intermediate forms between representative (i.e.: through vote) and direct (i.e.: popular assembly, referendum, etc.) democracy. A theoretical reference in this sense can be individuated in Mouffe's view of agonistic political action (2000), implying the domestication of antagonistic political processes into an agonistic one where the different stakeholders are acknowledged as legitimate adversaries. Structured participation paths (such as the Aalborg charter and the Agenda 21 engagements) are integrated into decision-making processes (i.e.: plans, designs and policies) in all the different phases without pre-defined bureaucratic limits and become ordinary instruments for territorial, environmental and economic government and the basis for future "local constitutions" ispired by medieval European municipal statutes, adapted to the empowerment of the different voices of today's society.

Within such a frame, participatory experiences with children and kids have been carried out as a part of ordinary educational programs (see, e.g.: Mortari, 2001), in order to interrelate the learning and design dimension, by making more autonomous teachers in both organising labs and workshops and interrelating with public administrators through the construction of common languages and innovative procedures. In fact, the major goal (also from an "educational" point of view) concerns the improvement of ordinary administrative routines due to the interaction with so unusual social actors.

In this sense, many critical aspects may emerge: first of all, the difficult for public administrators (that need immediate and visible results) in accepting the uncertainty of outcomes characterising this kind of experiences where, despite pre-established patterns, unexpected feedbacks to be further implemented can derive from practice. Time to be spent is another crucial factor, since not only children's and adults' view of time is very different, but also public administrations and schools have different but well-established

[1] Among the several workshops held in the Porto Alegre World Social Forum (2001), LaPEI has promoted the workshop "Self-sustainable local development: new municipalities' roles and tasks, and the valorization of local actors' social networks for a bottom-up globalization". Within it (merged with the one held by the Association "Démocratiser Radicalement la Démocratie"), the idea of a "Charter for a new municipium" has been proposed, discussed and submitted to the Forum for approval.

routines, needs and time horizons. Schools, however, are an important resource (Scoppetta & Scoppetta, 2013), as they can act as means of contact and dialogue between parallel networks that could never interact otherwise: not only teachers and public administrators or different administrative sectors, but also children's families and neighbours.

Difficulties clearly emerges even when the adopted methodology implies a playful dimension (see: Pecoriello, 2000). This is especially the case of workshops based on role games aimed at highlighting conflicts – between administrators and teachers, children's desires on public spaces and real feasibility of the proposed projects – in order to overcome them. Administrators, in fact, are forced to use their emotional sphere and their imaginative emphaty by overcoming their ansieties and fears: a municipal office, in fact, is really a "safer" context than a classroom in a primary school! By contrast, administrators seem to feel more at ease in the case of participatory games in public spaces, in which they can play the role of not directly and emotionally involved promoters (i.e.: spectators). This is the case of games (e.g.: drawing from Monopoly or similar) that can be intended as explorative devices for non-expert audience aimed at exemplifying what is really at stake in certain urban projects, by stimulating public debate and giving voice to alternative scenarios to be used as for long-term objectives (e.g.: developing design guidelines).

A further "educational" goal, however, regards planners, who are necessarily forced – following Schön (1993) – to a self-reflective work that could imply the need of modify the initially defined methods and objectives and, more generally, to widely rethink well-rooted ideas on what a project is, being them asked to design a project that «enables diversity» (Talen, 2006a) by constructing relationships rather than mere urban spaces. However, as underlined by Ferraro (1995) in his article on Patrick Geddes in India, planning itself is nothing but «the great game of city life» where the planner is just one player among many others and the final result depends on their interactions…

5 UNDERSTANDING CHILDREN'S DISTINCTIVE LANGUAGE

A real and effective involvement of children in participatory practices requires an understanding of their own distinctive language. In fact, as Poli (2006) underlines, space is usually thought as a real, objective and external construction, as a mere container of objects that exists in everyone's mind. By contrast, space actually is the result of a slow cognitive development that derives from perceptions, experiences, culture, individual and collective history.

In this sense, the geographical Euclidean space, where objects are placed following an exact metric relationship, does not exist: it is nothing but a whole of logic calculations which are elaborated by our mind in order to organise our perceptions about the territory, where objects independently exist (Dematteis, 1985). The ontological security of a map as a map cannot be automatically presumed, as its "truth" mirrors the ideological frame of its creator, so that a place has a different meaning that depends on its uses and users: a non-cultivated field, in fact, has a different meaning for a developer who want to built or for a group of kids who want to play football. Spatial concepts such as "distance" and "proximity" clearly show the ways in which space is a highly subjective social costruct, as the former is related to notions of strangerness and the latter rather concerns familiarity: the distance from a place which is known as enjoyable will therefore be perceived as shorter than that from a sad place (e.g.: a cemetery). In the same way, the physical experience plays a relevant role, as a distance will be differently perceived if the street slopes downwards or upwards. Furthermore, although time plays a relevant role in the perception of space (a distance, in fact, can be measured by the time needed to cover it), geometrical maps usually ignore it as well as they cannot capture the complexity of real space, as what is represented of an object is nothing but its measure.

Historical maps were different: subjective perceptions, symbols and narrations were part of the representation of space. Ancient maps represented a «hodological space» deriving from the Greek "*hodòs*" ("path") (Janni, 1984), wherein the perception of spaces follows a line according to a "route perspective", as in the case of the well-known Tabula Peutigeriana. Cadastrial maps required the physical experience of walking across the territory, so that a variety of local measurement systems derived from human pace and eyesight (Farinelli, 1981).

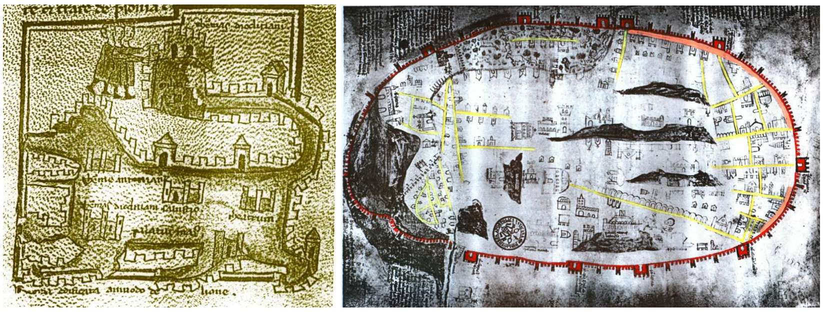

Fig. 1: On the left: "Roma in forma de lione" ("Rome in the form of a lion", rearranged by the Author), a medieval symbolic representation of the city of Rome. On the right: a further medieval representation of the city of Rome (rearranged by the Author), with a never existed oval form of the urban walls. Some of the seven hills, a few buildings (churches and towers) and an ancient aqueduct stand in the empty space inside the urban wall, witnessing the decline of the city after the fall of the Roman Empire. A more detailed representation of cultivated areas close to urban walls highlights the abandonment of the countryside during the Middle Age.

A "genealogical" inquire can clearly show how geometrical cartography has been progressively naturalised and institutionalised across space and time as a particular form of scientific knowledge and practice following the emerging of modern national states: maps, as Harley (1989) suggests, are a tool for the exercise of external power, in which plans and intentions of powerful agents become realised. But maps are also provided with a power internal to cartography consisting of the ability to categorise the world and normalise certain views of it, thereby influencing us at the level of meaning and experience. Many critical theorists from the Frankfurt School onward have echoed Weber's argument that the development of modern capitalism has been tied to that of an instrumental rationality in human relations and communication, with maps as one the most powerful and pervasive tool. Spatial sciences, in Lefebvre's (1974) view, are primary agents in the reproduction of capitalism: as they interfere, through a sort of inner colonisation, with the possibilities in everyday life through the use of space, by pre-judging the subjective world according to rational/bureaucratic typifications. According to Corner (1999), in fact, territory does not precede a map, as space becomes territory through bounding practices that include mapping. Thus, given that places are planned and built on the basis of maps, space itself is nothing but a representation of the map: the «differentiation between the real and the representation is no longer meaningful», as maps and territories are co-constructed, being the former not a reflection of the world, but its re-creation (see also: Baudrillard, 1994).

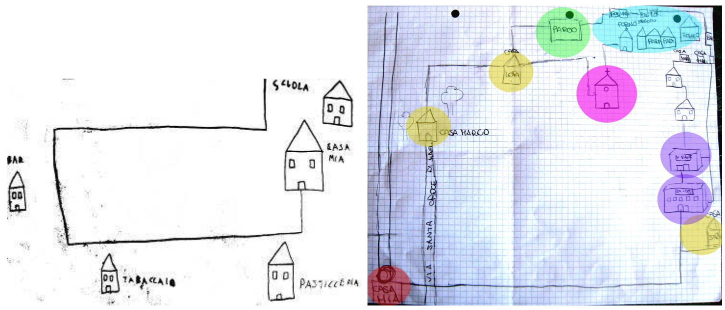

Fig. 2: Gabriele's representation of the neighbourhood (on the left) consists of his home-school daily route, with a small number of landmarks (i.e.: shops where he usually buys his mid-morning snack or football collector cards). Furthermore, the distance between the street and the buildings clearly reveals the urban pattern based on 1 or 2-families-houses, provided with a private garden. It is worth noting how, despite home-school proximity, the route appears surprisingly long. Although more articulated and provided with both 2 and 3-dimensional methods – the latter concerning only her primary and secondary school (dark blue) – Denise's representation (on the right) is quite similar. Differences regard well-known "emotional" landmarks, consisting of her friends' homes (yellow), some shops (blue), a catholic church (violet) and a park (green). Furthermore, two streets are drawn in a different way: one is Denise's address (her home in red); the other one is where her best friend's home is placed. It is worth underlining, however, that Denise (11 years old) usually goes to school by her mum's car.

Analogies exist between historical and children's representations, as the latter do not concern Lefebvre's (1974) «*espace conçu*» ("conceived space"), i.e.: space as a mental construct, the space of «*savoir*» ("knowledge", i.e.: expert knowledge), the (abstract, geometrical) «representation of space». Children's representations rather refer to both Lefebvre's «*espace perçu*» ("perceived space") and «*espace vécu*» ("lived space"), being the former (real) space as (materially practiceable) physical form and the latter the space of everyday life and social relations, which is produced and modified over time through its use and whose understanding refers to «*connaissance*», i.e.: informal or local forms of knowledge (involving symbolism and meaning) that is gained though personal experience. In this sense, being it at the same time both real and imagined, such «space of representation» is both the medium and the outcome of human spatial relationships (see particularly: Iori, 1996).

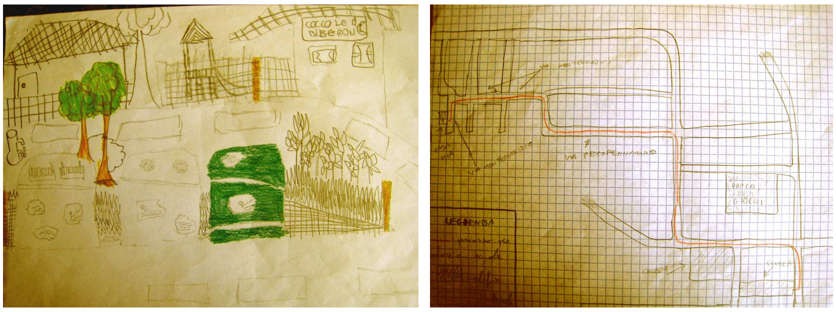

Fig. 3: Federico's view of the neighbourhood (on the left) corresponds to his own home, a familiar "island" around which recognisable "objects" can be grouped: a detailed represented shop, the children garden, which – in the reality – is located elsewhere. Both a dustbin and a tree play the role of landmarks: Federico, in fact, has first drawn them and these are the only coloured "objects". By contrast, the legend and streets' names in Riccardo's representation (on the right) clearly highlight an attempt of scientific description (not by chance he is among the best students in his classroom!), which, however, is framed within a scarcely lived and experienced space without any landmark (with the exception of the children garden as an anonymous rectangle).

Children, in fact, do not draw what they "know", but rather what they daily experience, without a clear distinction between reality and fantasy, as their representations (especially at the level of nursery and primary school) consist of a non-structured non-hierarchical dis-homogeneous whole of objects and events – also including a dream or a nightmare, a desire or a fear, a sketch from a television program or a landscape from a video game – to be organised through a cultural process into their own "mental archives" by using a non-detailed typological and often two-dimension representation, where the aim is to classify rather than to describe the real object (see: Pierantoni, 2001).

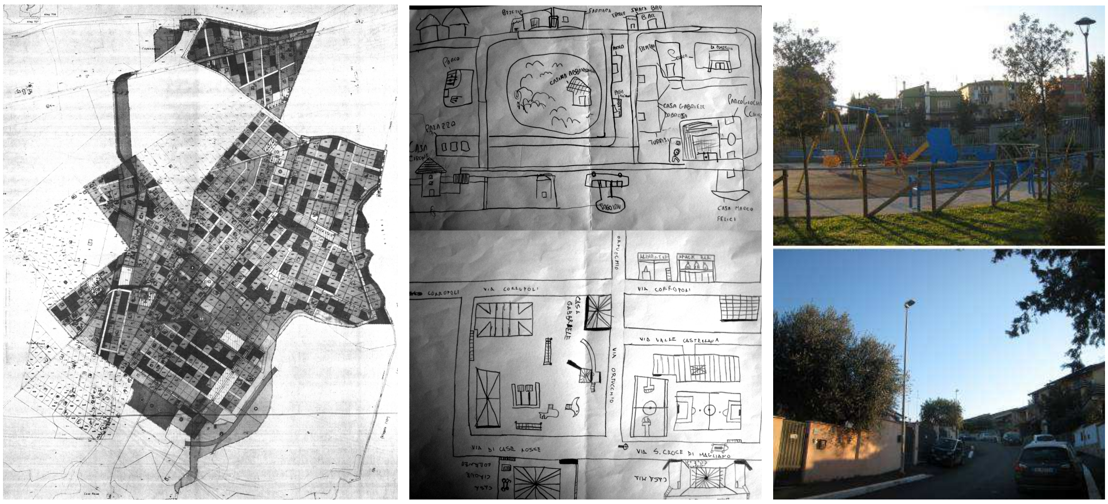

Fig. 4: On the left: recovery plan (1996) of the settlement called "Case Rosse", in the eastern periphery of the city of Rome. The orthogonal grid witnesses the typical original parcellation of sprawled illegal developments that shaped the periphery of Rome since post-WWII. As he would like to become an architect, Marco uses a set square as appropriate tool for drawing his map (in the centre, below) where space is formulated on the basis of extension and thought in Cartesian terms of co-ordinates, lines and planes. But such Euclidean effort finally ends to be contradicted, as Marco's emotional relation with his daily lived space unavoidably tends to re-emerge from his mental "scientific" re-construction of space: the represented playground is larger than the real and it actually is not located close to the football pitch, which is drawn in a more detailed way than the school (*sic!*). Thus, what at a first glance could be intended as an on-going "colonisation" by "expert knowledge" over Lefebvrian *connaissance* seems rather to be the result of Marco's both daily spatial by feet experience and social practice. As he also goes to school by feet, Lorenzo's map (on the right, above) is similar to the previous one. Differences concern the presence of an abandoned and apparently "wild" and dangerous area as well as the names of the different shopkeepers, the latter revealing how his spatial experience is linked to social relationships.

In this sense, drawing is one of their own way for knowing the world by giving a name to each thing as ancient or primitive population did. In fact, as Chatwin (1988) tells us about Austrialian aboriginals, «each totemic ancestor, while travelling through the country, was thought to have scattered a trail of words and musical notes along the line of his footprints […] these Dreaming-tracks lay over the land as "ways" of communication between the most far-flung tribes. A song […] was both map and direction-finder. Providing you knew the song, you could always find your way across the country. […] In theory, at least, the whole of Australia could be read as a musical score. […] By singing the world into existence […] the Ancestors had been poets in the original sense of *poiesis*, meaning "creation". […] Aboriginals could not believe the country existed until they could see and sing it – just as, in the Dreamtime, the country had not existed until the Ancestors sang it». Within such a framework, landmarks play a relevant role, as children's space is a sort of "unknown archipelago" wherein some familiar "islands", made by recognisable fragments, emerge.

Fig. 5: At a first glance, Aurora' representation of the neighbourhood seems to be a completely imagined one: there is neither her home nor the school or the orthogonal settlement pattern. Such a "rural idyll" actually represents the landscape surrounding the neighbourhood (i.e.: a fragment of the historical landscape once called "Roman Campagna") as well as the contemporary socially constructed imagery of a peaceful, not congested and green "urban-rural village", whose single-family houses are more affordable (although scarcely connected) than a flat in the city centre.

6 KIDS AND THE CITY

Despite the shift occurred in general planning theories and practices from modernist "rational" approaches based on zoning and functional separation to a more complex view of cities and societies, what concerns children's urban space still remains anchored to the old logic based on separation and aimed at control. Such spaces clearly mirror the ways in which contemporary cities are organised according to a generational order, i.e.: the pattern regulating the relationship between adults and children (see: Harden, 2000; Holloway & Valentine, 2000; Valentine, 2004; Zeiher 2003), where childhood is represented in a double Apollonian-Dionysiac perspective, the former to be protected into "safe" fenced areas; the latter to be tamed as they pretends to occupy adults' urban spaces. In this sense, children may be seen as social actors provided with a «pre-determined spatiality» (Satta, 2012b; see also: 2010; 2012a): on the one hand, the general progressive reduction of public open spaces; on the other, detailed designed age-based spaces devoted to children only, which are rhetorically promoted as giving them space, whereas, by contrast, such devoted and often fenced spaces actually subtract their the city's space as a whole.

In fact, the separation of children's playground from the adults' urban spaces as well as the rigid division among different ages not only prevents lively inter-generational relationships, but this also denies the idea of spontaneous, creative and self-organised games in the urban space, being fenced playgrounds the sole place in which the right to play (for adults too) is allowed. Furthermore, mass-produced equipments in children's gardens and playgrounds not only tend to influence their design – which will thus be characterised by horizontality, by avoiding hills or depressions – but they also and particularly imply a passive idea of children's and kids' games as a monotonous unchangeable and mechanical practice and prevent children from experiencing an imaginative self-construction of their own space based on the inventive use of *objects trouvés*. In this way, such kind of fenced and controlled children's gardens, where only pre-determined actions are allowed, keep them from autonomously managing their space and time and seem to be designed in order to construct passive subjectivities.

An example in this sense is given by the (neoliberal and rent-guided) Open Space Strategy of the city of London (see: Scoppetta, 2010), in which children are bordered into separated and hierarchically articulated areas[2] where the interaction among different age is substantially not allowed (more generally, on London's

[2] Examples are given by: Local Areas for Play or Doorstep Play Space (LAP) for under-6-years-old children (where mothers can interact with other mothers only!); Local Equipped Areas for Play (LEAP) for 6-to-8-years-old children; Neighbourhood Equipped Areas for Play (NEAP) for children and kids of primary schools; Multi Use Game Areas (MUGA), i.e.: playgrounds where the colours on the ground indicate the allowed games.

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urban strategies as neoliberal urban policies, see: Scoppetta & Scoppetta, 2013). It is to be underlined that the Open Space Strategy is presented as including "partecipatory" processes, but the latter are based on an audit methodology where participation is intended as a mere opinion (or marketing) poll aimed at assessing the satisfation degree of users (consumers?) and based on predetermined existing audit forms[3], where individual criteria are grouped under a set of pre-established categories in order to obtain cumulative scores for each one and a succint set of headings for the graphic and spatial representation of the result from the audit process[4]. In fact, «the objective is to gain information about the nature and quality of each open space and provide a comparative assessment across the local authority area. It provides a snapshot in time and should form the basis for future monitoring. To ensure consistency it should be carried out by a small team who are properly briefed and trained in the survey methodology. […] The audit should include a qualitative assessment of the features present within the open space, which is generally a score on a 1-5 or 1-10 range, reflecting condition and quality. Scores may, with care, be aggregated to give an overall indication of quality»[5]. In short: what is improperly called "participation" actually is nothing but a step of a typical top-down approach.

By constrast, a different example is given by the so-called "Junk playgrounds" conceptualised in the 30s by the Danish architect C.T Soresen as non-defined spaces to be freely modeled by children's imagination and fantasy through available pieces of equipment and materials. The first Junk playground was realised in 1943 during the Nazi occupation of the city of Copenhagen as a way to contrast and challenge authoritarian educational methods that characterised Nazism's ideology – aimed at constructing passive soldiers rather than active citizens, with a crucial role played by well-organised sport activities of children – and to provide children with a democratic education (see: Gutman & de Coninck, 2007).

As Lefebvre (1974) argues, however, the more and more homogeneous and commodified space of our contemporary society is conceived before it is fully lived and spatial practices, on which our knowledge of the world is based, emerge much more from representations and abstractions than from our daily experience, so that space itself becomes a representation – an overturning that Baudrillard (1994) calls «hyperreality» – by making us more easily manipulable by ideology. But, if space is constituted through mapping practices, this means that constructing maps can "activate" territory, by "remaking" it over and over again. In this sense, understanding children's representational language through their involvement in planning activities could really help us to imagine smarter urban spaces that enable diversity and active citizenship.

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[3] Such as: the Green Flag Award score sheet or the Institute of Leisure and Amenity Management checklist to assessing sites in Benchmarking and Performance Indicators for Best Value.

[4] According to the criteria expressed in: "Green Space Strategy. A good practice guide", first published in 2004 and then reprinted in 2006 by CABE. See also: OPDM, "Planning Policy Guidance Note 17: Open Space, Sport and Recreation", July 2002; DTLR, "Green Spaces, Better Spaces. The final report of the Urban Green Spaces Taskforce", 2002; OPDM, Assessing Needs and Opportunities: A Companion Guide to Planning Policy Guidance Note 17, Sept. 2002. All these references can be downloaded at the Office of the Deputy Prime Minister website (www.opdm.gov.uk).

[5] In: Greater London Authority, "Open Space Strategy. Best Practice Guidance", Sept. 2008 (www.london.gov.uk).

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Smart Navigation for Modern Cities

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1 ABSTRACT

Modern cities face a continuous growth of car population, at that, the number of drivers also grows and most of them use various navigation systems while choosing the best route as well as at the traffic situations' assessment. .In this regard it is important to have a navigator that secures a quick and easy access to the required information and proposes alternative routes. Usability of the navigator depends on the simplicity of the graphic user interfaces and also on the available collection of maps. Usefulness of the information received by the users on their requests depends on how well the context of the request, like driver type, driver experience, used vehicle, weather conditions, road surface, is taken into account. When creating a new route it is necessary to consider the current situation on the road using operative data, the driver's preferences and also to forecast the traffic density of the roads that are in the route. To solve the above listed it will be necessary to use in the navigator certain artificial intelligent tools as expert system and inference machine.

The paper presents the smart navigator for modern cities developed based on intelligent geoinformation systems. Similar smart navigators have been already developed for solving problems of small navigation. It is suggested to create smart car navigators for modern cities using key solutions developed for small navigation.

2 INTRODUCTION

Intensity of life in modern Smart Cities aggravates year after year, as caused by many different factors, for instance, by scales and rates of the economic development, scientific and technical progress, character of the population growth and changes in the population structure. The high dynamics of the cities development affects all spheres of the citizens' life in the spheres of their professional and personal interests as well as in their daily needs. To go with the pace of the cities' life the citizens have to move around more and more. Emergence of new areas and as a result enlargement of the territories occupied by the cities increases the distances which citizens have to cover and makes their routs more complicated. Modern information technologies provide a wide range of various services for organization and support of communication between people such as mobile communication, electronic mail, video conferences that currently are used by everyone and turned into an important part of everyday life. Unfortunately they are still not able to completely substitute personal contacts.

For moving around the city both public transportation and private cars are widely used. Lately the popularity of public transportation has significantly increased due to the efforts of local authorities, nevertheless, many citizens prefer to go by car. The high population density in modern cities and the peculiarities of the cities architecture especially in their central parts are the main reasons of heavy traffic jams. Though many efforts are made in design and reconstruction of the roads' network not much can be actually done without causing an essential damage to the architectural shape of the cities. In most of the cities, especially big cities the traffic jam can be several kilometers long. Two main resources that now are of primary importance, namely, the resource of time and ecological resources are wasted in the traffic jams.

One of the efficient ways of dealing with traffic jams in the conditions of the modern cities is an improvement of the traffic flows organization. The usually applied arrangements of the traffic organization include a package of managing, legal, organizational, engineering and technical measures that directly or indirectly impact on the state of the traffic. According to the world practice the optimization of the traffic is able to increase the capacity of streets and highways by about 20% at simultaneous increase of the traffic safety by 10-15%. As an example the following measures that are widely used can be considered: reduction or even prohibition of building new objects intended for the financial and business spheres, limiting the number of constructed commercial and servicing objects; turning the street parking lots into multi-deck ones; construction of bypass roads, etc.

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The given list of measures can be enlarged with one principal point that is able to impact on the traffic jams' situation. The jams can be reduced if it will be possible to organize the traffic flow within each local area according to the transport loading in the whole city accounting at that for various factors influencing upon the observed state of the traffic and its state in the near future. The organization of the flow is supposed to be continuously analyzed and accompanied by certain decisions generated for its possible improvement. In case, the overwhelming majority of the road traffic participants will lay out their routes following the proposed decisions it is reasonable to expect the jams' decrease.

Intelligent navigators can be used for laying out the routes according to the described approach to the of the traffic flow organization. Application of the intelligent navigators will allow considering the traffic participants as a self-organized flexible community. To meet the requirements to the laid out routes the intelligent navigators must possess a whole set of various complicated features: have access to various types of information, be context sensitive, be able to solve such complicated tasks as situation prediction and decision making support. The features can be provided by the wide use of knowledge. Knowledge can be considered at different levels of generalization. It can refer to knowledge about a single user, a group of users or the whole city. For dealing at the level of knowledge the acquired data and information intelligent technologies can be used.

It is also important to note that the software for intelligent navigators must be represented in the form of a line product, in which each of the products is oriented to the specified group of users.

In the paper an approach to the building of mobile navigations for smart cities based on the application of intelligent technologies is proposed. The paper is organized in the following way. In the third section the currently used mobile navigators are described, their main characteristics are compared and analyzed. Usage of the modern information technologies based on application of the artificial intelligence means is considered as a possible way to the essential improvement of the characteristics of the mobile navigators. In the fourth section the main problems of the intelligent navigation are listed and their possible solutions are proposed. The fifth section considers the problems of acquisition, application and management of knowledge that is the core element of the intelligent navigators. In the sixth section the experience in design and development of intelligent navigators for water transport like small vessels is proposed to be applied to developing the navigators for smart cities. In the conclusion the key ideas for prospective work on developing smart navigators are given.

3 INTELLIGENT TECHNOLOGIES FOR MOBILE APPLICATIONS

At present the navigation systems allow plotting a route from home to work, to school, to shops, to local destinations. Modern ground-based navigation systems include quite different functions and services. These systems make possible to:

- plot route and save it in the device memory;
- make real-time updates of traffic, speed limit signs, local events and showtimes;
- search for geographic objects on the map;
- add way points to the route;
- provide additional information about the objects on the map;
- provide voice-guided turn-by-turn driving directions;
- 3D visualization of the city and/or region.

Among the most popular navigation system are such systems as TomTom 1.8 (TomTom, http://www.tomtom.com), Magellan RoadMate 2.0 (Magellan GPS, http://www.magellangps.com), Garmin Street Pilot Onboard (Garmin, http://www.garmin.com) and TeleNav GPS Plus (Telenav GPS Navigator, http://www.telenav.com). Furthermore, some smartphones have build-in free navigation software. These include Google Maps Navigation 6.7.0, which operates with Android smartphones like HTC One X and Samsung Galaxy Nexus. In recent years the community-based traffic and navigation application Waze for iPhone (Free Community-based Mapping, Traffic&Navigation App, http://www.waze.com) is activity developed, thus, consolidating drivers in the given area who share real-time traffic and other information about roads. The main characteristics of these applications are given in Table 1.

Unfortunately, the navigation applications considered in Table 1 have some constraints. They are often cumbersome and have nonstandard user's interface. A lot of facilities and services of these applications are not obvious and easy accessible. Also the correctness of the operations depends on the relevance and correctness of real-time information.

GPS App Name	Vendor	Country	Price, $	Map Coverage	OS	Device
TomTom	TomTom	Netherlands	119–259	North, South & Central America, Europe, Middle East & Africa, Australia, New Zealand and Asia	Lunix, Windows Mobile, Windows CE, Symbian, iOS	car navigator, Smartphone, motorcycle navigator, built-in navigation system
Magellan RoadMate	Magellan Navigation, Inc.	USA	50–249	North America	Windows Mobile, Windows CE	car navigator, Smartphone, built-in navigation system
Navigon	Navigon GmbH	Germany	49.99–249	Europe	Android, Windows Mobile, Windows CE, iOS	Smartphone, navigation system
Garmin Street Pilot Onboard	Garmin International Inc	USA	49–150	North, South & Central America, Europe, Middle East & Africa, Australia, New Zealand and Asia	Android, Windows Mobile, Windows CE, iOS	car navigator, Smartphone, motorcycle navigator, built-in navigation system
Waze	Waze Mobile	Israel, US and UK	free	North, South & Central America, Europe, Middle East & Africa, Australia, New Zealand and Asia	Android, BlackBerry OS, iOS, Windows Mobile, Windows CE, Maemo	Smartphone iPhone
Google Maps	Google	USA	free	North, South & Central America, Europe, Middle East & Africa, Australia, New Zealand and Asia	Android	Smartphone iPhone

Table 1: Comparison of navigation information systems.

As distinguishing features of intelligent navigation systems in comparison with common navigation systems could be mentioned their abilities to receive information about traffic conditions, to improve the route choice, safety, comfort, sustainability in citizens' mobility. The development of such intelligent navigation systems and related technologies has been subjects of numerous projects. The majority of them are: SAFESPOT (Safespot, http://www.safespot-eu.org), SmartWay (SMART-WAY, http://www.smart-way.mobi), SESAR (SESAR, http://www.sesarju.eu), ERTMS (ERTMS, http://www.ertms.net), RIS (RIS, http://www.ripe.net/data-tools/stats/ris) and other.

Intelligent navigation systems use the following applied technologies: simple car navigation, regulation of traffic lights, cargo managment system, various announcing systems (including display boards), various road recognition systems and observation systems, as wellas systems that integrate information streams and feedback from heterogeneous sources, such as parking giudance and information systems, metrological services, swinging open bridges systems and other. And even more, the forecast technologies incorporating modeling and information gathering technologies are planned to be used in the intelligent transport navigation systems.

According to oral information provided by Andras Siegler, Director of the Transport Directorate of European Commission, DG Research and Innovation, development of such systems will allow to reduce congestion by 15%, CO_2 emissions by 20% and road fatalities by 15%.

However, the development of the intelligent transport navigation systems faces some difficulties. At first, the creation of such systems is quite expensive. Also the process of building the intelligent navigation systems is a complicated process and requires a lot of resources.

4 CONCEPT OF INTELLIGENT NAVIGATION IN IGIS

Intelligent navigation is based on the following key principles:

- the information and knowledge required for laying out the routes is acquired from the actual data gathered from heterogeneous sources using intelligent technologies based on mathematical and statistical algorithms along with means of artificial intelligence;
- the routes are built and constantly improved according to the needs and desires of each user, the observed situation and possible ways of its development;

- implementation of ready technologies provided by IGIS;

Below each of the above principles are considered, and IGIS components required for its implementation are listed.

Actual data and information from heterogeneous sources is constantly gathered by IGIS. The information required for laying the routes out includes the information about the current state of the traffic flow as well as all other required information such as weather conditions, various public activities. Three types of external data and information are considered under an angle of the data importance at solving the navigation problems. To the first type refers the information essential for laying the routes out, to the second type – the information that influences directly upon the results of the routs design. Other gathered information is considered as the information of the third type. All available data are considered as data that potentially can contain useful information. In IGIS for providing actual information dynamic information model of the subject domain is used. The dynamic information model is organized in accordance with a certain system of rules. The totality of the model elements that at each instant of time contains data matching actual parameters of the objects and medium of their functioning (Zhukova N. et al., 2013).

The processing and analyses of the gathered data is organized according to the concept of data harmonization, integration and fusion (Popovich at al., 2005). The implementation of the concept at the technological level is provided by IGIS. The adaptation of the technologies for processing data of the certain subject domain, in particular the domain of the navigation in modern cities, is organized at the level of the applied algorithms. For data harmonization intelligent algorithms are used to reveal the information about the received data that can allow for representing the data in standard formats. For identifying the structure of the received data that is supposed to be done for solving the first problem algorithms based on calculation of correlation functions, and representation of the data in the form of graphs and calculation of distances between graphs are developed. Implementation of the technology of data integration assumes that intelligent algorithms are used for solving two groups of tasks. To the first group of tasks refer the tasks of preliminary data analysis, in particular, the tasks of denoising, removing single and group outliers, filling gaps, identifying and removing duplicate values. Intelligent algorithms are required for solving the considered tasks as the algorithms of the preliminary analysis that have been developed by now are highly sensitive to the features of the processed data and have to be adapted before application. The tasks of the data estimation and the tasks of calculating characteristics of the data belong to the second group of tasks. Intelligent algorithms allow for comparing the analyzed data with the historical data at the level of the initial values and at the level of the calculated characteristics and to make estimations taking into account all relative data, for instance, measurements of an object parameters can be analyzed jointly with the measurements of the parameters that refer to the same subsystem or to the relative subsystems. Data are the most complicated from the point of view of their implementation. It requires application of intelligent algorithms almost at all stages of data processing and analysis that correspond to the levels of JDL model (Hall et al., 2001; Streinberg et al., 1999). At the level of signal processing the intelligent algorithms are used for extraction of valuable information and knowledge about signals. At the level of objects and situations the knowledge about the signals and the knowledge about the subject domain are used for building descriptions of situations and the objects that are involved in the situations.

The main features of the intelligent algorithms that are used for data processing are the following:

- the algorithms are self-training algorithms. The processes of algorithms training assumes that the algorithms are trained using historical data and improved each time when new data or new results of data processing are acquired;
- the algorithms are adaptable. The settings of the algorithms are defined according to the features of the data that are processed and the requirements to the formed results;
- the algorithms are based on using. The algorithms are able to use all types of available knowledge – knowledge provided by experts, extracted from historical data and from the results of their statistical processing;
- the algorithms represent the results of data processing in standard formats and using the notions of the subject domain allow to use the results by a wide range of consumers;

- almost all algorithms are iterative and multistep. At each step some new desired knowledge of the defined type is acquired. Thus, the result of the algorithms can be considered as new knowledge about a limited part of the subject domain;
- the algorithms are able to support the technology of prospecting analysis that allows to acquire additional information that can be useful for data processing.

The processes of data harmonization, integration and fusion for solving applied tasks are supposed to be built dynamically. Static processes cannot be used as they depend on a list of factors not defined a priori, particularly, the quality of the data, the requirements to the results of data processing, the state of the environment and other. Also during data processing some new knowledge can be acquired.

The descriptions of the situations built using the actual data from the base for building routes in the intelligent navigators. For building routes the following problems are being sequentially solved:

- the problem of situation recognition;
- the problem of situation assessment;
- the problem of situation prediction;
- the problem of building alternative routes;
- the problem of selecting the route from the possible alternative roots.

When solving problems for building routes situations are considered as a structured part of reality (Popovich et al., 2008). The structure is represented as an aggregate of elements of an entity in their relationships with each other. Under the situation recognition a process aimed at identifying a priori defined situations in a flow of data and information is understood (Popovich et al., 2008). The purpose is to assist the decision makers in focusing on relevant information by filtering out situations of interest. The situation assessment assumes execution of a process that dynamically attempts at developing a description of current relationships between entities and events in the context of their environment (Popovich et al., 2008). It aims at fusing information from heterogeneous sources in order to recognize high-level relationships in a complex scenario, composed of several actors and circumstances. Situation prediction is a process that allows to define the state of the situation at the defined time in the future (Baumgarthner et al., 2009).

The general algorithm for building routs contains the following main stages.

Stage 1. At the first stage an attempt to find a similar situation that was earlier observed is made. The formalized description of the observed situation is compared with the descriptions of the situations from the historical database. The historical data base contains all initial data and information in a packed form and the results of their processing in the form that provides a quick access to the stored information. In case similar situations are found the information about the situations and their development is used. For comparing situations an algorithm based on calculation of distances is proposed to be used (Pankin et al., 2013).

Stage 2. The second stage is aimed at solving the situation assessment problem. The complex description of the situation is built on the base of the following information and knowledge: information about similar situations; information and knowledge provided by the model of the subject domain about the objects and their behavior; any other additional information provided by the external sources.

Stage 3. The situation prediction that is realized at the third stage is organized based on complex description of the situation and the descriptions of the behavior of the traffic participants at the groups' level. The parameters of the observed situations are recalculated according to the observed groups of traffic participants and their capacity. In case when the information about the development of the external factors that influence on the situation can be obtained it is also considered.

Stage 4. At the fourth stage the set of possible routes is defined according to the description of the behavior of the user for whom the route are built, the description of the observed situation and results of the situation prediction. Commonly several alternative routes are built.

Stage 5. At this stage each route from the defined set of routes is estimated and the routs are ranged according to the criteria that are defined by the user.

Implementation of the described algorithm for building routes is based on using the subsystem of scenarios implementation and on playing scenarios provided by IGIS. The inference machine and the expert system that are integrated in IGIS are also required for building routes.

5 KNOWLEDGE OF INTELLIGENT NAVIGATORS

The concept of intelligent navigation is based on application of knowledge about cities infrastructure, especially transport infrastructure, citizens and their behavior as well as knowledge about the environment. Knowledge about the transport infrastructure includes knowledge about external and internal transport and their interaction, street roads network, off-street transport network (ground-based, and underground); the networks of long-distance transport that go through the city; different kind of vehicles, terminals and stations. For each element of the information about the networks actual state, for example, the state of the road surface and related information such as the number of accidents is constantly updated. The knowledge about the environment is usually limited by the knowledge about the climate condition and relief. The knowledge about the city's infrastructure and the environment can be quite easily gathered. The process of acquiring knowledge about the behavior of the citizens is much more complicated and is usually organized with the help of a considerable number of experts and a set of specialized tools.

Solving problems in intelligent navigators using knowledge assumes that three sub problems are solved: the problem of knowledge application; the problem of knowledge management; the problem of knowledge acquiring. The problems of knowledge application and management can be solved using technologies provided in IGIS. The problem of acquiring knowledge is specific to the applied subject domain and is considered below.

Knowledge can be acquired using the following main sources. The first source of knowledge is formed by the subject domains' experts of that represent their experience in standard formats that are interpretable by means of artificial intelligence. Knowledge provided by the experts is the most valuable. The second source are various external knowledge based applications and systems that provide knowledge stored in their databases. This type of knowledge is the least reliable. The third sources are the historical data. The data that have been gathered over a considerable period of time can be processed using various algorithms for knowledge retrieval. This type of knowledge is the most relative to the list of the solved tasks.

The main problem of assimilation of knowledge received from the first two sources is whether it can be represented in different formats and using different notions. The problem of using different formats can be solved using specialized instruments for transformations. As a rule, such instruments are developed for each format or a group of relative formats. The problem of notions' interpretation and alignment taking into account their properties, and their relations is much more complicated. Though by now various tools for ontologies' alignment and merging have been developed, they are in fact able to solve the tasks of low and middle levels of complexity, and not the highly complicated tasks.

For mining or retrieving knowledge from the gathered data a wide range of intelligent algorithms have been developed that are based both on statistical and empirical procedures. Two types of knowledge can be retrieved from the historical data: knowledge about entities of the subject domain that includes knowledge about the objects, their properties and relations and the knowledge about the subject domain processes in which the entities are involved or which describe the behavior of the entities.

For the subject domain of the smart cities the algorithms that allow to acquire knowledge are of primary interest as they can be used for building descriptions of the citizen's behavior. The algorithms can be used for building descriptions of the typical behavior of a single user of the navigator and of the typical behavior of the group of users. These two tasks differ significantly and, thus, special algorithms are proposed for solving each of them. The specifics of the first task are that it is important to reveal and to take into account the preferences and the habits of each user. The second task assumes the generalization of the data and information for the groups. Each group may belong to another group or contain several subgroups. Below presented the main steps of the proposed algorithms, they are. The key idea of the first algorithm is to use the algorithms of associations mining for defining the typical elements of the user's behavior and to use process mining algorithms for building sequences from the elements. The sequences are represented in the form of scenarios that reflect the user's behavior under different conditions. The scenarios can be described using standard format oriented to the describing processes. The notions that are used in the scenarios have to be defined in the model of the subject domain. For describing the logical relations between objects and logic rules of their behavior both crisp and fuzzy production rules based on using the first order logic can be involved. One of the most complicated steps of the algorithm is the step of the built descriptions estimation and improvement. Both tasks are proposed to be solved using modeling tools. For estimating scenarios various conditions are imitated and the scenarios are played. For improving the scenarios they are modified and after that are estimated again. The process of the scenarios improvement and estimation is iterative and is stopped as soon as the required rate of the predefined set of the characteristics is achieved. To verify the scenarios a part of historical data is used. The result set of the scenarios is considered as the templates of the user behavior.

Step A (Systematization step) Systematization of the historical data	
A1	Defining a subset of the historical data that correspond to the behavior of the defined user
A2	Estimating the amount of the available historical data and its quality
A3	Calculation of the data statistical characteristics
A4	Representation of the data in the structures oriented on application of intelligent algorithms
Step B (Mining step). Building descriptions of the behavior of separate users	
B1	Defining the information and knowledge in the subject domain model that can be used in the algorithms for building descriptions of the users behavior
B2	Revealing typical elements of the users behavior using algorithms for mining associations in data
B3	Building short sequences of elements using algorithms of the sequential analyses
B4	Building sequences using typical elements and short sequences of elements
Step C (Formalization step) Representation of the descriptions in the form of scenario	scenarios
C1	Defining the format for representing descriptions
C2	Defining the objects of the subject domain that are used in the descriptions
C3	Transforming the build descriptions into the scenarios using the defined format and the objects of the subject domain model
Step D (Estimation and improvement step) Estimation of the scenarios and their improvement	
D1	Defining various situations in which the user can take part
D2	Imitating the defined set of the situations
D3	Defining a scenario or a set of scenarios that correspond to the imitated situation
D4	Playing the scenarios and estimating the results
D5	Modifying the scenarios and estimating the modified scenarios
Step E (Verification step) Verification of the scenarios	
E1	Defining a part of historical data for scenarios verification
E2	Imitating the historical context for each of the scenario and playing the scenario
E2	Estimating the scenario and comparing it with the actual behavior of the user that was observed

Fig. 1: The algorithm for building the descriptions of the behaviour of a single user.

The key idea of the algorithm for describing the behaviour of the groups of users is to identify local groups of users with similar behaviour and to reveal the motives in their behaviour unlike the habits that are defined for separate users. Describing the behaviour of the group of users based on their habits causes a lot of contradictions that can be hardly solved. Motives are considered as a specialized sequence of actions that is reasonable and justified and that define the behavior of the users. Motives are represented in the form of scenarios. Local groups can be united in larger compound groups. For defining the behavior of the compound groups the descriptions of the behavior of the local groups are merged. The process of merging is based on application of the following set of rules: the scenarios that are similar for all groups are included into the set of scenarios of the compound group. The scenarios related to several groups are split into a set of sub scenarios from which elements that reflect the behavior of the users in all groups are selected. The sub scenarios from the remained subset are further decomposed unless they are represented in the form of separate typical elements. The scenarios build for the groups are estimated, improved and verified similar to the scenarios defined for separate users.

Step A (Systematization step) Systematization of the historical data	
A1	Define typical sequences, typical elements, grouping
Step B (Mining step). Building descriptions of the behavior of the local groups of users	
B1	Building local groups of users
B2	Identifying motives for the local groups of users
Step C (Formalization step) Representation of the motives in the form of scenario	
C1	Transforming the motives into the scenarios
Step D (Mining step). Building descriptions of the behavior of the groups of users	
D1	Defining compound groups of users on the base of local groups
D2	Merging scenarios defined for the local groups
Step E (Estimation and improvement step) Estimation and improvement of the scenarios for the local and compound groups of users	
Step F (Verification step) Verification of the scenarios for the local and compound groups of users	

Fig. 2: The algorithm for building the descriptions of the behaviour of the groups of users.

For implementation of the considered algorithms different intelligent algorithms can be applied depending on the amount of the available historical data and computational resources. For example, the first algorithm can be implemented using Apriori or Predictive Apriori algorithms, the second – using Simple KMeans or EM algorithms.

6 SOME ASPECTS OF THE MOBILE NAVIGATORS DESIGN AND IMPLEMENTATION

Transport infrastructure of the modern city is much diversified. It includes private and public land-based transport (cars, buses, and trams), underground transport (tram and metro), railway, air and also water transport (ferry, cutter, water bus). As known, many cities are located on the islands and have a well-developed water transport. Water transport also should be safe and comfortable for citizens.

Accordingly, it is necessary to develop intelligent navigators also taking into account the needs of such regions. Usage of mobile intelligent navigation system is an effective solution for providing safe navigation, as well as providing information assistance in vessels' control. The intelligent navigation systems use radar, automatic identification system to keep information about vessels and their location. In addition, the mobile navigation system uses decision support tools which provide:

- acquisition and processing of integrated information about the circumstances of the cruising from different data sources;
- providing contextual information and reference data upon the user's request or under the occurrence of certain situations;
- mapping of the nearest vessels' position equipped with mobile navigation system on the nautical maps;
- solving special navigators and service tasks.

The developed mobile intelligent navigation system is indented for mobile devices such as smartphones, laptops, tablets with the Android 4.0 operating system. To update the information model and download the function modules an access to the Internet is required.

The generalized structure of the mobile intelligent navigation system (MINS) is shown on Fig. 3. System includes the following elements:

- Cloud Services Platform – network of distributed servers that provides the set of the necessary services;
- Client integration platform – application, that provides the necessary interfaces for connecting modules that implement the required features and that are installed on the mobile device.
- Function Modules Repository – storage of functional modules, providing the capability to extend the functionality of the client's integration platform.
- By means of these structure components MINS supports a wide range of functions and services, that include:
- displaying the nautical chart showing the location of the users own ship and other maneuvering vessels;
- option of manual and automatic (AIS, radar) targets' drawing, target movement calculation;
- ship's routing between predetermined ports/points, at that, accounting for the navigational area features and the desired duration of movement/recreation;
- display and registration of the weather data at a point/on the route, broadcast of the storm warnings;
- calculation of the maneuvers aimed at the storm escape; speed and course calculations on the storm sailing;
- solving the tasks of maneuvering; positions' gaining and targets' passing;
- warning about dangerous maneuvers; entry into the closed/restricted areas, areas with special conditions for navigation, shallow water areas;
- advance warning of maneuvers on the route (time and turning point, speed changes, etc.);
- retrieve data about the locations of other vessels equipped with MINS.

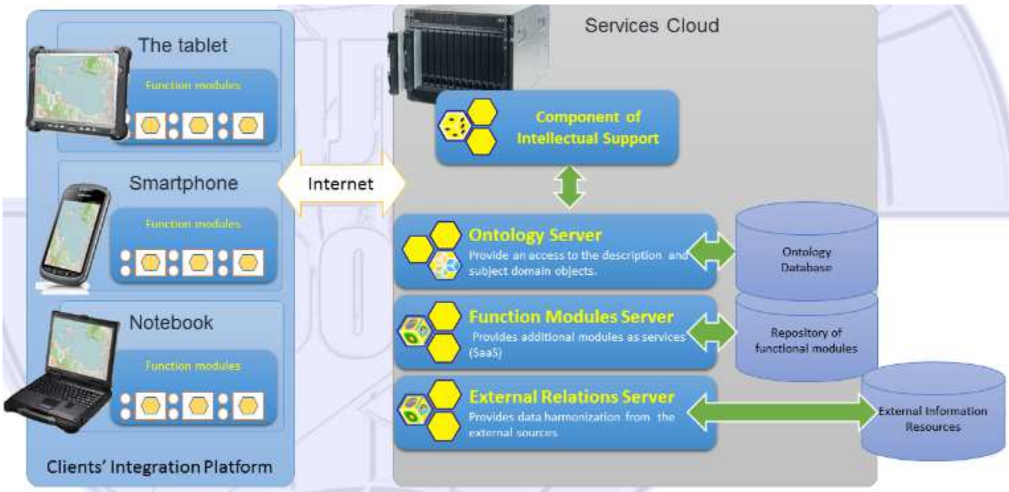

Fig. 3: General structure of the mobile intelligent navigation system for vessels.

Fig. 4 shows a map on which the vessels' icons, it routes (blue line) and additional information are plotted. The data on the map are updated in real time. By clicking on the vessel's icon additional information about the vessels, such as vessel's location (latitude and longitude), their lengths, widths, speeds, courses and names can be obtained. Various colors are used for displaying various vessels' types: green color for cargo vessels, blue – for passenger vessels, orange – for high speed crafts, grey – for unspecified vessels.

It is necessary to notice that the system is rather simple and easy in use; the user needs no additional knowledge and skills to start working with the system. Furthermore, the system can work in autonomous mode that allows using the system without a permanent connection with the server during a certain period of time.

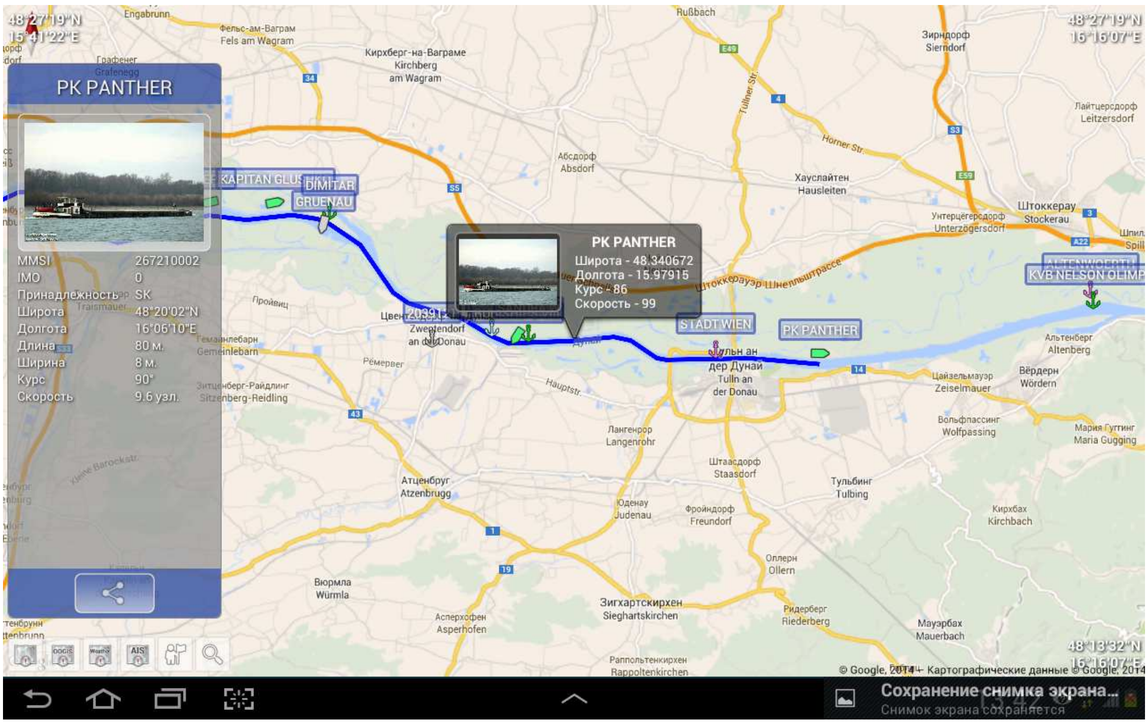

Fig. 4: Vessels' routes.

7 CONCLUSIONS

Intelligent navigation plays an important role in everyday life and affects the fundamental science and technological solutions. The approach described in this paper proposes to develop and to implement the intelligent navigators using the intelligent GIS technologies. The considered approach demonstrates the fusion of different technologies: navigation, GIS, Intelligent GIS and data analysis.

In the future the mobile intelligent navigation system will be improved and developed for city transport infrastructure, including street roads network, offstreet transport network, the network of long-distance transport and other. Mobile Intelligent GIS for general purpose aviation, pedestrians, tourists and disabled people (Audio-navigation) are planned to be developed.

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reviewed paper

Smart Planning & Smart Cities

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1 ABSTRACT

In the light of a comprehensive social and technological change, spatial planning is confronted with major changes in its basic conditions. It is faced with an increasing ubiquity of spatial relevant information of which the potentials and risks need to be discussed in the use for planning purposes. Besides the increasing pervasion of sensors in everyday life and the use of mobile communication devices, the networking and communication possibilities will play a major role in the conception of a connected and "smart" city. In addition to the above mentioned aspects and social networking capabilities, it seems that committed citizens appear increasingly as active stakeholders for planning purposes via inductive processes.

Based on the mentioned technological possibilities, topics such as Smart Cities are increasingly being discussed in the public debate in recent times. It is unclear if the term "Smart City" is based more on a scientific foundation or on marketing ideas. And what can planners do, to make the city more smart and especially to make it a better place for people to live? This paper embraces an examination of the various technologies an methodological approaches in relation to planning-relevant information and knowledge creation. Besides the proclaimed potential of making a city more efficient, there will also be a critical consideration of the problems of having a city, where all urban data is connected.

2 THEORETICAL FRAMEWORK

The topic of Smart Cities is increasing in the public debate in the past years and will have its effects on the working field of spatial planners. Due to the importance of ICT in this context, the most relevant aspects for planners will be shown in this paper. From the sixties to the end of the nineties, the use of ICT by planners was mainly dominated by the use of CAD and GIS applications for analysis and design purposes from experts, with the emergence of the Internet, a significant change has taken place. We are now facing a world, which represents a networked environment - and of course cities. In order to understand the various concepts for Smart Cities, besides the important technological developments, also the relevant social aspects have to be taken in consideration.

2.1 Technological background

The technological developments provide new ways, how planners can use ICT in their everyday work life. This is mainly due to the development of the Internet as a network for communication and also as basis for the deployment of sensors in the human environment. Sensors to produce spatial relevant data are becoming smaller and cheaper and with the rise of mobile communication devices, there is a new multi-sensor-device including communication functionalities.

2.1.1 Ubiquitous computing and the city as sensor network

The more the development goes towards an environment interfused with sensors which are producing spatial relevant data, the vision of Ubiquitous Computing is becoming reality as it was predicted more than twenty years ago (Weiser, 1991). The concept has foreseen the evolution of electronical devices (smaller and more powerful computers and mobile phones) in the last two decades. Especially the network abilties of the Internet strengthen this trend and are alonggoing with the development of the Geoweb. The basic idea for this were developed in the nineties (Herring, 1994). It represents a web structure that organizes itself and which references spatial data over the Internet and makes available to everybody. In the Geoweb, the boundaries between sensors, computers, and mobile communication devices are increasingly disappearing and in addition to this, the ability to capture spatial data via spatial sensoring arises. These networked information systems are the first steps to a daily routine for the citizens, in which all entities are linked together in space and interact with each other. All of this produced and connected data will also provide the way for the Internet of Things (IoT). Furthermore, this spatial relevant data could be made available for the public almost in realtime, which will make it possible, to gain totally new insights about the functioning of a whole city. In order to make use of this huge amount of data, new methods have to be developed. One concept which is going to be considered as very important from the scientific and business perspective is Big Data, which will play a crucial role in the future as tool to the generate knowledge out of data.

2.1.2 Humans and mobile phone as sensors and data producers for the city

The term of Volunteered Geographic Information (VGI) was introduced in 2007 and described the citizens as potential sensors. Goodchild explained in this context, that the „network of human sensors has over 6 billion components, each an intelligent synthesizer and interpreter of local information. It is User-Generated-Content (UGC) with spatial reference. One can see VGI as an effective use of this network, enabled by Web 2.0 and the technology of broadband communication" (2007, p. 218). The rapid distribution of mobile communication devices strengthens this trend. It forms the basis for the Sensor Web made out of the described elements. Furthermore, people can act as implicit as well as explicit sensors in their environment and generate a variety of data that is relevant for spatial planning which will be gathered by deductive and inductive monitoring methods (Exner, Zeile, & Streich, 2011). Based on the increasing amount of user-generated data, the question regarding the representative nature of information will arise and has to be deliberated wisely.

2.2 Social aspects

As mentioned before, the technological development forms the basis for the citizens' ability, to produce more UGC. This goes along with the development from the Web 1.0 towards the Web 2.0 which also contains a strong social perspective. In particular, the developments outlined in the field of mobile communication devices and social networking opportunities on the Internet offer many opportunities for spatial planning. With this progress, more and more people are seeing the ability for engaging themselves in urban Bottom-Up-Planning processes (Streich, 2012) and crowdsourcing for spatial planning purposes is getting more and more important (Papadopoulou & Giaoutzi, 2014). Though these developments are not new - even before the development of Web 2.0, social networks played an important role for human existence. They have always formed the hub for the development of cities in earlier times and are the origin of the city and society. Whereas most of the Smart City Concepts of big companies are focussing on efficiency, the social aspects were underweighted. „Markets, temples and palaces created social networks organized for commerce, worship and government. Over time the interactions within these networks became more layered and complex. It turns out that sociability, not (just) efficiency, is the true killer app for cities" (Ratti & Townsend, 2011, p. 45). In addtion, to find smart solutions for making cities smarter, technological and social aspects together will play a crucial role which could be seen by the development of new smartphone-based apps. Important at this point are the network-like structures, which have a catalytic effect on Bottom-Up-approaches and promote the endogenous creation of innovative solutions in urban areas. The aspects of mobility and networking previously described enable citizens new opportunities and encourage creativity in problem solving through Bottom-Up activities.

3 SMART CITIES

The topic of Smart Cities is increasingly discussed in the public debate but there is no sharp definition from a scientific point of view. An embracing explanation is a city, in which „ICT is merged with traditional infrastructures, coordinated and integrated using new digital technologies. These technologies establish the functions of the city and also provide ways in which citizen groups, governments, businesses, and various of agencies who have an interest in generating more efficient and equitable systems can interact in augmenting their understanding of the city and also providing essential engagement in the design and planning process" (Batty et al., 2012, p. 492). Due to this, the Smart City topic found it's ways on the agendas of big corporations like IBM, Cisco Systems, Siemens, Accenture, Ferrovial and ABB. They are setting their sights on the urban market and are foreseeing a multi-billion dollar market (Ratti & Townsend, 2011, p. 45). It is considered as a big future business field in the ICT-sector for developing tools which could improve the competitiveness and the quality of life for the citizens because the deduction from this is: „smart cities are competitive cities" (Batty et al. 2012, p.512). However, „a Smart City is something more than 'just' a digital or an intelligent city, where the attention is mainly drawn on the ICT components, as enabling connection and exchange of data and information within an urban environment" (Murgante & Borruso, 2013, p. 630).

Fig. 1: Smart Cities & Smart Planning (Own Source, 2014)

As seen on the previous quote by Michael Batty, there is no real clear defintion of Smart Cities and what they should provide. These broad definitions show that the requirements and demands on Smart Cities are not finally defined and the different entities (Cities, Companies, Research institutions e.g.) connect the term of „Smart Cities“ with their own respective goals (Wolfram, 2012). Basically, there could be a distinction into two main types. There is an array of cities which is focussing primarily on the effiency of the urban body in the fields of ecology (less CO2 pollution, less energy consumption, lower emissions, better urban transport e.g.) and economy (competitive, attractive for talented citizens cities e.g.). The other approach has a social perspective, which focusses on the citizens to provide them a better quality of life and to engage them to be a part of the participatory networks of the knowledge society. There are various types of smart cities whereas some of them contain charactersitics of both types, but the next sections shows representatives of each group.

3.1 Top-Down Smart Cities

Top-Down Smart Cities were primarily run by city institutions, often in a close cooperation with ICT-companies or other research facilities. There is a straight concept behind it, which is often focussed on measurable parameters like CO2-efficiency for example. One of the most prominent representatives is Masdar City in the United Arab Emirates, whose goal is the realization of an ecological and sustainable city in the outskirts of Abu Dhabi by the middle of this decade. After it is completed the city should be CO2-neutral due to the nearly exclusive use of renewable energy (Masdar City, 2012). To ensure this, a special condensed architecture has been implemented with the concept from the British architect Norman Foster. In order to establish this city, a completely undeveloped area was planned in the plain desert. The newly founded Masdar Institute of Science and Technology aims to provide the scientific backbone for developing new technologies, which are used during the city-building process and could act as a marketing instrument to attract talented students from over the world.

On the basis of the close cooperation with ICT-companies during this city-building process from scratch, these cities tend to act as forerunner and marketing instrument for the companies themselves. One well known example in this context is the city of New Songdo City in South Korea. This project is located in the hinterland of the metropolis Seoul, close to the international airport Incheon. New Songo is supported extensively by the domestic Korean companies in the field of ICT as well as from Cisco Systems in particular, who want to apply their concepts for networked and intelligent cities in this big urban research laboratoy. Like in Masdar, the approach was to create a city from scratch on a piece of a man-made coastal area. The goal for the city is to gain a population of 65,000 citizens by 2015, under the light of the implementation of comprehensive sustainability and high urban quality of life (Hatzelhoffer, 2011). Similar to the example from the United Arab Emirates, the concept was to design the new structures strictly according to the principles of efficiency. Furthermore, the equipment of the public space with various sensors to provide the basis for control and optimization abilities was an additional goal to that. The concept of an urban area penetrated with various kinds of sensors is called U(biquitous)-City in South Korea (Jang & Suh, 2010). Though, both cities are showing the example of a completely new planned city, most of the cities world wide are already existing which makes it much more complicated to apply such complex and comprehensive concepts for urban areas. There are examples like Smart Santander in Spain but in order to exploit the full potential, a closer look to Bottom-Up-Planning-principles in the context of Smart Cities has to be done.

3.2 Bottom-Up Smart Cities

The knowledge society and social networks are the basis for the second concept of Smart Cites which are mainly driven by local inhabitants. Bottom-Up Smart Cities are trying increasingly to make use of the inductive and innovative potential of the population to achieve new creative solutions. It is important to see: „What do the people want?“ instead of „What do city councils and companies think is the best for them?“. In this case, citizens are the driving force to makes a city "smarter". Due to the developments of ICT and the corresponding connection possibilities via social networks, the citizens have the ability to act by their own without any kind of supervison. It will be clear, that „the ability for all citizens to communicate with each other and with agencies and groups that represent them, has provided a new sense of urgency and possibility to the idea that smart cities are based on smart communities whose citizens can play an active part in their operation and design” (Batty et al. 2012, p. 492).

The creative potential of the citizens is significant and has to be taken into account. This could be realized when interested citizens can access urban data sets and services and develop their own creative ideas via ICT infrastructure and networks. As example for this, app competitons like „NYC Big Apps“ (City of New York, 2011) could be considered, because for this call, the citizens were encouraged to develope own smartphone apps with innovative solutions for the city (parking spot finder, bikeways navigation system e.g.). In order to gain a wide support by the inhabitants, it is important to form the dialogue with citizens and other stakeholder groups as widely as possible. This enables the development of a common understanding of problems and risks for their city. The reason is that „the value and importance of a city can not be alone measured in their efficiency and sustainability, but rather in the degree of its sociability” (Ratti & Townsend, 2012, p. 65).

4 SMART PLANNING

The question is, if and how planners could make cities smarter and turn them into Smart Cities and if the changing urban circumstances will have its special effects of the profession of spatial planners. The technological and scientifical influences are undergoing an important development (Batty, 2013) and could be considered as the foundation for the mentioned social aspects like Web 2.0 for example. The influences of ICT infrastructures contain some problematic issues which have to be discussed.

4.1 Potentials and risks of ubiquitous ICT-infrastructures for cities

Planners will be at a crucial role to foster smart cities through smart planning approaches and have to be aware of their important role at the intersection of companies, urban authorities and the citizens. As it can be seen on the agendas of many companies and city councils, most of the Smart Cities concepts focus on energy efficiency issues in order to improve ecological (less pollution) or economical aspects (less energy costs). With this as a background, the idea of a Smart City as competitive city seems to be clear. Furthermore, due to the wide range of ICT competitors in this field, the cities could be considered as technical laboratories which can produce innovative solutions to improve the people’s lives. Such Smart City concepts could also be used for image campaigns to present the city as a good and innovative location for attracting new companies and talented people. However, there are two sides to consider.

If Smart Cities are heavily based on ICT-networks, there will also be problems occuring with this circumstance. A complex connected mobility network for example has to be very robust in terms of system errors as well as cyber attacks. The more the city turns into a computer - the more the city turns into a computer, with all of its advantages and disadvantages. Even a small software problem in the meshing digital infrastructures could lead to huge effects for the citizens like traffic jams or heavy accidents for example.

The more automation of urban routines is introduced, the higher the risk potential by external influences. It has to be considered where to draw the line for blind reliance from the algorithms and besides this, whoever controls data can control urban routines. And the more the outsourcing process of such services by city councils is going on, the more the power lies in the hand of ICT corporations. If a company has wide data access rights in urban security issues, the question will be: Who watches the watchmen?

In additon to that, there are also open legal questions regarding defective automation routines of urban processes. Furthermore, an increasing dependence on the ICT service providers has to be seen as potential area of conflict. The aspects outlined above demonstrate the need for both technical and ethical consideration. What is often considered a problem, is that „planners of intelligent cities (…) actually make these technologies invisible, and hence put them in command rather than in dialogue with users “ (Sassen, 2011). Besides the technological problems the issues of data privacy will arise in all different kinds of Smart Cities. Although Top-Down approaches for urban data gathering, such as Opportunistic Sensing, will produce useful data for the general public (like crowdsensing-based traffic measurements), there might also be a violation of the citizens' privacy (Exner, 2012). It has to be considered very wisely by a city, which of its sensitive data will be given into the hands of a foreign company for example. The revelations of Edward Snowden in 2013 just gave an insight into possible consequences.

4.2 Organisation of cities

The mentioned developments will have effects on all actors in the urban evironment and the question from a planners perspective will be how to work on an intersection between the various Bottom-Up and Top-Down-approaches in order to improve the urban living conditions for the people. It is a crucial point at which „mayors, architects, designers and technologists can play their most effective role in shaping truly smart cities – by marshalling and integrating the great engineering ressources of Top-Down approaches with the innovation of grassroot initiatives” (Ratti & Townsend, 2011, p. 48). Although urban institutions tend to be quite inflexible, it will be important for the coming decades, that, „just as the town was changed by information and communication technologies (...), institutions must adapt to a flexibility that significantly differs from existing organizations" (Batty et al., 2012, p. 512). In addition to this the Open Data movement has to be seen. It aims to provide public data free for everybody in order to foster Open Government, by giving more transparency and other beneficial developments for the general public. An important pioneer in terms of open geospatial data is the portal Data.gov.uk from the British government, which provides a wide range of spatial data. Over 3000 records with spatial planning relevance are available through this service (Geere, 2012). It was initiated by the British Cabinet and serves as a basis to discuss comprehensive municipal records, technical issues or the political line (Batty et al., 2010, p. 38). Another example is Vienna Open Data (Stadt Wien, 2013).

4.2.1 Urban Information & Knowledge Platforms as incubators for smart urban solutions

There is an adminstrative support for Smart City concepts with a growing number in the recent years. Two of the most prominent examples are Smart City Vienna (Stadt Wien, 2012) and Smart City Amsterdam (2013). These cities host a website in order to bring creative Smart City solutions together and of course use them as a marketing tool. But these concepts could be carried out further, because especially for the big ICT companies, the ideas are going towards something like an Urban Operating System, which will be developed and updated and could be applied to various kinds of cities, to create a significant margin by scale effects for them. An average computer user is very familiar with problematic issues of an OS (instabilities, possible market dominace by a company, viruses...), but there is another big problem. The city has to be seen rather as an organism than a machine (Geddes, 1915). Cities agencies won't be able to regulate everything Top-Down by rigid concepts and ICT-infrastructures. If they want to do so against the will of the citizens, it will lead to emotional debates about the democratic principles in the society. It can not be neglected, that a city has grown over a long time, so too drastic changes to turn a city into a Smart City could be very problematic. Cities, as well Smart Cities, „always remain a construction site, a chaotic urban laboratory for innovation” (Ratti & Townsend, 2011, p. 68). Hence, the best way is to have an infrastructure that is not only flexible for adaptation, but also could act as an ecosystem for various kinds of urban software.

These software platforms could act as a „thriving bazaar of government services, offering basic building blocks that others can use" and „many of these new services are application programming interfaces (APls) -

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mini-platforms that form the basis of another digital product, allowing for endless permutations" (The Economist, 2014, p. 15). In the digital world, big corporations and big governments may play similar roles, as „platform managers and curators of ecosystems. Cities or even governments may offer services to other cities and countries in fields such as online identity and regulatory oversight" (The Economist, 2014, p. 15). There has to be a specific degree of standartisation in the urban ICT networks. These have to be chosen so that they are not proprietary and prevent innovative Bottom-Up-solutions and equally open to city adminstrations, companies and citizens. The ethical aspects have to take in account that Smart City platforms are not non-transparent "Black boxes" planned in top-down manner by a small group of "specialists".

A common platform as a hub for urban information is the London Dashboard (Centre for Advanced Spatial Analysis, 2012). This website provides various urban data sets for its citizens in order to make use of them for various purposes. It collects not only data by its own, but combines existing data streams (traffic cameras, wheather and even for example data from social communities). Another promising approach here is the LIVE Singapore! Project (MIT Senseable City Lab, 2011), where an Internet-based platform was designed, in order to "capture the recorded variety of communication tools and microcontrollers and sensors real-time data and thus the pulse of a city from moment to moment" (Ratti & Townsend, 2011, p. 65). There will be a basic infrastructure in the sense of an open platform which aims to adminstration, companies and citizens understanding it as a "tool box" in order to be actively engaged. This project is not officially referred to as a Smart City, but it has characteristic aspects to make a wide variety of urban data streams in real time available to interested users. For this case, it is important, that such a platform is easily accessible, in terms of its data and also in terms of the usability, that it isn't too hard for an average citizen to use it. Furthermore, its structure has to be modular due to the changes which often occur and must therefore be very flexible. Based on this, a variety of Top-Down- and Bottom-Up-processes could be designed by companies and citizens for example. Thus, the platform provides the ability for companies or individuals to realize their own creative solutions that make the city truly "intelligent". It is also important, not to design an isolated application with these platforms. Some problems might have been processed similarly somewhere else on the world an there is no need to invent the same innovative schoolbus-information app for the second time. An intelligent linkage to existing solutions for existing problems can be very beneficial and be seen with Citymart - a marked place for innovative Smart City solutions (Citymart, 2013).

4.2.2 Social aspects in smart urban areas

As it was stated before, besides the technological infrastructure it should not only be smart infrastructures, but also smart citizens be that shape the cities, because „rather than focusing only on the structure and control of networks, governments, technology companies and city planners should pursue more bottom-up approaches, to make cities smarter" (Ratti & Townsend, 2011, p. 44). Here, the participation of citizens (in this case the communication and collaboration between urban actors) and endogenous innovation potential of the city (innovative citizens, etc. social networks, education systems, triple helix, creative environments e.g.) play a crucial role. In smart cities also the manifestation of the concept of equality of sustainable cities is seen. This raises the question what makes a city really intelligent and how such an aspect can be measured.

Other important aspects are the ethical aspects of the ubiquitous information systems of the whole urban entity and its citizens. As mentioned before, questions about ownership and control of data have to be discussed. Especially the centralization of services in the hands of private companies could be complicated, and „centralization of smart-city infrastructure is risky, but decentralization doesn't always increase resilience“ (Townsend, 2013, p. 265). The slogan "Knowledge is power" will be definitely more relevant in the upcoming Smart City discussions. There is for example the danger of misuse by a company and as well for an authoritarian state. Issues like data privacy and protection have to come to the public debate. And a totally new question about which data is to sensitive to provide for the general public. The example of publishing crime mapping data shows the problems of potential self fulfilling propehcies as well as stigmatization of city quarters and the different handling in different countries (Wendt & Exner, 2013). Hence, there is the general question about the long term perspective and goal of the city development. Is it generally for effciency purposes from which big corporations could benefit or with smaller, tailored solutions from which every citizens can profit directly. If these things were not taken into account, people would not be satisfied with their urban living conditions and probably move away. The city of Masdar for example is facing the problem of attracting new people, because the majority of the people could not be convinced by this special Smart City concept (Sennet, 2012).

4.2.3 Cities as complex entities

Cities always have been and always will be complex and chaotic entities. Every city has its own history, geography, inhabitants and especially also the local political circumstances. There are recurring patterns in every urban area, which forms the basis together with new ICT technologies for a completely new scientifical view of the city and the development of varius urban simulation models as it is described by Michael Batty. The local particularities have to be considered every time. In the light of increasing automation processes for the control of urban processes, the ideas of Patrick Geddes of considering the city as an organism rather than a machine have to be brought to mind. The best potenials have to be extracted out of these ideas and so „Geddes would no doubt approve of how today's smart-city builders are applying technology to urban challenges and seeking to develop a new, rigorous empirical science of cities. But he also understood the limits of science, and the need to view cities with eyes that see not only facts" (Townsend, 2013, p. 282). The technological potential in ICT seems to be unlimited, built was the same case during the times of newly planned cities like Brasilia for instance. The accordance to these times is remarkable and „the description of the serene and masterful guidance of the city-as-machine-for-living we hear from Siemens or Cisco or IBM are strikingly reminiscent of Le Corbusier" (Greenfield, 2013). As well as the limitations for technological driven concepts, there will also be some for the Bottom-Up-movement. „The grass roots may be a source of new ideas, but what they need is someone who can design and deliver a robust infrastructure that is centrally planned to be safe, efficient, and reliable at a reasonable cost" (Townsend, 2013, p. 154). This means, there has to be some kind of incubator for innovative citizens solutions to make the city smarter. Furthermore, the smartness on a regional level is getting important as well (Roth, Kaivo-Oja, & Hirschmann, 2013) and the possible interaction with the urban area has to be observed.

Urban Information and Knowledge platforms could act as such, being a hub for the citizens, companies and authorties to inform themselves and to interact. The dashboard-idea is also very helpful, because it brings the chance for integrating existing data feeds in order to prevent from multiple and costly data gathering approaches. In addition, the concept of learning platforms with the Triple-Helix-Perspective is regarded as an important aspect in making cities smarter (Allwinkle & Cruickshank, 2011). In order to foster innovation, the Living Lab Concept could be considered as methodology, which is „a model for organising specific innovation programmes and innovation projects and conducting innovation experiments. " (Schaffers et al., 2011, p. 444). All these social, technological and administrative requirments ask for skilled people at the interface position, which could be the spatial planners of the future.

5 CONCLUSION

The question of how a city becomes a Smart City and how "Smart" planning may be, is difficult to answer, but a Smart City should first of all improve the living quality for the citizens and Smart Planning describes the necessary efforts which have to be done in the technological, social and adminstrative fields. There won't be any blueprint solutions, but the new developments in ICT provide a wide range of applications for cities. This opens the field for new scientific insights in relation to the functioning of the urban organism and besides searching for the most efficient way of functioning of the infrastructure, but also the necessary attempt to consider the city as a „laboratory for innovation" (Batty et al. 2012, p. 481).

Most of the prominent Smart Cities have concepts, wich focus mostly on optimization and efficiency, organized in a top-down manner and regarding the urban area simply as machine, which is controllable and adjustable. However, an intensive integration of the citizens for making cities smarter has to be done. This can be via participation through urban planning projects as well as by developing own creative Smart City apps, for example. There will be the challenge in the cities of the future to find the best way to combine the best from Top-Down- and Bottom-Up-approaches and convince the citizens of the fact, that they can be an active part of the city while contributing innovative solutions for the everyday life. The best way to create the best conditions for that is to have a common plattform to factor in the citizens. Though, whenever the inhabitants of a city will come in contact with such platforms, this "urban software" has to be „simple, modular, and open source" (Townsend, 2013, p. 286). The Smart Cities are not just built on smart infrastructures and smart ICT, but also the administrative authorties and citizens have to be smart and as an

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intermediary, also planners have to be smart (Exner, 2012). The new challenges embrace almost the entire field of planning activities, such as infrastructure planning, planning discussion, urban design, and participatory processes and are underlining the nature of an interdiciplinary working field. For its role acting as a mediator of various interests, he also has to be specially skilled with comptences in the technological, social and adminstrative fields. Hence, smart planners „have to be at least as familiar with the work of Jane Jacobs, Jan Gehl and Holly Whyte as they are with that of Vint Cerf or Eric Raymond" (Greenfield, 2011).

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Smarter Cities – ein Modell lebenswerter Städte

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1 ABSTRACT

Städte der Zukunft haben komplexe und systemische Herausforderungen wie Bevölkerungswachstum, Umweltprobleme, die Gewährleistung von flächendeckender Ver- und Entsorgung bei einer Verknappung der Ressourcen sowie gesellschaftliche Veränderungsprozesse zu bewältigen. Häufig fällt in diesem Zusammenhang die Forderung nach einer Entwicklung zu „Smarter Cities". Doch was steckt hinter dem Begriff „Smart City", der mittlerweile zu einem „Trendwort" geworden ist? Was zeichnet eine „Smart City" aus? Und vor allem: Wie und in welchen Bereichen müssen sich Städte weiterentwickeln, damit sie zu „smarter" Cities werden können?

Aufgrund der vielfältigen Herausforderungen und der Komplexität des Systems Stadt, ist es erforderlich, Prozesse in Smart Cities aufeinander abzustimmen und zu koordinieren. Neben der Infrastrukturversorgung (Energie, Verkehr, Ver- und Entsorgung, Informations- und Kommunikationstechnologien, etc.) besteht auch in den Bereichen Lebensqualität und Umwelt, Wirtschaft und Forschung sowie Verwaltung Abstimmungsbedarf. Oft wird Smart City aufgrund der Technologieorientierung der Gesellschaft mit dem Einsatz neuer Technologien in den Bereichen Energie, Mobilität und Informations- und Kommunikationstechnologien (ICT) gleichgesetzt. In diesem Kontext werden vielfach (technische) Systeme entwickelt, die weder angenommen werden noch den gewünschten Erfolg erzielen können. Daher ist es wichtig, nicht nur technologische Voraussetzungen für Smart Cities zu schaffen, sondern auch regulatorische sowie gesellschaftliche und soziale Fragestellungen mit einzubinden. Diese Ausweitung des Entwicklungsansatzes folgt darüber hinaus dem Prinzip der Nachhaltigkeit.

Ausgehend von einer Begriffsdefinition bzw. -abgrenzung der Smart City entwickelt diese Arbeit ein Modell, das den Prozess der Weiterentwicklung einer Stadt zu einer Smart City skizziert. Das „Smarter City Modell" resultiert aus einem komplexen Zugang, der Wechselwirkungen und Einflüsse von Akteuren und deren Handlungsfeldern in einem städtischen Entwicklungsprozess beleuchtet. Durch iterative Prozesse wurden Experteninterviews, Fallbeispiele und einschlägige Literatur in die Modellentwicklung integriert. Neben diesen Faktoren spielen auch technische, gesellschaftliche und regulatorische Voraussetzungen und ihre Wechselwirkungen eine zentrale Rolle. Das resultierende Wissen führt zu einer integrativen Formulierung von Herausforderungen, Neuabgrenzung von Handlungsfeldern sowie zur Definition von Voraussetzungen für Smart Cities.

2 SMART CITY – WAS VERBIRGT SICH HINTER DEM SCHLAGWORT

Der Begriff der „Smart City" ist zu einem Trendwort geworden. Jede Stadt möchte intelligent, lebenswert und modern sein bzw. sich auf diese Weise vermarkten. Dementsprechend sind unzählige Projekte initiiert worden, die sich mit städtischer Nachhaltigkeit beschäftigten und Städte auf die eine oder andere Art in Smart Cities verwandeln wollen, besonders wenn neue Informations- und Kommunikationstechnologien oder nachhaltige Lösungen im Energiebereich umgesetzt werden. In diesem Zusammenhang den Begriff „Smart City" zu verwenden ist keinesfalls falsch, eine Smart City sollte jedoch einige weitere Aspekte beinhalten und die Definition somit weiter gefasst werden. In der Literatur hat sich mittlerweile eine Definition von „Smart City" etabliert; diese Definition stammt von Caragliu et al. (2009), die in ihrem Artikel „Smart Cities in Europe" eine Smart City wie folgt definieren: „We believe a city to be smart when investment in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance" (Caragliu et al. 2009, S.6).

Dabei beziehen Caragliu et al. (2009) sich auf die oft zitierten „Charakteristika" von Smart Cities von Giffinger et al. (2007). Giffinger et al. (2007, S.10-12) definieren folgende sechs Charakteristika bzw. Handlungsfelder zur Beschreibung von Smart Cities:

- Smart Economy (Konkurrenzfähigkeit)

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- Smart People (Sozial- und Humankapital)
- Smart Governance (Partizipation)
- Smart Mobility (Transport und Informations- und Kommunikationstechnologien)
- Smart Environment (natürliche Ressourcen)
- Smart Living (Lebensqualität)

Eine weitere Definition für Smart Cities findet sich bei Saringer-Bory et al. (2011, S.11-13), die eine Smart City als eine „zukunftsfähige städtische postfossile Gesellschaft" bezeichnen und ihr die Attribute intelligent, integrativ, vernetzt und systemübergreifend, effizient und effektiver zuschreiben.

Jaekel & Bronnert (2013, S.13) beziehen sich auf den Smart-City-Ansatz von Caragliu et. al. (2009) und streichen den Aspekt der Partizipationsmöglichkeiten besonders heraus, indem sie die deutsche Version der Definition durch „(…) in Form aktiver, konstruktiver Gestaltungsmöglichkeiten mit und durch den Bürger" erweitern. Smart-City-Initiativen können sich ihrer Meinung nach nur dann etablieren, wenn die Stadtbevölkerung aktiv miteingebunden wird (Jaekel & Bronnert, 2013) und die Stadtbewohnerinnen und Stadtbewohner zu „Smart Citizens" werden (Mandl & Schaner, 2012).

3 SMART-CITY-MODELLE

Im Diskurs um die Modellierung von Smart Cities werden einerseits Konzepte für rechnerbasierte, integrative Planungswerkzeuge und andererseits Frameworks bzw. Modelle zur Beschreibung des Smart City (Entwicklungs-)Prozesses vorgestellt. Beide Arten von Modellen fassen die Definition von Smart City relativ weit, d.h. Annahmen, dass in Smart Cities lediglich moderne Informations- und Kommunikationstechnologien in den Bereichen Energie und Mobilität zu Einsatz kommen, sind überholt.

3.1 Modelle für integrative Planungswerkzeuge

Die rechnerbasierten Informationsmodelle für die integrative Stadtplanung bzw. die daraus entstehenden Anwendungen sollen es ermöglichen, urbane Systeme (in Echtzeit) aus verschiedenen Perspektiven abzubilden, zu optimieren und zu simulieren. Dabei wird vor allem auf die Stadtplanung und Stadtsteuerung mithilfe von (Echtzeit-)Daten abgezielt. Die Berechnung von unterschiedlichen Szenarien und die Untersuchung potenzieller Auswirkungen verschiedener Maßnahmen (z. B. Stadtumbau, Stadterweiterung, Verkehrsmodellierung, etc.) auf das urbane System inklusive dessen Umwelt und sozio-ökonomischen Gegebenheiten werden damit dargestellt und abgeschätzt (vgl. Hamilton et al. 2005, Saringer-Bory et al. 2011, Schaner 2012, Mandl 2013). Ein Beispiel dafür ist das Urban Operation System (UOSTM) von Living PlanIT. Es besteht aus vier Ebenen, die aufeinander aufbauen bzw. zwischen denen Wechselwirkungen bestehen. Die erste Ebene (Key Challenges) beschreibt die Hauptherausforderungen der Stadt, in der nächsten Ebene (People and Processes) wird die Interaktion zwischen den Stadtbewohnerinnen Stadtbewohnern untereinander bzw. der Bewohnerinnen und Bewohner mit der Stadt analysiert, die über technische Anwendungen verbessert werden soll. Der dritte Layer (Application Capabilities) enthält die Verarbeitung sowie das Generieren von Daten und der vierte Layer die dahinter stehenden Technologien wie beispielsweise Client/Server-Plattformen, Netzwerke, Hardware und Sensorik (Living PlanIT 2010). Vergleichbare rechnerbasierte Ansätze werden auch von IBM (Intelligent Operations Center for Smarter Cities), Siemens (City Cockpit) oder dem Massachusetts Institute of Technology (LIVE Singapore!) angedacht (Mandl 2013).

3.2 Systemische Smart-City-Modelle

Vereinzelt werden auch Smart-City-Modelle bzw. Frameworks vorgestellt, die einem Systemmodell entsprechen. Diese sind zum Teil sehr generalisierend, wie etwa das „Smart City Wheel" von Cohen (2012), in dem lediglich die „erstrebenswerten" Ziele bzw. Handlungsfelder von Smart Cities – inklusive diverser Indikatoren, um diese zu erreichen – in einem Kreis dargestellt sind. Im Vergleich dazu stellt das „Integrative Framework" von Chourabi et al. (2012) die Wechselwirkungen und Prioritäten wichtiger Smart City Faktoren dar. Andere systemische Modelle beschäftigen sich nur mit Teilbereichen von Smart Cities wie beispielsweise das „Smart City House", ein Modell für ICT (Informations- und Kommunikationstechnologien) in Smart Cities (Ferro et al. 2013) oder ein Smart-City-Modell im wirtschaftlichen Bereich für das Erbringen von Dienstleistungen (BIS 2013). Nachfolgend werden exemplarisch die Modelle von Chourabi et al. (2012) und von Ferro et al. (2013) kurz vorgestellt.

Chourabi et al. (2012) identifizieren für ihr Modell acht wichtige Faktoren (vgl. Abbildung 1), die sie in einem integrativen Rahmen inklusive der Wechselwirkungen und gegenseitigen Abhängigkeiten dargestellen. Die Faktoren Technologie, Organisation/Management und Politik werden als grundlegend und außerordentlich einflussreich für den Smart City Prozess beschrieben. Besondere Bedeutung kommt dabei dem Technologie-Faktor zu, der als „meta-factor“ (Chourabi et al. 2012) bezeichnet wird, da zahlreiche Bereiche und Anwendungen in Smart Cities von neuen Technologien profitieren bzw. nachhaltig beeinflusst werden.

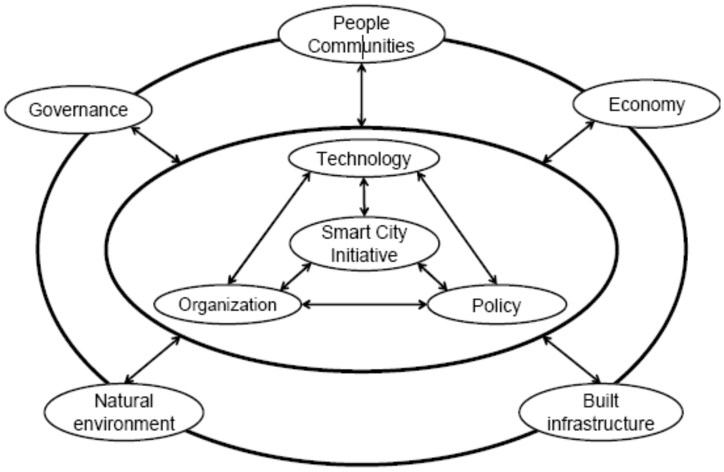

Abbildung 1: Smart City Initiatives Framework. Quelle: Chourabi et al. 2012, S.2294

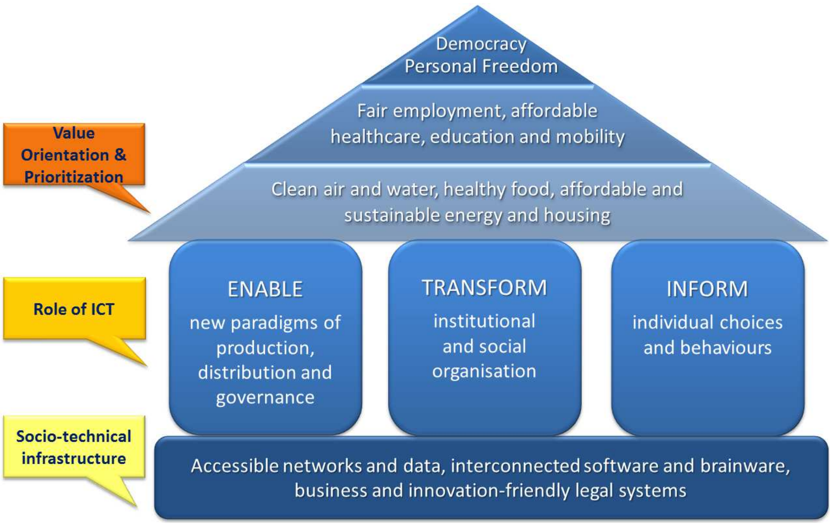

Abbildung 2: The Smart City House Quelle: Ferro et al. 2013, S.6

Das “Smart City House“ von Ferro et al. (2013) beschreibt mithilfe von drei Ebenen die Bedeutung der ICT für Smart Cities (vgl. Abbildung 2). Das Fundament und damit die Grundvoraussetzung für ICT in Smart Cities ist demnach die sozio-technologische Infrastruktur; dazu zählen Netzwerke, Daten, Software und Brainware (Bevölkerung) ebenso wie ein wirtschafts- und innovationsfreundliches Rechtssystem. Darauf fußen in der nächsten Ebene drei Haupteinflussbereiche von ICT für nachhaltigere und smarte Städte. Laut Ferro et al. (2013) machen ICT neue Paradigmen in den Bereichen Produktion, Verteilung und Steuerung beispielsweise von Energiesystemen möglich („=Enable“ in Abbildung 2). Die Art und Weise von täglichen Aktivitäten verändert sich („=Transform“ in Abbildung 2) beispielsweise durch das Trennen der Aktivität von einem fixen Ort (Telework, Telemedizin, etc.). Weiters soll der Einsatz von ICT in Smart Cities (z. B. durch Sozialen Medien) eine informierte Stadtgesellschaft mit stärkerem Bewusstsein für Nachhaltigkeitsbelange ermöglichen („=Inform“ in Abbildung 2). Im Dach des „Smart City House“ werden Werteorientierungen inklusive einer Prioritätenreihung vereint, die in einem Smart City Prozess nie aus den

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Augen verloren werden dürfen. Dazu zählen mit oberster Priorität eine saubere Umwelt, Nahrungsmittelsicherheit sowie bezahlbare Energie und leistbares Wohnen, gefolgt von fairen Arbeitsbedingungen, Gesundheitsversorgung, Bildung und Mobilität. Die Werte Demokratie und persönliche Freiheit bilden den Abschluss des Daches des „Smart City House".

4 DIE GENESE DES „SMARTER-CITY-MODELLS"

Das vorliegende „Smarter City Modell" entspricht einem Systemmodell, das in seiner Genese einerseits aus einem iterativen Prozess hervorgegangen ist, andererseits auch einen iterativen Prozess abbildet. Ausgehend von einer ausführlichen Literaturkritik, die die Bandbreite der theoretischen und methodischen Zugänge in das Modell integrierte und der Teilnahme an Smart City Foren der Stadt Wien, die den Praxisbezug in das Modell mit einfließen ließ, wurden die grundlegenden Schwerpunkte (Handlungsfelder, Voraussetzungen, Smart City Prozesse) für das Smarter City Modell vordefiniert.

Mit dem Ziel der Verfeinerung und Detaillierung dieser Schwerpunkte wurden 23 leitfadengestützte Experteninterviews mit Expertinnen und Experten und Experten aus den Bereichen Infrastruktur, Forschung und Entwicklung, Verkehrs- und Raumplanung, Stadt- und Umwelttechnologien, Industrie und Verwaltung sowie aus dem Bereich der Interessensvertretungen geführt. Rund zwei Drittel der Expertinnen und Experten und Experten wurden erst im Zuge der laufenden Interviews ausgewählt bzw. von anderen Expertinnen und Experten und Experten vorgeschlagen. Aufgrund der unterschiedlichen Schwerpunkte und Arbeitsbereiche der Expertinnen und Experten konnte einerseits das Wissen zu den klassischen Smart City relevanten Themenbereichen wie Informations- und Kommunikationstechnologien, intelligente Energieversorgung oder Verkehrssysteme vertieft werden. Andererseits wurde die Thematik der Smart Cities von sehr unterschiedlichen Ausgangspunkten beleuchtet; dabei wurden Aspekte angesprochen, die in anderen Smart-City-Modellierungen oft zu kurz kommen. Zudem konnten neue und interdisziplinäre Einblicke in die Thematik gewonnen werden. Hier sind die regulatorischen (vgl. 5.3.2) und insbesondere die gesellschaftlichen (vgl. 5.3.3) Voraussetzungen zu nennen, die sehr oft in der Modellierung von Smart Cities vernachlässigt werden.

5 EINE STADT WIRD SMART … DER WEG IST DAS ZIEL

Mithilfe des Smarter City Modells (vgl. Abbildung 3) werden die Wechselwirkungen von Herausforderungen, Handlungsfeldern und Voraussetzungen für Smart Cities in einem theoretischen Zugang aufgearbeitet. Ziel des Modells ist es, insbesondere das komplexe System einer Smart City und dessen Wirkungsgefüge darzustellen. Auf die Angabe dezidierter Schritte, die eine Stadt zur Smart City werden lassen, wird aus verschiedenen Gründen verzichtet, vornehmlich weil es DIE Smart City per se nicht geben kann. Jede Stadt muss sich ihren eigenen, individuellen Herausforderungen stellen, ihre wichtigsten Handlungsfelder definieren und die für sie bestmöglichen Voraussetzungen schaffen, um das Ziel lebenswerter bzw. „smarter" zu werden, erreichen zu können.

Die Darstellung des Smarter City Modells als Kreis visualisiert einen ständigen Erneuerungsprozess mit variierenden Herausforderungen und sich ändernden Rahmenbedingungen. Damit ist es systeminhärent, dass das komplexe System Stadt auf neue Anforderungen reagieren und sich der wandelnden (Um-)Welt anpassen kann/muss. Gleichzeitig symbolisiert der Kreis, dass es ein endgültiges Ziel der Smarten Stadt nicht gibt und dieses nach Meinung der Autorinnen auch nicht erreicht werden kann. Es handelt sich um einen stetigen Prozess, der als solches bereits das Ziel darstellt. Wurden Ziel(e) oder Teilziele erreicht, ist die Stadt bereits „smarter" bzw. nachhaltiger, lebenswerter und intelligenter geworden. Es werden sich allerdings neue Herausforderungen ergeben, für die es eine Lösung zu finden gilt. Daher werden die unterschiedlichen Schritte des Smarter City Modells nacheinander, aber auch parallel ablaufen, mit Sicherheit jedoch als permanenter Prozess.

5.1 Herausforderungen für Smart Cities: Was gibt es zu tun?

Der Ausgangspunkt des Modells sind die Key Challenges, die wesentlichen Herausforderungen der Stadt. Diese Herausforderungen können systemübergreifend, das heißt aus einer globalen Perspektive identifiziert werden, müssen jedoch im Detail von Stadt zu Stadt spezifisch angepasst werden. Prinzipiell fallen darunter Probleme wie ein rasches Bevölkerungswachstum ebenso wie eine Bevölkerungsabnahme, Umweltprobleme wie etwa Feinstaubbelastungen oder hohe CO_2-Emmission, ständig wachsender Flächenverbrauch pro

EinwohnerIn, Veränderungen im demographischen Gefüge (Überalterung) sowie soziale Probleme wie z. B. Segregation oder auch wirtschaftliche Schwierigkeiten (Mandl 2013). Bei der Analyse der Key Challenges gilt es darauf zu achten, dass es zahlreiche Wechselwirkungen und Abhängigkeiten der Herausforderungen untereinander gibt. Erschwerend kommt hinzu, dass sich die Herausforderungen bzw. deren Lösungsstrategien häufig widersprechen. Eine Stadt mit starkem Bevölkerungswachstum sieht sich der Herausforderung gegenüber, für die Bevölkerung neuen Wohnraum zu schaffen – dies geschieht, klassischerweise auf Kosten des Naturraums, indem Grünflächen verbaut werden. Seltener wird der smarte Weg gegangen, indem bestehender Wohnraum verdichtet oder gar Wohnraum in Stadtzentren revitalisiert wird. Unzählige solcher stark voneinander abhängigen bzw. sich widersprechenden Herausforderungen und Lösungsansätze gibt es in Städten. Eine Smart City zeichnet sich dadurch aus, dass diese Wechselwirkungen erkannt, Lösungen gefunden werden und die Probleme von unterschiedlichen Seiten mit einem ganzheitlichen Ansatz zu lösen versucht werden.

Abbildung 3: Smarter-City-Modell. Quelle: Mandl 2013, S.103

Nachdem eine Stadt in partizipativen und interaktiven Prozessen ihre Probleme erkannt und festgeschrieben hat, muss entschieden werden, ob ein Hauptproblem identifiziert werden kann, an dem vorrangig gearbeitet werden muss oder ob man sich mehrerer Probleme intensiver annehmen möchte. Bereits von Beginn an ist die Einbindung unterschiedlicher Akteure und Stakeholder (Politik, Verwaltung, Bevölkerung, Wirtschaft) wichtig, um einerseits Ziele und Visionen definieren sowie Abhängigkeiten rechtzeitig erkennen zu können und andererseits Verantwortliche im Umsetzungsprozess benennen zu können.

5.2 Handlungsfelder für Smart Cities: Was ist wo zu tun?

Neben den Definitionen von Smart Cities werden in der Literatur häufig Handlungsfelder beschrieben, in denen konkrete Lösungen für die smarte Stadt ansetzen können. Diese Handlungsfelder bauen aufeinander auf, können sich überschneiden und sind ähnlich den Herausforderungen sehr stark miteinander vernetzt. Am häufigsten werden die Charakteristika für Smart Cities von Giffinger et al. (2007) zitiert bzw. weiterentwickelt. Themenbereiche wie Energie, Umwelt, Mobilität, Wirtschaft, Kommunikation, Gesundheit, Verwaltung, Sicherheit, Infrastruktur und Versorgung, Bevölkerung, Bildung, Lebensqualität, etc. werden immer wieder zu den wichtigsten Handlungsfeldern für Smart Cities gezählt (Schaffers et al. 2009, S.435; Acatec 2011, S.13-15; Saringer-Bory et al. 2011, S.9-10).

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Abbildung 4: Smart-City-Handlungsfelder. Quelle: Mandl 2013, S.34

Darüber hinaus wurde von den Expertinnen und Experten besonders unterstrichen, dass Smart Cities mehr sein müssen als Städte mit weitreichendem Einsatz von modernen Technologien. In diesem Zusammenhang wurden Smart City Konzepte bzw. Smart City Handlungsfelder oft als zu technologielastig beschrieben. Auf die Bereiche Lebensqualität, Bildung, Gesundheit sowie Partizipation und Integration (vgl. Abbildung 4) muss daher bei der Definition von Entwicklungskonzepten für Smart Cities ein besonderes Augenmerk gelegt werden. Nachdem mit Hilfe des Smarter City Modells (vgl. Abbildung 3) die Hauptprobleme einer Stadt identifiziert wurden, muss definiert werden, in welchen Bereichen vordringlicher Handlungsbedarf besteht und welche Priorität diese Adaptionen haben. Hierbei werden Parallelen zum Konzept der strategischen Planung sichtbar. In der strategischen Planung werden integrierte Entwicklungskonzepte und strategische Leitbilder erstellt, die in einem ständigen Lernprozess bzw. „Wechselspiel" (Kuder 2001, Heintel 2005, Kühn 2009 (weiter-)entwickelt, modifiziert und realisiert werden – ähnlich dem Smarter City Modell, das gleichermaßen einen iterativen Prozess darstellt. Durch diese „Gleichzeitigkeit von Leitbildprozessen und Projekten" (Fassbinder 1993) soll bei der strategischen Planung sowohl das Erstellen von Leitbildern ohne deren Umsetzung als auch das Durchführen von Projekten ohne Beachtung deren Wechselwirkungen im Gesamtsystem (Stadt) vermieden werden (Fassbinder 1993, Kühn 2008). Auch dieser Zugang der Vernetzung spiegelt sich im Smarter City Modell wider.

Veränderungen in einem einzelnen Bereich bzw. Handlungsfeld der Stadt werden jedoch nicht ausreichen, um die komplexen Herausforderungen lebenswerter Städte der Zukunft bewältigen zu können. So müssen meist alle fünf Handlungsfelder und von Wechselwirkungen und Abhängigkeiten in Betracht gezogen werden, um richtungsweisende Innovationen und nachhaltige Entwicklungen initiieren zu können. Wiederum ist es unumgänglich, dass auf die besonderen Bedürfnisse und individuellen (Start-)

Voraussetzungen der Stadt Rücksicht genommen wird, um die richtigen Entwicklungskonzepte und Leitbilder erstellen zu können, die eine Entwicklung in Richtung Smarter City ermöglichen. In dieser Phase des Smarter City Prozesses muss daher in einem iterativen Prozess immer wieder die Rückkoppelung zu den Problemen und Herausforderungen bzw. Zielen erfolgen. Zudem wird es dabei immer wieder zur Revision oder zur Definition neuer Herausforderungen und Probleme kommen, die zukünftig mit bedacht werden müssen, da es in einer Stadt häufig widersprüchliche Herausforderungen gibt.

5.3 Voraussetzungen für Smart Cities: Was braucht es für das Tun?

Nachdem die Herausforderungen benannt und erste Leitbilder und Entwicklungskonzepte in den Haupthandlungsfeldern angedacht sind, müssen einerseits bestehende Rahmenbedingungen beachtet und andererseits oft neue Voraussetzungen geschaffen werden. Darunter fallen neben den technischen Voraussetzungen auch neue Regulative oder auch gesellschaftliche Prozesse. Diese unterschiedlichen Teilbereiche der Voraussetzungen für Smart Cities sind nicht klar zu trennen, vielmehr bedingen sie einander und bauen aufeinander auf.

5.3.1 Technische Voraussetzungen

Zu den technischen Voraussetzungen für Smart Cities zählen vor allem moderne Informations- und Kommunikationstechnologien (ICT), intelligente Versorgungs- und Sensornetze sowie zuverlässige Datengrundlagen für diverse technologische Anwendungen. Der Vernetzung von Informationen und Technologien sowie der Verarbeitung von Daten mit den Zielen der Visualisierung, Simulation und der Problemerkennung im komplexen zusammenhängenden System Stadt kommt dabei eine besondere Bedeutung zu (Mandl & Schaner 2012).

Die Breitbandtechnologie zählt zu einer der Hauptvoraussetzungen für alle ICT Anwendungen in Smart Cities (Acatec 2011). Erst durch diese werden Anwendungen wie Location Based Services, mobile Datenverarbeitung, allgegenwärtige und kontextsensitive Computertechnologien sowie moderne Internetpartizipation ermöglicht. Die Anwendungen der ICT für Smart Cities reichen von einfachen Smartphone-Applikationen wie etwa multimodalen Routenplanern oder Nutzerinformationen zum persönlichen ökologischen Fußabdruck, über Katastrophenmanagement und e-Government bis hin zu strategisch integrativen Stadtinformationsmodellen, die das gesamte komplexe System einer Stadt abbilden, simulieren und optimieren können.

Für eine Smart City ist zudem die Kombination und Integration von bereits bestehenden Systemen notwendig (Correia & Wünstel 2011). Systemintegration bedeutet einerseits das Integrieren von allen städtischen Infrastrukturen mittel ICT (Acatec 2011), andererseits eine stärkere Integration bzw. Zusammenarbeit und Kooperation der Städte auf regionaler, nationaler und internationaler Ebene (Correia & Wünstel 2011). Konkret ist Systemintegration durch den steigenden Stromverbrauch vor allem im Bereich der Energieversorgung, -erzeugung und -speicherung sowie bei intelligenten und multimodalen Verkehrssystemen erforderlich. Um die Effizienz der Systeme zu erhöhen und um sie nachhaltiger zu gestalten, bedarf es einer Integration der technischen Systeme sowie einer über die Stadtgrenzen hinausgehenden Zusammenarbeit mit dem Umland (stadtgrenzenübergreifender, multimodaler Verkehr, erneuerbare Energie, etc.) oder mit Partnerstädten (Austausch von Know-How, Best Practice, etc.).

Da die Anwendungen und Dienste einer Smart City sehr datenintensiv sind, ist eine Datenbasis notwendig, auf die unterschiedliche Systeme zugreifen, Daten speichern und austauschen können. Ein Lösungsansatz dafür ist die Vision einer City Data Cloud, die Smart City Anwendungen einen vertrauenswürdigen Zugriff auf Daten zur gemeinsamen Gestaltung der städtischen Prozesse und Abläufe bieten soll (Schieferdecker et al. 2010). Da diese Datenbasis sowohl städtische bzw. öffentliche sowie nutzergenerierte und gewerbliche Daten enthalten soll, müssen hier neben der technischen Umsetzbarkeit vor allem regulatorische Aspekte sowie Aspekte des Datenschutzes berücksichtigt werden.

5.3.2 Regulatorische Voraussetzungen

Die regulatorischen Voraussetzungen für Smart Cities werden sehr breit gefasst. In erster Linie zählen dazu natürlich das Schaffen von Regelungen, Normen und Gesetzen z. B. zur Normierung und Standardisierung von ICT-Anwendungen oder zur Regulierung des Datenschutzes und der Datensicherheit (Acatec 2011). Genauso wichtig sind jedoch auch klare Definitionen von Leitbildern, Entwicklungskonzepten und Zielvorgaben seitens der Stadt, um eine integrative und nachhaltige Entwicklung in Richtung einer Smart City zu ermöglichen. Um Wechselwirkungen und Synergieeffekte von Raum-, Verkehrs- und Energieplanung nutzen zu können, ist eine übergreifende und kombinierte Planung in den häufig getrennt betrachteten Bereichen nötig. Des Weitern haben die Expertinnen und Experten auf die Bedeutung von ressort- und stadtgrenzenübergreifender Zusammenarbeit in der Verwaltung sowie auf die Entwicklung neuer Governance-Strukturen als bedeutenderegulatorische Voraussetzung für Smart Cities hingewiesen. Ziel hierbei ist das Abbauen von unnötigen Bürokratien, um eine ressortübergreifenden Zusammenarbeit einfacher schneller und effektiver abwickeln zu können, sowie die Schaffung von Rahmenbedingungen zur Verbesserung der Partizipation der Stadtbevölkerung. Damit eine Smart City auch wirtschaftlich erfolgreich sein kann, ist es notwendig, Managementstrukturen zu verändern und neue Businessfelder und Geschäftsmodelle zu definieren, besonders wenn es dabei um den Einsatz innovativer und neuer Technologien geht, insbesondere wegen der hohen Investitionskosten.

5.3.3 Gesellschaftliche Voraussetzungen

Smart Cities setzen natürlich auch oder insbesondere gesellschaftliche Veränderungen voraus. Gesellschaft und Smart City sind untrennbar miteinander verbunden. Während beispielsweise der Einsatz neuer Technologien die Gesellschaft verändert, braucht es auch ein Umdenken von Seiten der Stadtbevölkerung (z. B. Offenheit gegenüber neuen Technologien und eine engagierte Bürgerinnen- und Bürgerschaft) damit eine Stadt zur Smart City werden kann. In diesen Zusammenhang werden vermehrt Smart People (Giffinger et al. 2007) bzw. Smart Citizens (Mandl & Schaner 2012) gefordert. Mandl & Schaner (2012, S.3) definieren Smart Citizen als „intelligente und informierter Bürgerinnen und Bürger, die bereit sind in einer Kultur der Beteiligung und Partizipation, (ökologische) Verantwortung zu übernehmen und die Stadt nach ihren Bedürfnissen nachhaltig zu gestalten". Um dem Ideal eines Smart Citizen nahezukommen, müssen zwei Hauptvoraussetzungen erfüllt sein: Diese sind einerseits Information, Bildung und Bewusstseinsbildung und andererseits Partizipation und aktive Einbindung der Bevölkerung bei der Entwicklung von Maßnahmen (Bottom-up-Strategie), da es nur gut gebildeten und informierten Bürgerinnen und Bürgern möglich ist, sich konstruktiv in Smart City Prozesse einzubringen. In diesen Zusammenhang ist jedoch besonders auf die unterschiedlichen Lebenswelten, Werthaltungen, sozio-ökonomischen Milieus und Bedürfnisse der Bevölkerung zu achten, um Menschen aus allen Gesellschaftsschichten gleichermaßen für Smart City Prozesse zu gewinnen.

5.4 Innovationen und Entwicklungen: Was bewirkt das Tun?

Mit dem Erkennen der Herausforderungen, dem Identifizieren der Handlungsfelder und dem Festlegen, konkreter formuliert, dem Schaffen der entsprechenden technologischen, regulatorischen und gesellschaftlichen Voraussetzungen sind wesentliche Schritte im Prozess der nachhaltigen Entwicklung zu einer Smarter City gesetzt. Die Anknüpfungspunkte, Schnittstellen oder lapidar formuliert Schrauben, an denen Einfluss geübt, also „gedreht" werden kann, sind identifiziert. Bereits durch die Erkenntnis der Notwendigkeiten oder Bedarfe, die eine Entwicklung voraussetzen, wird eine Entwicklung in Gang gesetzt. Allerdings ist für eine (Weiter-) Entwicklung auch der Schritt der Implementierung und Umsetzung dieser Erkenntnisse erforderlich.

Im Zuge der Umsetzung werden Probleme einer Lösung zugeführt, Fragestellungen beantwortet und damit Herausforderungen bewältigt – im besten Fall unter der Prämisse der Nachhaltigkeit und im Sinne eines systemischen Ansatzes. Im Vergleich zu „herkömmlichen" Stadtentwicklungen sind dabei neue Ideen und Ansätze gefragt, kreative Zugänge und systemische Sichtweisen. Diese erfordern auch das Handeln auf einer Metaebene, um Vernetzungen und Auswirkungen sowie Rückkoppelungsprozesse im gesamten Modell zu erkennen und zu berücksichtigen. An diesem Punkt angelangt, wäre der Schritt zu einer Smarten City „eigentlich" gemacht.

Allerdings handelt es sich – wie bereits betont – um einen iterativen Vorgang und damit ist man am Ende der ersten Umsetzungs- und Implementierungsphase wieder am Beginn angelangt. Mit anderen Worten: zurück an den Start. Bei einer Smarteren City angelangt, werden sich neue Herausforderungen ergeben, die gelöst werden müssen. Mit neuen Erfahrungen und Erkenntnissen wird der Smarter-City-Prozess erneut gestartet, denn Smart Cities sind vor allem dann smart, wenn sie immer wieder in der Lage sind, ihre Herausforderungen zu erkennen und angemessen darauf zu reagieren.

Letztendlich wird ein besonderes Augenmerk auf den Menschen gelegt. Der Entwicklungsprozess zu einer Smarten City bringt „smarte" Citizens hervor, die sich unter anderem durch Engagement, Bereitschaft zur Partizipation und Innovationsfähigkeit auszeichnen. Die Einschränkung dabei besteht darin, dass es allerdings auch smarte Citizens braucht, um Innovationen und Entwicklungen auszulösen. Andererseits gilt: Je smarter die Stadt, umso mehr smarte Citizens gibt es, umso stärker wird der Prozess in Bewegung gehalten und vorangetrieben. Je innovativer eine Stadt ist, umso iterativer läuft das Smarter City Modell ab. Eines muss an dieser Stelle zusammenfassend festgehalten werden: DIE Smart City gibt es nicht, es kann nur einen Smarter City Prozess geben, der die Entwicklungsprozesse permanent am Laufen hält.

6 DISKUSSION

Im aktuellen wissenschaftlichen Diskurs um die Modellierung von Smart Cities werden zum einen Modelle für rechnerbasierte, integrative Planungswerkzeuge kreiert. Hierbei wird der Fokus auf die technische Umsetzung, die Akquisition und Integration von (Echtzeit-) Daten, die Optimierung der Systeme sowie auf die Simulation von (Zukunfts-) Szenarien gelegt. Die systemischen Modellansätze hingegen sind oft nur überblicksartig angelegt – sie beschränken sich auf eine Auflistung der wichtigsten Ziele bzw. Handlungsfelder und deren Wechselwirkungen – oder zielen auf Teilbereiche von Smart Cities wie etwa auf Informations- und Kommunikationstechnologien oder wirtschaftliche Aspekte ab.

Das Smarter City Modell entspricht einem klassischen Systemmodell, welches den komplexen Prozess der Entwicklung einer Stadt zu einer Smarter City darstellt. Durch die Reduktion der Komplexität werden Vorgänge, Abhängigkeiten und Wechselwirkungen im Entwicklungsprozess zu einer Smarter City vereinfacht abgebildet. Ziel des Smarter City Modells ist es, einen stadtspezifischen Systemüberblick zu schaffen, der in erster Linie als Grundlage für die Erstellung von Entwicklungskonzepten und Leitbildern herangezogen werden kann. Durch die Reduktion der Komplexität ist es möglich, das Gesamtsystem zu analysieren, Monitoring zu betreiben, (falsche) Entwicklungen frühzeitig zu erkennen und zu überprüfen, ob die Entwicklungswege "on trade" sind.

Das Smarter City Modell stellt somit eine Diskussions- und Planungsgrundlage dar, mit dessen Hilfe alle wichtigen Aspekte, angefangen bei den Key Challenges über die Handlungsfelder bis hin zu den Voraussetzungen einer Smarten City Berücksichtigung finden. Durch die Zusammenschau von inter- und transdiszipliären Zugängen wird das gesamte komplexe urbane System in einem Systemmodell inklusive Abhängigkeiten und Wechselwirkungen abgebildet, in das in weiterer Folge konkrete Projekte und Maßnahmen eingebettet werden können.

Da sich das Smarter City Modell durch einen theoretischen, abstrakten Ansatz auf einer Metaebene auszeichnet, kann es auf unterschiedliche Stadttypen und auf eine große Bandbreite an städtischen Entwicklungsprozessen angewandt werden. Dies geht jedoch mit dem Nachteil einher, dass viele der Themenbereiche nur angeschnitten werden können. Details und konkrete Handlungsempfehlungen müssen im Rahmen eines Smarter City Prozesses von den verantwortlichen Akteuren selbst erarbeitetet werden. Das Smarter City Modell dient in diesem Zusammenhang als Systemüberblick, das „Füllen" mit Inhalten und das definieren von konkreten Teilprojekten erfolgt – abhängig von den unterschiedlichen städtischen Herausforderungen, Voraussetzungen und Zieldefinitionen – im Rahmen des Smarter City Prozesses, immer abgestimmt auf die Bedürfnisse der jeweiligen Stadt.

Ein nächster Schritt in der Weiterentwicklung und Verfeinerung des Smarter City Modells stellt dessen Evaluierung im Rahmen der Anwendung des Modells auf verschiedene städtische Szenarien bzw. Städte dar. Der praktische Einsatz des Modells bietet Gelegenheit, die Prozessstrukturen zu schärfen, zu detaillieren und gegenfalls zu erweitern. In jedem Fall eignet sich das Smarter City Modell als Instrumentarium, um den Entwicklungsprozess einer Stadt zu einer Smart(er) City zu strukturieren, Leitbilder und Szenarien zu entwickeln, Monitoring auf den Handlungsebenen zu betreiben und den Prozess transdisziplinär und iterativ zu begleiten sowie die Umsetzung zu evaluieren.

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Smarting the City or Development: The Dilemma of the Post-Oil Countries in sub-Saharan Africa

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1 ABSTRACT

Although sub-Saharan Africa (SSA) is the home of over 900 million people, it is estimated that this is likely to treble at the end of the 21st Century. More than 50% of this population would be living in Cities with its infrastructure woefully inadequate to support these lives. SSA is a region with 54 countries, 28 of which are listed among the world's 30 least developed countries. More than two-thirds of the people in the region live on less than 2 dollars per day. However, despite the fact that mobile phone penetration in Africa is about 80%, it is estimated that not more than 20% has direct access to electricity.

Most of the SSA countries on the advent of oil or gas discovery have embarked on many audacious infrastructure projects with the goal to develop the cities and the country as a whole. With the influx of the hype of 'Smarting everything', that is from mobile phones, computers, and cars to communities and cities, most of these countries are faced with the generational question- whether to 'smart' the development or the cities? This paper takes a look at what 'smart development' and 'smart cities' are in the context of the SSA socio-cultural milieu. It also explains what would be the dynamics for the urban fabric of Smart fractal communities within the cities in the light of quality of life, sustainability and resilience. It goes further to expatiate what strategies needs to be adapted if smart cities or development is what SSA currently needs to tackle its urbanisation crises. Finally, recommendations for the way forward shall be posited.

2 URBANISATION AND DEVELOPMENT IN SUB-SAHARAN AFRICA (SSA)

Only one century ago, two out of 10 people in the world were living in urban areas. In the least developed countries, according to the UN-Habitat (2012, p.25) this proportion was as low as five per cent, as the overwhelming majority was living in rural areas. Interestingly, only 60 years ago (1950), the number of people living in urban centres was slightly higher in the developed nations (54 per cent, or 442 million) compared with developing countries. Today, of every 10 urban residents in the world more than seven are found in developing countries, which are also hosts to an overwhelming proportion of humankind (82 per cent of the world's population) (UN-Habitat, 2012, p.25). Moreover, it is estimated that, between 2010 and 2015, some 200,000 people on average will be added to the world's urban population each day. Worth noting is that 91 per cent of this daily increase (or 183,000) is expected to take place in developing countries (UN-Habitat, 2012, p.25). In the last decade, the urban population in the developing world grew an average 1.2 million people per week, or slightly less than one full year's demographic growth in Europe's urban areas. Asia dominated the picture, adding 0.88 million new urban dwellers every week. Africa was the second largest contributor with an additional 0.23 million per week (UN-Habitat, 2012, p. 28). Large urban configurations come with a number of well identified, specific risks: poor urban/regional planning, lack of coordination and deficient coping strategies in the face of social and fiscal disparities (UN-Habitat, 2012, p.33). Although sub-Saharan Africa (SSA) is the home of over 900 million people, it is estimated that this is likely to treble at the end of the 21st Century. More than 50% of this population would be living in Cities with its infrastructure woefully inadequate to support these lives. In a region with 54 countries, 28 of these were listed among the world's 30 least developed countries having more than two-thirds of its people in SSA living on less than 2 dollars per day (Kieh Jnr, 2008). With this dire need prevailing in the sub-region, it becomes obvious that any attempt to boost the development is long overdue. More so, although mobile phone penetration in Africa is about 80%, it is estimated that not more than 20% have direct access to electricity. Despite the fact that official statistics reveal that 89 per cent of the urban population in Africa now have access to improved water supply, a large majority of Sub-Saharan African cities experience regular water shortages. The UN-Habitat survey shows that 11 of the 14 African cities (79 per cent) under review are faced with such serious problems (UN-Habitat, 2012, p.50). Though urbanisation in SSA seems to have an exponential growth, the corresponding development to support it is either stagnant or seems to have taken a nose dive downwards to exacerbate the problem of degradation of the urban fabric. Policies of spatial decentralisation of many African Countries which favour smaller cities investment and planning decisions have contributed immensely to the growth of medium-sized cities and they have been growing faster than the largest cities (Kieh Jnr, 2008). African city development is an expression of rapid population concentration characterised by urbanisation running ahead of industralisation;slow or declining economic growth and imbalance between industrial, social, administrative infrastructures and the demand cum expation of the in-migrants (Kieh Jnr, 2008). More so in developing countries, especially SSA, urbanisation and city development are characterised by 'international demenstration effect' whereby national surpluses (if any) are wasted by elite purchases of fashionable consumer goods rather than being used to stimulate the local economy (Herman, 1999). This trend is not only far from smart development but could be as well described as unintelligent.

3 DEFINITION OF 'SMART DEVELOPMENT' AND 'SMART CITY'

3.1 What is development?

Development implies changes in the economic, social and environmental situation of individuals, households, groups, institution, firms and countries (Zeller, 2011). These changes overtime could be referred to as process of development whereas the situation at a certain point in time as the state of development. Though changes over time are certain to make individual or groups worse off while others better, development is understood intrissically as something positive(Zeller, 2011). Development as a term is usually used with different connotations and sometimes behaves as suffix, it's therefore ambigous and depends on the value concepts. Due to the multiplicity of objectives and viewpoints regarding 'good' development in any society, the term development defies precise definition (Zeller, 2011). The SSA lags both in the process and the product. The process of development is stagnated and the state of development appalling. It is only when the process of the development is 'smarted' that would be relevant if the state of development is usually affected by the objectives pursued by development strategies and policies and thus determines which policy instruments, programmes and projects should be considered for promoting development. Hence the stem of development being referred to in this paper may be group into Ecological, Historical, Political, Social, Human, Economic and Technological. The foundational or root process that lead to the desired changes include hard and soft infrastructure development whilst the geo-spatial environment consisting of the rural or urban communities may be considered as the product or fruit.What one sees as a geo-spatial environment could be referred to as a city, town, community or village and has its foundation from the hard and soft infrastructures that have been created over a period. The city is thus a product of developments and hence the big question is - do we 'smart' the Product or the Process?

3.2 Smart development as a function of smart infrastructure

Smarting a system is enabling behaviourial change via community engagement using contemporary information communications technology to generate a resilient and sustainable output (ARUP, 2011). This entails the design and implementation of sensor instrument networks and associated technologies that report in the activity and performance of the infrastructural system. In 'Smart Development' provision of real-time data allows the out-sourcing and procurement, operational frameworks and management, organisational structure and data policies. Whereas, with 'Smart Infrastructures', the process of engagement and management is affected possitively as better information is released to users for behavioural change, emissions reduction and increment of quality of life.

The term infrastructure connotes the underlying structural ’base’ of a society or economy that helps it to function and without which economic growth and overall development is severely hampered (Caves, 2005; Chambers, 2007). Caves (2005) defined infrastructure as ’the physical structures, facilities, and networks which provide essential services within a community such as transportation, utility companies, water and communication systems as well as public facilities such as schools, hospitals, and government buildings’. In an attempt to distinguish between different groups of infrastructure, Caves (2005) described comprehensively as: capital assets that traditionally have included public and privately owned facilities and systems such as utilities (gas and electricity, water supply and sewerage, waste collection and disposal, storm water management); public works (roads and bridges, dams and canals, ports and airports, railways, transit and other transportation services); community facilities (schools, parks, recreation, hospitals, libraries, prisons, civic buildings); telecommunications (telephone, fax, internet, radio, television, satellites, cable, broadband, multimedia); and knowledge networks (universities, research institutes, corporate research and development, government, philanthropic foundations, libraries, museums, archives) (2005, p.261).

Consequently, due to the broad nature of what infrastructure means, it could be classified as soft and hard/physical. Smart urban infrastructure can keep track of city operations, predicting faults before they occur, while optimising delivery of resource or services to match demand. For the development to be smart, one has to reckon that instrumenting resource systems and infrastructures is vital and crucial. For example, sensors located on existing infrastructure, can monitor water quality or air quality or mobile phone data, revealing patterns of movement and energy use in the city. Hence soft and hard/physical classification of Smart urban infrastructure could be expatiated as follow:

(a) Physical/Hard infrastructure refers to the large physical/technical/fixed networks and capital assets, as ecological capital and digital capital, serving to convey or channel or transmit people, vehicles, materials, fluids, energy, information, or electro-magnetic waves. It is the base for the functioning of a smart nation, as:

- Green Infrastructure, Land, Environment and Landscape
- Sustainable Transportation infrastructure
- Green Energy infrastructure
- Water management infrastructure
- Smart Communications infrastructure
- Solid waste management infrastructure
- Environment/Earth monitoring and measurement networks
- Basic energy or communications facilities, such as oil refineries, gold mines, coal mines, oil wells and natural gas wells, radio and television broadcasting facilities, are classified as part of national infrastructure.

(b) Soft infrastructure refers to all the institutions which are required to maintain the economic, health, cultural and social sustainability and quality of being of a country/region/area/city. Smart soft infrastructure systems include the fixed assets, the control systems and intelligent software to operate, manage and monitor the systems, as well as constructions, facilities and vehicles. For the scope of this discussion, smart soft infrastructure comprises;

- Smart Financial System,
- Smart Education System,
- Smart Health Care System,
- Smart System Of Government,
- Smart Law Enforcement System,
- Smart Emergency Services
- Smart Defence System.

The infrastructural integrity of the cities in SSA is critically important as it can either create a technological lock-in or facilitate 'positive' change or development towards smartness. Deficient Power infrastructure constrains social and economic development in SSA. Most SSA countries, especially those with post-oil economies are in the midst of power crises which is characterised by inadequate, unreliable and costly electricity infrastructure. Infrastructure is also an important input into human development. Better provision of electricity improves healthcare because vaccines and medication can safely be stored in hospitals and food can be preserved (Jimenez and Olson, 1998; Ebehard & Shkaratan, 2012). Electricity also improves literacy and primary school completion rates because pupils can read and study in the absence of daylight (Ebehard & Shkaratan, 2012). Similarly better access to electricity lower cost for business and increases investment, driving economic growth positively (Reinikka and Svensson,1999; Ebehard & Shkaratan, 2012).This correlation could also be extended to the supply of transport, food and water related infrastructures.

3.3 The city as a cncept and place

Although the terms urban and city according to Herbert & Thomas (1990) have often been used interchangeably by urban geographers, Caves (2005) defines a city as a permanent and densely settled place with boundaries that are administratively identified. The classification of a city may vary and overlap as this may depend on the geographical location, settlement pattern, time/age, the city's economic base, its function, population size and density (Herbert & Thomas, 1990; Caves, 2005). The type, growth and function of a city may be specific or diversified and may change over time (Kotler, Haider, & Rein, 2002; Caves, 2005). The city is the embodiment of an urban lifestyle characterized by individuality and impersonal relations (Herbert & Thomas, 1990). The city is also distinguished from a village by its sheer numbers, retail outlets such as shopping centres, medical centres, offices, banks; public utilities, bright street lights, extensive transportation network, cars; and entertainment or leisure avenues such as golf courses, parks, pubs and restaurants (Herbert & Thomas, 1990; Potter & Lloyd-Evans, 1998; Caves, 2005; Williams, 2005).

Conceptually, a city's importance is not just limited to itself but also functional to the surrounding towns and cities within a nation or region (Herbert & Thomas, 1990; Caves, 2005). A city may function as an industrial centre, administrative centre, transport node or commercial centre inter-alia. Most cities and towns however, as O'connor (1983) posits, in developing countries, are the result and dynamics of colonial and post-colonial processes or policies. As indicated in Box 1, there are about seven different types of cities by O'Connor's analysis of the progressional formation of SSA cities. These historic conceptualisations of most SSA cities have direct reflection of the current city structure governance and urban fabric.

More so, the city as a basis for economic activities essentially, 'every place performs a particular economic function' (Kotler et al., 2002, p.230). Cities have a primarily non agricultural economic base often distinguished by a more industrial and service oriented economic base (Jacobs, 1984; Herbert & Thomas, 1990; Caves, 2005). They are economically efficient in that they are a location for dense economic activity (Jacobs, 1984). They serve as a place for mobilizing the production and consumption of goods and services. The city as a place has a meaning and value for its dwellers or simply having a 'unique spirit of place' (Holloway & Hubbard, 2001 p 68). It is this sense of meaning and value that holds a point of significance for place marketing. Besides, a positive economic growth enables the city itself to expand in size and develop basic infrastructure which combined with better incomes leads to a higher standard of living, acting as an urban pull which attracts jobseekers and migrants (Jacobs, 1984; Potter & Lloyd-Evans, 1998).

Box 1: Conceptual Typology of African Cities

In a more comprehensive analysis O'Connor (1983) identified seven types of African city:

(1) The Indigenous City. Indigenous cities were constructed in the period prior to European colonization in accordance with local values and traditions.

(2) The Islamic city. Though influenced by an urban tradition brought across the Sahara, most Islamic cities were built by Africans, with local initiatives dominant in their early growth. Found across much of the Sahara, this type includes Tombouctou, Katsina and Sokoto.

(3) The Colonial City. Established by Europeans, mainly in the late nineteenth and early twentieth century's, colonial cities comprise the majority of urban centres in tropical Africa and include most of today's capital cities.

(4) The European City. Founded primarily in southern and eastern Africa, for example Nairobi, Lusaka and Johannesburg, these settlements were established by and principally for Europeans. African in-migration and permanent residence were constrained, subject to the labour requirements of the Europeans.

(5) The Dual City. In a dual city, two or more of the above types are combined, as in Kano, where a walled Islamic city is surrounded by a modern colonial-type city, or Khartoum–Omdurman, where the Islamic and colonial city elements are separated by the river Nile.

(6) The Hybrid City. A hybrid city is one that comprises indigenous and alien elements in roughly equal proportions (as in the dual city) but in which the parts are integrated. This urban type has increased since decolonisation as cities expand and become more integrated. Examples include Accra, Kumasi and Lagos.

(7) The Apartheid City. South Africa's apartheid city represented a unique form of urban social segregation that dominated the national urban system for most of the second half of the twentieth century. The roots of the apartheid city lay in the concept of 'separate development' and in early British colonial policy, which favoured 'native' reserves

Source: (O'Connor, 1983; Pacione, 2009, p. 468-470)

Cities are centres of innovation and not surprisingly, there is a strong association between industrial agglomeration and urban growth (Glaeser, 2000, p. 138; Porter, 2000). Across space and time, cities have been pivotal in civilizations and reputedly, most cities in developed countries are characterized by industrial growth (Herbert & Thomas, 1990; Potter & Lloyd-Evans, 1998). The city structure refers to the pattern or arrangement of the development blocks, streets, buildings, open space and landscape which makes up the urban areas (Marful, 2012). It is the inter-relationship between all these elements and the landscape, settlement and movement that creates the framework for the structure of the city to be appreciated. The structure which provides the basis for detailed designed of the constituent elements also provides a coherent framework for individual designs to be implemented (Marful, 2012). As a place, the city structure provides integration through connection and overlapping of contingent areas. They also demonstrate functional efficiency which is reflected in the working together of individual elements (building, streets) (Marful, 2012).

3.4 Smart city – a cfunction of smart development

Just as the definition of development, Smart City is another term that has generated a lot of debate in recent times. While images of the digital city, intelligent city, high-tech district and neighbourhoods of smart communities abound, they fail to convey what it means to be smart and why it is important for cities to be defined in such terms (Deakin & Al Waer, 2012, p. 9). Whereas Deakin & Al Waer, (2012) suggest that progressively smart cities must be seriously start with people and the human capital side of the equation, rather than blindly believing that IT itself can automatically transform and improve cities, Holland (2008) infers that, the recent developments have more to do with cities meeting the corporate branding needs of marketing campaigns than the social intelligence required for them to be smart. Hollands (2008), futher posited that cities too often claim to be smart whithout defining what this means or offering the evidence to support such claims. A smart city as posited by ARUP (2011) is one that uses technology to transform its infrastructure and make better use of energy and resources. Information and communications technologies (ICT) can be deployed to create new, intelligent ways of making our urban centres more resources efficient and reduce their carbon footprint. It goes further to suggest that what makes a 'Smart City' smart is the combined used of leadership, urban informatics and systems architecture (or smart systems) to enable residents to make better and more informed choices. The Smart city is further being developed as a concept which many communities and states are deploying as part of their developmental (positive change) strategy.Though a Smart city also uses technology to transform its basic infrastructure and optimise energy and resource usage, it's also all about giving people better information so that they can behave differently in itheir energy and resource usage.

However, according to Climate Consortium Denmark (2011) 6 dimensions to a 'smart' city and these dimensions interact progressively through integrated systems to function effectively. The Consortium opines that, whether developing new cities from scratch or rebuilding existing cities, the challenge is to ensure that the city becomes more liveable, economically successful, and environmentally responsible. A research project carried out by European Smart Cities defines a 'Smart City' as a city that performs well in these 6 dimensions:

- Smart economy: High productivity, entrepreneurship and ability to transform
- Smart mobility: Strong ICT infrastructure and sustainable transport systems
- Smart environment: Sustainable resource management, pollution prevention, environmental protection
- Smart people: Diversity, creativity and participation in public life
- Smart living: Cultural facilities, housing quality, health and safety issues
- Smart governance: Political strategies and perspectives, transparency and community participation in decision making

It could be seen that all the above six dimensions are aspects of the the process of development hence a smart city can only exit if the development is tackled in a smart way.

4 POST-OIL CITY TREND EVOLVEMENT IN SSA

4.1 What is a post-oil city?

A Post-Oil City is a relatively large and permanent urban settlement which generally have advanced or complex infrastructural systems which has evolved or been developed after the discovery of oil in the country of location (Marful, 2010). These cities manifest itself by the type of investment and infrastructure that follow the city's development. Due to the hysteria that follows oil find and economy, a lot of basic fundamental process that are considered the building blocks of sustainability are overlooked or side-tracked (Marful, 2012). A vision for the city that considers the entire country as well as the welfare of the current and future populace is critical. This is usually accompanied by a pragmatic action plan that is built on consensus building but not necessarily democratic principles (illiteracy level is critical for a successful democracy). This is really important because after the oil economy becomes a focal issue in national discourse, the people must take ownership of this vision and implement it for the upliftment of the living standard of the entire country (Marful, 2010). Oil and gas which is termed as black gold has also been described as a blessing in many Arabian countries whilst turning out to be a source of a 'curse' in many African countries (Marful, 2012). The difference is the approach of utilization and distribution of wealth and infrastructure that accompany the Post-Oil Cities (Griffiths, 2012).

4.2 Examples of post-oil cities in SSA

The effect of post-oil economy in SSA does not depict the type of scenarios evident in the Middle Eastern countries with respect to city development and fabric. Most cities in the Middle East have transformed their developmental agenda and strategy into a smart one and are now pursuing what they term as smart cities. In countries like Nigeria and Angola which possess about 75% of SSA oil capacity, their cities shows evidence of some level of massive transformations but shy away from being called smart. (Ebehard & Shkaratan, 2012). From table 1 below, although Sudan and South Sudan have mature production of oil, the effects of income accrued from the oil-economy is yet to be felt across the countries. What is going on in Nigeria and Angola cannot be compared to the effect of the oil -economy on the Middle Eastern Countries like Kuwait, United Arab Emirates, Qatar and Saudi Arabia. Although Abuja and other satellite towns are undergoing massive urban transformations, oil cities like Port Harcourt is nothing to be proud of. New SSA Post-Oil countries like Ghana, Uganda and Niger are also experiencing some levels of uncoordinated massive urban transformations which looks like a wholesale copying of the styles from the Middle East without any recourse to the effect from and on climate. Almost all the capital and industrial cities of the top five oil producers in SSA are potential post-oil cities but are all experiencing uncoordinated developments without any grand developmental vision for the urban fringes and the rural peripheries.

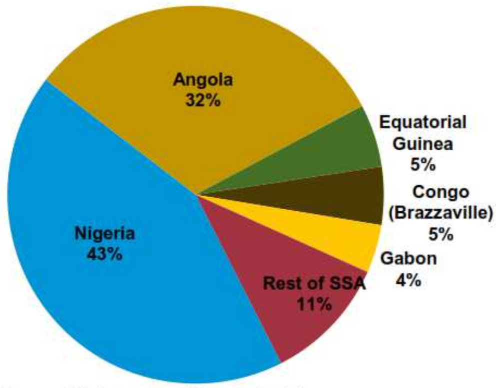
Mature Production	**Production Management**	**Production Growth**	**New Producers**
Production is forecast to decrease because of natural decline in mature fields. New production may come on-stream, but volumes are not large enough to offset the declines	Forecast production is flat or steadily increasing. New production coming on-stream equals or exceeds the natural decline in mature fields	Production is forecast to grow in countries that are relatively new producers as additional fields come on-stream	Oil Production is expected to start sometime within the next five years
Sudan and South Sudan	Nigeria	Ghana	Uganda
Equatorial Guinea	Angola	Niger	Magadascar
Gabon	Congo (Brazzaville)		
Cameroon	South Africa		
Chad	Ivory Coast		
Congo (Kingshasa)			

Table 1: An Overview of SSA Countries with potential Post-Oil Economies. Source: (Adapted from Griffiths 2012)

Top SSA Liquid Fuels Producers in 2012

Country	Production (million bbl/d)
Nigeria	2.52
Angola	1.87
Equatorial Guinea	0.32
Congo (Brazzaville)	0.29
Gabon	0.24
Other SSA	0.64
Total SSA	**5.88**

Source: EIA, International Energy Statistics



Source: EIA, International Energy Statistics

Figure 1: Liquid Fuel Production Overview for SSA

5 MORPHOLOGICAL DYNAMICS OF SMARTNESS IN SSA COUNTRIES

If people can work and operate businesses from anywhere, the organic development of cities would not need to be restructured. However, due to lack of creative solutions for the so called chaotic communities, Grid plan structured formation is predominantly used. The rate of wiping out the fractal communities which coincidentally happens to be the marginilised sections of the old cities in SSA shall be reduced due to the intelligent systems and community consultations that comes with smart community development.

5.1 How Fractals Manifest in SSA Communities

The morphology of the communal spaces in Tropical SSA is a direct reflection of some aspects of the morphological details inherent within its traditional housing units. Roberts (1996, p.87), makes it clear that the basic settlement unit is a house and thus it is also evident from the most superficial observations that settlement forms have close and complex relationships with human culture, reflecting lifestyles and aspirations. At the first glance of it appears chaotic and more of a labyrinth than a functional plan of a unit within small settlement (Griaule, ibid p. 97; Oliver,1976, p.13).

Based on the recognition that urban patterns are highly complex, heterogeneous and hierarchically ordered revealing self-similarity across scales, numerous models of fractal analysis have been applied at the study of the urbanization processes. Fractals are by definition complex, hierarchically ordered structures revealing self-similarity across scales presenting remarkable similarities to urban built-up patterns, urban boundaries, land use distribution etc. Fractals have been widely used in order to distinguish between different urban typologies (Frankhauser 1998), to measure the degree of urban sprawl and examine the way cities expand in space and time (Batty & Longley 1994).Prior to the formalisation of Fractal Geometry by Benoit Mandelbrot in the late 1970s, Doxiadis' Ekistics (Doxiadis 1968; Batty and Longley 1994, p.33) which represent one of the most complete statement of organic approach to city planning was used to identify most of the cities in Africa.

More so, based on the speed at which cities change or the scale of the development, one can classify a city as naturally (organically) or planned. In terms of visual and statistical order, organic towns when viewed in plan form resembles cell growth, weaving in and out of the landscape, closely following the terrain and other natural features embodying the technology of movement through the main transport routes like spider webs or tree-like forms focussed on centres which usually contains the origin of growth. Hence these organic city structure and layout usually depict some levels of fractal geometry it its structural formation. Fractals are self-similar , at least in general sense. It also can be described as hierachy of self similar objects and modules and are ordered hierachically accross many scales. (Batty & Paul, 1994). These manifestations is eveident in almost all the post-oil countries whoes cities are under massive transformation.

5.2 Implications of Smartness on Fractal and Marginalised Communities (FMC) In SSA

Whereas living the Smart Development Concept will make communities in SSA resilient, following a leapfrog approach to smart city ideology will just create more fragile and marginalised communities within the urban centres. As resiliency involves self-sufficiency, smart development with the vision of smart

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communities (not cities), will help create more sustainable supplies of goods and services including food, fuel and power, water as well as the ability to source basic materials and manufacture everyday goods and services. In SSA self-sufficiency is long overdue and ought to be considered as efficient integration of the rural and urban regions to wean off total dependency on imports, grants and foreign aid. The smarting of the communities would invariably create cities and neighbourhoods that would embrace density, diversity and mix of uses, users, building types, and public spaces. Since most of the fractal communities happened to be the areas marginalised in the cities in SSA, the idea of making all old city centres and downtown to be slum would be checked.

Through the use of mobility management as a result of the smart concept for the fractal communities, could prioritize walking as the preferred mode of travel, and as a defining component of a healthy quality of life. As a destination of most in-migrants and brisk commerce, the smart fractal communities could also develop in a way that is transit supportive. Instead re-planning these marginalised areas to be grid structure, the neighbourhoods could focus energy and resources on conserving, enhancing, and creating strong, vibrant places, which are a significant component of the neighbourhood's structure and of the community's identity. This shall promote tourism and increase the local economy through the growing and production of the resources they need, in close proximity (200 kilometre radius). More so, apart from developing building types and urban forms with reduced servicing costs, and reduced environmental footprints these emerging smart communities would enhance active participation of community members, at all scales mobile phone apps. These new qualities that could be accrued to the fractal communities could make them more resilient and bring some meaning into the perceived chaotic urban structure.

6 THE WAY FORWARD TO SMARTNESS IN DEVELOPING COUNTRIES

6.1 Recommendations

With the current unprecedented population growth, increase rate of urbanism and the advent of the post-oil economy SSA are experiencing growth pains in its cities. Critical growing pains of SSA cities include such things as air and water pollution, congestion, noise, urban sprawl, overburdened infrastructure, inadequate public services, and the social consequences of unaffordable housing, under-employment, crime, and under-privilege. Rising concerns about global climate change over the past decade have also elevated energy consumption and CO_2 emissions to the top of the list of urbanisation challenges (Hodgkinson, 2011). One could legitimately ask, why would influx of oil-economy create growth pains? The lack or absence of well prepared development plans and agenda to utilise these finacial influx aggravate the already existing problems without providing any meaningful solution. Hence it is recommended that the Policies, Development Planning, Technology, Human Capacity and Accessibility of basic infrastructures needs to be 'smarted' to spearhead smart development which could culminate to smart communities of which smart cities are part.

- Smart policies: Simplifying requirements for rural electrification schemes, defining common ground rules for integrating technologies and business practices, balancing cost recovery mechanisms for utilities, identifying better ways to support effective demandside management, and developing new policies to support the integration of distributed generation. All such policies would need to be underpinned by welldefined performance goals and transparent metrics to ensure effective monitoring of anticipated benefits. In SSA, leveraging international Smart city frameworks for smart communities, legislation, regulation and standards, and adjusting them to the subSaharan African contextwill are essential. New policies may need to diverge from international precedent, in order to prioritize access to affordable utilityservices for the poor, respond to rapid demand growth and urbanisation, and reduce theft of electricity and utility assets. Such policies should enable access through flexible, no-regret electrification strategies that accommodate expansions of stand alone systems, mini and national grids, and that support their integration.
- Smart Planning: Adjusting the planning system and education to local circumstances and developing design principles that ensure an effective interoperability of existing and new grids, leading to even smarter communities over time. In SSA a balanced approach between regional planning integration, national development strategy and deepened decentralisation is required.

- Smart Technologies: Deploying proven smart technologies, optimising interoperability with emerging technologies, and developing future solutions to best address electrification needs. For SSA, The technology deployment path will vary widely at regional and country levels due to diverse needs and goals of different societies and markets. Defining these technology pathways and markets and verifying them through pilot projects will be important first steps.
- Smart People: Building stakeholder capacityto facilitate the transition to Smart Communities, to manage and administer thesecommunities and to attract and actively engage the private sector and consumers so that as many people a possible profit from the transition. For example in SSA, educating consumers in sub-Saharan Africa about efficient electricity use whilst moving towards Smart Grids will be essential, especially for those who previously had no access. Training tools and materials about state-of-the-art power systems will also need to be widely disseminated. Specific attention needs to be paid to the training of off-grid communities so they can manage and maintain mini grid systems in a sustainable fashion.
- Smart Accessbility: Ensuring universal access to basic utilities like electricity and water. This could be done by encouraging that utilities are tapped off from larger grid extension projects to local customers' enroute. Connections for large consumers are often the primary driver for grid extensions. Such extensions may offer a great opportunity to connect the underserved at the same time; Using grid technologies that can cope with fluctuating supply and demand in rural areas and thus increase supply quality of supply, for example by building on strategic load control and management instead of conventional load shedding; Also introducing hybrid and off-grid electrification for communities that is difficult for the grid extension.

7 CONCLUSION

Smarting Cities in SSA should not be the goal and vision but Smarting the Development and Communities. The rural fringes and territories represent a vital segment of the SSA region. Hence when the cities get 'Smarted' and the entire development and its process remain in the status quo, it will serve as a pull factor for the rural-urban migration. This would in the long-run off-set any gains that might have been made on the smarting of the cities as in-migrants usually tend to develop slums within the cities.The inter-dependency of the villages and the cities in SSA is so crucial that any attempt to smart one prtion without the other will not solve the problem of the rapid urbanisation with its negative effects.

- E-Urban Planning and Development: Online publication of city policy and planning information, online processing of development submissions, online forums to promote citizen participation in the urban planning discussions.
- E- Governance: All appropraite public services are available online, over the phone or both to boost productivity and reduce unnecessary travel. Open access to public data encourages more eyes and transparency as well as good governance which is the missing puzzle for the the anti-corruption drive for the oil funds.

Apart from the above two basic strategies, the developmentprocessshould also encompass preparation, implementation and adhearance to a vision for ICT industry and leadership. This in the long run shall feed into promoting a digital economy as well as a digital inclusion and ICT Capacity building for all. In addition to these, promotion of centres of innovation and technology clusters as well as research and development need to be done religiously. Policies and regulation to monitor infrastructure development, management and maintenance needs to be pursued. Effort ought to be made my governments to showcase best examples through the media and the public sector. Subsequently, awards and incentives could be used to promote start-up enterprises that develop supporting Apps and softwares to enhance the quality of life for rural and urban poor. Smarting the cities in SSA will make the communities eficient but not necessarily effective. Being effective is doing getting things done in the right way but these things may be the wrong ones as it may not have any direct impact on the quality of ife of the entire country. Nevertheless, when the development is 'smarted' it would make the communities effective. As effective communities do the right things in effecient way.

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Suffice it to say, SSA Post-Oil Countries needs to focus on ‘smarting’ their development process and their communities as per their national development framework and plan and not follow the hype of smarting only cities from the developed world.

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Social Media Geographic Information: Current Developments and Opportunities in Urban and Regional Planning

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1 ABSTRACT

This paper deals with the convergence of Social Media and Geographic Information and discusses its potential as useful source of knowledge in spatial planning. With the underlying assumption of the acknowledgement of the innovation that digital geographic information- including Spatial Data Infrastructures (SDI) and Volunteered Geographic Information (VGI)- is already bringing to urban and regional planning, the authors argue Social Media may also play an important role due to both their pervasiveness in content exchange and their emerging spatial convergence. To support this thesis, a review of best practice examples in different domain is presented in order to understand what tools are currently available and what kind of knowledge can be extracted from Social Media. On the base of this analysis, the paper present an original user-friendly tool developed by the authors to extract information from Social Media and to perform Spatial-Temporal Textual (STTx) analysis. The paper ends with some brief conclusions on the opportunities for the application of STTx analysis in urban and regional planning.

2 INTRODUCTION

In the last decade an unprecedented wealth of digital (geographic) information has been made available to planners to support spatial analysis, design and decision-making. On the one hand, development in Spatial Data Infrastructures (SDI) (i.e. INSPIRE Directive in Europe) is fostering the access and reuse of public authorities' (Authoritative) Geographic Information (A-GI) according to common data, technology, and policy standards (Campagna and Craglia, 2012). On the other hand, developments in geobrowsers and mobile technologies enabled citizens acting as volunteer sensors (Goodchild, 2007) to crowdsource GI real-time in a bottom-up fashion. These trends represent enormous opportunities to enhance the knowledge base for supporting informed spatial decision-making in urban and regional planning. Both expert knowledge from planning professionals and individual volunteers and experiential knowledge from local communities can be now easily collected in digital form, analysed, understood, and eventually used to support decision-making according to a transactive approach (Friedman, 1973). These opportunities may become an important building block for implementing sustainable and democratic communicative planning processes (Innes, 1995). More technically, the unprecedented wealth of GI, which has been made available to planners to support analysis, design and decision-making, is fostering wider innovation in urban and regional planning methodologies, as claimed by a growing number of geodesign evangelists (Miller, 2012; Steinitz, 2012). More recently, widespread diffusion of social media has favoured the diffusion of the geo-referenced multimedia (Sui and Goodchild, 2011), or Social Media Geographic Information (SMGI). The latter can be considered an innovative Big Data source (Caverlee, 2010), inasmuch as traditional spatial analysis methods and techniques may be not fully suitable for eliciting its full knowledge potential. This potential may be considered still limited for the public users both in terms of accessibility and of available analytical apparatus, and new methods and tools should be developed accordingly.

Focusing on these trends with a closer look, the implementation of the Directive 2007/02/CE, establishing a shared INfrastructure for SPatial InfoRmation in Europe, has fostered developments in Spatial Data Infrastructures (SDI) in Member States and regions. SDIs enable the access and reuse of authoritative Geographic Information (GI) according to common data, technology, and policy standards, with beneficial impacts for public administration, developers and planning practitioners (Campagna and Craglia, 2012). In Italy for example, in regions such as Lombardy and Sardinia, spatial planning regulations established the local SDIs as the technical platform supplying data and services for developing regional and local plan-making processes. Representations and design models change format in the plan, and a delay in the adoption of such digital uptake would imply an unbearable loss of competiveness for practitioners.

A second current trend with minor, but still relevant impact in spatial planning, follows developments in geobrowsers and mobile technologies, which are overtaking past limits in data acquisition and communication. Citizens act as volunteer sensors (Goodchild, 2007) to crowdsource and broadcast GI in real-time with an innovative bottom-up fashion. In some countries worldwide, the use of this kind of technology is easing and fostering the diffusion of participatory processes, and has became a main source of information in domains such as planning emergency response, and in local planning especially in those countries where authoritative data sources are lacking at large scale. As a matter of facts, the concept of citizens obeservatories for environmental protection is an issue of interest in the EU Framework Programme for Research and Innovation Horizon 2020 (i.e. Call SC5-17-2015).

More recently, progress in technology and connectivity, and diffusion of social media disclosed innovative opportunities for disseminating and gathering geographic information. The widespread diffusion in social media applications, especially location-based social networks, fostered the media convergence with GIS (Sui and Goodchild, 2011), spreading the geo-referenced multimedia, or Social Media Geographic Information (SMGI) among million of users over the internet. This trend may also offer opportunities for innovation in spatial planning since users are offering through social media petabytes of freely and publicly available information, which can be detected and used to perform further analysis, aiming to extract useful knowledge for decision-making (Zin et Al, 2013). The integration of SMGI with A-GI can lead towards innovative analysis opportunities in spatial planning, with regards not only to measures of geographic facts but also to users perceptions and feelings of places and localities (Campagna et Al, 2013). However, one major issue to extract useful knowledge from these innovative sources is to find an efficient way to manage this great deal of information. The management issues for information from Big Data sources (Caverlee, 2010) gave rise to the emergence of a new field of research called computational social science (Lazer et Al, 2009). In literature several applications have been found, that propose different approaches for management and analysis of social media contents in a variety of domains, aiming to elicit useful knowledge.

With the above premises, the remainder of the paper is organised as follows. In section 3 recent trends on social media are analysed in more details, in order to better frame discussion on the convergence of GIS and social media. In section 4 the authors present a literature review of advanced social media analysis case studies and propose an assessment framework, with the aims of putting light on current development opportunities and identifying research issues contributing to further innovation. In section 5 an original methodology encoded in the tool Spatext by the authors is proposed for the development of spatial-textual analysis of SMGI in GIS. In section 6 the authors draw some conclusions, summarising the discussion on the opportunities offered by SMGI as analysis, design and decision-making support in urban and regional planning.

3 SOCIAL MEDIA AND INFORMATION RELIABILITY

Widespread diffusion of web and mobile social media applications is producing an unprecedented availability of information over the internet. A measure of the information avalanche phenomenon can be easily given by available statistics on major social platforms (100 Social Networking Statistics & Facts, 2012): Facebook holds over 1 billion of registered users, of which 552 million are daily active, spending over 6 hours monthly on the social platform; Twitter, Google+, Linkedin, Instagram, Pinterest, Flickr, YouTube, to name few of the major, show smaller values in terms of users but considerably high values in terms of contents production. Every day 340 million tweets are sent, 300 million pictures are uploaded via Instagram, every minute 2 million queries are submitted to Google, and 48 hour of videos are uploaded on YouTube, getting 600 million views per day. Contents about any topic could be readily found through available internet services, fostering new opportunities for analysis and research. Furthermore, new features in social networks enable users to embed geographic location into their own media contents, bringing geography into people daily routines so favoring the convergence of GIS and social media.

As such, arguably social networks could be considered as potentially boundless and affordable sources for information about not only on facts, of which accuracy represents a major issue, but also on opinions and feelings of users featuring a geographical component. However, the latter kind of information faces major issues in finding ways for both managing huge data volumes and eliciting reliable knowledge from these sources. In general the social platforms offer diverse ways for content management and extraction, affecting the degree of suitability for knowledge processing. Unlike traditional data, SMGI refers to dynamic processes and requires new kind of tools to support real-time monitoring and decision-making. The quality and reliability of SMGI for research and practices is actually being discussed, and further investigations are required to establish the extent of credibility of this information. Moreover, several issues arise in finding suitable practices and procedures for the integration of crowd-sourced with authoritative data. Advanced Big Data analysis may be a suitable solution for extracting and managing social media information. Several analysis could lead toward a direct extraction of the content (what?) rather than the causality (why?) from data (Pohl et Pohl, 2013), so avoiding data volume issues and shifting the traditional scientific method by means of current computing capabilities. In several domains, advanced Big Data analysis approaches and tools have been proposed and explored to manage this wealth of digital information for different analysis purposes, as explained in the next section.

4 ADVANCED SOCIAL MEDIA ANALYSIS AND ASSESSMENT FRAMEWORK

The wealth of information available from social media about facts, opinions and feelings of users can affect several domains of interest where subjectivity of observation is relevant for expressing the views, the needs, the call of individuals and communities, such as: disaster events, political events, media events, social studies and last but not least urban planning, to name few. In literature several relevant applications have been found in these domains, which promote methodologies and innovative tools to provide solutions in dealing with social media contents. Although the applications provide specific procedures and features according to the different design purposes and domains of interest, several commonalities can be found both in analysis and in technology. In order to develop a suitable assessment framework for these innovative methodologies and analysis, a review of applications for each domain is presented in this section. The aim of the framework, which will be presented later in the following section, is to define current opportunities for development, considering both technology and analysis of applications, and offering a set of tools to choose from, according to specific different working settings and capabilities. The view offered by the assessment framework may also contribute to define open issues to shape the research agenda.

4.1 Disaster events

In the domain of disaster events four applications have been found, which offer different methodologies and procedures to deal with SMGI in eliciting useful knowledge for decision-making. As first example, an application developed by Liu et Al. (2008) to retrieve photos of disasters from Flickr is reviewed. The application proposes a methodology based upon a qualitative study to investigate if and how users activity on Flickr can evolve in case of notable disasters. Flickr is a social platform, that allows users to store, search and share photos publicly or into thematic groups. Photographs and activities of groups report features of the disaster over time, exposing the online social convergence related to the event. Through a qualitative study, the collected images regarding the hazard, the post-impact and the online convergence may be significant to disaster response efforts. Especially the photos of latter kind, combining data from different sources, have been found useful to create new overviews and map mash-ups, providing spatial information on the event location and the potential response resources. The application proposes an approach to capture SMGI, demonstrating how these data could be useful for disaster response and recovery issues. However, the methodology does not provide advanced technology and requires a manual intervention for recognition and extraction of data in order to develop a qualitative analysis for suitable results.

As second example of this review, a case study proposed by Vieweg et Al (2010) to enhance the situational awareness (SA) through analysis of Twitter posts during a disaster, is analysed . The aim of the application is the harvesting of real-time contents during a crisis event according to information production and consumption lifecycle in microblogging. Two disaster events occurred in the 2009 in USA have been analyzed, relying on the Twitter API for data collection. The research of information among tweets is based on well-defined terms related to each event, oriented by the results of an initial investigation of the Twitter public stream. The geographic component is obtained through a manual analysis of users locations to achieve a manageable dataset for each event. The analysis shows different behaviours between people in the warning phase (anticipatory awareness) of a disaster and those in the impact phase (real-time awareness). Moreover, results exhibit a higher percentage of tweets with georeferenced information during the impact phase in order to supply useful information to users. The case study proposes several procedures and analysis for managing SMGI of Twitter, relying on advanced instruments and technology. The manual intervention is strongly reduced both in data harvesting and analysis.

The third case study presents an application which allows to detect events related to disasters by Twitter contents. The Twitter Event Detection Analysis System (TEDAS) proposed by Li et Al (2012) aims at

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detecting and ranking new events according to their importance, generating spatial and temporal patterns of the extracted data. The system relies on Java, PHP and APIs (Twitter API and Google Maps API) to collect tweets and location of users, according to well-defined search terms. The results of the query offer a real-time overview of spatial and temporal patterns of the detected events. In this case technologically advanced instruments are used, and no manual intervention is required.

The last case study example in disaster management is a recent application developed by Zin et Al (2013) to extract information about disaster events from social media. The application extracts visual and textual data respectively from YouTube and Twitter to describe the situation awareness related to disasters. An approach composed by several steps is proposed to analyze SMGI, focusing on location, network, contents and aggregating the relevant data into hourly temporal groups. Statistical operations are then carried out on collected data to rank the detected events according to their importance. Nevertheless, the application requires an empirical procedure to correctly manage data, and the results shows differences for the detection of events between textual SMGI and visual SMGI.

4.2 Political events

A case study was found in the field of politics which proposes several analysis on SMGI. The event of French Presidential election in 2012 has been analyzed from the Twitter stream by an application named Pytolab (Luce, 2012). The application relies on the Twitter API to perform several real-time analysis on contents related to well-defined search terms. The results show a report on textual analysis of relationships among keywords in data and several statistical reports about spatial and temporal patterns of the event. Moreover, the results show that less than 1% of processed SMGI of Twitter supplies geographical information, causing a potential loss of information. In this case several advanced instruments and procedures are fostered to elicit knowledge from SMGI.

4.3 Media events

Further case studies have been found in the domain of media events, of which two applications have been reviewed here, introducing several methods and procedures for obtaining useful information from social media data. The first one enables the real-time exploration of Twitter contents in search of media events. The TwitInfo platform developed by Marcus et Al (2012) aims at identifying media events according to well-defined terms of research, offering results in a timeline with an aggregate sentimental analysis of contents. The data volume is processed in real-time, offering users the capability to further explore the detected events. The application also provides analysis on spatial and sentimental pattern of the event. In this case both advanced technology and analysis have been used to deal with SMGI retrieval and analysis. The second case study, proposed by Mathioudakis and Koudas (2010) enables the analysts to detect in real-time social media trends from the Twitter stream . The TwitterMonitor application can automatically detect high-rate keywords in tweets (bursty keywords), relying on the Twitter API. The results are then processed to extract further information about the detected event or topic. In this case study advanced technology and instruments have been also applied to perform a trend analysis on social media data.

4.4 Social studies

In the domain of social studies two case study were reviewed, which propose the use of SMGI for different research purposes: semantic analysis and social graph analysis. The first case study offers several methods for the semantic analysis of the Flickr tags, with the aim of determine whether the tag refers to a place or an event (Rattenbury et Al, 2007). The system relies on several statistical methods to achieve the result of information extraction from the unstructured knowledge of tags. However, manual intervention is required in the data extraction and processing. In addition, a technical paper has been found which presents a methodology to visualise social graphs from the Twitter contents. The proposed approach relies on the Twitter API to perform an automatic extraction of data and on a graphing software to achieve the social graph (Bertrand, 2012). In this case, available data of social media are processed and used as input for the creation of a social graph representation.

4.5 Urban planning

Two case studies have also been found with relevance for urban and regional planning, which introduce different methodologies and procedures in an attempt of extracting knowledge from SMGI for supporting design and decision-making.

The first case study deals with an application developed by Frias-Martinez et Al (2012) for investigating the human interaction with the urban environment. The methodology proposes an interesting approach to determine the urban land uses according to human dynamics (i.e. where people are at what time?) as detected by Twitter . The approach is applied on the case study of the urban area of Manhattan, relying on the Twitter API to extract geotagged tweets. In this methodology several spatial clustering operations are performed, according to the neural networks theory, to obtain meaningfull maps from SMGI. Moreover, statistical operations on temporal frequency of SMGI have been used to identify the different land uses on maps. The results of the analyses shows how the approach can accurately detect the commercial, leisure and residential areas, as well as new urban land uses. This methodology relies on advanced instruments and technology to automatically perform innovative analysis. The results demonstrate how SMGI can supply meaningfull information for urban analysis and planning processes.

A second methodology was also found which enables to investigate people movement and landmarks preferences in urban environment. The approach proposed by Jankowski et Al (2010) aims at applying geovisual analytics techniques on photographs of urban landscapes and their related tags, to detect new potential landmarks in the city. The approach has been applied on the case study of Seattle, relying on the Flickr API for performing an exploratory spatio-temporal analysis on both locations and periods of the data volume. The procedural approach for data processing involves three main steps: in the first one, several spatial clustering operations are performed on SMGI to obtain maps, while time periods are divided in weekly intervals; in the second step, statistical operations are computed on data to identify potential interesting landmarks, according to given ranking criteria; eventually, further investigations are performed in the third step to validate the results. In this case advanced instruments and innovative spatio-temporal analysis have been applied on SMGI to elicit knowledge. The results of this methodology also contribute to demonstrate how SMGI can be used as affordable source for the collection of geographic information relevant for urban studies and planning.

4.6 Assessment framework

In the light of above review of advanced social media analysis methods and tools, an assessment framework is presented for synthesising recent advances and opportunities. The aim of the framework is to provide a usable set of parameters for the classification of case studies with regards to technology and analysis. Central to the framework is a two-dimensional matrix, whose variables are “Technology” and “Analysis”. In the Technology-Analysis Matrix (TAM) each field represents an unique combination of technological level and analysis level. The reviewed applications and methods have been evaluated by means of suggested matrix, with the aim of defining the current state of development. The TAM is shown in Table 1, highlighting the most interesting advances.

TECHNOLOGY LEVEL / ANALYSIS LEVEL	*MANUAL TASKS (T1)*	*AUTOMATIC TASKS (T2)*
VISUALISATION (A1)	*case study: 1* retrieve Flickr photos for response efforts	*case study: 9* visualise social graph from Twitter contents
ADVANCED PROCESSING (A2)	*case study: 2,4,8* harvest real-time tweets on crisis event analyse video and tweets to rank events perform a semantic analysis on Flickr tag	*case study: 3,5,6,7,10,11* detect disasters events real-time from Twitter Twitter statistical, spatial, temporal reports detect media event real-time from Twitter detect real-time trends on Twitter investigate urban land uses from Twitter investigate favorite landmarks from Flickr

Table 1: Matrix Technology-Analysis for 11 reviewed case studies.

The Technology Level relies on the following two categories:

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level T1 – a strong manual intervention is required to perform data collection or analysis;

level T2 – advanced programming procedures perform automatic operations.

The Analysis Level relies on the following two categories:

level A1 – analysis results offer a descriptive visualisation of collected data;

level A2 – analysis on data elicit further knowledge from data.

The classification of the methodologies provide interesting information about advanced social media analysis methods and tools. All considered methodologies include data visualization. While in 36.4% of the case studies a manual intervention is required, in the remaining 63.6% automatic procedures for data processing are available. Altogheter 54.5% of cases include both automatic procedures and advanced analysis functions. The field T2–A2 can be considered the space for advanced systems both in terms of technology and analysis, including most powerfull tools encoded in user-friendly applications.

The application of the TAM for categorizing and assessing the case studies put lighs on opportunities and issues for SMGI analysis. The results of this assessment were used by the authors as a guide for the design of a novel Spatial-Temporal Textual (STTx) analysis tool presented in the next section.

5 A METHODOLOGICAL APPROACH FOR SMGI IN GIS

The current state of development for advanced social media analysis methods and tools demonstrates how the use of SMGI is spreading in several domains. Nevertheless, further advances and innovation, both in technology and analysis, may lead toward more reliable and user-friendly methods for knowledge extraction from SMGI. In order to contribute to this challenge, an original methodology is proposed below for the STTx analysis of SMGI. The method has been applied to a case study example using a tool called Spatext, that features several functionalities to analyse SMGI in GIS environment.

5.1 Spatext tool

The Spatext STTx suite is implemented as add-in for ESRI ArcGIS©. Spatext includes nine tools, which can be used to achieve three main goals: harvesting social media data from Twitter, data geocoding, and tag clouding. The functionalities rely on three open Python modules, namely tweetersearch for data harvesting, geopy for the geocoding, and pytagcloud for the tag clouding. The functionalities introduced by Spatext and their coupling with GIS spatial analysis tools eases the integration of SMGI with authorative data, for analysis, design and decision-making support in urban and regional planning. In the remainder of the paper, the Spatext functionalities for SMGI processing are synthetically described using the illustrative case study of the cyclone Cleopatra in Sardinia (Italy). Collected SMGI in the case study encloses perceptions, opinions and needs from the local communities during the occurrence of cyclone Cleopatra in November 2013. The integration of authorative geographic information with opinions and needs from the local communities provided by SMGI could offer meaningful information both for design and decision-making. The results of the data harvesting, the spatial-temporal analysis and the textual analysis on the case study are proposed to demonstrate the main features of the suite.

5.2 Data harvesting

In Spatext the Twitter data harvesting is executed by the “Tweet Extractor” tool, which retreives all relevant data according to given keywords (several languages can be set for the query). In the case study the dataset has been collected setting the keywords “Sardinia floods” in English language to avoid disturbance for harvesting because of too generic keywords. The setting allowed the extraction of 399 different tweets strictly related to the topic, approximately 16 and 24 hours after the start of event (2013.11.19 from 8:30 to 9:30 and from 17:30 to 18:00). The tool automatically stored the public tweets and their metadata in a data table including text, user name, user location, user registration data, tweet creation time, and if available, country, place name, the geographic coordinates. Only 0.01% of extracted tweets presented geographic information. The value is smaller than 0.77% that statistically refers to percentage of tweets with geographic component (Semiocast2012 – Twitter Stats), but this may be due to time and language constraints. Spatext has been also designed for metadata processing, in order to address the lack of geographic information, so providing suitable results for spatial-temporal analysis.

5.3 Spatial-temporal analysis

The lack of available geographic information in the dataset could prevent the development of spatial analysis on SMGI. A potential solution provided by Spatext to deal with this issue is the use of tweets' metadata, that is user location for populating the location fields. This approach could introduce positional uncertainty because the geographical information is being shifted from the tweet to the user location, but at the same time it could provide the spatial distribution of the topic, according to the spatial distribution of users. In the case study example, the tool has been used to generate a point feature dataset containing the locations of the 399 collected tweets, offering as a result opportunity for developing further spatial analysis in combination with other spatial data layers. A check on the dataset has pointed out how 42.6% of tweets has provided wrong places for user location, showing reluctance by users for disseminating personal information.

The spatial analysis has been conducted studying the spatial distribution of the topic among worldwide countries with the aim of discovering dissimilarities and potential spatial patterns. Several countries have been chosen because are the most representative of the spatial distribution of the topic: the United States, the United Kingdom, Italy, Nigeria and India. According to the spatial distribution, the dataset has exposed as percentage of tweets a value of 22.5% for the USA, 6.5% for the UK, 6.0% for Italy, 2.5% for Nigeria and 1.7% for India. These values could be considered as a representation of the different degree of interest of users about the topic among these countries. An assessment of this hypothesis could be addressed through the analysis of the different percentages. The USA percentage has exhibited notably higher value (> 300%) than the UK, Italy, Nigeria and India, but this peak of interest could be explained considering that the USA are ranked 1st in Twitter top countries classification with over 140M accounts. Similarly, the percentage of the UK could be explained considering the 4th position in Twitter rank with over 30M accounts. The italian percentage (6.0%) raises interesting questions about the spatial influence of the topic. In fact, the percentage is both affected by language constraint in data harvesting and by the less importance of Italy in Twitter top countries (over 5M accounts). An analysis on values shows the 1.2 value for the ratio percentage / accounts for Italy, exposing the higher level of interest among the countries. This peak of interest in Italy could be explained considering the geographical extent, indeed the topic concerns Sardinia. In addition, the percentages of Nigeria and India raise further questions related to the spatial distribution of the topic on Twitter. In fact, both countries are affected by language constraint and do not expose specific spatial relationships with the topic. These values have been investigated through temporal and textual analysis to better understand potential hidden dynamics.

The analysis on the spatial distribution of dataset has been conducted through standard spatial analysis tools in GIS environment. The dataset used as input for the analysis has been developed directly by Spatext, demonstrating how the tool could be suitable for an integration of SMGI from Twitter in GIS environment. In figure 1 the spatial distribution of the collected tweets about the topic is provided worldwide. Several tweets are depicted with different colours and symbol, because they are related to the relevant countries. The map of spatial distribution is useful to better explain the results of assessment on spatial distribution. Moreover, the map may suggest hints on the temporal distribution of SMGI, that are discussed below.

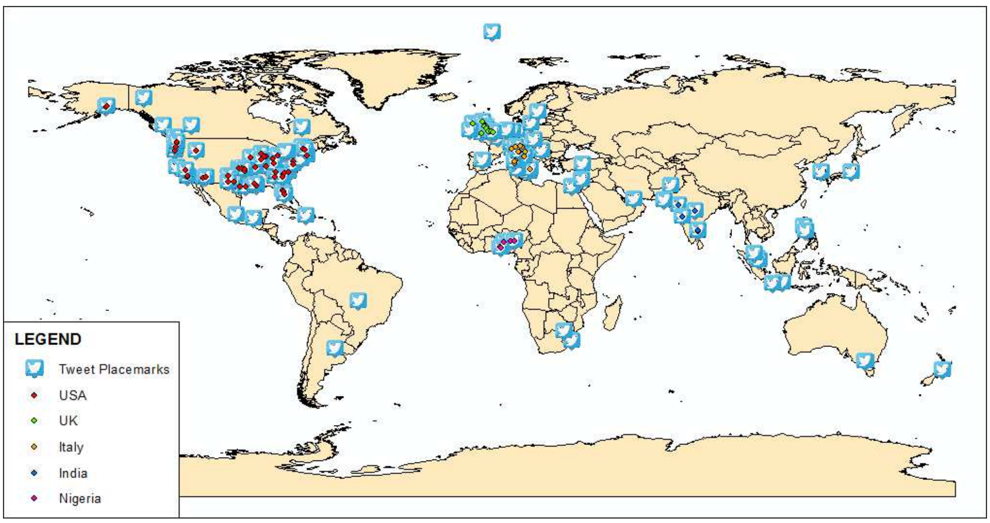

Fig. 1: Spatial distribution. Results of analysis on most representative countries.

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The introduction of temporal distribution analysis has been possible using the metadata of tweets creation, which are stored in the dataset by Spatext. The temporal component has been investigated in search of meaningful patterns about the topic according to two different approaches. For the temporal distribution the collected tweets have been processed with the aim of inquiring the geographic extents through the associated temporal component. The first approach considered the spatial distribution of the first 30 created tweets, but the results have pointed out a heterogeneous spatial distribution, so dismissing any meaningful spatial pattern. The second approach considered the spatial distribution of tweets for the two extraction periods (from 8:30 to 9:30 and from 17:40 to 18:05 2013 Nov 19) and then for 17 periods of 5 minutes. The result of analysis on extraction periods has exposed 199 tweets for the first period and 200 for the second, suggesting how the interest was increasing along time. The analysis on 5 minute periods has been computed to search for anomalies in temporal distribution and to show the trend in the time-series graph.

The results showed peaks of interest in the 9th and 13th period that were further investigated for validation. The validation of a peak of interest was based on the contemporary fulfilment of two criteria in order to avoid false positives. The first criterion for the validation of a peak requires a value for the period >=100% than the specific value of linear regression in the same period, meanwhile the second criterion requires a value for the period =>100% than the average value. The identified peaks satisfy both criteria and therefore were validated as peaks of interest in the trend. The graph of temporal analysis is provided in figure 2, which shows the time-series and the peaks of interest. The identified peaks have been further investigated in the textual analysis.

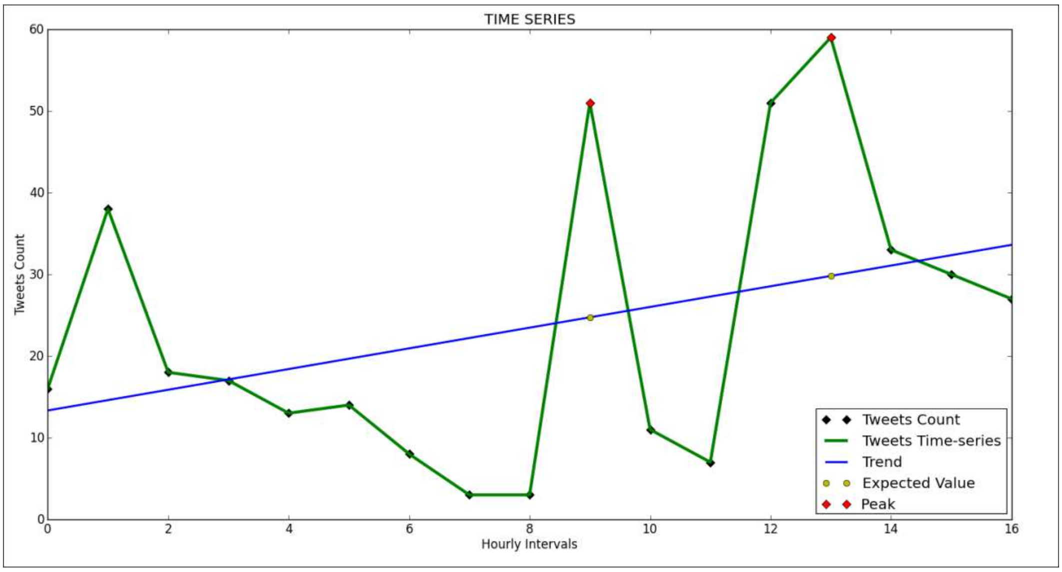

Fig. 2: Temporal distribution. Results of analysis on tweets.

5.4 Textual analysis

The peaks of interest, detected by the temporal analysis, oriented the analysis toward the study of further aspects on the SMGI dataset. A textual analysis has been conducted on the dataset to discover further knowledge in order to find potential answers to peaks. Tag-cloud functionalities in Spatext have been used to discover the most used words in the dataset. The tag-cloud is the visualisation of word frequency in a weighted list and graphical form, and it is suitable to depict the most used words in a text and recognize possible hidden information. The textual analysis has been conducted both on worldwide tweets and on tweets from Italy, investigating possible differences in contents. Furthermore, a search was conducted on tweets from Nigeria to discover potential causes for spatial distribution in this country.

The results of tag cloud on worldwide tweets identifies words used for the data harvesting (Sardinia and floods), words strictly related to the subject (storm, cyclone, cleopatra, rain, italy), several terms related to the consequences of the event (apocalyptic, dead, bridges) and several unrelated terms (wall, journal, bbc, http). The results of tag cloud on Italy tweets have exposed the same related terms, while several different unrelated terms were existent in the results (allertameteosar, yesterday, http). A further investigation has been conducted on the unrelated words worldwide, disclosing how they were provoked by a viral sharing phenomenon of tweets posted by the Wall Street Journal and BBC World. These tweets have caused the identified peaks of interest and the tag ‘http’ by means of their diffusion and their url-related contents. Results of analysis on Italy showed the use of the word ‘allertametosar’ as tag in several tweets, while the word ‘yesterday’ was related to tweets with a temporal reference to start of the hazard event. Finally, an investigation on nigerian tweets has disclosed how the interest on the topic was caused by an high sharing phenomenon among users leaded by Breaking News Nigeria, which offers overviews of worldwide events. In conclusion, the provided results have explained the causes of the peaks and demonstrate how the textual analysis could enhance the awareness on contents of SMGI. These results also strengthen both the concept of media as GIS and the current convergence of GIS and social media. The resulting tag cloud visualisations are provided in the next figure (fig.3) respectively for italian and worldwide tweets.

6 CONCLUSION

In this paper the authors presented a review of advanced social media analysis method and tools, and an original methodology for the spatial-temporal textual analysis of SMGI. Advanced methodologies and analysis have been reviewed in order to discover potential suitable approaches for the integration of the SMGI spatial analysis as a support in urban and regional planning. Early examples of analysis methods and tools were found in several domains such as disaster events, media events, political events, social studies and urban planning in facts. An assessment framework was proposed to define the current advances and opportunities for SMGI analysis. The proposed framework sets the context for the proposal of an original methodology developed by the author for the Spatial-Temporal Textual analysis of SMGI. The method relies on a tool called Spatext in order to demonstrate the opportunities and the potentialities for the collection and analysis of SMGI. A simple example case study is provided as a demonstrator of how the SMGI could be directly used into GIS environment, disclosing new opportunities for spatial analysis. These results arguably show new opportunities for enriching authoritative data with information about perception, opinions and needs from the local communities. In the current time of convergence of GIS with pervasive social media, the users perceptions and feelings of facts and places enclosed in SMGI may eventually offer meaningful information for planners. As such language and power-relational barriers between expert professionals, stakeholders, and local communities may blur in pluralist representation models and databases. The early examples proposed in the paper aims at demonstrating how it is now possible to analysis what, when and where people know, feel, appreaciate, need with regards to places, facts, and processes. If properly (and ethically) used, this new pluralistic knowldge might eventally change decision-making dynamics and affect the discourse in the urban and regional planning process. In conclusion, the knowledge of SMGI if proficiently elicited might be used to discover and expose the will of users and could be a valid support for design, analysis and decision-making in urban and regional planning. Further research is definitely needed and SMGI analysis methods and technology should be applied from within real-life urban and regional planning process to proof the full efficacy. Nevertheless, early results are promising and the research agenda challenging.

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State Space Model for Accounting Smart City Heating by Municipal Solid Waste Management

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1 ABSTRACT

As per the recent estimates, India produces about 100,000 MT urban solid wastes daily with typical characteristics. The municipal solid waste (MSW) generation in metro cities varies between 0.2 to 0.8 kg/capita/day and urban MSW generation is estimated to be approximately 0.5 kg per capita per day. This is estimated to be two or three times more than the waste generated by rural residents. The figures, however, vary from city to city. Over the next two decades, growing urbanization in India will result in a massive increase of waste. A study conducted by the Central Pollution Control Board, Government of India on management of MSW in the country estimates that waste generation from the present 48 million tons (MT) per year is expected to increase to 300 MT per year, by the year 2047 (490 g per capita to 945 g per capita). So, the estimated requirement of land for disposal would be 169.6 square kilometer (Sq. Km) in 2047 as against 20.2 Sq. Km in 1997.

More than 91% of MSW collected is still landfilled or dumped on open lands and dumps (Akolkar, 2009), impacting public health, deteriorating quality of life and causing environmental pollution. It is estimated that about 2% of the uncollected wastes are burnt openly on the streets; and about 10% of the collected MSW is openly burnt in landfills or is caught in landfill fires (Akolkar, 2009). Due to an increase in population and subsequently increase in waste generation, landfills could become a major source of atmospheric methane. Methane, at its current atmospheric concentration of 1.7 ppmv, accounts for about 15% of the anthropogenic greenhouse effect and concentration is on the increase. Generally, 50% of carbon emissions in the landfills are transformed into methane. It has been reported that 13% of landfill emission or 36.7 Tg/year of methane is emitted from municipal solid waste landfills in the World. Other reports said that the global projection of methane flux from landfill areas would be between 63 to 93 Tg/year by 2050, which will be due to population growth and subsequently increase in waste dumping in landfills. The total methane flux from Indian cities are 0.33 Tg/year. The power generation potential in India at present from municipal solid waste is 3276 MW/year against waste generation.

The quantity of MSW generated depends on a number of factors such as food habits, standard of living, degree of economic activities, seasons and location. Data on quantity variation and generation are useful in planning for collection and disposal systems. These are mainly depends on input state variables i.e. population, per capita generation, net inert material for disposal, Technological viability, air space limit and mangement approach. Difficulty in acquiring land for establishing waste management and disposal facilities are usual in urban areas. Total estimation of land requirement will be more over years. It is imperative that the existing dumpsites are redesigned to recover space for receive present and future wastes on the basis of minimization of practice.

State space model shows the temporal relationship of several factor or input state variables with output value. State Space model is a mathematical model of a physical system as a set of input, output. State-space modelling showed that temporal correlation in solid waste generation with input variables of population, per capita generation, technological viability for minimising the inert, air space of disposal and financial viability for indian cities. This correlation will help to predict the total estimated heat potentiality of smart city from waste generation over the period.

2 INTRODUCTION

The cities only encompass two percent of the world’s land surface, yet they are responsible for consuming over 75% of the planet’s resources and produce 75% of the world’s waste (Siemens, ‘Sustainable City’). The most pressing problem faced by any urban centre in India today is Municipal Solid Waste Management (MSW). Rapid urbanization and changing lifestyles have led to the generation of huge amounts of garbage and waste in the urban areas. Over the past few years, the handling this MSWM has become a major organizational, financial and environmental challenge. (Ramachandra T. V. & Bachmanda S. 2007). During the last century urban population of India increased ten folds from 27 million to 270 million. India produces 48.0 MT of MSW annually at present. Central Pollution Control Board, India (2009) said that by the year

2021, the urban population is expected to represent 41% of the overall population and subsequently MSW is expected to increase to 300 MT per year, by the year 2047 (490 g to 945 g per capita). A number of technologies are being proposed for management and disposal of garbage but so far no technology has been shortlisted as the one which would be viable not only from the environment angle but also in terms of the cost involved for unanimously in Indian context. (CPCB, 2000)

Waste dumping is the only favorable method to urban local body without any further action. Day by day increasing trend practice of dump to dump yard won't sustain the function. So there is a requirement of taking integrated policy and technology to use less land as land is precious.

Concentration of intense economic processes and high level of consumption in urban areas increase total waste generation and more space is required for waste disposal. Ever increasing population with end lasting waste production can be sustained with adopting an integrated approach for accounting solid waste management towards heat potentiality assessment from landfill waste in city planning. This requirement may vary on the basis of different state vector.

3 HEAT POTENTIALITY FROM WASTE

In developing countries like India with MSW which has a low calorific value (7.3 MJ/kg compared to values greater than 10 MJ/kg in Europe, Japan and US) and high percentage of inerts, processing of waste is necessary to make it suitable as a fuel. This makes RDF an important alternative to WTE combustion. One of the less expensive and well-established technologies to produce RDF from MSW is mechanical biological treatment (MBT). An MBT plant separates out metals and inert materials, screens out organic fractions (for stabilization using composting processes), and separates out high-calorific fractions for RDF. RDF can also result from a 'dry stabilization process' in which residual waste (after separating out metals and inert materials) is dried through a composting process leaving the residual mass with a higher calorific value (USEPA, 2010). The RDF thus produced is either used directly as floc/fluff or is compressed to make pellets. RDF fluff (as it is called in India) can be directly combusted in dedicated WTE plants whereas making RDF pellets increases the marketability of the product as they can be used for co-combustion in various solid fuel industries like cement kilns, coal fired power plants, etc.

RDF plants which make fluff are located near Hyderabad, Vijayawada, Jaipur and Chandigarh. RDF produced at Hyderabad and Vijayawada is taken to dedicated WTE plants for electricity generation, whereas RDF from Jaipur and Chandigarh plants is transported to cement plants to be used in place of coal. Hyderabad and Vijayawada had the first RDF facilities in India which served as demonstration projects. The administration of Nashik composting plant is testing the feasibility of using composting rejects as RDF in a cement plant; similar attempts are being made at Pimpri composting facility too.

High percentage of rejects from MBT facilities (60%), having a high calorific value (9.5 MJ/kg) opens a huge opportunity for RDF and WTE. Assuming 6% of all MSW generated in India is treated in MBT facilities, out of which, 60% is compost rejects which could be used as refuse derived fuel (RDF), India is currently generating 2.48 million TPY of RDF. Such a huge source of energy is being generated and landfilled every year. This is equivalent to landfilling nearly 4 million barrels of oil because there are no facilities which could use them. This RDF can be used in the already well established solid fuel industry in India. India would have landfilled 58 million barrels of oil in the form of RDF alone by 2041 if there were no RDF co-combustion or WTE facilities to generate energy out of it (NSWAI, 2010)

The overall power potential from MSW in India is estimated to be 3,650 MW by 2012 (NSWAI, 2010) Power potential from MSW from 59 cities was found out to be 1,292 MW. Generation of energy from MSW can displace 14.5 million TPY of low grade coal every year. Delhi has the highest potential for power generation from MSW (186.8 MW), followed by Mumbai (186.6 MW), Chennai (149 MW), and Hyderabad (91 MW). MSW generated in Chennai (6,118 TPD) is only about half of the waste generated in Kolkata (11,520 TPD) but it has a higher calorific value (10.9 MJ/kg), more than twice of that of MSW in Kolkata (5 MJ/kg). Chennai has the highest calorific value of MSW compared to other cities generating MSW > 1,000 TPD, followed by Ludhiana (10.7 MJ/kg), Pune (10.6 MJ/kg), and Bengaluru and Coimbatore (10 MJ/kg). WTE is a large scale technology. Most WTE plants are built with a capacity to handle 1,000 TPD of waste. The concept of regional landfills should be adopted to build regional WTE facilities to serve two or more cities, each of which landfill less than 1,000 TPD of MSW after recycling and composting (NSWAI, 2010).

S.No.	City	MSW Generated (TPD)	Calorific Value (MJ/kg)	Power Production Potential (MW)	Coal substituted (TPY)
1	Kolkata	11,520	5.0	129.9	1,445,194
2	Mumbai	11,124	7.5	186.6	2,075,263
3	Delhi	11,040	7.5	186.8	2,078,043
4	Chennai	6,118	10.9	149.0	1,657,716
5	Hyderabad	4,923	8.2	91.0	1,012,526
6	Bengaluru	3,344	10.0	74.9	833,427
7	Pune	2,602	10.6	61.8	687,908
8	Ahmadabad	2,518	4.9	27.9	310,362
9	Kanpur	1,756	6.6	25.9	288,159
10	Surat	1,734	4.1	16.1	179,314
11	Kochi	1,366	2.5	7.6	84,327
12	Jaipur	1,362	3.5	10.7	118,652
13	Coimbatore	1,253	10.0	28.0	311,631
14	Greater Visakhapatnam	1,194	6.7	18.0	199,801
15	Ludhiana	1,115	10.7	26.8	298,041
16	Agra	1,021	2.2	5.0	55,457
17	Patna	945	3.4	7.3	80,844
18	Bhopal	877	5.9	11.7	130,174
19	Indore	867	6.0	11.7	130,139
20	Allahabad	815	4.9	9.0	100,455
21	Meerut	804	4.6	8.2	91,457
22	Nagpur	801	11.0	19.8	220,216
23	Lucknow	743	6.5	10.9	120,839
24	Srinagar	713	5.3	8.5	94,139
25	Asansol	706	4.8	7.7	85,250
26	Varanasi	706	3.4	5.3	59,291
27	Vijayawada	688	8.0	12.3	137,263
28	Amritsar	679	7.7	11.7	130,219
29	Faridabad	667	5.5	8.3	91,897
30	Dhanbad	625	2.5	3.5	38,583
31	Vadodara	606	7.5	10.1	112,737
32	Madurai	543	7.6	9.2	102,832
33	Jammu	534	7.5	8.9	99,398
34	Jamshedpur	515	4.2	4.9	54,279
35	Chandigarh	486	5.9	6.4	71,478
36	Pondicherry	449	7.7	7.8	86,578
37	Jabalpur	380	8.6	7.3	81,410
38	Bhubaneswar	356	3.1	2.5	27,592
39	Nashik	329	11.6	8.5	94,918
40	Ranchi	325	4.4	3.2	35,985
41	Rajkot	317	2.9	2.0	22,748
42	Raipur	316	5.3	3.8	42,019
43	Thiruvananthapuram	308	10.0	6.9	76,506
44	Dehradun	247	10.2	5.7	63,082
45	Guwahati	246	6.4	3.5	39,032
46	Shillong	137	11.5	3.5	39,153
47	Agartala	114	10.2	2.6	28,901
48	Port Blair	114	6.2	1.6	17,552
49	Aizwal	86	15.8	3.0	33,831
50	Panaji	81	9.3	1.7	18,707
51	Imphal	72	15.8	2.5	28,323
52	Gandhinagar	65	2.9	0.4	4,739
53	Shimla	59	10.8	1.4	15,851
54	Daman	23	10.8	0.6	6,218
55	Kohima	20	11.9	0.5	5,941
56	Gangtok	19	5.2	0.2	2,449
57	Itanagar	18	14.3	0.6	6,419
58	Silvassa	11	5.4	0.1	1,472
59	Kavarati	5	9.4	0.1	1,171
	TOTAL	81,407		1,292	14,367,909

Table 1: Potential for Waste to Energy (WTE) Generation. Source, NSWAI 2010

Small scale biogas is a decentralized technology and the most environmentally friendly technology to recover energy from organic wastes. It can be successfully deployed in South India where the temperatures favor the process yearlong. However looking at the public investment and integrated waste management perspective, it takes many such single units to address organic waste from a single community and the technology would be able to address only 50% of the waste stream in Thiruvananthapuram or Kochi.

12th Fuiive yaer plan (FYP: 2012-2017) has also emphasized the WTE for all SWM process. It has also emphasized that Solid Waste Management is an area that is funded through a separate central programme, namely the Jawaharlal Nehru National Urban Renewal Mission (JNNURM). This subject, being of immense importance, should be monitored as a policy thrust area through the Prime Minister's Council; while the Habitat Mission under NAPCC should focus on critical areas like evolution, adoption and implementation of green building codes, urban habitat planning and development, so on. The state of solid waste management in Kanpur was no different from most other Indian cities until only a few years ago. Kanpur Nagar Nigam (KNN) had the responsibility for collecting, transporting and disposing of the solid waste generated in the city, estimated at about 1500 tonnes per day.In June 2008, KNN gave a BOOT (build, own, operate, transfer) contract for processing, disposing, collection and transportation of solid waste which was selected through a process of competitive bidding. Land (46 acres) was given free on a long lease of 30 years for the project. The plant to process 1500 tonnes per day capacity of solid waste was set up with a tipping platform, a pre-segregation unit, a composting unit, an RDF (Refuse Derived Fuel) unit, a plastic segregating unit, a briquette manufacturing unit, and a secured landfill in place. Garbage transport vehicle is equipped with Global Positioning System (GPS) and every incidence of the compactor halt to collect garbage is monitored and recorded. Rag-pickers have been given the opportunity of starting a new life. Some of the former rag-pickers (130, to be precise) now earn a regular salary as safaimitras, sport a bank ATM card, enjoy social security and health benefits, and their young kids have started going to schools.The garbage is taken to a central site where it is sorted, segregated, transformed into a number of products of value, for example, premium quality compost, refuse derived fuel (RDF), interlocking tiles from construction debris for use in footpath paving, and so on. Kanpur Waste Management Plant is the largest producer of compost from organic waste. The plant is not able to meet the growing demand for organic fertiliser. In the Twelfth Five Year Plan, every attempt will be made to replicate the similar model in maximum number of cities in the country. The main thrust is Sustainable Solid Waste Management Systems in Towns and Cities to reduce the carbon credit.

Being town and regional plan land is our subject. The precious land would become save from waste-ward site by using waste to enegy potential technique implementation in global earth. To account the space control and reduction of heat can be accounted by State space model.

4 STATE SPACE MODEL

In control engineering, a state space representation is a mathematical model of a physical system as a set of input, output and state variables related by first-order differential equations. To abstract from the number of inputs, outputs and states, the variables are expressed as vectors. Additionally, if the dynamical system is linear and time invariant, the differential and algebraic equations may be written in matrix form. The state space representation (also known as the "time-domain approach") provides a convenient and compact way to model and analyze systems with multiple inputs and outputs. With inputs and outputs, it would otherwise have to write down Laplace transforms to encode all the information about a system. Unlike the frequency domain approach, the use of the state space representation is not limited to systems with linear components and zero initial conditions. "State space" refers to the space whose axes are the state variables. The state of the system can be represented as a vector within that space. (http://en.wikipedia.org/wiki/State_space)

System type	**State-space model**
Continuous time-invariant	$\dot{\mathbf{x}}(t) = A\mathbf{x}(t) + B\mathbf{u}(t)$ $\mathbf{y}(t) = C\mathbf{x}(t) + D\mathbf{u}(t)$
Continuous time-variant	$\dot{\mathbf{x}}(t) = \mathbf{A}(t)\mathbf{x}(t) - \mathbf{B}(t)\mathbf{u}(t)$ $\mathbf{y}(t) = \mathbf{C}(t)\mathbf{x}(t) + \mathbf{D}(t)\mathbf{u}(t)$
Explicit discrete time-invariant	$\mathbf{x}(k+1) = A\mathbf{x}(k) + B\mathbf{u}(k)$ $\mathbf{y}(k) = C\mathbf{x}(k) + D\mathbf{u}(k)$
Explicit discrete time-variant	$\mathbf{x}(k+1) = \mathbf{A}(k)\mathbf{x}(k) + \mathbf{B}(k)\mathbf{u}(k)$ $\mathbf{y}(k) - \mathbf{C}(k)\mathbf{x}(k) + \mathbf{D}(k)\mathbf{u}(k)$

where:

$\mathbf{x}(\cdot)$is called the "state vector", $\mathbf{x}(t) \in \mathbb{R}^n$;

$\mathbf{y}(\cdot)$is called the "output vector", $\mathbf{y}(t) \in \mathbb{R}^q$;

$\mathbf{u}(\cdot)$is called the "input (or control) vector", $\mathbf{u}(t) \in \mathbb{R}^p$;

$A(\cdot)$is the "state (or system) matrix", $\dim[A(\cdot)] = n \times n$,

$B(\cdot)$is the "input matrix", $\dim[B(\cdot)] = n \times p$,

$C(\cdot)$is the "output matrix", $\dim[C(\cdot)] = q \times n$,

$D(\cdot)$is the "feedthrough (or feedforward) matrix" (in cases where the system model does not have a direct feedthrough,

$D(\cdot)$is the zero matrix), $\dim[D(\cdot)] - q \times p$,

$\dot{\mathbf{x}}(t) := \frac{\mathrm{d}}{\mathrm{d}t}\mathbf{x}(t)$.

5 STATE-SPACE VARIABLES IN SWM

For Solid Waste Management the input state variables are:

(1) Per Capita generation

(2) Waste Composition

(3) Technological viability/options

(4) Management Approach

(5) Costs

These variables are positively correlated of following factors:

Factors influence variables

(1) Per Capita Waste Generation

(I) Population

(1) Sector wise/ward wise present population (Initial Year)

(2) Population projection in different years (block year)

(II) Socio-Economic Condition

Social

- Family size
- Education
- Life style
- Practice

Economic

- Gross Income of family
- No person employed
- Type of job

(2) Waste Composition

(III) Types of Waste

Biodegradable

- compostable
- non compostable

Non Bio Degradable

- recyclable
- debris

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(IV) Quantity of each typology waste

- Source
- Segregation
- Waste Reduction

(V) Quality of waste

- Physical Characteristics
- Chemical Characteristics

(3) Technological Option

(VI) Composting

(VII) Sanitary landfill

(VIII) Bio Methanation

(IX) Incineration

(X) RDF

(XI) Pyrolysis

(4) Management Approach

(XII) Collection

(A) Source Segregation

(B) Methods

- Residential Collection
- Open Residential Collection
- Municipal Residential Collection
- Municipal Contracted Residential Collection
- Zoned Residential Collection
- Commercial Collection
- Recyclables Collection
- Residential Curbside Collection
- Commercial On-Site Collection

(XIII) Transportation

- Direct Haul
- Transfer Station

(XIV) Drop-off Recycling Centers

- Recyclables Commodities / Material Processing (MRF: Material recycling facility) :
- Newspaper/papers (Office Paper , Phone Books, Magazines, Mixed Paper)
- Corrugated Cardboard
- Aluminum Cans /Misc. Aluminum
- Bi-Metal (Tin) Cans
- Ferrous
- Non-Ferrous
- Glass Containers
- Plastic Film /Plastic Containers

- Yard Waste
- Food Waste
- Wood
- Textiles
- Rubber

XV. Yard Waste Composting

(5) Costs

XVI. Capital Cost

- Collection Costs
- Transportation Costs
- Operating Costs
- Total Facility Costs (Equipment Cost)
- Debt Service
- Gross Costs
- Net Costs

XVII. Revenue cost

- Tipping Fees
- RDF Sales
- Electricity Sales
- MSW Compost Sales /Yard Waste Compost Sales
- Recyclables/Commodities Sales
- Other Fees if any

Per Capita Waste Generation: City size and per capita waste generation is positively correlated. Subsequently bigger city occupies big landfill area so > population > waste generation > landfill area. 366 towns' data has collected and tabulated as under.

Original Classification	**Classification for this Study**	**Population Range (2001 and 2011 Census)**		**No. of Cities Studied**	**Total No. of Cities**	**Per Capita kg/day average**	**Landfill Area to City area %**
Class I	Metropolitan	5,000,000	Above	6	6	0.605	Upto 5
	Class A	1,000,000	4,999,999	32	462	0.518	Upto 3
	Class B	700,000	999,999	20		0.487	Upto 2
	Class C	500,000	699,999	19		0.464	
	Class D	400,000	499,999	19		0.459	
	Class E	300,000	399,999	31		0.448	Upto 1
	Class F	200,000	299,999	58		0.445	
	Class G	150,000	199,999	59		0.436	
	Class H	100,000	149,999	111		0.434	
Class II		50,000	99,999	6	345	0.427	Upto 0.5
Class III		20,000	49,999	4	947	0.425	Crude Dumping
Class IV		10,000	19,999	1	1,167	0.342	
	TOTAL			366			

Table 2: Per Capita Waste Generation in Different Class of Town in India. Source: Census of India, CPCB Report, Municipal Document

Waste Composition: Materials in MSW can be broadly categorized into three groups,

Compostables: Compostables or organic fraction comprises of food waste, vegetable market wastes and yard waste.

Recyclables: Recyclables are comprised of paper, plastic, metal and glass

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Inerts : The fraction of MSW which can neither be composted nor recycled into secondary raw materials is called Inerts. Inerts comprise stones, ash and silt which enter the collection system due to littering on streets and at public places.

366 towns data has analyzed to assess the waste composition in different region of country as under.

Region/City	**MSW (TPD)**	**Compostables (%)**	**Recyclables (%)**	**Inerts (%)**	**Moisture (%)**	**Cal. Value MJ/kg**	**Cal. Value kcal/kg**
Metros	51,402	50.89	16.28	32.82	46	6.4	1,523
Other Cities	2,723	51.91	19.23	28.86	49	8.7	2,084
East India	380	50.41	21.44	28.15	46	9.8	2,341
North India	6,835	52.38	16.78	30.85	49	6.8	1,623
South India	2,343	53.41	17.02	29.57	51	7.6	1,827
West India	380	50.41	21.44	28.15	46	9.8	2,341
Overall Urban India	130,000	51.3	17.48	31.21	47	7.3	1,751

Table 3: Composition of MSW in India and Regional Variation.

A major fraction of urban MSW in India is organic matter (51%). Recyclables are 17.5 % of the MSW and the rest 31% is inert waste as shown in above table. The average calorific value of urban MSW is 7.3 MJ/kg (1,751 Kcal/kg) and the average moisture content is 47%. It has to be understood that this composition is at the dump and not the composition of the waste generated. The actual percentage of recyclables discarded as waste in India is unknown due to informal picking of waste which is generally not accounted.

Technological Viability: Waste composition categories include organic material (biodegradable) and inorganic material (non-biodegradable). Inorganic portion is mostly occupied by inert material but also include paper, plastics, glass, paper, rubber, etc. Despite the best efforts to reduce, reuse and recycle, there will always be residual waste requiring disposal. The alternative treatment and disposal technologies are:

- Recycle/Reuse/Material Recovery
- Energy recovery
  - Aerobic digestion
  - Anaerobic digestion / Biomethanation
  - Pelletisation / Refuse Derived Fuel (RDF)
  - Pyrolysis and Gasification
  - Incineration
- Composting
- Landfills - Sanitary Landfill / Bioreactor landfill / Secured landfill (for inert waste)`

Recycling and composting efficiency are greatly reduced due to the general absence of source separation in India. Absence of source separation also strikes centralized aerobic or anaerobic digestion processes off the list. Anaerobic digestion is highly sensitive to feed quality and any impurity can upset the entire plant. Aerobic digestion leads to heavy metals leaching into the final compost due to presence of impurities and makes it unfit for use on agricultural soils. In such a situation the role of waste to energy technologies and sanitary landfilling increases significantly in India. This is due to the flexibility of waste-to-energy technologies in handling mixed wastes. Cost and space requirement for different time the comparative assessment of different process are as under:

Item	**Composting/ aerobic Digestion**	**Sanitary/Bioreactor Landfill**	**Bio-Methanation /Anerobic Digestion**	**Incineration**	**Pelletisation**	**Pyrolysis**
Retention Period	*5 Year*	*25-30 Years*	*6days*	*30 minutes*	*20-30 minutes*	*1 hour*
Space Requirement	High : (50-70% reduction of waste to manure)	Moderate : 10-20% reduction of waste Quantum	Low to Moderate 70 % reduction and produce electricity	Low 90% reduction	Low 7-10% waste inert	Moderate 30%
Area Calculation (based on usual practice)	*1 MT for 20 sq mt area*	*1 MT for 10 sq mt*	*1 Mt for 15 sq mt area*	*1 Mt 5 sq mt*	*1 Mt for 5 sq mt area*	*1 MT for 15 sq mt*
Concern for Atmospheric Pollution	Moderate	Low	Low	High	Moderate	Moderate
Capital Investment	*High (INR 200,000 per tom)*	*High*	*High (INR 350,000) per ton*	*High (INR 1000,000 per ton)*	*Moderate (INR 5310 per*	*High ((INR 1000,000*

Item	Composting/ aerobic Digestion	Sanitary/Bioreactor Landfill	Bio-Methanation /Anerobic Digestion	Incineration	Pelletisation	Pyrolysis
					ton)	*per ton)*

Table 4: Technological Viability with Space and Time in India.

Management Approach;

In India, in most of the cities, residents collect waste in plastic buckets and deposit it regularly in community bins located near the house. In some areas, the waste is collected from individual houses by corporate staff. Street sweepings are also collected in community bins. There are no separate bins exclusively for collec¬tion of waste paper, plastic, etc.(S. Kumar et al. in Waste Management 29 (2009) 883-895). Several types of waste receptacles are used in the urban area. These are (i) large masonry bins, locally called "Dhalao" , a community storage of solid waste (ii) metallic bins of covered and open types (iii) 4-wheeled plastics and FRP (Fibreglass Reinforced Plastics) bins with large covers (iv) dumping in open area low lying or road side. For effective solid waste management in a city, the desired strength of workers is 2-3 workers per thousand, which has been indicated as adequate and can be considered to be 200-250 kg/worker/8 h shifts. But very few cities is following the MSW Rule, 2000. The following table gives the idea of management status of municipality and state capital of India.

S N.	Name of City	Waste Qty. (TPD)	MSW Management Scenario			Collection of MSW			Transportation of MSW			
			Organization in charge	Penalty clause	Manual handling	Community bin system	House to house collection	Segregation by rag pickers at community	Municipal vehicles	Private vehicles	Provision of good tarpaulin/ quality cover	Transfer station facility
	Meerut	490	HO	X	✓	✓	No	✓	✓	X	X	X
	Nashik	200	HO	X	✓	X	Fully	✓	✓	✓	✓	X
	Jabalpur	216	HO	X	✓	✓	Partially	X	✓	✓	X	X
	Jamshedpur	338	PP	X	✓	✓	No	X	X	✓	X	X
	Asansol	207	ME	X	✓	✓	Partially	X	X	✓	X	X
	Dhanbad	77	SO	X	✓	✓	No	X	✓	X	X	X
	Faridabad	448	HO	X	✓	✓	Partially	X	✓	X	X	X
	Allahabad	509	AHO	X	✓	✓	No	X	✓	X	✓	X
	Amritsar	438	MHO	X	✓	✓	Partially	X	✓	X	✓	X
	Vijaywada	374	MC	X	✓	✓	Partially	X	✓	X	X	X
	Rajkot	207	DMC	X	✓	✓	No	✓	✓	X	✓	✓
	Port Blair	76	SO	X	✓	✓	No	X	✓	X	X	X
	Guwahati	166	MC	✓	X	✓	No	X	X	✓	✓	X
	Chandigarh	326	MOH	X	✓	X	Fully	X	✓	X	✓	X
	Raipur	184	HO	X	✓	✓	Partially	X	✓	X	X	X
	Panjim	32	AO/TO	X	X	X	Fully	X	✓	X	✓	X
	Gandhinagar	44	DC	X	✓	✓	No	✓	✓	X	✓	X
	Simla	39	HO	X	✓	✓	Partially	✓	✓	X	X	X
	Srinagar	428	HO	X	✓	✓	Partially	X	✓	X	X	X
	Ranchi	208	HO	X	✓	✓	Partially	X	✓	X	X	X
	Thiruvanamthapuram	171	HO	X	✓	✓	Partially	X	✓	X	✓	X
	Imphal	43	HO	X	✓	✓	Partially	X	✓	X	X	X
	Shillong	45	CEO	X	✓	✓	Partially	X	✓	X	✓	X
	Aizawal	57	SO	X	✓	✓	No	X	✓	X	X	X
	Kohima	13	AO	X	✓	✓	No	X	✓	X	X	X
	Bhuveneshwar	234	HO	X	✓	✓	Partially	X	✓	✓	X	X
	Agartala	77	CEO	X	✓	✓	Partially	X	✓	X	X	X
	Dehradun	131	SHO	X	✓	✓	Partially	✓	✓	X	X	X
	Pondicherry	130	HO	X	✓	✓	Partially	✓	✓	X	✓	X
	Itanagar	12	DC	X	✓	✓	No	X	✓	X	X	X
	Gangtok	13	JS	✓	X	X	Fully	X	✓	X	✓	X
	Kavaratti	3	CP	X	✓	✓	Partially	X	X	✓	X	X
	Daman	15	ME	X	✓	✓	No	X	✓	X	X	X
	Jammu	215	HO	X	✓	✓	Partially	X	✓	X	X	X

S N.	Name of City	Waste Qty. (TPD)	MSW Management Scenario			Collection of MSW			Transportation of MSW			
			Organization in charge	Penalty clause	Manual handling	Community bin system	House to house collection	Segregation by rag pickers at community	Municipal vehicles	Private vehicles	Provision of tarpaulin/ good quality cover	Transfer station facility
	Silvassa	16	CMO	X	✓	✓	No	X	✓	X	X	X

Table 5: Status of State Capital Cities in implementation of MSW (Management and Handling) Rules, 2000. Source: CPCB 2006-07

Note: Note; CEO: Chief Executive Officer, DC: District Collector, MOH: Municipal Officer (Health), AO/TO: Accounts Officer/Tax Officer, DC: Dy. Commissioner, JS: Joint Secretary, CP: Chairperson (Village Panchayat), CMO: Chief Medical Officer, SHO: Senior Health Officer PP: Private Party, ME: Municipal Engineer, SO: Special Officer, AHO: Asst. Health Officer, MHO: Municipal Health Officer, MC: Municipal Commissioner

Cost:

To account the cost of solid waste management process in city the following cost to be accounted:

For accounting Transportation cost

(1) from individual node to transfer stations or processing unit or disposal sites.

(2) from transfer station to R.D.F. plant , compost plant, recycling plant and landfill

(3) from transfer station to incinerator, vermicular compost plant and landfill

For accounting revenue cost

(4) revenue respectively per unit of waste from RDF plant mechanical compost plant, recycling plant, incinerator, vermicular compost plant, bio-medical treatment plant .

(5) cost of buying dumpers and special vehicle for bio medical waste.

(6) total amount of waste at transfer from different stations

(7) fixed cost incurred in opening a RDF plant, mechanical compost plant, recycling plant , an incinerator , vermicular compost plant , bio-medical treatment plant and landfills

(8) respectively variable cost incurred in handling of plants and landfill site

6 STATE SPACE MODEL IN SWM

For Accounting Per Capita Waste Generation in State-Space Linear modeling is as followed:

Based on Linear Equation

Equation:

$Z1 = \sum Y1 / \sum X1$

$Z2 = \sum Y2 / \sum X2$

Where:

$\sum X1$ = Total Population of wards

i-n

where I to n are wards

$\sum X2$ = Total Projected ward Population

i-n

where i to n are wards

$\sum Y1$= Collected total waste

i to n

$\sum Y2$ = Estimated total waste

i to n

For accounting Waste Composition

Based on Linear Equation

Equation

$\sum a_{i-n} + \sum b_{i-n} + \sum c_{i-n} + \ldots\ldots \sum Z_{i-n} = \sum Y2$

where:

$\sum a_{i-n}$= Composting Waste

$\sum b_{i-n}$= Recycle Waste

$\sum c_{i-n}$= Construction Debris Waste

$\sum d_{i-n}$= WTE Waste

$\sum Y2$= Estimated total waste

For accounting Technological Option

Based on Linear Equation

Equation:

$\sum Y2 - (\sum a_{i-n} + \sum b_{i-n} + \sum c_{i-n} + \ldots\ldots \sum Z_{i-n})$ = Sanitary Landfill

Where:

$\sum a_{i-n}$= Composting Waste= compost plant

$\sum b_{i-n}$= Recycle Waste= Pyrolysis

$\sum c_{i-n}$= Construction Debris Waste= incineration

$\sum d_{i-n}$= WTE Waste (RDF)

For accounting Management Approaches

Based on Linear Equation

equation

$\sum aX\ it1 + \sum a\ Xyt2 \geq T1 + T2$

Where:

Total waste moved from each waste collection points i=1,…5

and j=1,…4 should at least be equal to the total amount of waste at that point or net density waste.

t1, t2 : transfer station

If only direct Haul exist then Transfer station is equal to zero

For accounting the Cost

Based on Linear Equation

Net cost ≤ Revenue Cost

Net Cost= $\sum F1Xi\text{-}z + \sum F2Ti\text{-}z + \sum F3Oi\text{-}z + \sum F4Ei\text{-}z + \sum F5Si\text{-}z$

where

$\sum F1Xi\text{-}z$= Sum of Every HH/Nodes collection cost

$\sum F2Ti\text{-}z$-= Sum of Every node to transfer station cost

$\sum F3Oi\text{-}z$= sum of Operating cost of different processing plant per unit

$\sum F4Ei\text{-}z$= Sum of equipment cost

$\sum F5Si\text{-}z$= Sum of salary cost

Net revenue= $\sum f1X1 + \sum f2R + \sum f3\ E + \sum f4A + \sum f5B$

Where

$\sum f1X1$=Sum of revenue collection from HHs

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∑f2R= Sum of RDF sales cost (yearly)

∑f3 E=Sum of electricity sale

∑f4A= Sum of Compost plant sale

∑f5B= sum of recyclable waste

7 CONCLUSION

The proposed model is a good starting point upon which future variation can be built. So for net Cost determine the selection of processing technology for town and on that account net inert to be account. After calculating net inert area requirement for waste disposal will be identified on different time perspective. Basis of characterization of the system like waste composition, heating value, material recovery possible treatment method is to be identified. In different perspective this value will change and selection process will change. Overall the cost benefit analysis will determine the feasibility of the choice for town. To account the viability of individual city space can opt the technological choice and account the heat piotentiality from total quantum under each category.

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reviewed paper

Technological Solutions for Knowledge Management in Smart Cities

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1 ABSTRACT

Nowadays huge volume of information, data and knowledge, that directly or indirectly relates to modern cities, their state and problems is gathered and stored. Effectiveness of its use significantly influences on effectiveness of city development. Due to constantly increasing amount of information and knowledge, for its best use special tools for knowledge management, including tools for knowledge systematization and building formalized descriptions as well as new algorithms for knowledge processing and application are required. In the paper a set of technological solutions focused on knowledge retrieval from multidimensional measurements provided by different sources of information is suggested. Use of developed technologies allow to organize operative processing of new measurements, taking into account all available knowledge. Dealing with measurements at the level of knowledge about measurements provides solutions of end user problems in terms of subject domain objects or situations but not separate measurements. Several subject domains and their tasks, that can be solved using the proposed set of technological solutions, are defined.

2 INTRODUCTION

Time, when tasks of departments of city economy could be solved locally and independently have passed. Nowadays almost all tasks are supposed to be solved jointly; moreover in many cases it is reasonable to consider the set of the solved tasks as a unique complex task that is oriented on providing stability in the economic and social spheres of a city. Many external factors influence on the process of forming solutions such as state of the interconnected departments of the city management, state of the neighbouring territories, state of the environment and etc.

In the sphere of the city's economy hundreds of various domain specific business processes are created every day. Business processes specify how operational activities have to be executed in order to provide a defined set of services [1]. The number and the complexity of the executed processes are constantly increasing. Results of their execution significantly depend on amount and quality of available information. Consequently, the state of the development of modern city economy as a whole can be characterized as highly information dependent. Under information a semantic interpretation of data is considered [2]. Data is a product of observations or facts used to calculate, analyze, or plan something. After data is processed into a usable form, information is received [3]. The distinguishing feature of information is that it has sense. Entire amount of information available about the considered subject domain as well as about related subject domains forms information space. An information space provides an environment for allocation of information flows. Information flows transfer information from a provider to a consumer in the information space. All tasks of information processing and analyses as well as tasks of information space and information flow support and management require knowledge for building solutions. Knowledge is typically defined with reference to information. Most frequently knowledge is defined as a fluid mix of framed experience, values, contextual information, expert insight and grounded intuition, that provides an environment and framework for evaluating and incorporating new experiences and information [4]. The terms data, information and knowledge are linked together in Ackoff's hierarchy described in [5].

The key problem of data and information processing and analyses is to select knowledge, which is necessary or useful for solving the defined task or the subtask from the huge amount of knowledge, that is available nowadays and to apply knowledge correctly. This task refers to the tasks of knowledge management (KM) and as well as all other tasks of this type requires considerable amount of time, financial resources and assumes involvement of experts of the subject domains. To reduce amount of resources, that are spent on supporting the infrastructure required for solving end tasks of the city's economy, it is important to develop software applications that are capable to solve highly complicated tasks of data, information and knowledge processing, analyses and management for the subject domain of the smart cities.

For solving the enumerated tasks applications must meet following requirements:

- applications must gather actual data about the state of the controlled objects;
- applications must be able to assimilate gathered data and to use it for solving end tasks;

- applications in the case of available computational resources have to estimate the state of the information space, to create and manage processes, that are oriented on the improvement of the information space;
- applications must be able to acquire knowledge of different types, to interpret and to integrate knowledge, in order to obtain new knowledge on the base of existing knowledge.

Software applications that have features, necessary for solving considered tasks, are known as knowledge based or knowledge centric applications. A knowledge based software application in the narrow sense means an application for extending and/or querying a knowledge base. In extended sense the term is perceived as a synonym of the term expert system, but normally expert systems refer to more domain-specific systems used for a specialized purpose such as medical diagnosis [6]. In the broad sense knowledge based applications are applications, that use artificial intelligence or expert system techniques in problem solving processes. They incorporate a store (database) of expert knowledge with couplings and linkages designed to facilitate its retrieval in response to specific queries, or to transfer expertise from one domain of knowledge to another [7]. Knowledge centric applications are applications, that use knowledge at all stages of their life cycle including construction, development, usage and support.

For solving tasks of KM the following set of technological solutions are highly required: harmonization, integration and fusion technologies [8], intelligent data processing technologies, technologies of preliminary and exploration data analyses. Implementation of the enumerated technologies is commonly based on usage of various means and tools that include tools of artificial intelligence, in particular, expert systems and inference engines, modelling tools, tools for business processes management and libraries of intelligent methods and algorithms.

In the paper the technological solutions for KM in the applications developed for smart cities and the ways for their implementation are considered. The proposed technological solutions are focused on solving a limited group of tasks based on measurement processing. Input data for the considered group of tasks contain by the most part measurements of the parameters of both natural and technical objects and parameters of the environment. Measurements can be represented in the form of time series or sets of separate measured values.

The paper is organized in the following way. In the next section common approaches for KM are considered. In the fourth section the proposed basic technology for KM is described. In the subsequent sections the proposed technology is detailed. In the last section questions of application of the technology for solving several tasks of the city’s economy are discussed.

3 COMMON APPROACHES FOR KNOWLEDGE MANAGMENT

KM is defined as a process of getting correct knowledge to the proper consumer, that can be either a person or a system at the right time [9]. KM also allows solving tasks of new knowledge creation, acquiring and retrieving, the tasks focused on knowledge sharing and storage and the tasks of knowledge refinement.

Considerable experience in KM is gained in the sphere of corporate information systems (CIS). The developed solutions for KM in CIS implies a strong tie to corporate strategy, understanding of where and in what forms corporative knowledge exists, creating processes, that span organizational functions, and ensuring that initiatives are accepted and supported by organizational members. KM in CIS is aimed to improve and refine the organization's competences and knowledge assets to meet organizational goals and targets. The main aspects of organizations that are considered in implementation of KM include [9]:

- organizational strategy. KM strategy is dependent on corporate strategy and is aimed to meet tactical and strategic requirements;
- organizational culture. The organizational culture defines the context within which knowledge is created and shared in an organization;
- organizational processes. The organizational processes define processes, environments, and software, that can be used for implementation of KM in an organization.
- management and leadership. The structure of management and leadership of the organization defines a set of possible KM-related roles and defines the need in each of them;

- technology. The technology aspect defines systems, tools, and technologies, that can be used for implementation of KM and fit organization's requirements;
- politics. The politic aspect describes politics of the organization from the point of view of long-term perspective initiatives and investments, that requires development of the existing solutions for KM.

The best practices of KM are described in many publications, for example, [10-13].

Scientific and technological solutions for KM, developed for an organizations cannot be directly applied for solving tasks of smart cities. The main reasons for that are following:

- business processes, that are required for solving tasks at the city level, are much more complicated and unlike the processes, implemented in organizations, are undetermined and hardly predictable;
- almost all of the considered aspects, that define the backbone of KM at the level of organizations, cannot be defined at the level of cities.

To overcome the difficulties, that are caused by the complexity of the business processes of cities, it is proposed to develop a system of patterns, that describe business processes in the general form and business rules for the processes adaptation to the sphere and the context of their application.

The possibility of development of patterns is defined by distinctive features of the subject domain of city’s economy, that are considered below.

Feature 1. The subject domain of the city’s economy can be considered as a set of interconnected applied subject domains, that are integrated in a complicated single subject domain, that has its own goals and tasks. For example, a model of the subject domain of smart city economy contains models of the subdomains, that define the structure of the city’s economy, in particular, the model of the subdomain of the social organizations, of the natural resources and etc. For each of the subdomains the formal models have been developed or can be built. The models of the subdomains are oriented on solving applied tasks.

Feature 2. Tasks solved in the subject domain of the city’s economy form two groups. To the first group refer the specialized tasks, that can be solved using the predefined set of business processes. The second group contains tasks, that are context dependent. The tasks of the first group can be solved using approaches for KM implemented in CIS. For solving the tasks, that belong to the second group, solution-oriented subject domain models are used. The example of the solution-oriented subject domain is the subject domain of data processing and analyses. Integration of problem-oriented and solution-oriented domains allows solve complicated undetermined tasks of the applied subject domains using basic solutions.

Feature 3. Software applications, developed for various departments of cities economy, have been always based on the most advanced information technologies. Due to that technologies of data and information gathering and storage have been used for many years already and now amount of available data and information is enough for building extended knowledge bases. Knowledge provided by knowledge bases is sufficient for defining rules, that can be used for adaptation of the process patterns to the sphere and the context of their application. The high level of qualification of the specialist, working in the departments of city economy, allows them to estimate and to verify the defined business rules.

Using the proposed solutions, based on the features of the subject domain of city’s economy, a basic technology for KM for smart cities has been worked out. The proposed technology is described in the next section.

4 BASIC TECHNOLOGY FOR KM

The basic technology for KM requires three main components: a base set of subject domains models, a set of patterns for data processing and analyses and a set of appropriate mathematical libraries. The models provide actual information, required for solving end user tasks. The base set of models contains the model of the subject domain of city economy that provides information and knowledge about the objects of the domain, their characteristics and relations between objects, the model of the domain of data processing and analyses that is used to describe initial data and results of its processing and optionally models of the related subject domains (Fig. 1). Problem-oriented models of the subject domain and models of the applied subject domains (subdomains of the domain of city economy) are implementations of the defined base set of the models. The set of patterns for data processing and analyses is given in Fig.2. The overwhelming majority of patterns

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were developed for processing measurements represented in the form of time series or in the form of sets of separate values. The set of developed patterns contains two groups of patterns. To the first group refer the typical patterns, that are oriented on executing basic operations of data processing, aimed to extract knowledge from analyzed data. The second group contains patterns for solving data processing tasks, specialized for the considered subject domain. The patterns of the first group describe processes of data harmonization, integration and fusion as well as the processes of data prospecting analyses and data exploration analyses. The main goal of data prospecting analyses is to retrieve additional information about analyzed data before processes are started and during their execution. Exploration data analyses processes allow solving tasks of mining knowledge both from operational and historical data. The set of the mathematical libraries may significantly differ, depending on the subject domain and available implementations of algorithms.

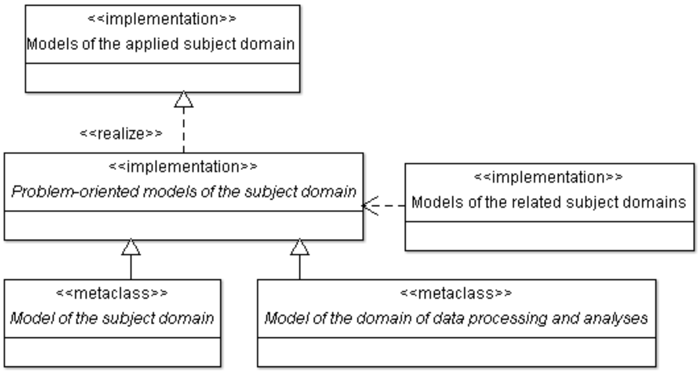

Fig. 1. The set of information models required for KM

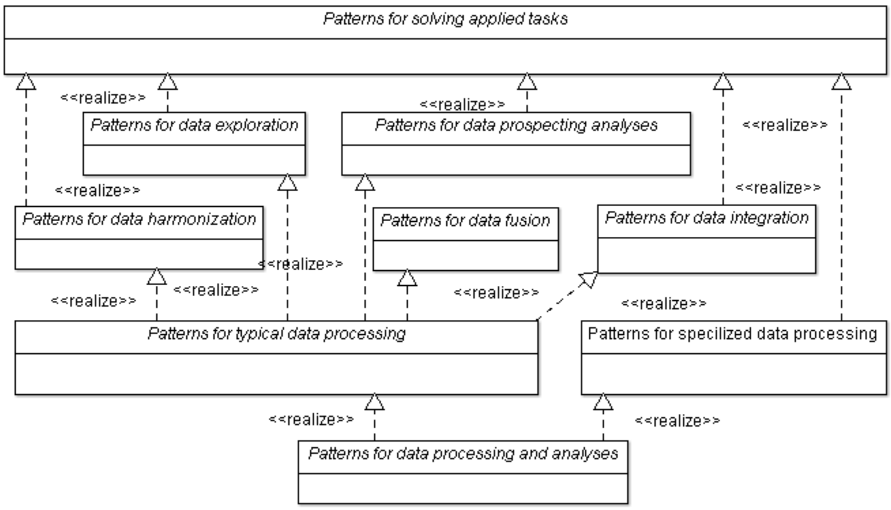

Fig. 2. Set of patterns for data processing and analyses

The proposed technology assumes execution of the following main steps.

1. Using information and knowledge about the applied subject domain and the set of patterns for data processing the subset of the patterns, that are required for solving the tasks of the considered subject domain is formed.

2. Patterns of the defined subset are detailed according to available knowledge about the subject domain and rules for patterns detailing [14]. The detailed set of patterns defines the range of processes, that are assumed to be used for data processing in the considered subject domain. The patterns, defined for the subject domain, may be represented in the form of processes, that can be executed or in the form of patterns, that need further detailing directly before or during their execution.

3. Structure of knowledge required for data processing at each of the steps of the process, build on the base of the detailed patterns, is inherited from the models of the domain of data processing and analyses. Knowledge according to the inherited structure is extracted from the model of the applied subject domain.

4. Amount of used knowledge can be extended using results of analyses of the historical data or it can be enlarged with expert knowledge. Knowledge can be refined using knowledge, provided by the model of the subject domain and means and tools of data, information and knowledge processing and analyses.

Below each of the key technologies, used for data processing, is considered and knowledge required at each of their stages is defined. Theoretical backgrounds of the technologies and examples of their implementation are considered in [9,15].

5 USAGE OF KNOWLEDGE FOR SOLVING HARMONIZATION PROBLEMS

For solving problems of data harmonization two groups of patterns are developed. The first group of patterns is oriented on processing initial data, that is represented in the form of structured data streams. The second group of patterns is used for processing measured values. The list of the patterns of the first group contains the patterns for interaction with external data sources, for revealing the structures of the streams, for estimating the main parameters of the streams and for defining the format of the streams. The second group contains patterns for gathering metadata about the acquired data, for restoring missing values in the measurements, for building formal descriptions of the measurements and for the transformation of the measurements formats. For each group of patterns base patterns are developed. The base pattern of the first group is a pattern for harmonization of the data stream, the base pattern for the second group is the pattern for harmonization of measured values. Both patterns are high level patterns, that are based on the general pattern of data harmonization.

Patterns are linked with the relations of the association type. Existence of the association relation between two patterns means, that the processes build on the base of associated pattern are supposed to be executed before the processes build using the associable pattern. The set of the defined associations reflect the sequence of the patterns execution. All of the represented associations are binary association. The patterns and the relations between the patterns are shown in Fig.3 in the form of the class diagram.

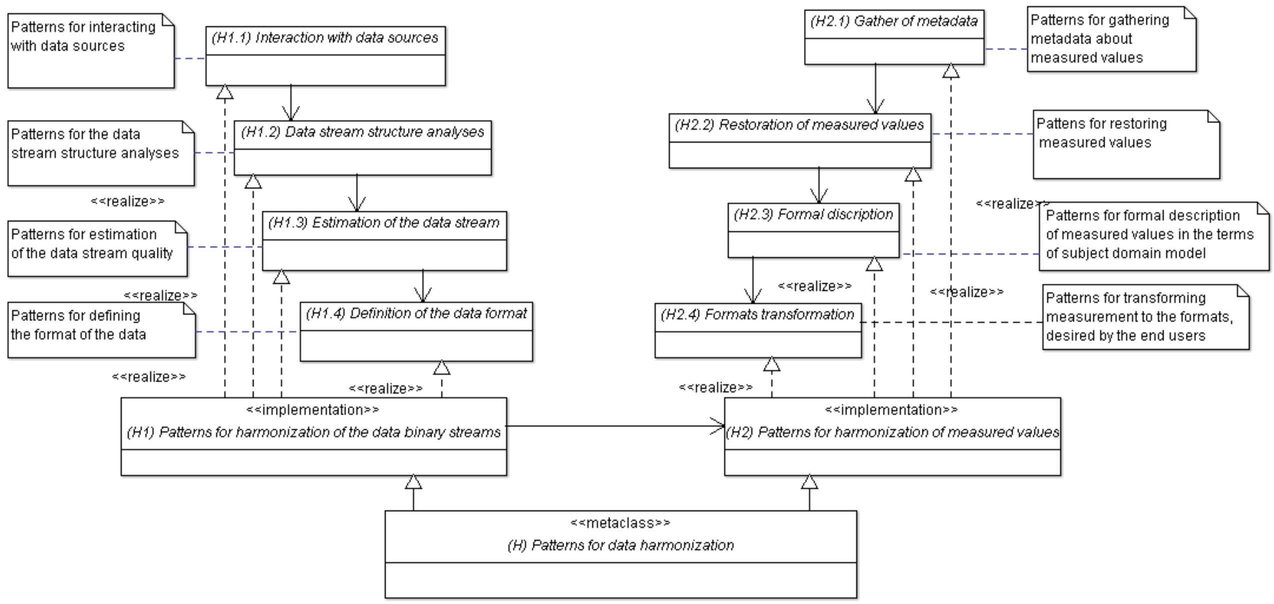

Fig. 3. Patterns for implementation of the data harmonization technology

In the table 1 for each low level pattern its description, the required and the produced knowledge are given.

No.	Pattern	Description	Required knowledge	Produced knowledge
H1.1	Interaction with data sources	Patterns for receiving data from providers and patterns for providing data to possible consumers	List of formats supported by providers / consumers and descriptions of the formats	-
H1.2	Data stream structure analyses	Patterns for defining or for improving the description of the structure of the input data represented in the form of structured streams	-	Knowledge about the structure of data streams
H1.3	Estimation of data stream	Patterns for estimating quality of the data streams; if quality of a stream is different at different intervals then intervals are defined and the quality at the intervals are estimated	-	Knowledge about quality of data streams

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H1.4	Definition of the data format	Patterns for defining formats of the input data	Knowledge about formats used by different providers	-
H1.5	Gather of metadata	Patterns for gathering information about input data. Meta information can be received from the model of the subject domain and from data providers	The vocabulary for interpreting metadata	Additional knowledge about data. The structure of the knowledge is preliminary not determined
H1.6	Restoration of measured values	Patterns for restoring measured values from the data streams according to the description of the streams structures and their quality	Knowledge about the structure of the streams and the quality of the data streams	-
H1.7	Formal description	Pattern for building formal descriptions of the restored measurements	Model of the subject domain; knowledge about data sources and measured values; the descriptions of the terms in which knowledge is expressed	Model of the subject domain that contains information and knowledge about the received measurements.
H1.8	Format transfor-mation	Patterns for transforming measurements to different formats required by the consumers	Knowledge about the supported formats, formalized descriptions of the formats and rules for the formats transformation	-

Table 1. Description of harmonization patterns.

6 USAGE OF KNOWLEDGE FOR SOLVING INTEGRATION PROBLEMS

Problems of data integration are proposed to be solved using two groups of patterns. The first group contains patterns oriented on solving problems of measurements integration, the second contains patterns, that are supposed to be applied for solving end users specialized problems. Composition and relations between the patterns in the considered groups are shown in Fig.4.

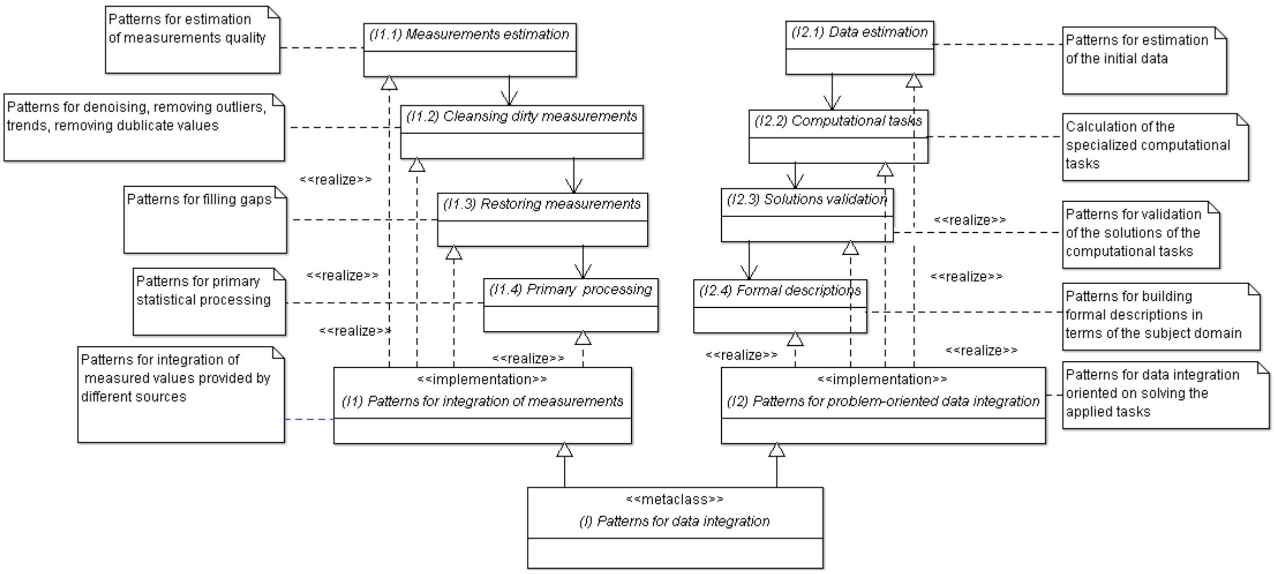

Fig. 4. Patterns for implementation of the data integration technology

Description of the integration patterns, knowledge required for the application of the patterns and knowledge produced at different steps of data integration technology is given in the table 2.

No.	Pattern	Description	Required knowledge	Produced knowledge
I1.1	Measure-ments estimation	Patterns for estimation of the quality of measurements, represented in the form of separate measurements or time series	Knowledge about quality of the data streams, knowledge about the data sources, additional knowledge about measurements	Knowledge about quality of the measurements
I1.2	Cleansing dirty measure-ments	Patterns for removing noise, outliers, trends, identifying and removing duplicated values	Knowledge about the quality of the measurements	Knowledge about probable true values of measured parameters
I1.3	Restoring measure-ments	Patterns for filling gaps in measurements	Knowledge about measured parameters behavior, behavior of the observed objects, conditions in which measurements were performed	Knowledge about probable true values of measured parameters at all required time points
I1.4	Primary processing	Patterns for primary data processing using statistical procedures	Knowledge about the statistical characteristics that are significant for the processed data	Complex statistical primary description of measurements that reflect the key features of the data
I2.1	Data estimation	Estimation of input data required for solving end user tasks	Knowledge about composition of estimations required for solving	Knowledge about the level of adequacy and compliance with

			tasks and the border values for the estimations	the requirements to the data
I2.2	Computa-tional tasks	Patterns for solving end user computational tasks	Knowledge about the requirements to input data and means, necessary for executing the tasks	Knowledge produced as the result of executed calculations
I2.3	Solutions validation	Patterns for validation and estimation of the formed solutions	Subject domain model, knowledge about solved tasks, knowledge about the requirements imposed to results	Knowledge about the formed solutions and expediency of their further application
I2.4	Formal descriptions	Patterns for building formal descriptions of the results of the end user tasks calculations	Subject domain model, knowledge about the results of the executed calculations	Model of the subject domain that contains additional knowledge acquired as the result of solving tasks

Table 2. Description of integration patterns

7 USAGE OF KNOWLEDGE FOR SOLVING FUSION PROBLEMS

The set of patterns, developed for solving data fusion problems contains patterns oriented on solving typical problems and patterns oriented on solving specialized complicated end user problems (Fig.5). To the patterns, oriented on solving typical problems, refer the following groups of patterns: patterns for revealing the structure of measurements, patterns for revealing dependencies in measurements, patterns for measurements exploration, patterns for building statistical models, patterns for building fields. The structure of the listed groups of patterns and relations between the patterns inside the groups and between the groups are shown in Fig. 6. The descriptions of the patterns and knowledge, required and provided by the patterns, are given in table 3 and table 4.

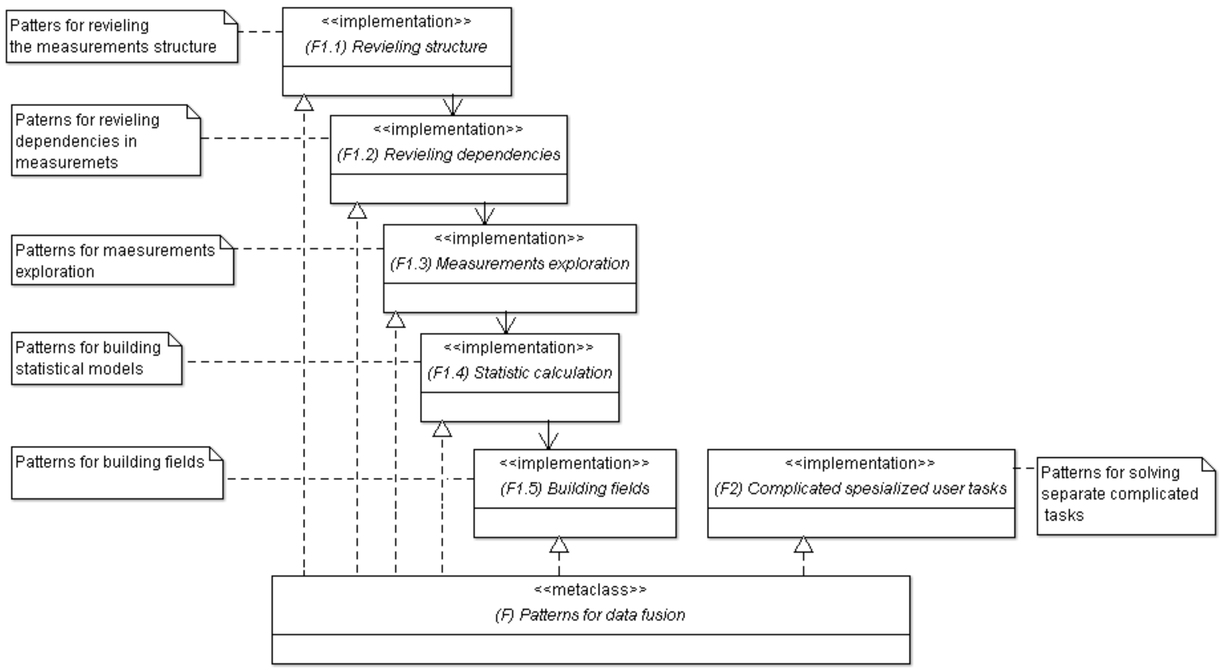

Fig. 5. Groups of patterns for implementation of the data fusion technology

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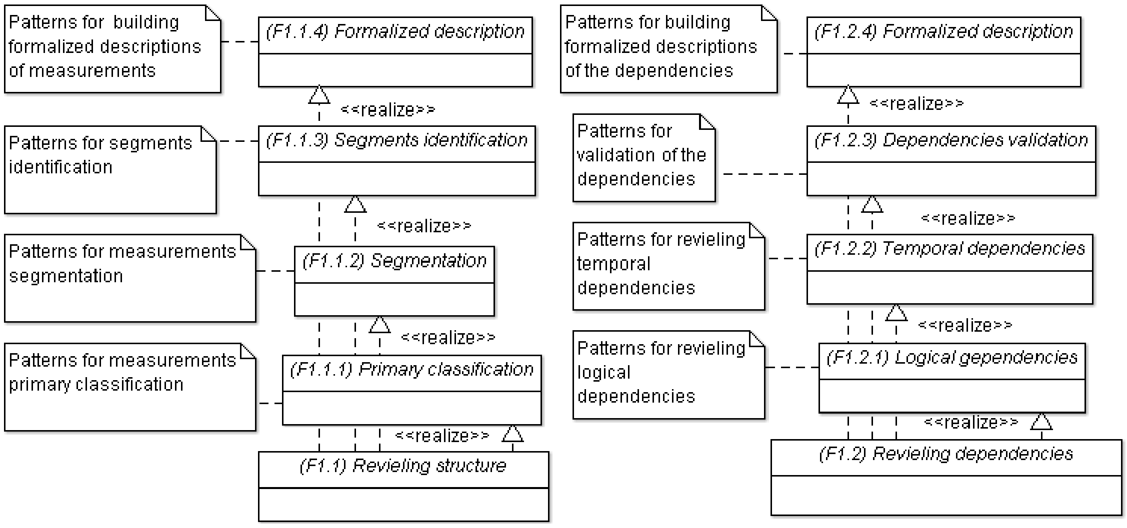

Fig. 6 (a). Patterns for implementation of the data fusion technology

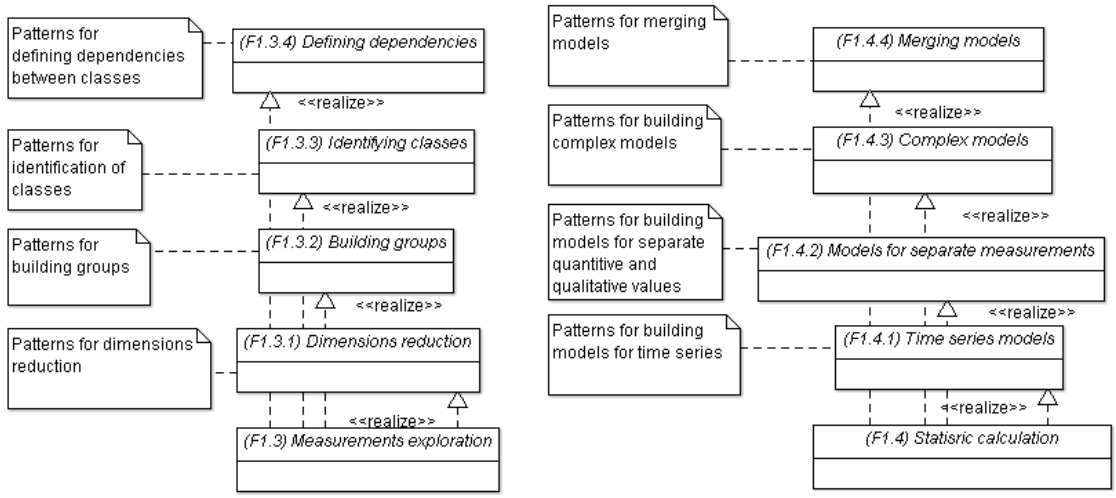

Fig. 6 (b). Patterns for implementation of the data fusion technology

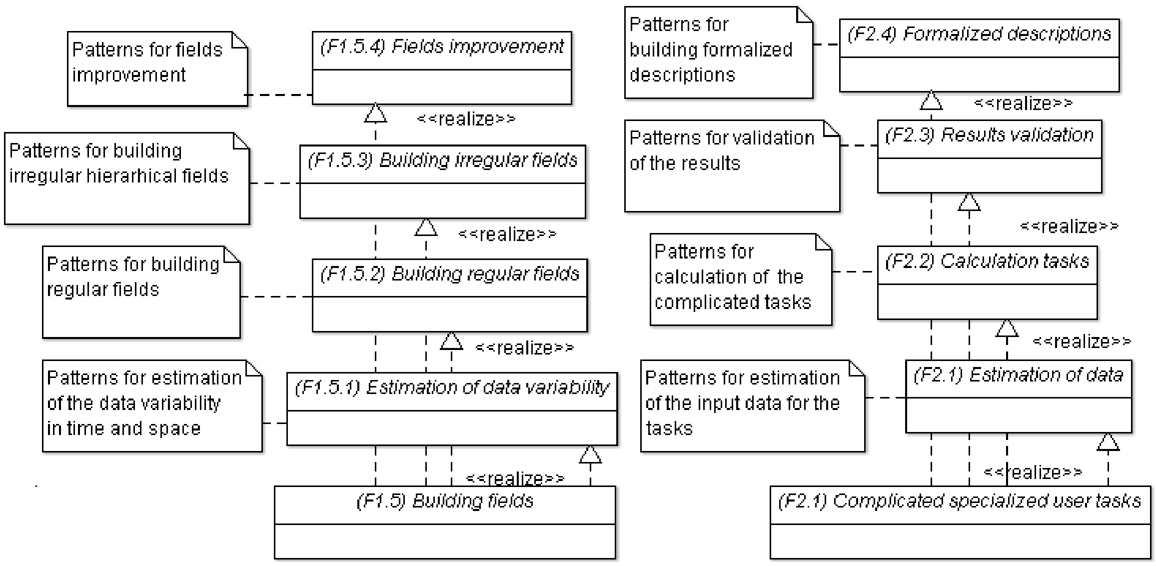

Fig. 6 (c). Patterns for implementation of the data fusion technology

No.	Pattern	Description	Required knowledge	Produced knowledge
F1.1.1	Primary classifi-cation	Patterns for defining types of the measurements. The types can be defined according to calculated statistical characteristics, specialized rules for types identification, results of execution of the	Primary statistical description of the data, knowledge-based rules for types identification, sets of tests and the sequence of their execution for identification of the	Knowledge about the types of measurements

		specialized tests	measurements of the defined type	
F1.1.2	Segmen-tation	Patterns for representation of time series of measurements in the form of the sequence of intervals, on which the time series have stationary behavior and the patterns for describing each interval with the separate vector of characteristics	Knowledge about behavior of the parameters, the states of the observed objects, conditions in which measurements were made; knowledge about characteristics that can be used for describing time series	Knowledge about the structure of the time series
F1.1.3	Segments identifica-tion	Patterns for identifying the types of the distinguished segments	Knowledge about the possible types of the segments and their descriptions	Knowledge about the types of the segments
F1.1.4	Formalized description	Patterns for building formalized descriptions of the time series structures on the base of the identified segments	Model of the subject domain, knowledge about the structures of the time series	Model of the subject domain, that contains additional information about the time series structures
F1.2.1	Logical depen-dencies	Patterns for detection logical dependencies in behavior of the time series of parameters measurements, that are represented in the form of a sequence of the identified segments	Knowledge about the structures of the time series	Knowledge about the logical dependencies in the parameters behavior
F1.2.2	Temporal dependen-cies	Patterns for detection of temporal dependencies in the behavior of the time series of parameters measurements, that are represented in the form of a sequence of the identified segments	Knowledge about the structures of the time series	Knowledge about the temporal dependencies in the parameter behavior
F1.2.3	Dependen-cies validation	Patterns for identification and validation of logical and temporal dependencies of the parameters behavior	Knowledge about logical and temporal dependencies in the behavior of parameters	Knowledge about physical sense of identified dependencies, knowledge about probable true dependencies
F1.2.4	Formalized description	Patterns for building formal descriptions of the dependencies in the parameters behavior	Knowledge about probable true logical and temporal dependencies in the behavior of the parameters	Model of the subject domain that contains additional information about the dependencies in the behavior of the parameters
F1.3.1	Dimension reduction	Patterns for reducing dimensions of the feature spaces used for describing time series	Knowledge about the structures of the time series	Knowledge about the structures of the time series represented in compact forms
F1.3.2	Building groups	Patterns for building compact groups of the measured parameters described in the reduced feature spaces	Knowledge about the structure of the time series represented in compact forms	Knowledge about similar parameters according to the defined set of parameters features
F1.3.3	Identifying classes	Patterns for identifying classes for the formed groups of the parameters. The classes can be identified using expert knowledge, classifiers or procedures for finding similar earlier identified groups	Knowledge about the classes of the parameters and the features of the classes, knowledge about the formed groups of the parameters	Knowledge about the classes of the formed groups of the parameters
F1.3.4	Defining dependen-cies	Patterns for defining dependencies for the groups of the parameters. On the base of the groups hierarchical trees are build and logical dependencies between separate groups are defined	Knowledge about the formed groups of the parameters both identified and not identified	Knowledge about the dependencies of the formed groups of the parameters
F1.4.1	Time series models	Patterns for building the hierarchy of the formal descriptions of time series. The levels are defined according to the amount of available knowledge [16, 17]	Knowledge about the described time series	Systematized knowledge about the time series
F1.4.2	Models for separate measure-ments	Patterns for building the hierarchy of the formal descriptions of the sets of separate measured values. The levels are defined according to amount of available knowledge [17]	Knowledge about the described sets of measurements	Systematized knowledge about sets of measured values of the parameters
F1.4.3	Complex models	Patterns for building complex formalized descriptions of the data sets, that contain data of different types using the formalized descriptions of time series and sets of separate measured values	Knowledge about the described sets of data that contain different types of data	Systematized knowledge about the described sets of data, that contain different types of data
F1.4.4	Merging models	Patterns for merging models, that describe time series, patterns for merging models, that describe the sets of separate measurements, patterns for merging complex models	Systematized knowledge about the time series, about the sets of measured values and about the sets of data that contain data of different types	Extended systematized knowledge about the time series, the sets of measured values, the sets of data that contain data of different types
F1.5.1	Estimation of data variability	Patterns for estimation of time and space variability of data, patterns for defining regions with low variability, patterns for idetifying dynamic of changes in regions	-	Knowledge about variability of data
F1.5.2	Building	Patterns for building regular grids	Knowledge about behavior of the	Knowledge about probable

	regular fields		analyzed parameters in the defined regions	values of the parameters in the nodes of the regular grids
F1.5.3	Building irregular fields	Patterns for building hierarchical irregular grids	Knowledge about behavior of the analyzed parameters in the defined regions; knowledge about measurements quality	Knowledge about probable values of parameters in the nodes of the hierarchical irregular grids
F1.5.4	Fields improve-ment	Patterns for improving regular and hierarchical irregular grids	Knowledge about behavior of the analyzed parameters in the defined regions	Extended knowledge about probable values of the parameters in the nodes of the regular and hierarchical irregular grids

Table 3. Description of fusion patterns for measurement processing

No.	Pattern	Description	Required knowledge	Produced knowledge
F2.1	Estimation of data	Patterns for estimation of adequacy of the available data, information and knowledge for solving defined set of the end user tasks	Knowledge about features of input data, important for solving the end user tasks, knowledge about the solved tasks	Knowledge about correspondence of available data, information and knowledge to the solved tasks
F2.2	Calcula-tion tasks	Patterns for calculation of the complicated end user tasks based on application of knowledge	The model of the subject domain, knowledge about correspondence of available data, information and knowledge to the solved tasks, knowledge about the solved tasks	Knowledge acquired as the result of the tasks calculation
F2.3	Results validation	Patterns for validation of the results of the end user tasks calculation	Knowledge of the subject domain, in particular knowledge about the features of the objects and their behavior, knowledge about the similar earlier solved tasks	Knowledge about possibility of usage of the formed solutions of the end user tasks
F2.4	Formalized descriptions	Patterns for building formal descriptions of the formed solutions for the end user tasks	Subject domain model, knowledge about solutions of the end user tasks	Model of the subject domain, that contains additional knowledge acquired as the result of solving the end user tasks

Table 4. Description of fusion patterns for solving complicated user tasks

8 USAGE OF TECHNOLOGICAL SOLUTIONS

Proposed technological solutions can be used for building applications almost for all spheres of smart cities economy for solving various tasks. As an example of the spheres, where KM in data processing is of the primary need, three spheres can be considered: the sphere of cities industry, the cities transport and the cities natural environment. The distinguishing feature of the spheres is that in all of them telemetric systems are widely used and consequently the tasks of telemetric information processing are solved. In the enumerated spheres extraction of knowledge from data is strongly required for solving three key tasks: the task of monitoring, the tasks of the short term and the long term prediction of the sphere state and the task of the planning of the sphere future development.

The task of monitoring is based on gathering data about the state of the analyzed objects. Two types of data is usually available: separate measurements and series of measurements. Measurements are received from various measurement instruments, that are installed on objects. Complexity of a monitoring task is conditioned with the necessity of processing huge amounts of data in real time or with minimum delay. Additional difficulties, that arise during data processing, are defined by complexity and bad quality of data. Besides the features of data as well as methods and algorithms applied for data processing significantly depend on conditions, in which data was acquired and has to be processed. Application of the predefined set of methods and algorithms can lead to essential errors in calculated estimations of the objects states. Due to that experts are almost always involved in the processes of monitoring. They analyze received data and make decisions about the controlled objects state. The developed technological solutions allow to use knowledge during data processing and extract knowledge from the analyzed data. Calculation of estimations of the controlled objects states based on using knowledge are expectedly of higher precision and reliability. Some experimental results of solving monitoring tasks using knowledge are described in [18]. In separate cases knowledge based solutions allow to automate processes of monitoring, in other cases – to improve quality of information provided to experts and consequently to simplify their work.

Short term and long term predictions of the states of the considered spheres are commonly based on a set of formal mathematical models, that describe separate objects, their behavior, the rules of their interaction, their life cycle as well as many other parameters of the objects and the environment in which they are functioning. This approach has been used for a long time almost in all spheres. During this period experts of applied subject domains in close collaboration with mathematicians have developed plenty of models, that have been successfully used. The high speed of development and constant changes, that are observed in all spheres nowadays cause three problems. The first problem is that some models because of occurred changes don't completely reflect the corresponding objects. The second problem is concerned with necessity of creation of new models. The third problem is conditioned by exponentially increasing amount of data that must be processed in real time. Increasing amount of data requires additional computing resources for processing and analyses. The developed mathematical models are in most part highly complicated from the computational point of view. Complexity of the models aggravates the problem of lack of the computing resources. Application of the solutions for KM at all stages of data processing allows to extract knowledge from historical data and to build knowledge-oriented formal descriptions. These descriptions can be considered as statistical models. Main advantages of the statistical models are the following. The models can be simply built and updated using historical data, available information and knowledge of the subject domains. They are easily interpretable by both experts and computers and are actual, as they can be updated each time when new data is received. The statistical models can be used separately or together with mathematical models. An example of statistical models build for ocean data can be found in [19].

The most complicated task from the list of the considered tasks is the task of planning of the spheres future development. There are many approaches that can be used for planning. The most part of them are domain-oriented and task-oriented. Usually these approaches are quite simple and assume application of the predefined technologies or sets of methods and algorithms. They can be used for planning activities of separate small and middle organizations. The task of planning at the level of the city because of its extremly high complexity refers to creative tasks rather than to technological tasks. The only way to form proper solutions of the creative tasks is to use imitation modeling tools along with means and tools of artificial intelligence. To solve the planning task it is proposed to decompose it into the five subtasks: to build formal descriptions of the subject domain or its separate elements, to define models that can be used for predicting the subject domain state, to define imitation models, to execute several modeling cycles and to estimate the results of the modeling. Each of the considered subtasks assumes application of knowledge. Solutions for the first two subtasks are considered above. To build imitation models and to model different plans scenario approach [20] is suggested to be used. Scenarios are algorithms represented as a sequences of stages and decisions. Execution of the scenarios requires a set of artificial intelligence tools, including expert system and inference engine [21]. The results of the modeling and their estimations form the base for making well founded decisions about the plans of the cities development created by the experts.

9 CONCLUSION

In the paper technological solutions for KM for the subject domain of the smart cities economy are proposed. Main attention is paid to the problem of using knowledge for data processing and to the problem of knowledge extraction from data. The described set of the technological solutions includes base technology for KM that assumes building high level patterns and their detailing. In the framework of the base technology three main technologies for data processing and analyses are considered: the technology of data harmonization, integration and data fusion as well as the technologies of data prospecting analyses and data exploration. The developed solutions can be used for solving various applied tasks, based on data processing in different spheres of the city's economy. Main advantage of the proposed solutions is that they are flexible and easy in use and support. The technologies are represented in the form of the class diagrams that are ready for implementation. Further development of the suggested solutions for KM assumes enlargement the set of the technologies with the technologies oriented on processing symbolic information, in particular, textual information.

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🏆 *reviewed paper*

The City of Matera and the Sassi: Smart Places with a Dantean Attraction

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1 ABSTRACT

In Matera, in the course of millennia, there have been favorable and stable conditions that allowed the development of a specific architectural language, juxtaposition of materials, interpenetration of spaces and conformation of volumes, thus creating a unique urban phenomenon. The distribution of similar building artifacts in symbiotic unity with the connective texture of limestone, led to a spontaneous figurative harmonious balance between man and nature that characterizes the building, the techniques distribution and morphological solutions and that is based on a wise use of resources. Certainly, since several years, the Sassi does not longer reserve the experience of a "descent into hell" for those who take narrow streets and steep stairways. The conditions of misery and lack of hygiene described in 1945 by Carlo Levi in his novel "Christ Stopped at Eboli" and, then, the long abandonment and decay of the rupestrian settlement following the displacement of its population, in fact, seem to belong to a very remote time. So, by the end of the forties, critical reading and semantic analysis of the urban complex and environmental structure made up of Sassi and the "murgico" highland was configured as a real construction site of experiments, investigations and research and has involved different disciplines.

The work of geo-graphy in the Sassi, that means writing on the ground, in fact, takes on a deep meaning and a great importance given by the complexity of the built environment development in the three dimensions, that determines a unique image of a biunivocal relationship between natural landscape and human settlement.

This complexity reveals itself in a high density of buildings, and then in a clear prevalence of the full on the vacuum, configuring a compact urban space as negative of the built, defined by the complex system of connective elements such as streets, stairways and squares. It is due to this complexity of urban and domestic spaces, tangled one into the other, that the open space of the Sassi assumed a significant role in the development of settlement models. In fact, the urban space of the Sassi is often configured as an extension of the residence in the so called "urban rooms", with an essential form and enclosed by more housing units, that defines a special type of collective space. It is just for the socializing and community vocation of these places which is possible to prefigure future uses similar to the most modern examples of Social Housing and generally to the Smart settlement models.

The city of Matera, in fact, is going to take action on its neighbourhoods, including "Rione Sassi", with the project named "Clara" (Cloud platform for Landslide Risk Assessment), who achieved the second place in the final ranking of the call "Smart Cities and Communities and Social Innovation", issued by the Ministry of Education, University and Research and funded with € 20 million. In addition, the city will also benefit from the project of the Basilicata Region "Smart Basilicata" funded by the same announcement, which will allow a systematic approach to the region as a "city-region", including the Val d'Agri, Matera and the metropolitan area of Potenza, in order to make it an "intelligent community" through the use of technologies of Information and Communication and participatory planning as part of the most recent paradigm of the Internet of things. There is also a significant experimentation taking place in the Palace "Rione Sassi" of Matera with the first "unMonastery" in the world, co-living and co-working space and place of technological and social innovation, which will accommodate not monks, but hackers, artists, designers and developers throughout Europe. The project, supported by the network of activists Edgeryders and the European Commission, aims to identify sustainable, cultural and smart alternatives, to make the city more beautiful, livable and attractive. It will also support the candidacy for European Capital of Culture 2019 of Matera (entered in the short-list of the six finalists cities), one of the most complex example of redevelopment of urban community and first southern site entered in the UNESCO list.

2 INTRODUCTION

When in 1945 the Italian writer Carlo Levi published the book "Christ Stopped at Eboli", written in the years between 1943 and 1944 during his exile in Lucania ordered by the Fascist regime, the city of Matera and its "Sassi" came finally out by that cone of shadow made by indifference and silence in which they were relegated for years and imposed themselves to the attention of general cultural debate as a "national shame",[1] becoming the symbol of the poverty and backwardness of rural culture of the South. In the description of the city, trusted to the story of his sister, the writer expressed himself as follows:

"I got there at about eleven in the morning. I had read in the guidebook that it was a picturesque town, quite worth a visit, that it had a museum of ancient art and some curious cave dwellings. But when I came out of the railway station, a modern and rather sumptuous affair, and looked around me, I couldn't for the life of me see the town; it simply wasn't there. I was on a sort of deserted plateau, surrounded by bare, low hills of a grayish earth covered with stones. In the middle of this desert there rose here and there eight or ten big marble buildings built in the style made fashionable in Rome by Piacentini, with massive doors, ornate architraves, solemn Latin inscriptions, and pillars gleaming in the sun. Some of them were unfinished and seemed to be quite empty, monstrosities entirely out of keeping with the desolate landscape around them. A jerry-built housing project, for the benefit, no doubt, of government employees, which had already fallen into a state of filth and disrepair, filled up the empty space around the buildings and shut off my view on one side. […] But where is the city? I can't see Matera. […] I set out at last to find the town. A little beyond the station I found a street with a row of houses on one side and on the other a deep gully. In the gully lay Matera. […] The gully had a strange shape: it was formed by two half-funnels, side by side, separated by a narrow spur and meeting at the bottom, where I could see a white church, Santa Maria de Idris, which looked half-sunk in the ground. The two funnels, I learned, were called Sasso Caveoso and Sasso Barisano. They were like a schoolboy's idea of Dante's Inferno".

Certainly, today the Sassi does not longer reserve the experience of a "descent into hell" to those who come across the narrow streets and steep stairways. The conditions of misery and lack of hygiene described by Carlo Levi, and subsequently, the long abandonment and decay of the settlement rock followed to the displacement of its population in the fifties, in fact, seem to belong to a very remote time. The transition from the "apocalyptic vision of the city of caves" to the current perception of the "beautiful, picturesque, breathtaking"[2] is, in fact, the result of the continuos work of citizens and years of research by local and international researchers, who have made Matera a real experimentation laboratory on the function of living, based on an use of balanced, harmonious and sustainable development of energy, a virtuous mechanism of social relationships "neighbourhood" and the synergistic sharing and implementation of technologies for communication and information. Today in Matera, in fact, the history and the testimonies of a thousand-year experiment are intertwined with the demand of knowledge to solve critical problems, the innovation and the technological research take advantage of historical knowledge, the protection of heritage becomes strategic to the technological advanced project. Qualities that make it potentially a "smart" city, not so much in relation to the development and use of technologies of sustainability and energy saving, but rather in relation to the development of the idea of "communities" where it becomes vital the ability of the communities to take advantage of the technological quality of the projects put in place.

According to the Italian journalist and writer Luca de Biase, in fact, the smart city can be defined using three metaphors, which represent three critical approaches complementary to the dominant concept of smart city and that give form and structure to the city, creating narrative and operative responses: city as "Ecosystem", whose center are the places, the life and the social dynamics and whose logic of development is the co-evolution, which directs consciously towards the crucial context of common goods and culture of active participation; city as "citizenship", in which the city does not emerge without a reflection on smart citizenship, its codes of behavior and on efficiency of city services and their effectiveness in terms of improvement of civil coexistence; city as a "platform", whose center are information and innovation and whose aim is to connect the parts and manage the flow of information, so that they are favored in their development and use of the digital technology and new generation applications, services and products.

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[1] The definition is given to the leader of the Italian Communist Party, Palmiro Togliatti, in the occasion of his visit to Matera in 1948.

[2] C. Levi, Cristo si è fermato ad Eboli (1945).

3 AN ANTE LITTERAM BALANCED URBAN AND NATURAL ECOSYSTEM

The Sassi of Matera are a unique testimony of human activity over thousands of years in the Mediterranean, whose "outstanding universal value" is the symbiosis between cultural, environmental and natural fruit of a collaborative process in harmony with the ecosystem.

This concept was at the base of the reasons according to which the Sassi, with their overlooking Park of the Rupestrian Churches of Matera, were recorded in 1993 in the World Heritage List:[3]

(iii) the Sassi and the Park of Matera are a remarkable example of rock settlement perfectly adapted to the geomorphological context and ecosystem through a continuity of more than two millennia;

(iv) the city and the Park are an outstanding example of architectural complex and landscape which illustrates a significant number of stages in the history of mankind;

(v) they represent an outstanding example of a traditional human settlement and land use showing the evolution of a culture that has maintained over time a harmonious relationship with its natural environment.

A "primordial" sustainable economy characterized by a holistic approach to the natural and cultural landscape and a measured respect to the cycles of the elements, which immediately brings to mind the concept of management and operation of energy, admirable in the past, worrying for the future of humanity. In fact, for at least twelve thousand years, men made a wise and intelligent use of locally available resources (water, earth, sun, air), creating a built and excavated city at the same time, with voids cut into the rock and solids made by square blocks consisting of the same rock, the calcareous sandstone, commonly known as "tufa", since the ninth century, worked and assembled in order to form housing and service facilities (sheepfolds, barns, mills, warehouses and/or grain pits, etc.) which provided shelter to people, animals and things.[4]

In the course of time, and particularly after the sixteenth century, the urban density increases and the Sassi take on the current urban structure. All this is done with sacrifice and with a reduced energy consumption for excavation, transport, edification: the works are provided with a precious intrinsic value, beyond that of representation, that has to be protected and maintained over time.

The site is configured as an outstanding example of bioclimatic traditional architecture in the Mediterranean Basin, where you can find underground dwellings, stone buildings and mixed houses, partly underground and partly above ground, in a unique relationship between nature and artifice, and in a complex structuring of a "layered" and "vertical" city, as more understandable in the section that in the plan, or at least not analyzed regardless of one or the other.

Within the indented area of the "Murgia Lucana", the urban configuration of Matera has been deeply marked by the geo-morphological conformation of the two crags of the "Gravina" (karstic depressions carved out over the centuries by the water of the streams), for which the city extends along the plateau and its steep edges, sometimes overhanging, and not on the bottom of the canyon as you might think. In fact, where the tufa bed is harder, there are only natural cavities (up to 350 mt), while at the softer layer (between 350 and 400 mt) rise the villages of Sassi "Caveoso" and "Barisano", characterized by a mesh of settlements and roads made of plazas, terraces, landscaped gardens, balconies, walkways, made in the "tufa", permeable and prone to erosion by water. And it is the meteoric water the undisputed protagonist, the main source of the labyrinthine complex of the Sassi, who have over ten overlapping layers, connected by wells, tanks, vertical ventilation devices, channels, settling tanks.

Local populations lived and excavate caves for climatic and defensive reasons and to better use the potentialities of the places, pick up the water and protect the soil. The climatic conditions with alternating and catastrophic trend, with rainfall concentrated in a few months of the year and torrid and arid seasons, made necessary an accurate management of the water resource not present in the free state (lake or river), and measures to control the variability in the time and the disruptive effects on the slopes. So it is configured as an accurate network of collection, storage and conveying of rainwater in special tanks dug into the rock ("palombari"), which, through an elaborate system of channeling and drainage, assured the community the

[3] http://whc.unesco.org/en/list/670/

[4] L. Rota, Matera. Storia di una città (2011).

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water resource for irrigative and productive uses in a first phase, and domestic and sanitary ones in a second phase.

Since the development of the original prehistoric techniques it is so configured in the Sassi of Matera a system of habitat based on the combined use of different principles of production of water: picking-up, percolation and condensation. In the season of heavy rains, terracing and water collection systems protect the slopes from erosion and convey for gravity the water to the tanks, built into a patio, surrounded by collectors wells. In the dry season the inner wall of the excavated cavity, not being exposed to the sun, during the day is at a lower temperature, which causes the condensation of water particles contained in the air. This water accumulates, giving moisture and cooling the environment, which increases the efficiency of condensation. During the night, the process reverses and the cavities function as extractors of atmospheric moisture: the outside of the room is colder and condensation occurs in the exterior surface of the stones.

Thanks to the improvement of living conditions and population increase, slowly begin to configure cave dwellings made from the underground tanks, with long tunnels that penetrate into the rock caves (as if they were the fingers of a hand), proceeding obliquely with a provision in a horseshoe around a central atrium, called the “neighbourhood” (“vicinato”) and with a southern exposure. In this way the central cave, the longest one, by arranging of openings (called “sopraluce”) at the top of the vault, in the winter allow the sun's rays to infiltrate deep in the rooms to warm and illuminate them, while in summer, the solar light does not directly affect the terminal part of the built environment so it remains cool and moist. Such structures are characterized by a series of bioclimatic strategies, so for this reason, thanks to the presence of natural ventilation and constant seasonal temperatures, they are able to ensure conditions of comfort, especially during the summer season.[5]

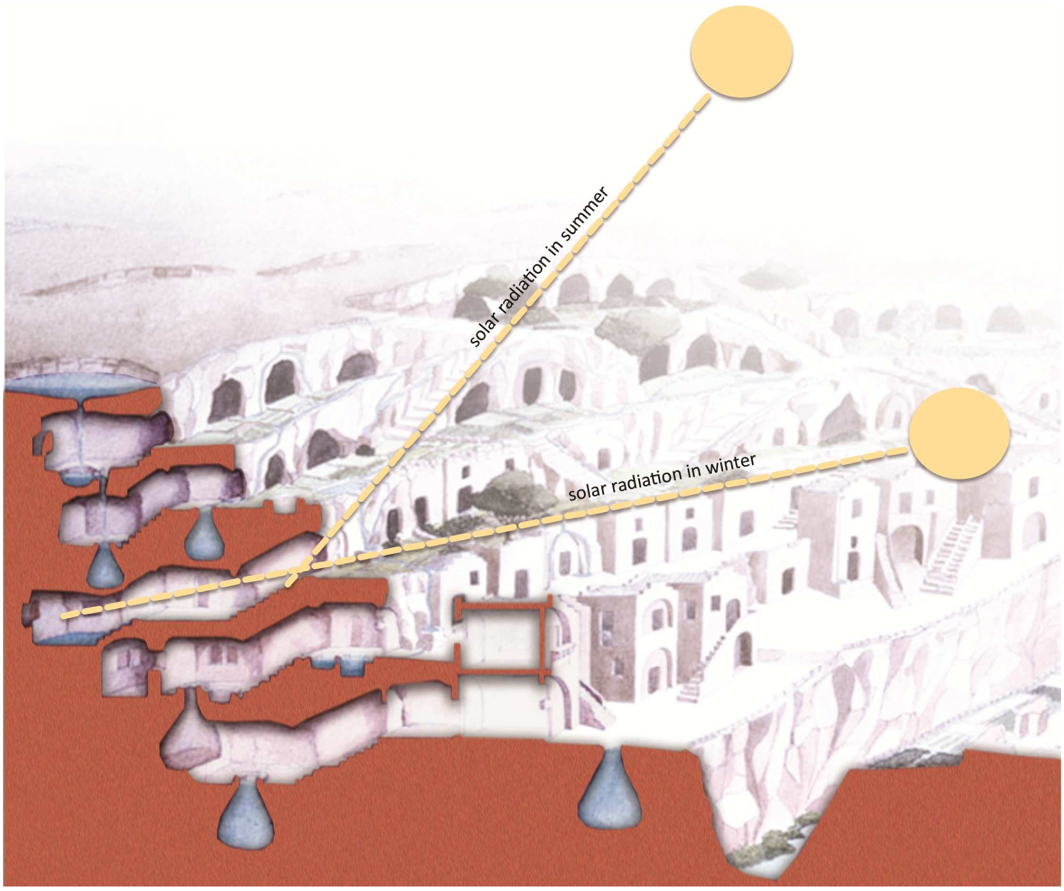

Fig. 1: Bioclimatic strategies in the Sassi (drawing by P. Laureano, reworking of the author)

In the course of time, then they began to determine, in addition to the caves, forms and types of built architecture, for examples real houses with walls and roofs: there were basically extensions and/or prolongations of the caves themselves, consisting of the material obtained from the excavation, which was used to provide the residential unit of a curtain wall at the entrance and to coat the internal cavity in the form

[5] P. Laureano, Giardini di pietra (1993).

of a barrel vault. These basic cells, called “lamioni” were thus formed by a very simple rectangular plan determined by a precise ratio, obtained thanks to the so-called “law of the fourth”, and for this reason the walls had to be thick at least a quarter of the light of the arc. In practice it was a “built” cave, independent and leaning against the initial cave bounded by two thick walls of “tufa” connected with filling material to contain the forces of the vault, and with openings, providing access and lighting, practiced on the short side, with no load-bearing function.

This complex and articulated mechanism has survived, with pain, fatigue and suffering for many centuries, settling itself and assuming an irreproducible historical value. The shape of the Sassi of Matera contains skill, expertise, aspirations and culture of the people who, day after day, had learned to control adverse and hostile conditions, learning to make living and comfortable a place so inaccessible. The inhabitants of the Sassi of Matera were sure also to transmit from generation to generation, their talent and their knowledge about materials and techniques that made it possible to adapt these artifacts to the more complex needs of its users and the site.

It is today necessary to use local potential, intellectual resources and heritage of knowledge to make harmonious the development by protecting the traditional methods of space management, which can also be used in an innovative way so as to ensure the ecological protection of the site and its sustainable development. It is clear that the evolution of this process is intimately interlaced with the complex dynamics of identity and heritage of the community that there has found a home and took charge of the care and protection of a unique and delicate heritage.

4 THE URBAN NEIGHBOURHOOD: A SMART FORM OF DENSITY THAT CREATES A SMART CITIZENSHIP

To the “technological” dimension of Smart City you need to add surely the “constitutional” one of the smart citizenship, without which the really idea of Smart City would have no meaning. The intelligence of a city then start from the bottom, by its citizens that in the course of the history, built it and live it in a constant reference between history, current needs and future expectations. Recognize themselves ”citizens” of a place certainly start from the concept of identity, and then from the unbreakable link between man and his land, so if on one side is the citizen to build the city, on the other one is the city itself to ensure that citizens recognize themselves as such. In this sense, the biunique relationship emerges between the concept of urbs, understood as the physical form of the city, and that of civitas, described by active and aware set of its citizens; so to talk about smart city, and therefore about smart citizens, not possible disregard the smart physical form of the city that encourages the development of neighbourly relations and, in general, the forms of community life and both material and immaterial sharing.

Looking today at the Sassi of Matera as a possible Smart City is certainly appealing both physically for the enormous potentialities of the place and ideologically because of the bad reputation that the city had over the last two centuries, earning itself the epithet of “national shame” because of the precarious living and hygienic conditions that immediately after the Second World War led to the displacement from the Sassi to the new residential districts that constitute the new city.

For a long time then the Sassi were left to themselves, as a symbol of a condition of degradation and misery now outdated by the citizens of Matera, who are living in modern residential districts with wide tree-lined streets and large squares. It is only in recent years that the topic of the Sassi has become to common interest not only on a purely tourism side but also on the urban one with a slow urbanization of the Sassi district, which today is experimenting the development of the residential activities and also of leisure, catering and hospitality ones. So it is feasible to imagine in the near future an increasing repopulation of the Sassi, which could convert the current image of abandonment in the one of urban vitality where new patterns of living can be developed.

The slow regain of the Sassi by Matera citizens is a process that shows how strong is the bond civitas-urbs and how the scenario of the Sassi is unique in its kind and is not comparable to the new town in terms of beauty and place attraction. In this sense, we should consider the issue of Matera identity and of its citizens that have to reflects itself in a place like the Sassi because they are bearer of cultural traditions, human relationships and therefore the precise historical references and so of the people memory who in this place finds its identity.

In fact, the unique morphology of the Sassi, a landscape with an ambiguous relationship between nature and artifice, emerges as a giant orographic sculpture shaped according to slow processes marked by time through the skilful hand of its citizens. Here, the work of geo-graphy, understood as writing on the ground, takes on a deeper meaning and a significant thickness due to the complexity of the development of the built environment in three dimensions that determines a unique image of biunique relationship between natural landscape and human settlement.

The complexity of the landscape is reflected, in the case of the Sassi, in a considerable density of the built environment which manifests itself in a clear prevalence of the solid on the empty. Then the open space shows itself compact, almost as if it was carved in the built environment similar to a continuous spongy fluid defined by the complex system of connective elements such as roads, staircases and squares, which creates environments for exchange and meeting. The urban space conceived in this way, although compact and apparently confined, configures multiple paths, almost a labyrinth, with respect to which it is not easy to tell where it originates and where it leads, then an unlimited space in a continuous flow. In this sense, it is natural to recall a famous description that in 1925 Walter Benjamin gave of Naples city, defining with the term “porosity” the relationship between space and spontaneous use by its inhabitants.[6] In the Sassi a “porosity” grows in a similar way, concerning the interpenetration between public space and private one, so the urban structure and daily life interfere continually in backyards, streets and staircases.

This socializing relationship between space and urban life, in fact, manifests itself in the Sassi in specific settlement and aggregation ways of multiple units, configuring in the intricate system of connective elements a scenario halfway between the public and private sectors. In this sense, the urban space often configures itself as an extension of the residence in true “urban rooms”, with a closed form by some housing units, defining a particular type of public space, a sign of a conformation of the urban space strongly linked to value of interpersonal relationships.

The structure that constitutes the urban form of the Sassi is largely given by a particular type of settlement: the so-called neighbourhood units, an aggregative form of multi-family units around a common area. The pattern of settlement generally includes about ten homes overlooking small courtyards, all consisting of a single room and without windows, each one containing about ten people. The life of the neighbourhood, for this reason, was carried outside in the common areas, so the social dynamics were in most cases explicated outdoors, figuring the urban space as a theatre of city life where neighbours were actors and public at the same time. It is precisely because of this complexity of using urban and domestic spaces, intricate one in each other, which emerges an intermediate state between public and private sector attributable to the open space in the Sassi, i.e. the collective space, which, although belongs to the public sphere, maintains peculiarities related to the domestic use.

In this way, the urban design, conditioned by the individual morphological conditions, is configured on both the formal scale and on that one of uses in an extremely varied and uncertain definition, generally interpreted through the concept of temporalized space, i.e. that of urban space structured and shaped by the contingent needs of everyday life.

The streets, the alleys and the stairways in the Sassi in fact seem to go beyond their duty to connect the buildings and parts of the city, showing themselves shaped by the gaze of who have lived there before as a meeting and sharing place, hosting today signs of a system of relations extremely clear, set on the labile balance between public and private.

Imagine to live today in the Sassi, inevitably means dealing with the issue of density, understood in its most complete and wide meaning, appearing on both the material and immaterial scale. As you can guess, in fact, an apparent physical density of the built environment accompanies itself in the case of Sassi with a high density of uses, that Michael Sorkin defines “density of meetings”, in his essay “Thoughts on density”, which represents the most important element in the definition of quality of lifestyle, because as the American author writes: “Density is an agent both physical as well as social and environmental. It’s in its most basic definition, which allows the closeness, the meet of bodies in space. This meeting density is the substrate of sociality and the material basis of democracy. [...] A district where you live in a good way is also another style of density, the density of uses. A good district is a place where all the necessities of daily life can be

[6] Cfr. W. Benjamin, Immagini di città (2007).

found within a short distance from home and within easy walking distance. This suggests an idea of completeness, both as a satisfactory density measure and both as unit of measure."[7]

The socializing and community vocation of these places, then makes it possible to imagine a high quality lifestyle, full of relationships and that encourages the formation of a sense of community, which reconstructs the sense of civitas of the Sassi, lost with the displacement of the postwar period. Specifically, it is possible prefigure contemporary living uses heavily based on the sense of community, close to the most modern forms of Social Housing and Co-housing, that through a social mix and a functional one, would support the vibrancy of the city and a correct social functioning. These modern housing models, if on one hand certainly would ensure services and urban regeneration, characterized by high levels of living, health and safety, on the other one would take advantage of the natural features of the Sassi, in terms of environmental sustainability and energy efficiency.

You can therefore say that the idea of looking today at the Sassi as a potential Smart City starts essentially from its particular dense morphology, that before any other device imposed from the top, would encourage the development of a balanced lifestyle among the most modern housing needs and the traditional social vocation of the historic city made of rich and meaningful human relationships.

Fig. 2: Social life in the "urban neighbourhood".

5 FROM CITY TO DIGITAL PLATFORM: PROJECTS "CLARA" AND "SMART BASILICATA" AND EXPERIMENTATION OF "UNMONASTERY" FOR MATERA 2019

In the era of knowledge and information, which enhances the immaterial aspects of life at the expense of the material ones, cities are called upon to solve old and new problems and to decide their own destiny and future. They are doing this, trying not to succumb to economy that today dominates almost all areas of life, through the development of new "narratives", made possible by the irruption of digital technologies. These technologies, however, while still providing useful tools to address the difficulties and problems of everyday life, do not always have the ability to fix them permanently. If on the one hand, the urban landscapes are progressively modified by digital culture, on the other hand they foreshadow more and more solutions which exceed the purely technological field to cross over into that of everyday life. Cities thus increasingly

[7] Sorkin M., Pensieri sulla densità (2003).

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resemble “enabling platforms for connection and expression of the people that live there, for the generation of initiatives and the development of conflicts, for the invention of words and thoughts”.[8] Today the main challenge for contemporary cities is the opportunity to design such platforms with awareness and vision, so that, thanks to operative meeting centers based on co-working, collaborative design and participated decisions, they can become places that facilitate the connection between people and things, favor the rise of innovative initiatives, attract talent and capital, encourage collaborative behavior and build a coexistence aware of the value of sustainability.[9]

The city of Matera, in a meaningful and decisive historical moment for its future, has taken up the challenge by adhering to an important project submitted for the call “Smart Cities and Communities and Social Innovation”, published by the Ministry of Education University and Research (MIUR) in 2012 with the objective to promote, especially in the South of Italy, the use of advanced technologies by citizens, businesses and administrations.[10] Based on the project proposal “Smart Underground Cities”, conceived by the Municipality of Ferrara and aimed at the development of innovative products and services for diagnostic imaging of the subsurface and structures, the final project “CLARA - Cloud platform for Landslide Risk Assessment” has come to second place in the final ranking of the announcement and was funded with EUR 20 million. The proposal forms part within the scope of the “Smart Cities & Communities” in reference to the issue of “Security of the Territory” and is focused on the development of sensors, technologies and innovative systems for non-invasive diagnostics of the subsurface for the purpose of seismic and hydrogeological risk mitigation in urban areas. Research and experimentation, in fact, will concern water management, control and monitoring of networks, techniques for the monitoring of soil and groundwater pollution, conservation and protection of architectural heritage and monuments in areas with high natural risk, preventive archeology, Cloud Computing for Smart Government technologies, innovative systems for control and management of sensors networks and distributed micro-sensors, 3D virtualization and web 2.0 applications.Three are the case studies on which will be tested the use of ground integrated 3D and 4D tomography: the city of Ferrara, interested in drawing up a plan for the seismic risk prevention and the protection of architectural heritage and monuments, the city of Matera, interested in the study of urban underground in the historic center of the Sassi (Unesco World Heritage Site) and the area of the municipality of Enna for the mitigation of landslide risk. The initiative is involved with a mixed public-private partnership, consisting of research centers operating in the country, universities and SMEs and the Municipalities of Matera and Ferrara, and is highly coherent with the most important European initiatives, including Plan-EII “Smart Cities & Communities”, Flagship Initiative EIP-EERA JP on Smart Cities, etc.

Still within the call “Smart Cities and Communities and Social Innovation”, the city of Matera has also been selected as a test area in the field “Smart Culture and Tourism” of the Basilicata Region project “Smart Basilicata”. Co-funded with a public-private intervention amounting to EUR 18.5 million, the project will promote a systemic approach to the region as a “city-region”, including the Val d’Agri, Matera and the metropolitan area of Potenza, according to a model based on the transfer of technology, which will be replicated in other areas of Basilicata, in order to make it “intelligent community” through the use of information and communication technologies and the participatory planning. The inspiring elements of the project were the scientific challenge represented by the definition of new methodologies for the analysis and integration of data acquired by the multi-platform sensors and with different spatial, temporal and spectral resolution (Sensor Synergy), which allows the study of complex environmental processes, and that of the integration of multi-resolution observation systems with technological platforms and ICT architectures (cloud-computing, web-sensors and web-services), which opens up new application scenarios for the provision of innovative services and products to the system of Public Administrations. Founded on the idea of a global Smart City and supported by a partnership of industrial, scientific and local staff, the project aims to identify and develop in the priority areas “Integrated Action for Sustainable Development” (Sustainable

[8] L. De Biase, Introduction to “Smart Cities. Gestire la complessità urbana nell’era di Internet” (M. Vianello, 2013).
[9] L. De Biase, Smart City ad alta connessione (www.ilsole24ore.com).
[10] With the “Call for submission of project ideas for Smart Cities and Communities and Social Innovation” MIUR has banned 655.5 million euro (of which 25 projects for Social Innovation presented by young people aged up to 30 years) for action and for the development of Smart cities throughout the country in various fields, including Territorial Safety, Welfare and Inclusion, Technologies, School, Transport and Mobility Earth, Smart Grids, Sustainable Architecture and Materials, Cultural Heritage.

Natural Resources, Renewable energy and Smart Grid, Energy Efficiency and low carbon technologies, smart mobility and last-mile logistics) and "Integrated Action for the Information Society" (Smart cultures and Tourism) innovative technological solutions based on the integration of enabling technologies, including cloud computing platforms for the access and use of data and services, service-oriented architectures (SOA), sensors and advanced networks of microsensors (including the "mesh networking"), the technologies of Earth Observation (EO) and technologies related to the Internet of Things (interfaces NFC, RFID). The interest is focused on the development of prototype applications, differentiated according to the specificities of the different socio-economic-territorial components of the "diffused city of Lucania", that will help to promote the use of new technologies in the field of Public Administration and the provision of multi-level e-governance services based on an innovative technological platform and consistent with the European priorities.[11]

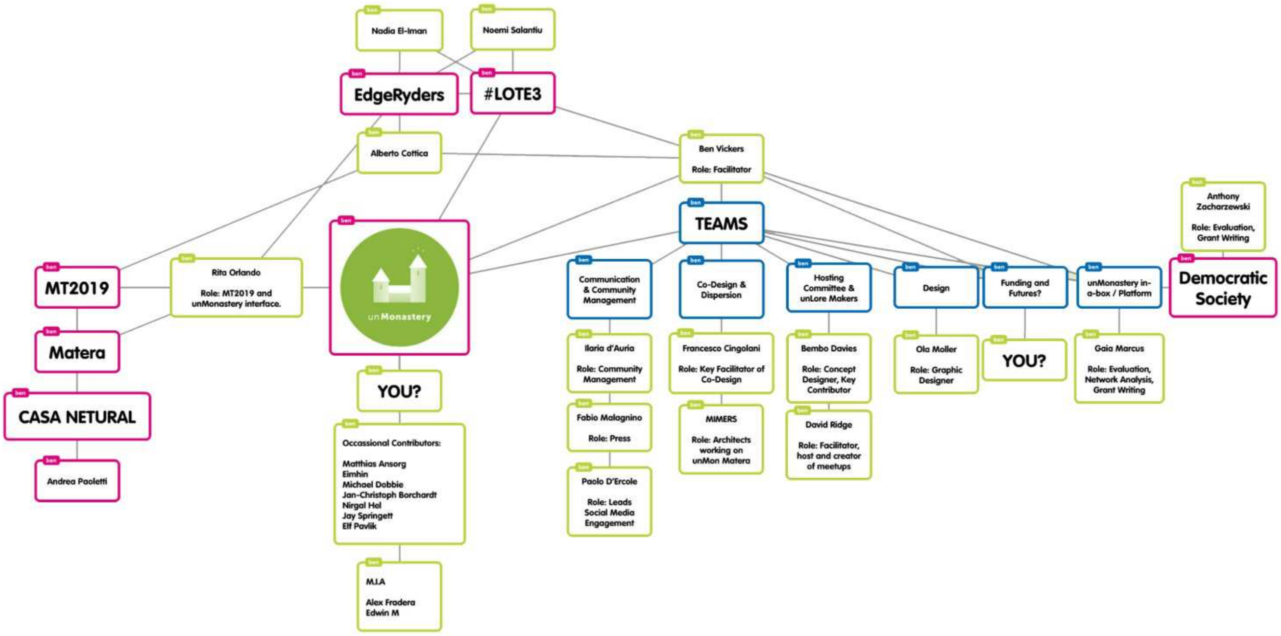

Fig. 3: Experimentation unMonastery. Map of the links between promoter subjects, community and thematic areas.

In parallel to the technical challenge represented by the projects dedicated to the development of new digital platforms, the city of Matera is also leading a major experiment on the social aspects higlighted by the development of such platforms. Since the beginning of 2014, in fact, was formed and established in the Palace "Rione Sassi" the first prototype of "unMonastery" in the world as an area of co-living and co-working at the service of small town and a place of technological and social innovation sustained by co-creation and co-learning processes between the local community and unMonasterians, which is accepting non-monks, or hackers, artists, designers and developers around the world to work on radical innovation.[12] The pilot project is part of the strategy for the candidacy for European Capital of Culture 2019 of the city of Matera (entered in the short-list of the six finalists) and is based on close collaboration with established networks online (through the platforms of the activists Edgeryders[13] and Committee Matera 2019[14]) and a calendar of activities offline made of participatory workshops and residencies. It is an answer to the waste of resources, material and intellectual, and aims to develop a new kind of social space, through a residency program between the Sassi inspired by the social functions of the traditional monastery, in which local communities welcome a group of innovators, bearers of strong skills and a spirit of service to the

[11] M. Salvia (CNR-IMAA), scientific coordinator of "Smart Basilicata", Il progetto SMART BASILICATA (www.factor20.it).

[12] It is inspired by some rules of monastic life, including but not visible hierarchy, the presence of only men and adherence to one religion, why it is called un-Monastery.

[13] Community born as "spread think tank" of experts citizens to support the Council of Europe for the European youth policy, that at the end of the project in which it was involved decided to continue to exist as an independent organization.

[14] Composed in 2011 by the main institutions of Basilicata to prepare and support the candidacy of Matera 2019, has signed a protocol agreement with Edgeryders LBG for the development of the prototype of the unMonastery.

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community, that in exchange for food, accommodation and social recognition are committed to resolve the critical issues of the place. In addition, the project aim to develop deep relationships among unMonasterians and between them and the local community in order to solve a number of priority issues for the city, with the help of everyone who wants to collaborate even not being necessarily a professional in that field. Among the main current initiatives there are “Open Analytics and Financing”, “Radical Transparency”, “Open Street Mapping Challenges”, “Business Plan vs. Sustainability Plan”, “Partnership Open”, “Open Space Initiatives” at the end of which the activities undertaken will be continued independently by local communities or may give impetus to new ideas for a new series of activities. The social impact of the project will be measured using the model “prove and improve” outlined by the New Economics Foundation (NEF)[15] and must be understood in terms of the needs of the community, defining areas of potential impact. The unMonastery will then be able to use a variety of tools and measures, in order to develop and support areas such as welfare, social connectivity, development of skills, enhancement of local social goods and common sense of purpose.

6 CONCLUSION

The urban scenarios of contemporary cities are increasingly modified by the impact of the new information technologies.

In the wide horizon of the elements that have contributed so far to define the concept of Smart City, from energy savings and environmental sustainability to digital platforms, is emerging the awareness that technology can not ensure the “smart” daily management of the cities if not integrated with the specificity of places, the needs of the community, the redefining of the life prospects of people who are part of it and the necessity of digital literacy of the masses.

Ecosystem, citizenship and digital platform can therefore be metaphors useful to define a potentially smart city like Matera, but not only that, in which the urban and natural ecosystem preserved intact for thousands of years, the dense structure of the built environment that has naturally generated the social spaces of the “unit of neighbourhood” and the “urban room” and the challenge represented by the possibilities offered by the new digital technologies, are helping to lay the basis for the development of a community technologically advanced, socially aware of its needs and culturally and economically competitive with national and international realities, thanks also to its candidacy for the European Capital of Culture 2019.

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http://www.comune.matera.it/it/sassi-centro-storico-e-opere-pubbliche/
http://simposimatera.wordpress.com/

[15] NEF is an English “think tank” promoting social, economic and environmental justice (www.neweconomics.org).

The E-City or the City on the Cloud

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1 ABSTRACT

We all know that the city emerges in history as concentration of people. The concentration permitted by the direct relationship between them, the exchange of ideas, the diffusion of innovations and the organization and division of labor. When cities arise in ancient times, communication between people is possible only through direct personal relationship. There were no other technologies and there were no other types of communication. We can speak well of “dcity”. So cities have existed for a long time, based on direct personal relationships.

From the nineteenth century a great development of transportation systems in the world is produced. This allows the extension and dissemination of the city. Progressively is no longer necessary next location of activities. New means of transport allow settlements farthest people that work together. The phenomenon of large metropolitan areas and large urban areas appears. The concentration of people and activities is no longer necessary. Transportation allows relations between persons are located, over time, increasingly remote areas . Relationships that allows transport do not replace the personal relationship they complement . The historic town remains an element of identity and economic and social activities are based on direct relationships and extensive use of transport. We can speak well of “tcity”.

Finally, from a few years ago, the Internet network allows daily relations among people unlocated. People can relate among ourselves regardless of where we are. Innovation and division and organization of work can be done, in fact, without physical presence. But again, these relationships do not replace but complement earlier. Simultaneously, the network provides access to vast amounts of information. We can speak well of “ecity”, a city without geography.

All this leads us to the possibility and the need to manage the cities and territory otherwise, another way of management yet to design and to define with the use of new technical tools. This requires a new way of thinking about the functioning of our democratic society where the limitation is time. There is no real time availability to all the possibilities that new technologies allow.

All this when some of the basic contradictions of our cities are not resolved. Specifically our cities, ie the normal life of its citizens, are not sustainable as reports consistently show the “Living Planet Report” of WWF.

In this context, the “smart city” does not exist. There are new technological tools that increase the efficiency of the activities of relationship. These tools are constantly changing and affecting specific aspects, and often very partial, to all activities of all types that occur each day in the city.

The text is a reflection about this new situation and the consequents in city administration and urban planning.

2 CITY AND KNOWLEDGE DIFFUSION

2.1 The beginning of the city

Are well known causes that explain the origin of the city. People concentration allows exchange of ideas and experiences and division of labor. So cities, in origin, are centers of knowledge diffusion, also cities are centers with more efficient production of goods and services. All this activity is based on direct relations between people and walk for contact between them.

The direct relations between people concentrated in city produces a community. This community occupies a geographical space. The limits of this space are fixed by maximum distance that can be traveled walk.

People realize all activities on this space: reside, work, entertainment, take steps …

The community creates an administrative organization, local administration, with certain functions: according regulations, safety, public works, public celebrations …

Therefore, in the origin, we have a community organized with local administration (municipality), which realize activities by direct relations between people and limited for walking distance. This situation is an initial situation of cities based on direct relation between people. We can name this kind of city as d-city, which inhabits d-community.

In the historical period of the Roman Empire (Fustel de Coulange, 2001), the Roman municipalities governed the city and a large surface of territory around. Therefore, municipalities has a territorial limit and people identify with their city.

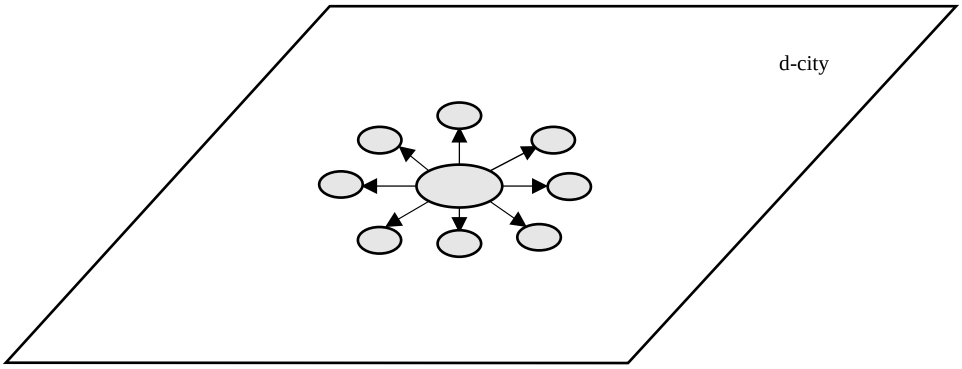

Fig 1. Scheme of d-city, concentration people based in direct relations between them and geographically limited by walking distance.

In this situation, normally the cities are far apart and each city is very autonomous. Therefore, it has been for a long time in the history of humanity.

2.2 The development of metropolitan areas

Late nineteenth and early twentieth centuries, a technological development of motorized transport systems occurs. This technological innovation will allow people to develop different activities in different areas of the territory. Technological innovation in the field of transport has continued to the present.

The news transport's systems allows news relation between people. However, these new relationships do not replace the above. These news relationships are further produced prior. Or rather, people have direct relations in home or district. Further people travel to work/studies and have direct relation with people's work. Further people travel to shopping and have direct relation with people shops. Further people travel to public services (health …) and have direct relation with their attendants. Further, so it is with all activities.

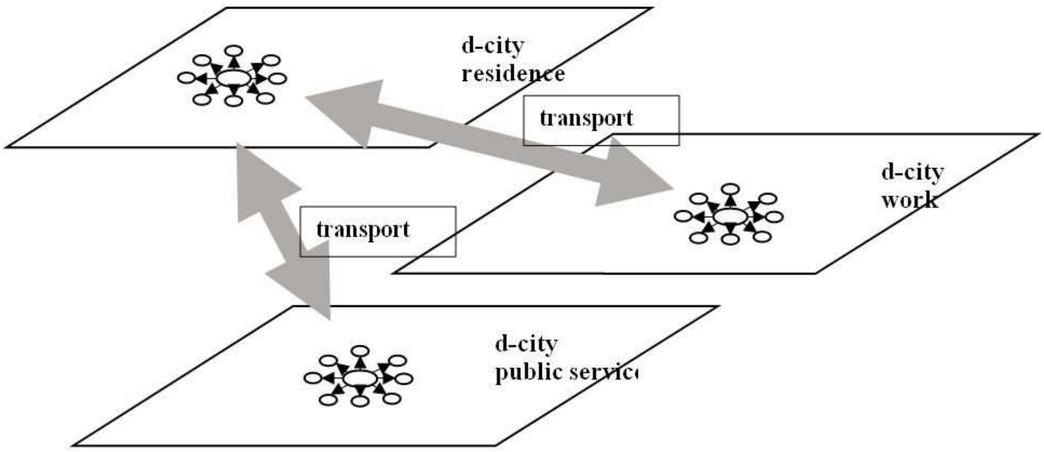

Fig 2. Schem of t-city, people travel usually between different d-city

This new reality creates a new form of land use and distribution functions. It is known as metropolitan areas or urban functional areas. In these new reality each activity (work, studies, public services …) have their hinterland. Generally, it not exist the same hinterland for each activity. In this situation now, the activities above concentrated in d-city, are distributed on territory and connected between them. We can name this new reality as a t-city: any d-city activities connected by transport system.

In any case, this new reality is a geographical reality: the d-city and transport system are located in territory. In many locations, administration has attempted to govern this new reality by creates a specific metropolitan administration. Difficult question because it is not clear the need for a new level of administration and how should the election of the new government to be representative to other levels of government.

For example, in Valencia (Spain) it exist four principal administration level and further another complementary administration. The principal levels administration are municipalities, autonomous community (regional government), Spanish State and European administration. As a complementary administration it exist the provinces and association of municipalities with different objectives. The metropolitan area of Valencia is today very large (IIDL, 2011). So geographical space of metropolitan area of Valencia is about one-third of Autonomous Community's territory and about one-third of Autonomous Community's population. The potential new metropolitan administration must take functions of municipalities and regional government and must have a good budget for public works and public metropolitan services. Municipalities and regional government not want translate Eigen functions (and the budget) to another administration, which do not control.

Today regional government of Autonomous Community of Valencia manages some public services through public companies created for the purpose.

However, in fact, we can see this new reality, the t-city, inhabited by people, the t-community. The people of the t-community realizes some activities in the d-cities and travel between them by system transport. The potential relationships increase. Also, increase potential innovation and diffusion.

2.3 The development of e-city

Since 1990 develops WordWideWeb technology. Since 1993 is possible free use and private use of this technology and digital net or internet. This new technology allows communications between people located anywhere in the world. As we all know, the number of Internet users has been a great increase in the world and allows an extraordinary diffusion of knowledge (Townsend, 2013).

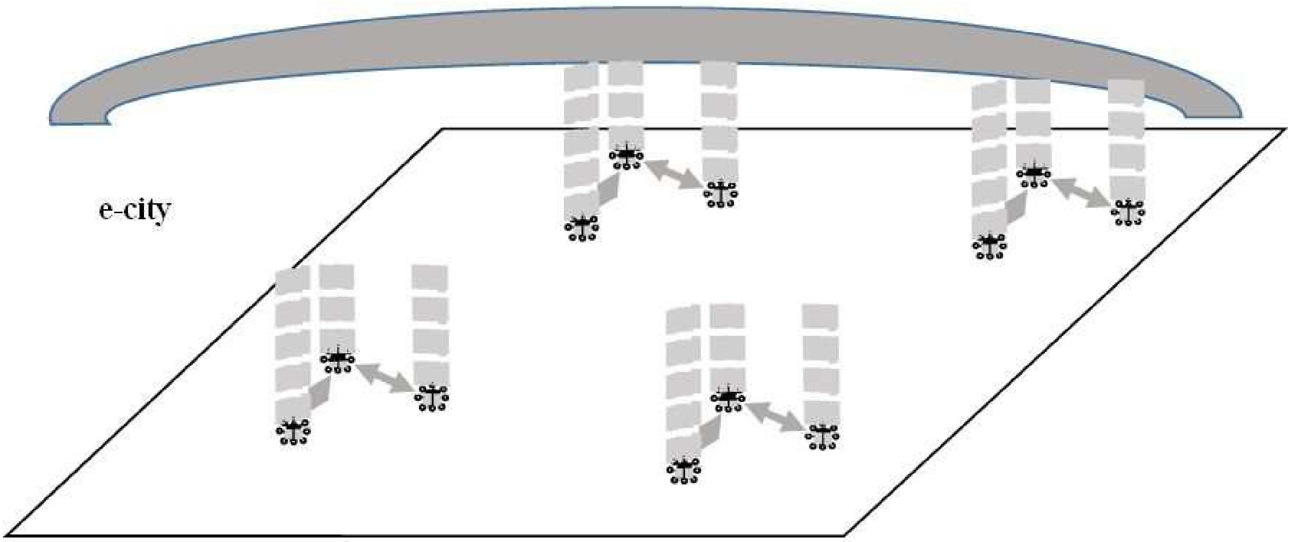

Fig 4. The global e-city.

Nevertheless, in fact it is spreading an international Internet community. For example, in this conference people have direct relation, people traveled here and people inscribed by internet application. After conference, probably, several groups of people maintain contact though internet applications. Therefore, the e-community is formed. The common interest, similar valor's systems and costumes in e-relations creates the e-community.

In the same way that membership in the local community creates a sense of identity, also membership of e-community creates a sense of identity. More and more people have a sense of global identity in addition to local and national identity.

In this situation, the limit is the time. Actually, our community is based simultaneous in direct relations, transport relations and e-relations. However, the day have only 24 hours. So, for each people, is not possible to maintain regularly the contacts with all communities.

Finally, I remember that some activities of people can be realize by digital applications. However, digital applications need a complete system of creation, customer service and maintenance. Applications are in continuous change. Governments or private companies can create all sorts of applications.

3 ABOUT A SMART CITIES CONCEPT

Obviously, the “smart city” is an undefined concept. Can be a description about the possibilities of new digital technologies for improve activities in the city (Towsend, 2013) especially for communication technologies. From this point of view, the “smart city” is a business opportunity. Really, ICT companies are well advanced and have many future possibilities. But only especially in large cities. The new generations of young people have adapted quickly to changes.

However, not all people use or know how to use the new technologies. In addition, we cannot speak of a situation of stable knowledge just because the new technologies are in rapid and continuous change. The possibilities of new technologies change quickly and a substitute for the other.

Others authors (Hammersley and alt, 2012) play with words and speak about smart ideas. Smart ideas about live, work, eat & drinking, buy and play in the city. Smart ideas, with or without new technologies, of people who, as the author says in the back cover of the book, “want to make their cities a little more fun, clean, friendly, green and above all, restore a sense of community”.

In any case, really the new technologies can improve the activities in the city and therefore the economic efficiency of the city. In fact, the economic activities use resources for produces goods and services with capital and work. New ICT can take and analyze information more efficiently and thus increase efficiency of all types of activity. The new technologies are specified in applications (software) that run on terminals (phone, iphone, pc computer …).

You can have ICT for anything, for improve traffic in Central Office Control or for general use by the people. If we focus on general users, for them all applications are a smart service because allows realizing many activities very efficiently. Smart is not the city but the citizen who properly use new technologies to make activities more efficient. So ICT can be a good instrument for improve public services and government of administration.

For example, in Spain as an another countries, each year the Ministry of Finance takes a draft of personal tax declaration for all people who should make the annual tax declaration. The declarant reviews the draft, check it and send the tax declaration with digital sign. The whole process is done online. The system greatly improves the management of annual tax declaration because people can do all in home. Usually, each year the application change. The users only know the final application. For users, the technology is on the cloud.

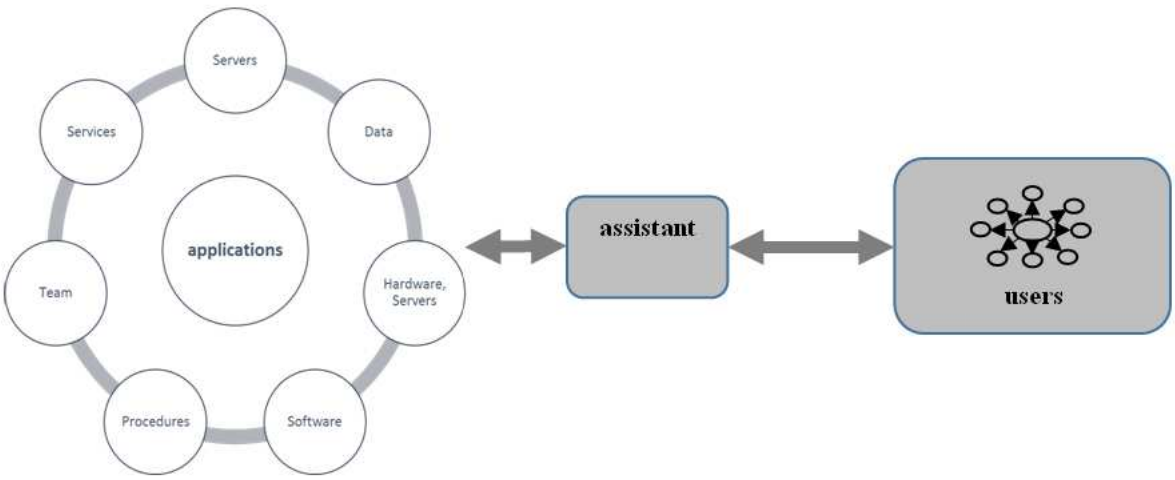

Fig 5. Scheme of applications system.

However, any new technology has positive and negative aspects. ICT technologies can have a good instrument but they are “on the cloud”. When applications fail, users are powerless to resolve the fault. Note you that application failures can cause major economic damage. For example, if you are a period for submission by application the tax declaration and application fail, then you can have a penalization. How can you prove to a court not meet the deadline for application fault? In addition, if application fail, really what it is the problem? Application failure or you do not know the use of application. How can we have objective evidence and certain about what was the error that has occurred?

Therefore, it is therefore necessary customer service, particularly efficient for solving problems.

4 SMART AND SUSTAINABILITY

I cannot speak about smart cities without speak about the sustainability of the cities. At other times, the economy of the cities could be based on the exploitation of resources and the increased exploitation of resources to produce more goods and services. Now we know that, in general, the resources are limited and the economic growth cannot be based in to increase the exploitation of resources.

The sustainability of the cities is a complicated problem that have many faces.[1] Sustainability includes environmental, economic and social issues.

From the environmental point of view, the analysis and proposals focus on the efficient use of resources in the city and the efficient collection and treatment of waste of all kinds (water, air pollution, solid …).

From the economic point of view, a balance between income and expenses is necessary for both private companies and public administration. The economy cannot base in a continuous increase in debt with no possibility of return.

From the social point of view, people must be aware of rules of sustainability and must be a democratic organization to effectively control compliance with the rules of sustainability.

ICT technologies can improve instruments for good development of these three groups of conditions. But only are instruments. The organization of our society is not yet prepared to manage sustainability. For example, the current financial crisis has been caused by international capital movements (“money” movements in e-city by internet) without any control by national governments to guarantee economic sustainability for people.

I think that efforts to achieve low carbon landscapes are very interesting (Scott & Ben-Joseph, 2012; Fraker, 2013). The experiences address many aspects of environmental sustainability of cities. But I want to stress the importance that all they give to the community. The community is essential to achieve a sustainable neighborhoods or sustainable districts. In this sense, highlights the contributions of Jan Gehl about the interventions in public spaces (Gehl, 2011; Gehl & Svarre, 2013).

According many authors, for sustainability, the community is very important. More actions for sustainability of the cities are based on the community and the community exist by direct relationships. So for a good democratic government it is necessary a local administration for community.

Our world and, in particular, our cities are very different form the reality of the world and the cities when our cities were founded. Usually, our local government system have the origin when the cities were founded.

Throughout the years, the activities of the cities has been materialized in urban forms (buildings, infrastructure, public spaces ...). The heritage of the city explain his history and becomes a sign of identity of its citizens. For this reason, society usually is opposed to the disappearance of municipalities.

However, the challenge of sustainability in our society is very strong. Or we get that our society is sustainable or our society will, with certainty, poorer. Therefore, it is necessary to adapt the governance of our society to our current reality of the world and the cities to be efficient in the guarantee of sustainability.

In Europe, in general, the governance of our society have different levels: european administration, states administration, regional administration and local administration. This paper is focused in local administration.

To generate a nearest neighbors administration is an ancient idea. For example, Jacobs already proposed his idea of the districts in 1961 (Jacobs, 1992). Jacobs proposed districts with 50,000-200,000 inhabitants to

[1] For to know a very complet list of sustainability topics about the city, you can see “Sustainability Urbanism and Beyond. Rethinking Cities for the Future”. Edited by Tigran Huas. RIZZOLI. New York, Paris, London, Milan, 2012. It is a collective book where a lot of authors write about a large list of sustainability items in the cities.

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optimize the management (governing and planning) of large cities. He realized that in a large city where the relationship between governors and governed is lost.

The idea of the d-city, the t-city and the e-city allows us to address the issue of sustainable management of the city, with rationality based on technology available today.

5 TO A SMART MANAGEMENT OF THE NEW CITIES

5.1 Local administration in Spain

D-level must be the level of local administration for services based in direct relations. In democratic situation this level is very important because is the administration with more proximity to citizen.

In Spain, municipalities or local administration have a roman origin. Actual municipalities are the results of continuous evolution to the present. The original criteria for functions and geographical limits are now obsoletes.

Over time, the people of the municipalities maintain their own identity based on their own history. History and identity of peoples maintain with few changes geographical boundaries and functions of local administration. In contrast, the urban reality has changed a lot.

Besides, in Spain, we have other levels for administration: regional (or autonomous communities) and state. It is an administration based in territory and oriented to manage territories (municipal, regional and state).

In local administration level, the more important organization are the municipalities but they are not the unique local administration. Also we can have another as a provinces, islands, association of municipalities, metropolitan areas … Of all the types of local government that exist in Spain, only municipalities are democratic and have governments elected by the people.

In table 1, you can see the number of municipalities by population in Spain, 2010. The situation is anachronistic. Around 1.000 municipalities have fewer than 100 inhabitants.

People size in 2010	Number municipalities
>1.000.000	2
500.000 – 1.000.000	4
200.000 – 500.000	23
100.000 – 200.000	33
50.000 – 100.000	83
20.000 – 50.000	252
10.000 – 20.000	354
5.000 – 10.000	564
1.000 – 5.000	1937
500 – 1.000	1062
100 – 500	2759
< 100	1041
TOTAL	8115

Table 1. Municipalities by population, Spain 2010. Origin: INE.

Many municipalities have lost a lot of people and currently have less than 100 or 500 inhabitants. With so little population is impossible to have an autonomous administration nor implement new technologies. There is not enough critical mass.

At the other extreme, the more big cities as Madrid, Barcelona or Valencia, have a lot of neighboring municipalities united in an urban continuum. In fact, many public services (transport, schools, health …) are shared.

The case of Madrid is especially unique. The inhabitants of Madrid was 3.265.038 in 2011. Madrid is also the capital of a region named Autonomous Community of Madrid which had 6.498.560 inhabitants in 2011. However, in fact, the metropolitan area of Madrid is larger than the Autonomous Community of Madrid. A part of Madrid metropolitan area is on another regions with own governments. Thus, in fact, there is no unity of government, or management, over an area that is a unique functional area.

In general, everyone think that it is necessary to change the local administration to add small municipalities as a way to obtain a minimum size and integrate municipalities that are actually urban conurbations. Thus, for a long time, studies are carried out in Spain to streamline the functioning of the local administration (Sáinz, 2004).

On the other hand, since 2007, the economic crisis in Spain is still very hard. Government need reorganized administration to make it more efficient. For this reason, last year approve the Act 27/2013 for rationalization and sustainability of Local Administration.[2] This has been a missed opportunity for a thorough reform of the local administration. This law eliminate any public local services and move another services to provincial administration which isn`t a democratic administration. However, not introduce new technologies for public local services nor reorganizes administration.

Thus, now, researchers and scientists are in agreement with the need to reform the local administration but no government has been able to effectively reorganize. In fact, local governments are very protective of themselves and do not want to disappear nor decrease his government capacity in their territories. They do not want to miss her history nor her identity.

5.2 For a new vision of the city

If we recognize of different city level (d, t and e) we can think in public administration to service each level. It is an administration based in relationships and oriented to manage relationships. The t-city manage a complete territory but, in general, the c-city will be a littles zones inside the t-city. We can name this new vision as the e-city.

On the other hand, the idea of the d-city is similar or coherent with the idea of "superblocks" development by Salvador Rueda team in Agència d'Ecologia Urbana de Barcelona (BCNecologia, 2013). The same author has studied the urban sustainability in information society (Rueda & alt, 2012). The "superblocks" for Barcelona have 400x400 meters (9 Cerda blocks) and about 4.000 inhabitants. The proposal for improve sustainability in Barcelona is generate communities in "superblocks" border with traffic corridors. Public transport and private are concentrated in corridors. The "superblocks" have only buildings and public spaces for walking.

Bus public transport is organized by orthogonal network. This idea about mobility was applied in Vitoria by a plan of sustainable mobility and public spaces with success (Vitoria-Gasteiz City Council, 2011). Vitoria had honored as a Green Capital in 2012 by EU, among others reasons, for this project. Now Barcelona council is transforming its bus network progressively to orthogonal network.

In this way, if we apply the vision of e-city, the d-city is the area where citizens receive direct services by local administration, among them, the terminal service of digital applications. Of course, more application services can obtain home (i.e., citation for the doctor) but not all people has internet connection or know how use internet connection.

At the next level, the t-city adds all neighboring d-cities connects between them by transport system. This level administration management transport system and public equipment associates for aggregate public services. Again, among them, the terminal service of digital applications.

Finally, we can have another administration level as a regional level, state level or european level. Remember that applications are in continuous change. So we cannot think in static organization of

[2] The original name in spanish is Ley 27/2013, de 27 de diciembre, de racionalización y sostenibilidad de la Administracion Local, published in oficial Gazette in 30 of desember of 2013.

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administration. Depends of the innovations in digital applications services and these innovation are unpredictable.

The location of application system for public services can be the t-city level or another higher level. All level must have a democratic system for select their government.

If we wanted apply this view of the organization of the administration in Spain, we must transform the current situation in the new situation. Change is not easy because, as we mentioned, people defend their history and identify. Therefore, it is necessary to compatibilist the new organization with the maintenance of history and identify.

5.3 Integrating history and identity in the e-city

If we want to implement the new vision of the city, it is necessary a progressive process because it is not possible change quickly an organization of public administration, and its administrative limits, on other.

Besides the reality of the communities in the d-city can change. I mean, it may happen that some communities decrease size and must join with other. Also may be that new communities are generated by new urban developments. Consequently, we should see the e-city as a dynamic reality.

On the other hand, now, in general but with exceptions, administration in Spain, particularly local administration manages by paper documents. Administrative files are archived in paper, only in paper. Therefore, it is very complicated to change the geographical boundaries of the local administration because only we have an historical archive on paper in each municipalities.

For the e-city administration we need, as a necessary condition that all information must be archived in digital format, some information in data base according applications and general documentation in pdf format or similar. In this situation, if all administration can use the database it will be easy change the geographical boundaries of local administration. Also, except personal data, is possible design free access to public information by internet for general, economic and environmental information of local administration. This facilitates participation in take decision about environmental issues as a say Aarhus Convention.

In Spain, we have a very good geographical information system for cadastral date.[3] This is a database with geographical referent. So it is possible use this database as a source and complement it with another data for local administration management. In this case, the information will be on the cloud.

For generate d-city we have two possible cases. First case, when we have great cities and we must generate communities for d-city level. Local government is elect by community and provide services that requires a direct relationship with citizens. Several communities can be associated, for historical reasons and identity, to develop joint cultural activities.

In this situation, we can imagine the t-city with diverse communities distributed in their territory. The t-city, with democratic government, manage territory.

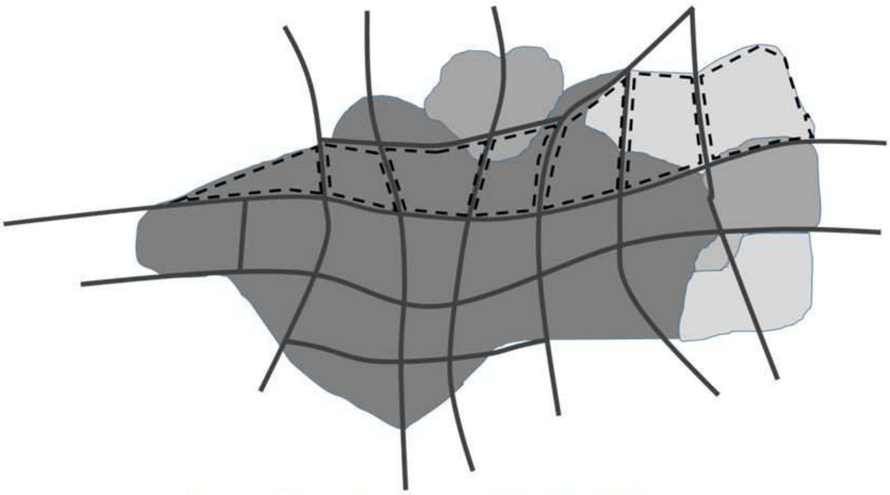

Figure 1. Generating communities for d-city.

[3] You can know public caracteristhics of any cadastral parcel registered in Spain in http://www.sedecatastro.gob.es/

We have a second case when we have several historic municipalities with small population. In this case we must add municipalities for generate a community with minimal size. To ensure continuity of the history and identity of each historical municipality, they must be represented in the representative assembly of the whole new community.

In this situation, we can imagine the community of the d-city as association of diverse small communities distributed in rural territory. The t-city will comprise several communities and will manage services for the entire territory with democratic government.

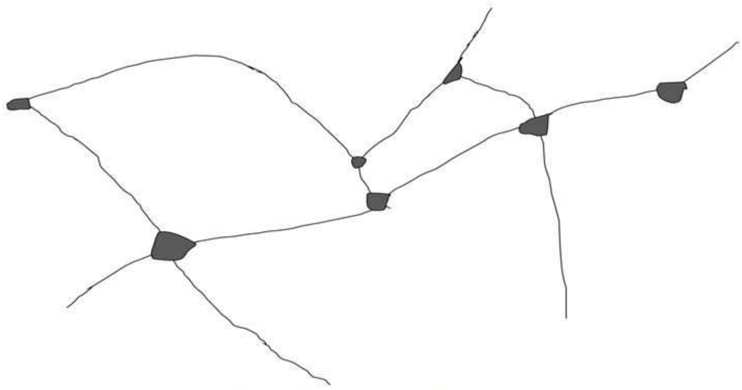

Figure 2. Adding municipalities for d-city.

It is easy to understand that all these changes cannot occur in a fast. It should be a gradual process in which, previously, must be sufficiently developed computer applications necessary for the process itself and for the results are successful.

Although the idea of e-city and its management may seem radical, but the fact is that young people in our society are very often on the cloud with their iPhone, iPad or tablets. So perhaps it is the time to take on the reality of our world.

6 CONCLUSION

The reality that society lived when most European cities were founded is very different from today. In the origin, we have a community organized with local administration (municipality), which realize activities by direct relations between people and limited for walking distance. We can name this kind of city as d-city. The relationships between community facilitate innovation and knowledge diffusion.

Since 1900s innovation intense transport systems occurs. It allows the efficient connection between communities for the development of multiple activities. We can name this new reality as a t-city: any d-city activities connected by transport system.

Internet introduce a new thecnology for relationship. So people have direct relations with another people for different activities (residence, studies, work …) connects between them by system transports and have e-relationships with the same people or another of the world by internet. We can speak of the e-city.

Obviously, the “smart city” is an undefined concept. Can be a description about the possibilities of new digital technologies for improve activities in the city but also we can speak of smart ideas, with or without new technologies, of people who “want to make their cities a little more fun, clean, friendly, green and above all, restore a sense of community”.

I can’t speak about smart cities whitout speak about the sustainability of the cities. According a lot of authors, for sustainability, the community is very important.

In Spain, the original criteria for functions and geographical limits are now obsoletes. Besides, in Spain, we have other levels for administration: regional (or autonomous communities) and state. It is an administration based in territory and oriented to manage territories (municipal, regional and state).

Because of the financial crisis, government need reorganized administration to make it more efficient. The last reform in 2013, does not address the fundamental problems.

If we recognize of different city level (d, t and e) we can think in public administration to service each level. It is an administration based in relationships and oriented to manage relationships. The t-city manage a complete territory but, in general, the c-city will be a littles zones inside the t-city. We can name this new vision as the e-city.

For the e-city administration, we need as a necessary condition that all information must be archived in digital format. We can imagine new t-city by generating d-city or adding small municipalities. The t-city and the d-city must have democratic government. The t-city manage transport system and services for territory. The d-city manage communities.

Although the idea of e-city and its management may seem radical, but the fact is that young people in our society are very often on the cloud with their iPhone, iPad or tablets. So perhaps it is the time to take on the reality of our world.

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🏆 *reviewed paper*

The Effect of Potential-based Land Tax on Land Utilization

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1 ABSTRACT

Land as a scarce resource requires efficient allocation, which includes efficiency in producing the highest value and efficiency in consumption conforming to people's willingness-to-pay. Thus methods for controlling proper land utilization are essential for societies to reach sustainability. Like in many countries land and property tax in Austria is based on the profit that everyone could achieve using the land. This concept of a productivity-based land tax was developed centuries ago, when land in European economies was mainly used for agriculture. The implementation was simple, because soil quality, which is the main factor for possible productivity, could be determined. However, economies changed and the profit from agricultural areas – and thus the value of agricultural land – decreased with the effect that also the utilization of former agricultural areas altered. Therefore, also an adjustment in the tax system seems to be appropriate. In the paper the effects of such a change will be discussed.

Determination of land tax should be objective and fair. The value of land is an objective criterion and since it reflects the wealth of the land owner it is also a fair measure. The value of land can be defined in different ways but the obvious meaning should be the market value, i.e., the revenue that will be gained if the land is sold. The market value is based on a number of factors including general economic situation and location, but one of the most prominent factors is potential use. Areas that allow a highly profitable use have a higher market value than areas with many restrictions on the use, e.g., due to regulations on groundwater protection or monument conservation. Austria has a large number of data sources that are suitable to determine land value in a mass appraisal approach (Muggenhuber et al., 2013). The implementation would be simple from a technical perspective, even if comprehensive political discussions are required.

Land and real properties are also commodities within the capital market with rather stabile asset values over time. Thus, they also can serve as parking place for investments with minimal maintenance costs.. Therefore, people may purchase land in residential areas as a financial investment without improving the land with the consequence that the municipality is forced to create additional residential areas and provide the necessary infrastructure. This stresses the budget of the municipality and has a negative effect on resource management. If land tax is based on the potential of the land, land owners may rethink their strategy. The tax causes financial losses of the potential is not exhausted. Potential buyers will have an interest in the land, because they want to utilize the potential now. In addition, the political decision makers explicitly see the monetary effect of their decisions, and the beneficiaries become visible for the public.

2 INTRODUCTION

Land administration and property tax have a long tradition. In medieval times, for example, farmers had to pay royalties to the owners of the land. Later, with the development of national states and modern administration, tax revenues were necessary to finance state procedures. Tax on local economy and population had a high fluctuation and were thus not easy to predict. Property tax, however, was a stable source of income for a country as land could not be transferred abroad. With the introduction of cadastres and land registers in the 19th century, a solid base for land tax assessment was created. Basis for the assessment of land tax was the revenue produced by the land. Since the national economies in the early 19th century were mainly based on agriculture, farm land was the main source of tax revenues.

However, in the 20th century economics changed, and in many countries tax burden on labour exceeded taxes on capital gains and property. Thus property tax based on the traditional assessment method becomes obsolete. Revenues from property tax do not make a significant contribution to the state budget and do not justify the maintenance of the expensive cadastral and land registration systems. Although there are still well-founded arguments for these systems, e.g., that the land register provides legal security and the cadastre serves as spatial reference for other data, land tax assessment could be adapted to the new economic situation. An obvious approach would be potential-based land tax, where the tax level is based on the potential revenues of the land. In the paper the effects of such a system are discussed using the example of Austria.

3 LAND ADMINSTRATION

Land administration is one of the basic processes that provide information on available resources. Land administration deals with the resource land, which is specific because it is immovable and cannot be increased. Thus, land is a scarce resource and should not be wasted. Proper land management has to guarantee that land is used in an optimal way. Land administration is the operational implementation of land management. The United Nations define land administration as "*the processes of determining, recording and disseminating information about the ownership, value and use of land when implementing land management policies*" (United Nations, 1996, p. 108). It provides information on land, which can be used in management processes. Land management, on the other hand, "is the process whereby the resources of land are put to good effect" (Dale and McLaughlin, 1988, pp. 1, 3).

Figure 1 gives an impression of the complexity of land administration. Land administration has a strong legal influence, but has also take public and private interests into account. The separation of the cadastral part dealing with geometry and the land registration part dealing with (private) rights is not always done, but the processes are differently structured due to the requirements of public or private law.

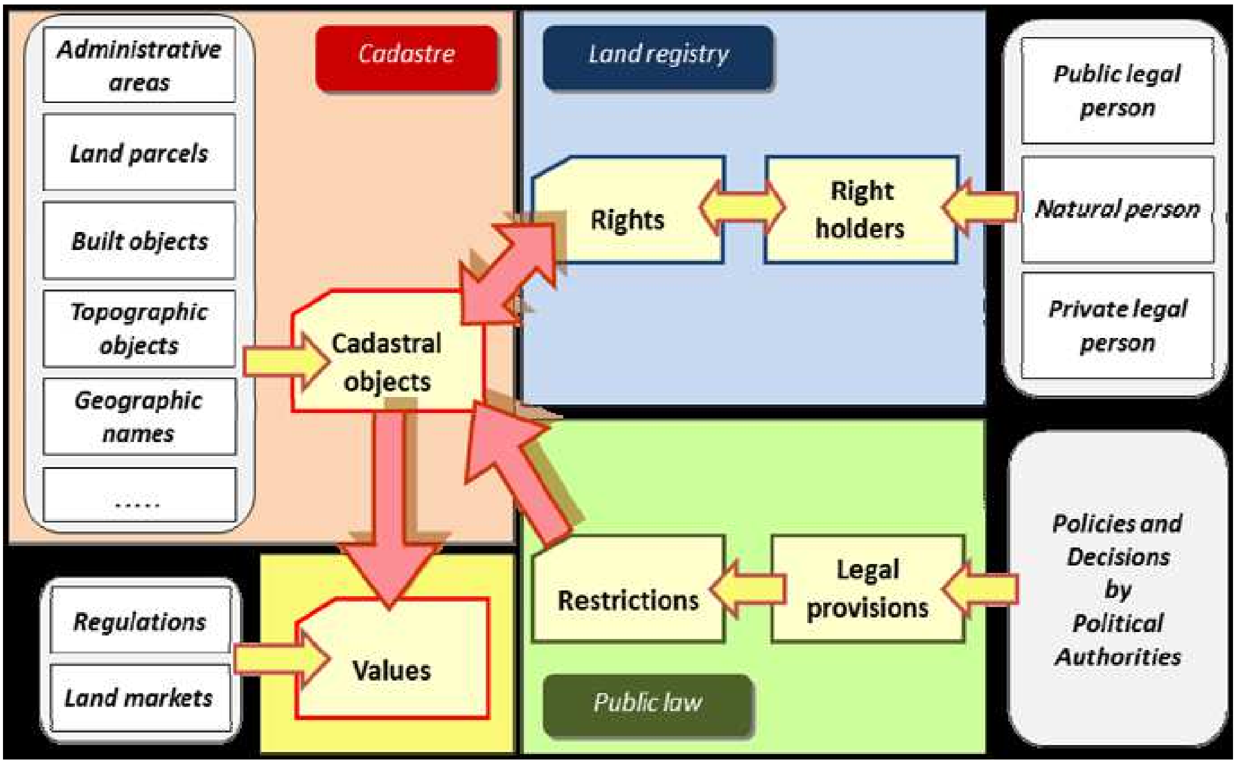

Fig. 1: The system of land administration (Source: Horisberger, 2011, as cited in Muggenhuber et al. 2011)

There are different possibilities for the implementation of land administration: Registration of title and registration of deeds are just two examples for the documentation of ownership rights. In general, a number of decisions are required when implementing a land administration system (compare Bogaerts and Zevenbergen, 2001). It is necessary that the rules of good governance are met (Mansberger et al., 2012). According to Törhönen and Grover, the following principles should be guaranteed (Törhönen and Grover, 2006): transparency and impartiality, legal security and rule of law, predictability and traceability, effectiveness and efficiency, equity and fairness, integrity and accountability, consensus orientation, civic engagement and public participation.

The principles of good governance should be applied to public administration and management in general, and to land administration in particular. Spatial planning will typically lead to NIMBY (not in my backyard) problems. It would contradict fairness, if these types of problems are always solved such that the same group of people suffer. Land administration is able to provide information about the winners and the losers of a taken decision, e.g., by publishing land value data continuously, the capital gain of land becomes obvious. This increases transparency and thus, improves governance.

4 PROPERTY TAX

“The property tax is, economically speaking, a combination of one of the worst taxes - the part that is assessed on real estate improvements ... - and one of the best taxes - the tax on land or site value”. (Vickrey 1999: 17). George & Drake (1879) argued that land tax shall relate to the location value of land instead of the value of improvements.

As land tax usually is paid by either the owner or the user of land, these persons must be identified by the tax authority. The tax object is the parcel, a defined piece of land with a unique ownership situation. Taxation requires an objective basis for calculation, which is typically provided by the cadastral system, a systematic inventory of the parcels in a country. Tax assessment shall be fair, equal, and transparent. Thus, the systems developed in the 19th century are based on productivity.

4.1 Tax Policy

Tax policy in general has several goals (Muggenhuber & Twaroch, 1998), like:

- Guidance: Taxation is a simple method to increase the costs of something. Income tax increases the costs of workforce, petroleum tax increases the costs of transportation, and land tax increases the costs of land ownership. Increasing a specific tax possibly lead to avoidance of the taxed goods. High land tax, for example, may motivate land owners to sell land, which they do not need.
- Distribution: Tax is an instrument to reallocate wealth. People with a high income have higher tax rates than people with a low income.
- Income: Fees and taxes are usually the only means of income for a state. Trade, labour, and assets are the traditional elements of taxation. In times of internationalization of productions processes, taxation of land and real property is becoming more important, because it is the only type of tax where the basis (the land) cannot be transferred to another country. Another benefit is the observation of quantity, which is easier for land than for other elements.

4.2 Property Taxation

In Austria, size or value of a parcel is the basis for numerous taxes and fees. Land tax is the obvious example for such a tax, but there are other taxes like land purchase tax, possible tax on rise in land value, property tax, inheritance tax, etc.

Land tax in Austria is based on the so-called unit value. The concept was developed in the end of the 19th century for agricultural land. The unit value was determined mainly by soil quality considering the availability of water and climate. The unit value does not take into consideration any improvement of the land for stimulating investment. Additionally, the concept of unit values does not work properly in more complicated situations, i.e., in built environments. In these cases, taxation of income (from renting houses or apartments) provides more revenue for the state than taxation of the land itself.

4.3 Reform of the Austrian Land Tax

The unit values in Austria are problematic, because the last complete survey has been done in 1973. Some adaptations have been performed since then (e.g. in 1982 the unit values were increased by 35% to compensate inflation), but they do not reflect the developments in different parts of the country. Therefore, the constitutional court requested a correction of the system.

Determination of land tax should be objective and fair. The value of land is an objective criterion and since it reflects the wealth of the land owner it is also a fair measure. The value of land can be defined in different ways, but the obvious meaning should be market value, i.e., the revenue that will be produced if the land is sold. The market value is based on a number of factors including the general economic situation and the location of the land, but the most prominent factors is still the potential use. Areas that allow a highly profitable use have a higher market value than areas with many restrictions on the use, e.g., due to regulations on groundwater protection or monument conservation.

A possible solution is the estimation of market values and the assessment of land tax based on the market value. Various countries use such a system, like Denmark, Sweden, Russia, and the USA. Discussions in Germany seem to lead to a similar decision (IWKöln 2014). There are different methods to get approximate market values, most of them perform a multiple regression analysis by using transaction data and other data (Wessely et al. 2013). This would be in accordance with the recommendation of the Organisation for Economic Co-operation and Development (OECD, 2010: 77) and would implement a concept that is quite old (George & Drake, 1879).

5 POTENTIAL-BASED LAND VALUE

One of the most important principles of real property valuation is the determination of value based on "the highest and best use", i.e. taking into account the potential of real property for further development. The International Accounting Standards Board (IASB), which sets the rules for accounting and financial reports since 2005, has worked on the definition of a "fair market value". In its International Financial Reporting Standard 13 (IFRS 13) it has included the "highest and best use" as an element for determining the market value of an asset. The principle of "highest and best use" is used to achieve a true market value balancing the interests of a seller and a buyer, who intends to make the maximum use of the property allowed under the regulatory conditions. In most instances, such a situation reflects the condition of a piece of land not yet used to its full potential. "Highest and best use" is that the potential use of the property would be fully exploit, regardless to the current use.

The parameters applied to the definition of "highest and best use" are:

- The potential use is legal.
- The potential use is physically, economically and financially feasible.

Austria has a large number of different data sources that are suitable to determine land value in a mass appraisal approach (Muggenhuber et al., 2013). Data describing physical and geometrical properties and data outlining private law or public law restrictions are available and it is not necessary to collect new data. However, some data may be protected and are not publicly available but this does not generally prohibit their use in a mass appraisal process. The implementation of such a process would be possible from a technical perspective, even if comprehensive political discussions are required. The biggest challenge for an implementation would be the integration of data describing public law restrictions, as not all of these data are available in a proper format and they are inhomogeneous as often being defined by communes. Building restrictions are an example: Theoretically, all communes must provide these restrictions in digital form, but it is not yet possible to obtain the data online. Delays come from the fact that not all communes have the technical possibilities and knowledge to provide online access to their data. Another problem is that not all public law restrictions are obvious. Thus, if soil pollution is determined, the land owner is forced to improve the soil. This obligation is documented in the cadastre on legacy of pollution. However, if it is unknown that there is any pollution, the area will not be in the cadastre.

Some of the most important sources of information on aspects influencing the land value are (Muggenhuber et al. 2013):

- Land register
- Cadastre
- Land use maps
- Topographic maps
- Orthophotos and satellite images
- Noise maps
- Road network datasets (e.g., GIP – Graphenintegrationsplattform)
- Environmental data

- Land transaction data

These geodata enable the modelling of potential use (e.g., existing infrastructure or legal restrictions) including regional peculiarities of the land market. E.g. in the region of the Austrian town Kitzbühel the land market is significantly different from the land market of the surrounding areas. The obvious explanation is a strong influx of wealthy people and the limited supply of available land. By using geodata and proper models, it can be showed, that there many of the areas available are kept as reserve (Steinnocher et al. 2012).

6 EFFECTS OF POTENTIAL-BASED LAND TAX

Potential-based land tax is a system, where the amount of land tax is a function of the potential. Since land value and potential are highly correlated, both could be used as a basis. The following examples are based on the assumption that potential use and market value are directly proportional.

6.1 Economic and ecological considerations

Potential is an important aspect of land. Land is wasted, if the potential is not used. An investor, for example, may buy building land with the intention of selling it 10 years later and profiting from the increasing land prices. However, he is not necessarily interested in improving or even using the land. If the owner does not use the land, then all public investments in connection with this land (e.g., roads, water supply, power supply, etc.) are wasted. This is the reason why the IASB proposed the use of “highest and best use” for the valuation of a real property, i.e. in most instances of a land parcel, under the parameters indicated above.

In an economic context, the pursuance of optimization of economic gains would include the investments in assets, which will increase in value over time. From an environmental point of view – considering the preservation of the non-renewable resource “land” – a speculative investment in land is not desirable, because the land will not be used. Optimality from an environmental point of view requests, that the land produces a maximum value and profit through utilization. Furthermore, it puts a undue burden on the communities, which have invested for infrastructure but will not gain any benefits from taxable income.

What would be the effect of potential-based land and property taxation? Proposals made by Muggenhuber et al. (2013) demand that property taxation in Austria should be based on a mass valuation system taking advantage of the vast volume of geo-data available in order to arrive at a fair property tax. This system shall include – as the authors of this article opined – the “highest and best use” principle. There are some arguments that support such a development:

- Land tax based on market value will be fair, because if the value of land increases or decreases it is related to the tax. Land with high potential also provides the basis for high (not necessarily financial) revenues.
- Decreasing land value (e.g., because the population in the area is decreasing) results in a decrease of the overall wealth of the land owners. It would be an additional burden if the tax remains unchanged. This could affect land owners to sell their land making abundant land available, which again would lower the prices. Land tax based on market values will automatically decrease the land tax and this could prevent or weaken such a development.
- The system should be simple and avoid unnecessary expenses. One of the main cost factors in every system is data acquisition. A system that uses data that area already available is preferable to a system that needs extensive data collection. Austria already collects numerous data that are useful for mass appraisal.

In addition to the arguments of the quoted article, the consequences of a potential-based property tax (by taking into account the “highest and best use” principle) are:

- Saving non-renewable resources and the environment thereby contributing to the sustainability of our eco-system, and
- Avoiding infrastructure expenditures by communities for not utilized properties (which are unproductive).

6.2 Political and social considerations

Transparency is an increasingly important aspect of public administration. The United Nations (1996) has identified transparency as one of the key aspects of good governance. Main influences for changes of land value are:

- Changes in the geometrical properties of the land
- Changes in the potential use of the land (regulated by laws)
- Changes of the land market

Changes of the physical properties are typically the result of cadastral processes, like subdivision and unification. As all these activities have to be applied, the modification of the physical properties are known to land administration and thus can be easily taken into consideration. However, physical processes like meandering of a river can also change the shape of a parcel. Monitoring these processes is more difficult. However, pragmatic solutions would be possible. The easiest solution would be leave the decision about resurveying the parcel to the land owners. Land owners would be willing to pay for the survey, if the lower land tax justifies the costs for the survey. Based on the average price per m2, the costs of the survey, and time period used in the calculation, a decision can be made.

Changes in the potential of the land are also easy to assess. Since fundamental physical properties, like slope, orientation, or soil type do not change, any significant change of potential is the effect of some action. Most of these actions will be changes in public law ownership restrictions, e.g., a changed land use policy, a new infrastructure concept, or a new nature protection project. Each of these actions will have an impact on the value of the affected parcels and parcels in the surrounding area. Typically, there will be parcels that rise in value and others that drop in value. These effects can be easily visualized using the results of a mass appraisal system if the design of the system remains stable. Since it becomes visible, which areas profit from the change, it is also obvious who is benefiting from the change. In a fair society, the actions should have different beneficiaries, although obviously people owning more land may profit more often. A transparent mass appraisal system can show, if this condition is met.

The obvious question rises, if it is fair that a land owner pays higher land tax, if the value of his land increases. One argument is that he benefits from something that happened without any effort from the owner’s side. The current situation in Austria (and probably other countries) is, that gains are privatized and losses are socialized, i.e., land owners do not pay for rise in value but are compensated for any loss. It is questionable, if this strategy is outdated in times of tight national budgets. The discussion is not restricted to Austria. Freyfogle, for examples analysed the situation in the USA from a legal perspective (Freyfogle, 2007, pp. 105ff).

Another aspect is the availability of data. A current buzzword is Open Government Data (OGD). Currently many European cities provide data to the public (e.g., https://open.wien.at/). Some of these data have already been published in different form (e.g., if it has been issued by public authority), but other data have never been published in aggregated form and can even save lives (e.g., the locations of defibrillators). Data on the value of land and its change over time are not yet available. Data from mass appraisal could be relevant not only for the tax authority and the land owners, but also for credit institutes, people thinking about immigration, developers, or economists.

7 CONCLUSIONS

The paper discussed some aspects of a potential-based land tax. Data required to assess the potential use of land in general and land parcels in particular are available in Austria. A methodology to use these data for value assessment in a mass appraisal system can be developed, although intensive political and economic discussion is still needed. But why should it be done? One argument in Austria is that land is currently not fairly taxed. This could be resolved by mass appraisal of land values and by taxing the land based on these results. However, the effect of estimating market values of real properties by mass appraisal would influence other economic and political decisions:

- Land tax on the potential “punishes” land owners, who do not exploit the full potential of their parcel. So a potential-based tax would stimulate a proper use of the land. The effects of an improved land use would result in reduced land consumptions and reduced spreading of cities. These effects are ecologically reasonable and improve sustainability. On the other hand, improved utilization also makes better use of existing infrastructure. Since less new infrastructure is needed, the expenses of the communes are reduced with a positive effect on their budget.

- Mass appraisal systems document the effects of political decisions. Comparison of the results from different years allows estimation of the economic development and on the impact of political decisions. This makes the beneficiaries of political decisions more visible and improves the transparency of public administration.

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The Reification of Resilience and the Implications for Theory and Practice

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1 ABSTRACT

A review of academic and grey literature in disaster risk reduction, construction, urban planning and architecture shows that the term „resilience" has been increasingly adopted to describe an ethical posture towards interventions in the built environment. Policy makers in the United Kingdom (UK) have followed this trend and increasingly adopt the resilience language in policy and Government agendas. However, a detailed examination of over 20 UK policy documents and 19 interviews with stakeholders involved in the planning, design, construction and operation of the built environment, reveals a multiplicity of diverse uses and representations of resilience. Moreover, the meaning attributed to the term is often influenced by the professional remits and decision space of policy and decision makers. Given these results, we argue that resilience should not be seen as a consensual concept but rather as an unfolding ethical paradigm through which stakeholders create their own dynamic representations and meanings. By illustrating how the term is often reified in divergent and incompatible ways, we identify five tensions that this creates, and the implications from both a theoretical and a policy perspective. Given the malleable and nebulous nature of the term we suggest that it should be used cautiously within both contexts.

2 INTRODUCTION

The term „resilience" is increasingly adopted by both policy makers and practitioners in the field of disaster risk reduction; however both the conceptual clarity and practical relevance of this term are unclear. It is used on a variety of scales and in a variety of ways: as a descripting term, as a tormative nerm, as a paradigm, as well as theory (e.g. Strunz, 2011). The original meaning was largely constructed in the field of ecology by authors such as Holling (1973). Resilience was understood as a measure of the ability of ecological systems to persist in the face of disturbance and maintain relationships between different elements of the system; this idea has been recently adapted (and, while doing so, diluted and stretched) by many other disciplines, creating ambiguity and uncertainty (Brand and Jax, 2007). Unsurprisingly, this has led to major difficulties in operationalising and applying resilience in the search for more harmonious relationships between the natural, the social and the built environment (Alexander, 2013). Despite this lack of clarity, the number of governmental and non-governmental reports mentioning resilience and aiming at developing „resilience-building" is increasing (Davoudi, 2012). Similarly, the term has become common among local authorities, construction stakeholders and emergency services (Bosher, 2014).

Resilience has generally been defined in two ways: as a desired outcome, or as a process leading to a desired outcome (Kaplan, 1999). Bahadur et al. (2010) conducted a comprehensive literature review in order to demonstrate how „resilience" is conceptualised and characterised, and concluded that while the term is widely used, its meaning is increasingly ambiguous. Funfgeld and Mcevoy (2012) argue that „resilience is not used in an exact, defined way, but more as a versatile (and seemingly fashionable) umbrella term, which loosely express some of the conceptual underpinning" (p. 326).

What is clear is that the term resilience is increasingly used to signify a particular state of being, or set of processes to bring about a state of being. In other words, rather than recognising the malleable nature of the term, and the ways in which it is continually shaped by discourse, it is increasingly mobilised to represent and/or to justify a cause of action. Building upon the work of Marx and Weber, Lukacs (1971) introduced the concept of reification in his critique of the economic construct of „labour'. Lane et al. (2006: 835) explain that „reification is the outcome of the process by which we forget the authorship of ideas and theories, objectify them (turn them into things), and then forget that we have done so". The act of reification is a key component of learning but, as Wenger (1998) explains, every community of practice produces artifacts, such as tools, procedures, stories, and language that reify some aspect of its practice. Consequently

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the construct's original meaning may get obscured as successive practitioners and researchers adapt it to fit the needs of their work and their personal biases (Latour, 1987).

This paper aims to illustrate how resilience is reified in a multiplicity of different, and often incompatible, ways. UK policy documents and interviews will be used as empirical evidence of this reification and the tensions it creates. The final section includes a discussion of empirical results and their implications for policy and practice.

3 METHODOLOGY

There are a number of ways of examining how policy and decision makers define, understand and implement the resilience paradigm. This paper reports the results of a study that focused on the following approaches of the inquiry. Firstly, from the perspective of the practitioner: examining common „practices'. This implies inquiring about what stakeholders perceive as being important in resilience. Secondly, from the policy perspective: identifying what institutions consider important and urgent by distilling results from the way objectives, targets and goals are exposed in policy documents). Thirdly, from the perspective of norms and standards, exploring what institutions do effectively enforce.

The first step of the study was to define a methodological framework to scrutinise policy and stakeholders" perspectives. Carpenter et al. (2001) highlight that a common problem in resilience studies which is to define „resilience of what?" and „resilience to what?". We adopted a framework that included five scales of analysis (the building, the neighbourhood, the settlement or city and the country) and two types of triggers: (a) Natural triggers (sudden triggers such as earthquakes, floods and tsunamis; and incremental slow triggers such as climate change); and (b) human-made triggers (including fire, violence and crime, international terrorism, industrial threats and pollution).

The second step consisted of creating a database of documents related to resilience, which included UK national policy documents ranging from 2000 to 2013, published on the UK government web site (www.gov.uk) and written by national agencies such as the Cabinet Office, Home Office etc. Overall, 23 policy documents were thoroughly analysed.

The third step examined the database through frequencies of word use (including the use of conceptual mapping and clouds) that allowed us to identify the most commonly used terms. This was carried out with the aid of Nvivo 8 software.

We then analysed transcripts from 19 interviews conducted with various stakeholders that are directly or indirectly involved in „resilience" agenda implementation. We interviewed the following stakeholders:

- Three architects working in the private sector
- The Head of regeneration, city council
- The Flood management officer, city council
- Three emergency planning officers, city council
- Two liaison architectural officer, police
- The Fire and rescue service officer
- The Counter-terrorism security advisor
- Two property developers
- An officer of the Civil Contingencies Research Office, police
- Three urban planners working in the private sector.

The semi-structured interviews were aimed at identifying the perceptions and representations that stakeholders make of resilience. They were conducted between May and October 2013 and lasted for approximately one hour each. Each interviewee was asked to define resilience and to comment on whether and how resilience is implemented in their day-to-day practice.

The final step of the study consisted of comparing word uses, frequencies and discourses among policy documents and the transcripts of the interviews. This allowed us to draw patterns and analytical generalisations. We transcribe here some quotes that help illustrate the differences and synergies found.

4 RESULTS: UK NATIONAL POLICY ON RESILIENCE

4.1 Brief introduction to the resilience policy framework in the UK

Since the introduction of the Civil Contingency Act (the Act) in 2004, civil protection activity in the UK has been conducted under the epithet „UK resilience“ (HM Government, 2004). The civil protection plan was significantly restructured to codify existing practices, and introduce new statutory duties (O'Brien and Read, 2005). A process of Integrated Emergency Management that includes six related activities - anticipation, assessment, prevention, preparation, response, and recover – was adopted (HM Government, 2012). Under this process, civil protection duties are now carried out by a range of designated Category 1 and Category 2 responders, which are expected to collaborate to achieve this common goal. Whilst UK Cabinet office has ultimate responsibility for civil protection, resilience is carried out through is the Local Resilience Forum (LRF).

The Act describes the duties of stakeholders to cooperate in a LRF, and formal meetings and allocations of work to responsible stakeholders. The LRF typically meets three times a year to discuss emergency planning within its county. In the event of a major emergency, the group forms the Strategic Coordinating Group for that emergency, i.e. it would provide a forum for the co-ordination of a multi-agency response. For example, during the recent Thames Valley flooding, the Thames Valley LRF facilitated Strategic Coordination Group meetings at 10am and 4pm every day during the month of February. While Environmental Agency was presented by the media as the main repondent to floods, they did so in coordination with the LRF (e.g. Buckinghamshire FRS, 2014). A number of sub-groups with specific areas of responsibility meet six times a year and report to the LRF. The UK Resilience Programme thus improves coordination among the emergency services but it does not take into account community involvement.

The UK policy defines community resilience in a rather restrictive way: „Community and individuals harnessing local resources and expertise to help themselves in an emergency, in a way that complements the response of the emergency services" (Cabinet office, 2011b). This definition does not provide any information on the activities that would „complement the response“ nor does it emphasise the importance of self-reliance or emergency prevention.

4.1.1 <u>UK Government definition of resilience</u>

The UK Civil Protection Lexicon (Cabinet Office, 2013b) defines resilience as: „The ability of the community, services, and of infrastructure to detect, prevent, and, if necessary to withstand, handle and recover from disruptive challenges". The definition dates back to the statutory guidance document „Emergency Preparedness“ (HM Government, 2006), where it was used in a context of risk management. It however differs slightly from an earlier definition used in the document „Dealing with Disasters“ (Cabinet office, 2003) („The ability at every relevant level to detect, prevent, and, if necessary, to handle and recover from disruptive challenges"). The definition used in the Lexicon underpins the development of all subsequent resilience-related work: it has guided the development of the LRF framework, as well as the creation of the National Risk Register and National Security Strategy (Cabinet Office, 2013; HM Government, 2010). It also influences the identification of people who might be vulnerable in a crisis, data protection protocols, cyber-security, the protection of critical national infrastructure, prevention of violent extremism, etc. Although Birkmann et al. (2012) points out that an examination of all current UK Civil protection guidance reveals that a total of 21 different definitions are used, all of them share elements of detection, prevention, resistance, management and recovery.

When exploring „resilience of what', the analysis shows that the majority (65%) of policy documents refer to measures and initiatives having a national/country scope of influence (compared to 17% at the regional level, 8% at the city level, 4 % at the neighbourhood level and 4% at the building level). At first glance this is hardly surprising, given that we examined policy written by the national government. However, considering the strong influence that the idea of community and city resilience has had in literature (Norris et al., 2008; Pelling, 2003; Stumpp, 2013; Tobin, 1999) it becomes clear that UK policy has had to make efforts to redefine the boundaries of the resilience approach.

Resilience is mentioned in documents aimed at foreign affairs, for example: The UK government's humanitarian policy (DFID, 2011), which „outlines how the UK will help build resilience to crises and respond to humanitarian need resulting from conflict and natural disasters". One of the programmes is

Building Resilience and Adaptation to Climate Extremes and Disasters Programme (BRACED) supported by the Department for International Development. It is also used in relation to terms of data protection (service resilience) and telecommunications (Cabinet Office, 2011a). The definition of resilience therefore resonates with a wider discussion within the UK Government on how to handle new forms of risk triggered by a more globalised and interconnected world. As demonstrated by the policy analysis (Figure 1), the policy framework focuses on using a multi-hazard approach, taking into account natural hazards as well as man-made threats (although the term „resilience" is not used in the Terrorism Act).

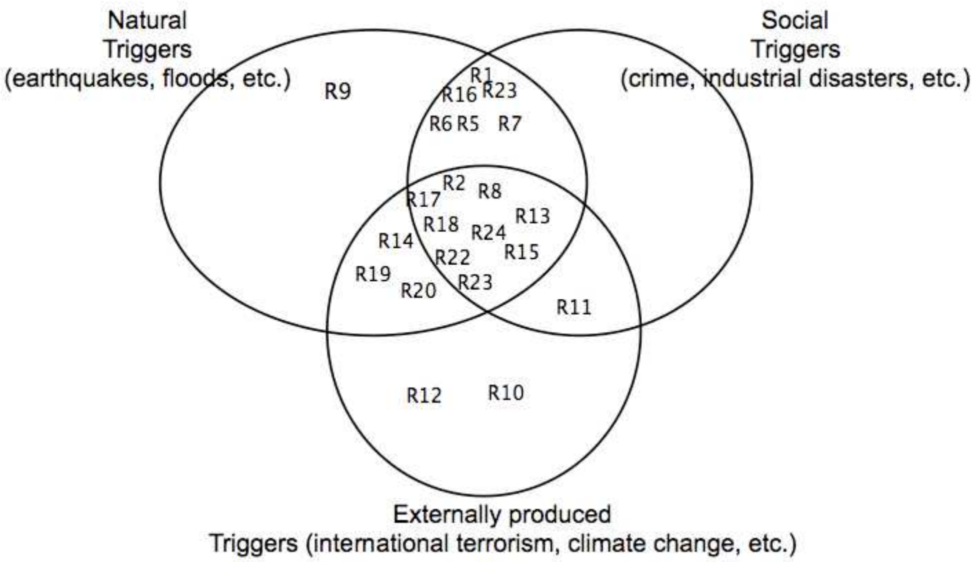

Fig. 1: Mapping of Resilience policy documents in the UK, identifying „resilience to what" according to three types of disaster / emergency triggers

All the activities are based around the integrated emergency planning (cycle of emergency planning): „Resilience is built around several key activities. Firstly, risks of disruptive challenge must, when possible, be identified, either by considering internal weakness or scanning the horizon for external threats. Anticipation allows choices to be made. In some circumstances it is possible to prevent disruptive challenges occurring by taking action at an early stage. In other cases, planning has to take place to deal with a disruptive challenge. This cycle – anticipation, prevention, preparation, response, recovery – is at the heart of resilience" (Cabinet Office, 2003). It is appreciated that it is impossible to fully eliminate some risks, therefore resilience is seen by the Government as a way of building capacity to respond to emergency events while taking into account the potential interdependencies of services/systems that maybe disrupted. In this perspective, resilience primarily refers to the capacity to respond to emergencies and to quickly return to some form of „normality'.

Essentially, local efforts in enhancing resilience are built on collaboration between organisations whereas central efforts are based on command and control. Policy on resilience in the UK put much emphasis on the capacities expected from other stakeholders in order to achieve „resilience', however these documents are extremely vague, and so local stakeholders understand and adjust the principles differently.

4.2 The differences in interpretations and the tensions they create

The definition of resilience provided by the national policy is not strictly accepted at the local level and in addition is reified by the professional remits of those who are „implementing resilience'. This leads to tensions not only among national policy makers and local level policy implementers, but also among those who are directly and indirectly affected by the Resilience Programme. Five identified tensions are discussed here:

Tension 1: National vs. local scale: The widespread use of term resilience in the national policy documents is not reflected on local level and is often at odds with the practical understanding of resilience (Table 1 highlights different characteristics of resilience).

Construction	Emergency	Regulators	Policy

Flexibility	Business continuity	Preparedness	Business continuity
Durability	Preparedness	Protection	Recovery
Robustness	Recovery	Security/ safety	Preparedness
Coping	Coping	Business continuity	Detection
Business as usual		Robustness	Prevention
			Resistance
			Bounce back-ability

Table 1: Characteristics of resilience within four sectors of intervention

Unsurprisingly, the definition of resilience provided by the emergency services goes in line with the one provided by the Act, and is infiltrated into every aspect of emergency services" activities:" [I understand resilience] fairly technically in the sense of the CCA 2004, which defines resilience. (...) I define resilience as the ability to withstand disrupting events or shocks, man-made, terrorist or natural" (Emergency Planning Officer). But at the same time, stakeholders add an extra layer to the definition, explaining that resilience is more about the organisational capacity of the respondents: „We have to be resilient enough. (...) We need to have resources and the infrastructure in place to enable us not only to deal with incidents but also have enough capacity for another incident coming in" (Fire and Rescue Service Officer).

Construction stakeholders define resilience in the context of buildings and urban environment, although the term „resilience" is not often (if at all) used in their daily practices. Their definitions focus on characteristics of resilience rather than the process of implementing resilience (as emphasised by the policy and local authorities). The key characteristics for responants are durability: „Resilience is about buildings or places lasting for beyond one or two generations" (Urban Planner), and flexibility in a sense that the building should be able to adapt to changing conditions: natural (e.g. climate change), economic (e.g. building should be sellable and thus should be multi-purpose) and social (e.g. migration and change in demographics).

Tension 2: Response and preparedness vs. prevention: Whilst the UK policy acknowledges the importance of prevention, the majority of documents (notably those that emphasise the importance of local resilience) focus on response. Local level respondents understand resilience as a way to deal with an event, i.e. being prepared for the event in order to be able to respond to it rather than to eliminate it: „I am not sure resilience is a more upfront thing. I am not sure that you can define it in terms of being ready because I don't think you ever are. I think [you can] cope but you never have the best solution ready at your fingertips" (Emergency Service Officer). Another respondant argues: „We plan for the contingency of the actual event and then we are there to respond thereafter if something happens, but we don't at this moment in time (...) get prepared to make ourselves more resilient prior to it. [It's] what would happen if something happened now rather than trying to make it safer immediately, if that makes sense? Our team is very much more a response after the event and planning towards such events" (Emergency Planning Officer).

On the contrary, construction stakeholders understand resilience as inherent safety, and assume robustness and resistance as the critical part of resilience: „It is about risk avoidance as in where in the building is located and how it is designed" (Architect). Robustness - a term that is often interchangeably used with resilience among the construction stakeholders - is argued to be a part of their daily practice: „[We] know that the building has got to be secure, (...). Buildings have got an element of robustness against accidental damage which actually also transfers to intended damage" (Architect). „We are designing out risk, and that's how it should be done" (Urban Planner). Local authorities however argue that in some cases, when inherent safety cannot be achieved due to practical (including financial) reasons, preparedness and protection (which are used as synonyms to resilience) are the best routes: „There'll always be a flood area where it is unaffordable to build something to stop it from happening, and in which case you will have to go down the resilience type route" (Flood risk manager).

Tension 3: Business continuity vs. community resilience: Preparedness, prevention and response are all aimed at least to two different audiences: community and business. Practitioners on the local level believe that the key to achieving resilience is community preparedness (and therefore community resilience). They aim at making sure that the community is prepared for any event and does not need to rely on external support. Policy promotes the opposite: to an extent, it underestimates the ability of the community to respond and instead suggests to rely on the Category 1 respondents. Curiously, however, when policies are analysed

(Table 2), the words such as „community', „public" and „localism" appear much more often in policy documents that in practitioners" vocabulary, the focus of which is on „planning', „designing" and „building" for the event.

Policy	**Practitioners**
national	resilience
regulations	plan
flood	building
risk	flood
power	business
localism	*people*
community	ability
land	event
water	design
public	risk

Table 1: Ten most frequently used words relevant to resilience among policy documents and practitioners" responses

In several policy documents, resilience is used to promote business continuity in any circumstances - this is also reflected in activities carried out by those directly influenced by the policy documents. Local authorities and emergency services emphasise the importance of business continuity and promote its importance among the business sector: „It's not just the case of dropping everything and dealing with the event that's taking place; it's also being resilient enough to carry on your daily business and at the same time maintain continuity" (Regulator). These stakeholders argue, however, that this may lead to the underestimation of community resilience. In contrast, construction stakeholders do not see business continuity as a crucial aspect of resilience, and deplore that continuity does not actually leave a place for change and adaptation. They argue that continuity is not always the best option as an event may present an opportunity for improvement.

Tension 4: Negative vs. positive connotations of resilience: In both policy and practice resilience is closely associated with security. However this creates another tension: while policy makers and implementers promote the security aspect of the resilience concept, they often underestimate the fear and increased isolation that is effecively triggered by the term „security'. Due to its negative connotation, measures for increasing resilience are not flagged up by the commercial developers as there is a fear of alarming potential clients. There is a lack of interest - and therefore investment - in an incident which (in the eyes of the clients and developer) is highly unlikely (i.e. a terrorist attack on a building or a flooded housing estate). Emphasis on resilience is seen as counterproductive because it implies that something may happen to a property: „All marketing literature is too positive to be able to incorporate the reality and the negatives. (...) If you had a building next to a river you wouldn't see in the sales brochure the fact that it's been lifted up to a certain height because it just flags up an issue into the purchaser's mind. (...) The developer only wants to tell a positive story".

Construction stakeholders and emergency services both agree that this perception should be changed, and instead the idea that security can be achieved by increased inclusiveness and participation should be promoted: „Security (...) means putting up walls and gates and that sort of stuff. [While] the inhabitants inside feel secure, it is very difficult to explain to them that interacting with the street and making it more friendly puts the antisocial behaviour off because they [people who conduct antisocial behaviour] feel overlooked" (Architect).

Tension 5: Business as usual vs. low probability event: The term resilience appears more to be useful in policy and among the local level regulators when it comes to the unexpected events. Resilience is understood as preparedness to something that is out of order, although it is seen as a long-term process that will eventually lead to the incorporation of resilience into day-to-day practice: „Resilience is built in what we are trying to achieve, that's what the planning system is all about creating robust environments, buildings. (...) It is central, it is everything" (Regeneration Planner). Construction stakeholders and emergency services, on the other hand, argue that resilience is a business as usual type of activity: „[Resilience] is not something that is „Oh, it is resilience!" and it is put into a little pigeon hole. Resilience is mainstreamed. (...) It is normal business, it's business as usual" (Fire and Rescue Service Officer). Resilience is not seen as an explicit part of the design, planning and construction process - it is an embedded process that does not get acknowledged unless the issues of safety and security are specifically expressed by the client. This understanding of resilience however does not focus on a more serious event with a low(er) probability. Resilience is a part of a day-to-day practice included in business as usual, and its implementation is assumed: „We make sure that things don't fall off buildings and make sure that the occupants are essentially surrounded by the right construction and technology (...) but nothing more serious than that" (Architect).

5 DISCUSSION AND CONCLUSIONS

There is no problem per se with having multiple definitions of a term, however if the term is too malleable and is used in a number of scales, it raises concerns about how practitioners can make sure that they understand it similarly. As this analysis has illustrated, neither stakeholders nor policy documents seem to take into account the limits of these scales: they interchangeably navigate the term of resilience as an objective, a means to attain an objective, a framework of analysis, a concept, or an aspiration among many other scales. This, together with malleability of the term raises the possibility of tensions emerging between the agendas that a focus on differential definitions of resilience induces.

The use of the term „resilience" presents us with a curious dilemma: while the UK policy definition of resilience is widely known and accepted, practitioners use the meaning of the term (as opposed to the term itself) or the synonyms (according to their understanding) of the term. For example, prevention, preparedness and response all appear to be important components of resilience - but their prominence in practice can be different from one discipline to the other. Similarly, both policy and practitioners talk about resistance and robustness, but the implied meaning is different - from the ability to withstand to the ability not to be affected at all. Resilience can be seen as two-faced: on one hand, it is a descriptive concept used by many academics, and on the other hand it is a boundary object with a wide range of meanings used by policy-makers and practitioners. In any case, resilience must be increasingly viewed as a vague and malleable concept (Alexander 2013; Bosher 2014); this however should not be seen as a negative notion, as such vagueness and malleability may also bring advantages. The interpretation of „resilience" has moved from a term to a way of thinking, a paradigm that collects a number of concepts rather than a concept itself. This investigation suggests that resilience has become a boundary object, meaning that it now plays a role of a term that facilitates communication across various disciplines and is used as a shared vocabulary – although the understanding of the parties would differ regarding the term in question. But at the same time – and as demonstrated here - the vagueness and malleability of the term „resilience" has led to a variety of interpretations and applications. It could be argued that such vagueness makes this term politically successful and useful helping – to a certain extent – to reconcile the interests of politicians and practitioners. Boundary objects however have a fundamental disadvantage: in the case of resilience, the extension of the term has become so wide that it hides conflicts and power relations, since everyone agrees on „implementing resilience" while implying different meanings. In a long-term this may lead to further tensions not only among those involved in „implementing resilience" but those affects by „resilience', which could be reinforced by policies and their stance on the use of the term „resilience.

Resilience has thus become an idea used on many different scales with many different intentions and with a very wide extension. It includes a range of components, from international aid and leadership (as demonstrated by the UK policy) to resistance and security (as discussed by the interviewees) to sustainability and community well-being (as often argued by the academic literature). It is used to connet discourses of separate stakeholders but in equal measure it may confuse them by conflating many meanings.This makes it impossible to decide whether a specific state is resilient or not, and to find out how a resilient state can be achieved. The principle of resilience therefore should be adopted with prudence, and the long term consequences of interrelated variables must be considered: instead of trying to come up with a new definition, both academics and practitioners should instead try to overcome the drawbacks the term „resilience" may pose while taking advantage of its capacity to create a collective narrative to a variety of ethical positions .

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reviewed paper

The Research on New Town Development Strategy in Metropolitan Outskirts: A Case Study of Liangzhu New Town

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1 ABSTRACT

New Towns in the outskirts of city has existed for a moment within the period of China urbanization, and lots of experiences are accumulated during the practices while building this system.

This essay is mainly established by the first multifunctional outskirt town, as well as the research object --- Liangzhu New Town, and it also make dicussions and summaries about the concept of design, the structure of this project, the operation process, the mode of operation and etc.

Overall, by combining the objective requirements of the outskirts new town development, which is affected by the metropolitan suburbanization, this paper explores a smart way in the construction of the new style urbanization, as well as the solution to the problems which may happen during the construction of the outskirts new town.

2 INTRODUCTION

In the past 30 years, China went through a fast track of economic development and urbanization process. From 1978 to 2009, the percentage of urbanization in China increased from 10.6% to 46.6%. State Council Development Research Center' study predicts that another 300 million people will move from countryside to cities in 20 years' time in China. Urbanization in China has shown its irreversible trends in various cities, which means the current way to promote urbanization is probably incorrect. The rapid growth of China's urbanization rate strongly depends on the low cost of land and labor, lack of public utilities and infrastructure. Moreover, China's land urbanization is significantly faster than population urbanization. One research points out that scale growth elasticity of urban land of China is 1.36-2.30, and this number is much higher than the world recognized reasonable limits of 1.12(Wu, 2010). Entering the 21st century, there is a tendency for China to find a smart way to improve the traditional way of urbanization. Such trends can be summarized as the following three points:

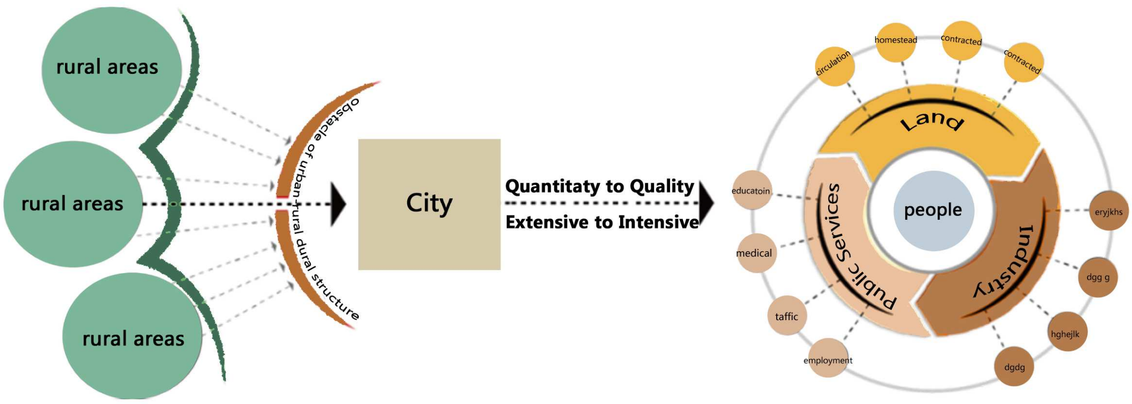

Fig. 1: Connotations on a new-style urbanization that puts people at the center

(1) The existing urban-rural dual structure is the main obstacle to integrated development. Efforts must be made to allow farmers to participate in China's urbanization, and allowing farmers to make free choice in the migration.

(2) Build a smart new-style urbanization that leads people to the center. Reform of the hukou (or household registration) system will accelerate the process of farmers become urban residents.

(3) Form of urbanization changes from the extensive type to the intensive type. It is necessary to find a smart way to change from the tradition growth.

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On the stage of new-style urbanization, there is a particular requirement of transformation. New-style urbanization strategy for the construction of the new town is full of opportunities, as well as lots of challenges.

The opportunity mainly appears in the following two aspects:

(1) New towns will become the central space carrier of the new-style urbanization. Small cities and towns will usher in much more development opportunities and development resources.

(2) By breaking the urban-rural dual structure, a new situation will be created in the urban and rural areas. The new town is in the forefront of urban and rural areas, and it will develop further in the process of promoting the development of urban and rural.

The main challenge reflects in the following points:

(1) The traditional development pattern which relies on the land finance will be limited.

(2) Under the situation of limited finance, how to solve the problems of migrant workers' housing, public services, and social security demand will be the biggest challenge.

(3) The traditional mode of urbanization of land is limited. Urban and rural development need to rely on inefficient use of land to achieve the increase of construction land index, so that the cost and difficult in the construction of new towns will greatly improve.

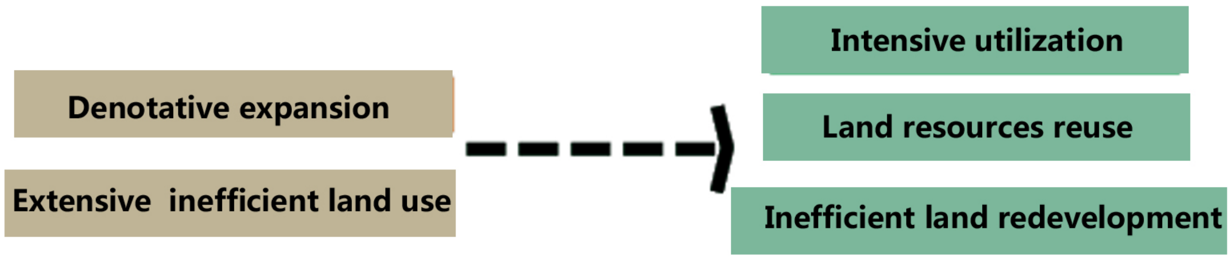

Fig. 2: A smart way of Urbanization

Towns in China has traditionally been the government's development and operation of the object. With the growing area of city suburbanization, however, private-developers oriented large-scale development of new towns in metropolitan outskirts becomes another new type of suburban development. This approach requires the size of initial land is large enough, and in the proper scale. These new towns should be able to achieve self-sustainable, instead of 'dormitory suburbs'. Private companies instead of government are responsible to real estate, municipal infrastructure and public transportation as a whole in this project, including planning, construction and management. The construction of suburban new town which is provided by private company has already seemed as a kind of brand-new concept, and it has been wildly accepted in China. Although the traditional extensive development mode has exposed a lot of problems, it is lack of operable case and model can be used as a great reference.

It is meaningful to draw lessons from private companies in the development of suburban new towns. How to accumulate the capital and improve the function and scale effect of the city through the development of suburban new towns is a new topic that people are concerned about. Situated north-east of Hangzhou, Liangzhu New Town is a residential project which is specially built by a private company Vanke Group in China. This paper introduces Liangzhu new town as a model project for private development, and it highly emphasizes the attention given to public facilities and a responsibility for the future of the community. As a dynamic case, Liangzhu new town may not be the standard "answer" to the ideal new town. It is enough to become a smart way for the consideration of China's new-style urbanization.

3 A GLIMPSE OF LIANGZHU NEW TOWN PLANNNING

3.1 The town of Liangzhu

Hangzhou is the capital of Zhejiang province, as well as the political, economic and cultural center. Surrounded by enchanting natural beauty and abundant cultural heritages, the city is known as 'Heaven on

Earth' and it’s one of the China's most important tourist venues. Liangzhu is one of the most renowned features in additional to the West Lake of the city.

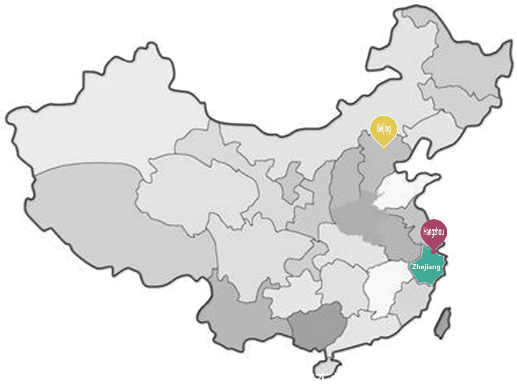

Fig. 3: Location map of Hangzhou and zhejiang

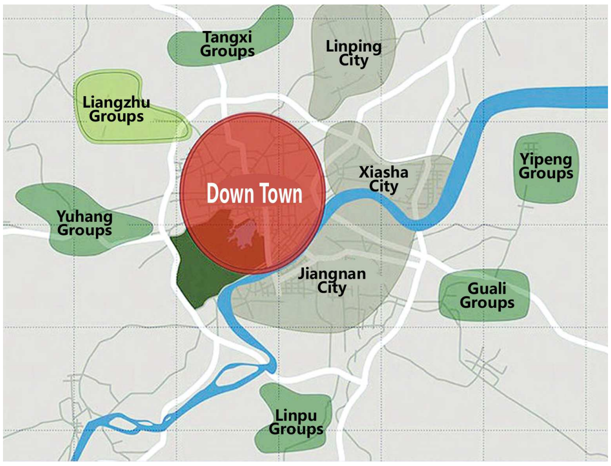

Fig. 4: Hangzhou strategic planning layout

In 2001, the master plan of Hangzhou made a determination about the leading industry of the Liangzhu group as leisure travel. Liangzhu New Town has been included in the key tourism projects of Zhejiang province. As the same time, Liangzhu New Town has the unique natural resources endowment which has wonderful connections with residential patterns and leisure tourism. The special location makes it is possible to create more interesting lifestyles in this new town than big cities. As a result, Liangzhu New Town becomes the new town construction exploring ‘pilot’ during the progress of Hangzhou new-style urbanization. It also carries the dual requirements of internal and external in the process of regional development. Liangzhu New Town is focusing on such a goal: Efforts to create a vibrant town with multifunctional integration, diversification of living, full employment.

Around the year 2000, Vanke Group started the construction of Liangzhu New Town of 8 sq. Km, and the skeleton of the new town was formed after 10 years’ intensive development. Derived from the reformist ideas of Ebenezer Howard, and Liangzhu New Town’s planning follows this philosophy, “A self-contained development with a balance of commercial, educational, social, and cultural institutions that satisfy all the needs of families and individual alike.”: On spatial aspect, a village scale can provide more comfortable life, as well as coexisting with nature. Liangzhu New Town is divided into a number of different features and various themes of villages. In order to make a comfortable walking distance between the public facilities and open space, the New Town offers a variety of orchard road as the connections. From the function aspect, this community has plenty of advanced infrastructure to provide the residents here a better city life in countryside. Residents can have all their pervious daily activities here, such as catering, entertainment and sports. However, from the perspective of the whole town, there are different culture, tourism, leisure, and life supporting facilities, for instance, Liangzhu museum, resort hotel, shopping mall, parks, hospitals and

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schools, all of these are strewn at random distribution. These facilities form a more completed system of the Liangzhu New Town.

3.2 The scale of the Liangzhu new town

The project covers an area of nearly 800 ha, which is consist of more than 400 ha natural landscape, 230 ha residential land, 80 ha tourism land and about 60 ha public facilities land. This entire project has eight series theme villages, including apartments, row houses, villas and other various products. The population is approximately 35,000 at built out, and the goal is to have 8,000 jobs on-site.

3.3 Land operation

On the outskirts of city, whatever slowly peripheral spread or ‘leaps and bounds’ space development, considering the low cost of land construction, Vanke Group hope this project can get a benefit through large-scale land development. So that the company can get control of the regional sustainable development. In 2000, Yuhang district government make an agreement on selling 800 ha to Vanke Group for 15 million dollars. All fees including the construction of roads, drainage, sewage ditch, parks and other infrastructures shall be borne by the developer.

3.4 Location of the project

This project is located on northeastern part of Hangzhou, Liangzhu New Town is 20 km far away from the city center, and 2 km to the type site of Liangzhu Culture (3400-2250 BC) which was the last Neolithic jade culture in the Yangtze River Delta of China. At east are Tiaoxi River and Tianmu Mountain range, and the Beijing-Hangzhou Grande Canale is going across Liangzhu County, Expressways of Shanghai to Hangzhou and Shanghai to Nanjing also have entrance in this region. Xuan hang railway and 104 National Road have transit in Liangzhu area. Environmental landscape is preserved to be original in this region. The site sits within a spectacular setting, with forested mountains to the northwest and the Liangzhu River to the southeast. Be richly endowed by nature of the geographical location, cultural resources, ecological tourism resources, this region has an excellent conditions of the town development, which make it become one of the most potential development place of Hangzhou.

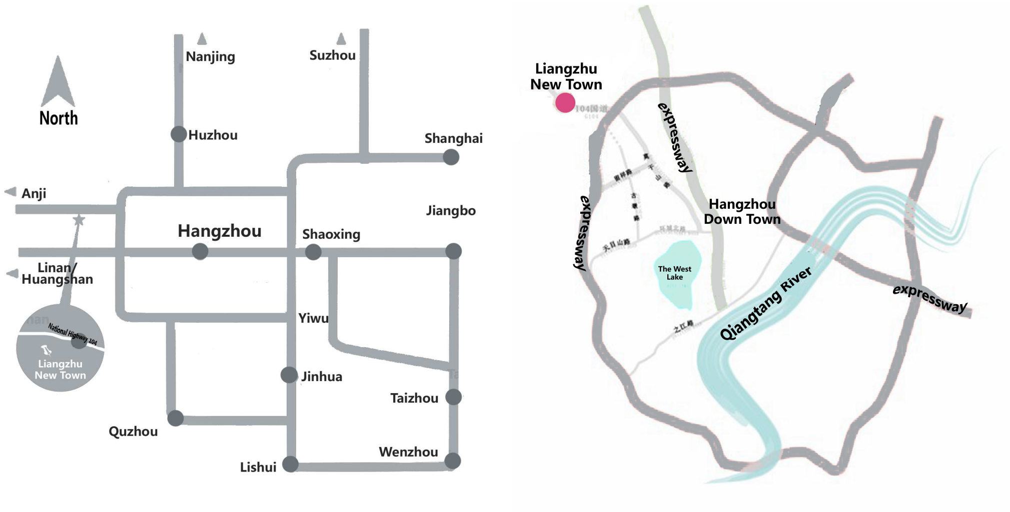

Fig. 5: Traffic zone map of Liangzhu New Town

3.5 The goal and principle of the project

As the continuously expansion of modern industrial cities, different kinds of “city diseases” gradually appear, such as the environmental pollution in urban area. Nature is leaving our city farther and farther away, which causes the natural daily life environment become most of people’s ideal living. “Let nature immerse into our life” is a pastoral dream between urban and rural areas, harmoniously dissolve into the surroundings; keep a proper population density, keep the balance of residence and working place. A new kind of infrastructure and industry without depending on the central city. Central city and country city are connected by convenience transport with radiative and circular shape. On the basis of this ability competition, it achieve lots of planning concept, such as countryside design, functional combination, and the revolution of village.

Following the traditional city special construction principle, including low-density, small scale, humane, close to nature, organic grow. Founded a comprehensive organic city body, which collected travel, residence and venture all together, which is also self-organization, self-circulation and self-balance. Since the beginning of 2000, Vanke Group hopes to achieve the dream of living in country life of urban people by cultivating its new ideal countryside on this ground ----- Liangzhu New Town.

3.5.1 A model project for New Town construction

Derived from the revolutionary dreams of the Utopians and the later reformist ideas of Ebenezer Howard, the planning of Liangzhu New Town inherit the concept of “Garden City” and it also involved the core ideas of organic evacuation, composite function and urban village. This project has created a unique and charming form of new town.

3.5.2 Included into the planning system of Hangzhou

Make sure the planning of Liangzhu New Town links up with the master plan of Hangzhou City in the aspects of land use function, traffic organization, municipal supporting and employment. The concept not only envisioned for the Liangzhu New Town, a liberating opportunity to achieve “modern” town forms and better ways of urban living, but also as a device for larger ends. To reshape city regions, and help to solve the social, economic and environmental problems of Hangzhou city.

3.5.3 Continued growing of small town life form

The plan of the Liangzhu New Town emphasizes the characteristics of the core concept of urban village which include compact layout, appropriate density, mixed land use, pedestrian zones, social space and flexibility. The final purpose is to make the new town become an organic syntheses which includes functions of tourism, housing and employment.

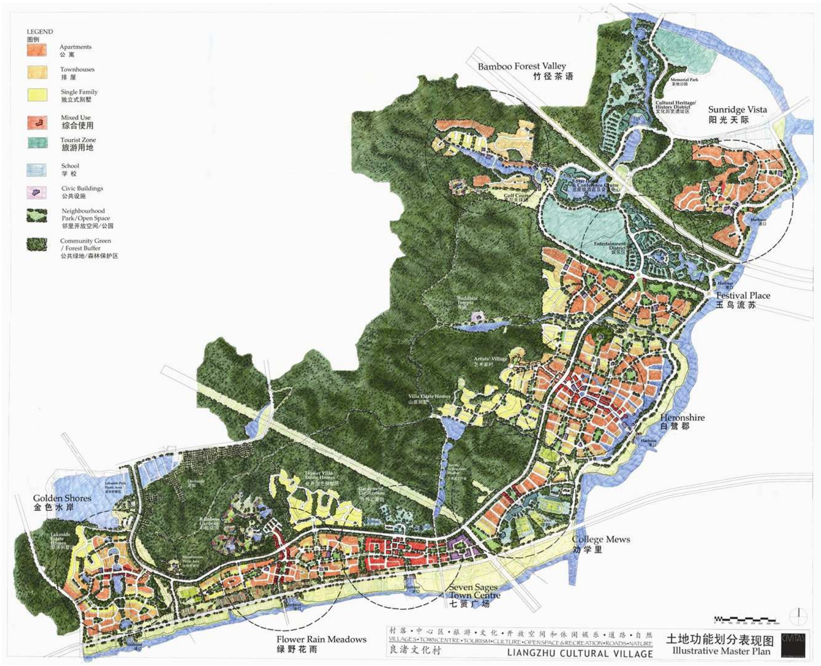

Fig. 6: Master Plan of Liangzhu New Town

4 MASTER PLAN OF THE PROJECT

4.1 Function layout

The project consists of 833 ha of existing agricultural and forest land, with 398 ha considered for residential and tourism development. The site sits within a spectacular setting, with forested mountains to the northwest and the Liangzhu River to the southeast. Designer has developed an overall master plan that foresees a series of eight villages linked by a major parkway boulevard. The villages are to be sized and spaced on a 5-minute walking radius. Open space links are to be preserved between the villages allowing ‘green fingers’ of the mountain forest to link with the riverfront.

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(1) Road network structure: Based on the fast track zone, there is a three-level road network system: connection way, internal road and pedestrian road. Along the mountain and river, this road network forms two "axises" of traffic.

(2) Land use structure: The plan of Liangzhu New Town consists of two centers which are public building service center and tourist center, there cultural tourism functional areas, waterfront residential area.

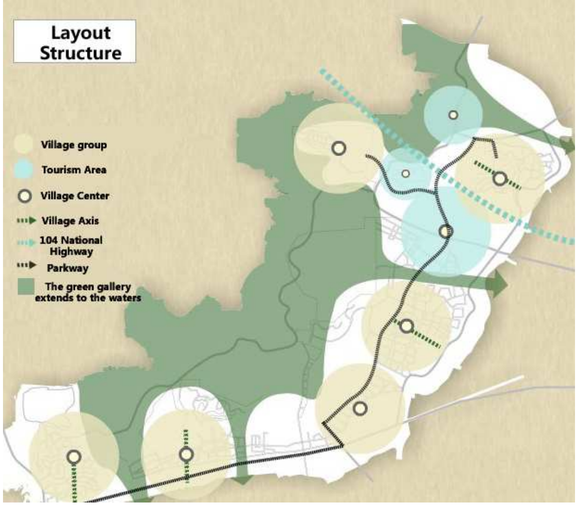

Fig. 7: Layout Structure

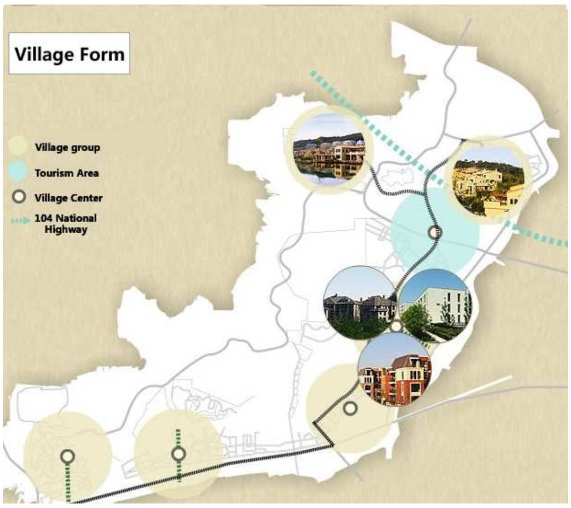

Fig. 8: Village Form

4.1.1 The urban form in natural ecology

Planning respects the natural texture. In order to effectively protect the original ecological system and native village distribution, every units' location avoid to destroy the mountains in the north, instead, they situated in the south side of the mountain. Different theme villages present a banded structure. There is an open green space between each village, which means between each two groups there is a free unit, and each unit is a major parkway boulevard.

4.1.2 Urban life with multiple units

To emphasize the integrity of village life, the layout of the villages makes the cultural center, business center, and other supporting groups to be the center of plan. In which set up a more comprehensive business services and public entertainment facilities, so that the village can be widely shared. So as the new town becomes a self-contained development with a balance of commercial, social and cultural institution that satisfy all the needs of families and individuals.

4.1.3 Various themes of villages

Village is separated with 5 minutes' walk: Taking village center as the center of the circle, buildings layout density decreases gradually from the center to the border. Villages always have 5 minutes walking distance radius to the demands of the daily activities place, as well as providing the corresponding jobs. Planning puts the village public facilities and open space in the consideration of comfortable walking distance.

4.2 Road system

Liangzhu New Town has four categories of road systems, which are external roads, connecting roads, internal roads and pedestrian roads. On the basis of convenient, the design fully considered with humanity and rationalization to let residents have a relaxed state of mind no matter to travel, visit other villages or walk in town.

4.2.1 External road system

External road system is an important link of Liangzhu New Town's external traffic. At present, Liangzhu New Town mainly relies on the 104 National Highway and West-East Avenue. To make it convenient to the old city, 'new district', Xiaoshan airport and surrounding cities.

4.2.2 Connecting road system

Connecting road system is divided into three levels.

Town's important roads: Important roads are connected to the external road, at the same time, as an important way of connection among the village groups. It is convenient and fast for residents travelling within the town.

Fig. 9: External road system

Town's important branches: Important branches are the diversion roads of the important roads, connecting the important road and village groups. It make residents travel directly into their own village.

Town's ordinary branches: General branches are the connection roads between adjacent village groups.

4.2.3 Internal road system

Internal road system are connecting roads within the village group. It can not only convenient for residents to enter the village center but also satisfy villagers' travel demands.

4.2.4 Pedestrian road system

Pedestrian road along riverside: Residents can walk along the Liangzhu River enjoying the scenery.

Pedestrian road inside village: It can integrate the park, greenbelt, the Boulevard inside village.

Mountaineering Pedestrian road: It is throughout the mountain forest reserves of Liangzhu New Town.

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Fig. 10: Connecting road system

5 THE FEATURES OF DEVELOPMENT AND MANAGEMENT

Vanke Group is responsible for planning, management and development of Liangzhu New Town. The master plan of Liangzhu New Town has made a position itself as a particular New town with Liangzhu culture in the Hangzhou suburb, and it’s a New town with a combination of culture, travel, leisure, holiday, nature, completed function, and abundant form of residence, which lead Liangzhu to get a worldwide influence in the new century.

The project started construction in 2000. From apartment to villa, Liangzhu New Town provides various residential types for different classes in each group. The diversity of residents ensure the harmonious development of the new town.

In the developmental process, the first completed is main roads, infrastructure and then the center of Liangzhu new town. Among its cultural and social offerings, there are a museum by David Chipperfield, Community center by Tadao ando, schools, a resort and spa, idyllic residential areas, various public amenities, and a church by Tsushima Design Studio. Vanke Group is the builder and owner of these projects. These famous facilities enhance the regional value in culture and social. At the same time, these initiatives enhance the land value of Liangzhu region, and it also brought great social and economic benefits for the subsequent development for Vanke Group.

For almost 8 years, Liangzhu Cultureal Village didn't have any social committee, as well as the owners committee. During this period, more than 4000 owners and developers come out an agreement on a “Villagers Convention”, which established by owners, eventually determined to be 26. The Convention covers from the neighborhood to the environment of the community. In fact, the convention with self-discipline requirements completely, it not only depends on the self-discipline to implement. After implementing in the convention, the community property established a committee for the “Villages Convention”. The committee recruited many volunteers from house owner to be sidewalk commander, garbage classification propaganda members, etc. They hope the effect of volunteers’ work can cause more villagers to join and abide the “Villagers Convention”.

6 CONCLUSION

Liangzhu New Town is a successful community which is designed under the New Urbanism theory.Firstly, Liangzhu New Town reflects a mixed use concept, including residence, office, business, entertainment, travel, and other various function. In addition, it provides plenty of housing types, it not only has the 15 thousand dollars apartment, and it also gets 200 thousand dollars independent villas. Because of this housing arrangement, land is more efficiently use, and residence form is more abundant, just like giving this community a fresh vitality.

The first purpose for designing Liangzhu New Town is to bring the community design back to benefit people’s communication, a new town model with a human-centered lifestyle and walking scale. Everything is measured in the range of walking scale, so that the residents are able to do every activities by walking or bike in this town. Streets are also designed under this thought, it's belonged to human, not cars, that's why the planning of this town highly emphasize to bring street and walking road back to the public space.

Liangzhu New Town is set up as a new town, it not just only satisfy human a good living environment, it takes more effects on building a "happy working" atmosphere. Although Liangzhu is 30 mins car driving distance far away from the center of Hangzhou, it still commit to be an independent town. On the first phase of building Liangzhu New Town, it explored the road infrastructure and office park area, and then it went to explore the residence area, which means the industrial prosperity is basically fundamental to community development.

Liangzhu Project is a governmental explore project at the beginning. However, Vanke Group become a part of community government on some extent. In order to keep the sustainable development of this new town, Vanke Group's concept --- "From the community, service the community", it become a clue for designing a scientific management system, leads community healthily developed, improves the working efficience, and stimulate the owners' passion for building a better home altogether.

Overall, from the angle of urban planning and management, Liangzhu New Town provides a great sample of new town for taking experience today.

Being as a small town under construction, Liangzhu New Town also has some problems. For instance, later construction increased the building density, which may causes the increase of the load of infrastructure; operating costs is high in this town, and it will be a problem to maintain the house; the transport in this town is a shortage, although till from now, there aren't lots of traffic. The public transportation system is not very well, and residents are almost using small cars for long distance, which also becomes a limitation of new town's scale.

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The TRANSFORM DSE – an Interactive Decision Support Environment for Serving Smart City Strategy Development and Local Measure Implementation

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1 ABSTRACT

The contribution deals with the decision support tool developed within the EU FP7 TRANSFORM project, a collaboration of varoiuous partners including 6 cities (Amsterdam, Copenhagen, Genova, Hamburg, Lyon and Vienna) aiming to achieve a significant progress in the transformation towards Smart Cities. The project rests on three main pillars: the development of a Transformation Agenda, designing a Decision Support Environment (DSE) and developing local measure implementation plans. The DSE is carried out by the AIT – Austrian Institute of Technology GmbH and Accenture B.V. supported by Macomi B.V. as sub-contractor of Accenture.

The TRANSFORM DSE tool addresses several features: an "easy to use" interactive scenario development- and result mapping, allowing selection, virtual allocation of measures and finally assessing the local and city-wide effects of the measures regarding impacts on urban environment – due to energy use and greenhouse gas emissions, and on the economy – through implementation costs and effects on the cities' employment and income.

The paper gives an introduction on the topic, describes the process to gather user requirements, decribes the tool design regarding data base, graphical user interface and measure editor and depicts some results through screen shots. Conclusoins will be made rearding the user requirement gathering process, the tool functiality requirments and an outlook discusses steps to improve the toll and extend the functionality.

2 INTRODUCTION – TOWARDS LOW CARBON CITIES

Smart cities are addressed through various characteristics (e.g. Giffinger et al, 2008, Caragliu et al. 2009.Rambol, 2014) which are discussed in several papers presented on this conference. Here we concentrate on the environmental sustainability issues focusing on energy consumption, on transition using renewable energy and on reducing carbon emissions: In the TRANSFORM project the central question is: "How can we make our cities low carbon cities?"

There is a large variety of tools that can be used for decision support in urban energy planning. A more comprehensive list of such tools is described in Connolly et al (2010) or in Stöglehner et al.(2013). Some software tools supporting the energy planning process are CitySim (Robinson, 2009), EnergGIS (Girardin et al, 2010) SynCity (Keirstead, 2009) or ReMAC (Metrex, 2014) However, these tools do not fulfill all following conditions: (i) Support of perspectives of different stakeholders. (ii) Shared understanding of the output among all the stakeholders. (iii) Decisions integration and resources negotiation. (iv) Addressing different exploration and implementation scales, (v) web-based open source application.

Finally it was decided to develop a new tool that meets specific requirements and covers all ranges from local scale to city wide scale. The spatial allocation aspects will be enabled through GIS functionality. Predefined measures related to certain use cases will be integrated in the system to assess possible impacts and interactions on other measures. The project – and the tool –finally helps to prepare, develop and execute the cities' transformation agendas to make the shift towards a low carbon future providing sustainable and attractive environments. Linking strategy with implementation, TRANSFORM shall combine this transformation agenda with single projects to be implemented across neighbourhoods or districts of various cities (Le Fevre, 2013).

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3 DSE – USER REQUIREMENTS ACQUISITION - USE CASES AND DATA

Developing a tool to support decision making requires knowing which decisions shall be made by which users, based on which informations, for what purpose, achieving which targets. This is called user requirements acquisition comprising tool use case identification (related to tool functionality) and data acquisition.

The user requirement acquisition process is rather time consuming: it makes necessary to identify the key stakeholders in the administrative departments of the cities and eventually energy service providers (ESCOs) where the tool shall be applied, to identify the topics turning out as crucial issues for the cities to becoming a smart (energy) city and to identify the relevant data to be able to model measures and to simulate the impacts in an appropriate wayThis involvement of stakeholders is a crucial topic as they know about the use cases for their cities and can provide criteria for the applicability of suggested measures. Thus the use case definition and the exporation of the data availability requires various contacts – per mail, per telephone as well as physical, to be able to receive all information.

As in each city the governance and administrative structures are different, the identifcation of stakeholders, of data owners, of actors responsible for planning and implementation of measures, these requirement investgations take quite some time and have been lasting until now more than a year, where teams of the two tool developing partners AIT and Accenture have visited the six cities several times for project meetings, workshops and bilateral talks. The repetitions of these “stocktaking missions” in the six cities have been necessary, as the stakeholders have changed, the understanding of the topics have been changed, the smart city targets as well as the use cases and related measures to be implemented have been changed and with them to some extent necessary input data.

3.1 Use cases definition

It was decided to establish three initial use cases and the related measures per city. It was important to develop a tool shall satisfy – to some extent - non experts and experts as well, and to consider the different stages of the six cities on theire way to a transfomation agenda and to be able to implement more or less sophisticated measures. So the definition of the use cases as well as the required output had to fulfill a range of requirements to satisfy the various users. At the current stage of the 30 months-project – and we have passed one year now – not all use cases and related measures have been defined.

In general it tuns out that the city representations addresses both the energy demand and the supply side as use cases and select measures: concentrating on (a) construction of smart buildings. (b) building new housing and commercial areas requiring additional energy demand, (c) on retrofitting of buldings reducing the energy demand (insulation, improvement or exchange of heating systems), (d) on establishing distributed energy supply systems (like photovoltaic panels, or groundwater heat pumps) aiming in smart grids, (e) improving and extending district heating and cooling grids (integrating waste heat from industry and services into the systems and connecting new areas to the thermal heat grid). (f) As two cities are harbour cities the large cruise ships with an electicity demand of some thousand guest cabins during their stay in the harbour to be connected to the land grid instead of producing electricity by large diesel generators is a crucial issue. (g) Use cases on mobility are in discussion – here we expect measures like change in the modal split (shift from private to public transport) and reduction of car ownership.

3.2 Data and data gathering:

Data gathering is carried out in collaboration with the cities and their supporting partners following the use case exploration. Data on infrastructure and infrastructure costs to allow further cost estimation of future measures are (or still will be) provided by the infrastructure partners in the TRANSFORM project. Use cases and related measures will be negotiated between the cities’ stakeholders and are defined by the cities. Measures will are translated into equations and transferred into code, to be integrated in the DSE.

The data provided by the cities and further stakeholders vary in type and scope – typical data are:

- City layout with focus on buildings and blocks containing specifications to estimate its energy consumption for heating and cooling.
- Population specifications: any details on population, e.g. household size.to estimate electricity consumption.

- Energy consumption and production: data on (aggregated) consumption and production of various types of energy (e.g. gas and electricity).

In general different data sources are required depending on the measures that are specified into the system. The data sources can be specified on different spatial levels: city, district, or building level. To select the right data, the cities must have defined their use cases to identify and model measures to finally estimate the effects which may be changes in energy demand, in renewable energy generation and in greenhouse gas emissions. The energy service companies (ESCOs) must provide data on network and infrastructure costs as well as on energy generation costs. Providing energy prices for the customers allows estimating savings in energy costs to be related against costs for energy efficiency improvement.

4 THE DECISION SUPPORT ENVIRONMENT (TRANSFORM DSE) –

4.1 TRANSFORM DSE - purpose and approach

The tool serving as an "easy to use" decision support provides actors and stakeholders with a deeper insight regarding the selected city's or district's current performance on energy efficiency, energy consumption, CO_2 emissions and energy supply, as ability to reveal its full energy savings and greenhouse gas reduction potentials.

A planning support process in a city administration is defined through a sequence of steps, and considerations which decision makers pass, in order to achieve certain targets, by establishing measures aiming to change a given set of properties of a given environment. The tool usage flow shall follow those steps, carried out by actors and stakeholders also described in figure 1:

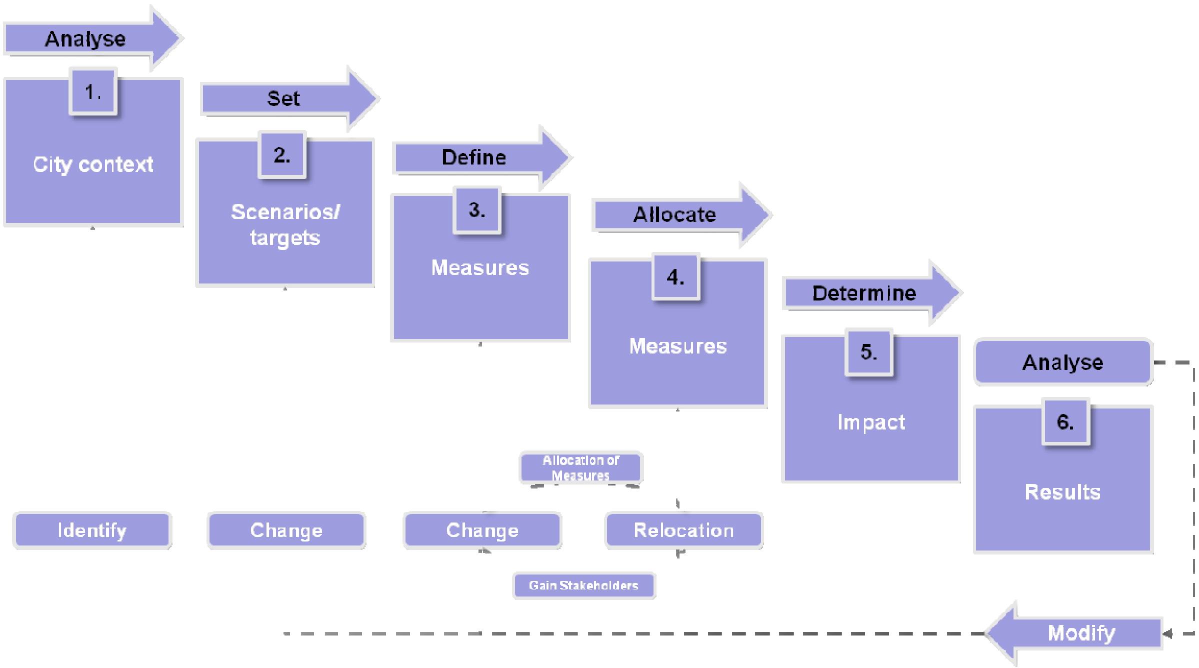

Figure 1: Decision sequence – built as Support Tool - Usage flow

- The starting point of the usage flow is the selection of the spatial context "the city context" (step 1). One city is selected and a spatial scale is addressed: the higher the level of detail of the explored data, the more detailed the analysis can be conducted.
- The selection of a scenario (step 2) provides a set of current and future framework conditions regarding energy demand and energy supply, as well as future changes e.g. of demand (e.g. through urban growth) and of energy prices of the different energy carriers.
- In step 3 measures will be defined – either selected from a set of available nes or edited as a new measure. Such information supports stakeholders in deciding which measures need to be part of the city's transformation agenda and where and when they shall be implemented for improving energy efficiency increase of renewable energy use and mitigation of GHG emissions.

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- In step 4 the measures are allocated within the case study area through the interactive map or in the entire city.
- Later on the various impacts is determined – the effects will be simulated over time (step 5).
- Finally the impact shall be explored through maps and diagrams (step 6) and allo steps may be repeated by selecting and or allocated new measures to improve the results.

4.2 The DSE tool concept

To follow the steps depicted in figure 1 the TRANSFORM tool has to cover a range of functionalities: The following figure 2 sketches the concept and marks the usage flow addressed above.

City data (top left) have to be collected and harmonized to be integrated in a geospatial database which has to cover all different spatial scales (and must be able to aggregate data from the small scale entities (e.g. single houses, blocks) to larger ones (neighbourhoods, districts, entire city).

Then the tool application steps are aligned to the decision steps addressed in figure 1:

Step 1: City Context

The objective of this step is the analysis of the current state identifying possible opportunities e.g. for reducing carbon emissions in their city. After selecting the city the city data will be loaded into the system. Afterwards the analysis of opportunities can be carried out –e.g. by conducting e.g. running variable data queries on several geographic levels and across different assets. This is iterative process where the area, assets or KPIs can be changed after each analysis of opportunities and interdependencies. The GIS-data are visualized in a map.

Step 2: Scenarios/targets

The step is dedicated the definition of scenarios and targets to set the boundaries and scope of the applied model. A first sub-step includes the definition and loading of scenarios like fuel cost trend over the next 20 years. By changing these parameters a sensitivity analysis can be conducted. The second sub-step permits setting of the performance targets for the considered measures. Those include the energy indicators but also costs and non-energy targets. The definition of the different targets should be done by the different responsible and involved stakeholders.

Step 3/4: Measures

In step 3 the objective is the revealing of the interrelations and interdependencies between measures by building a portfolio of measures. Each step is subdivided in three parts. The sub-steps consider creation of measure, enabling measures and preconditions. The execution will be supported by a measure editor. (Details on the measure editor will be shown later).

Step 4 focuses on the allocation of the measures. First the measures are allocated in a selected area and then the time frame will be determined. Both sub-steps have to be discussed with the involved stakeholders to assure the stakeholder commitment.

Step 5: Impact estimation

The impact assessment in step 5 is determined by running the appropriate simulation for the portfolio of measures. Therefore the considered simulation time is defined and the simulation is started.

Step 6: Results

The last step of the decision sequence is the evaluation of the outcome by viewing results and identifying additional actions to close the gap between outcomes and targets. Therefore the results are viewed on chosen tables and graphs. If the outcome does not meet the expectations of the tool user a new simulation can be defined.

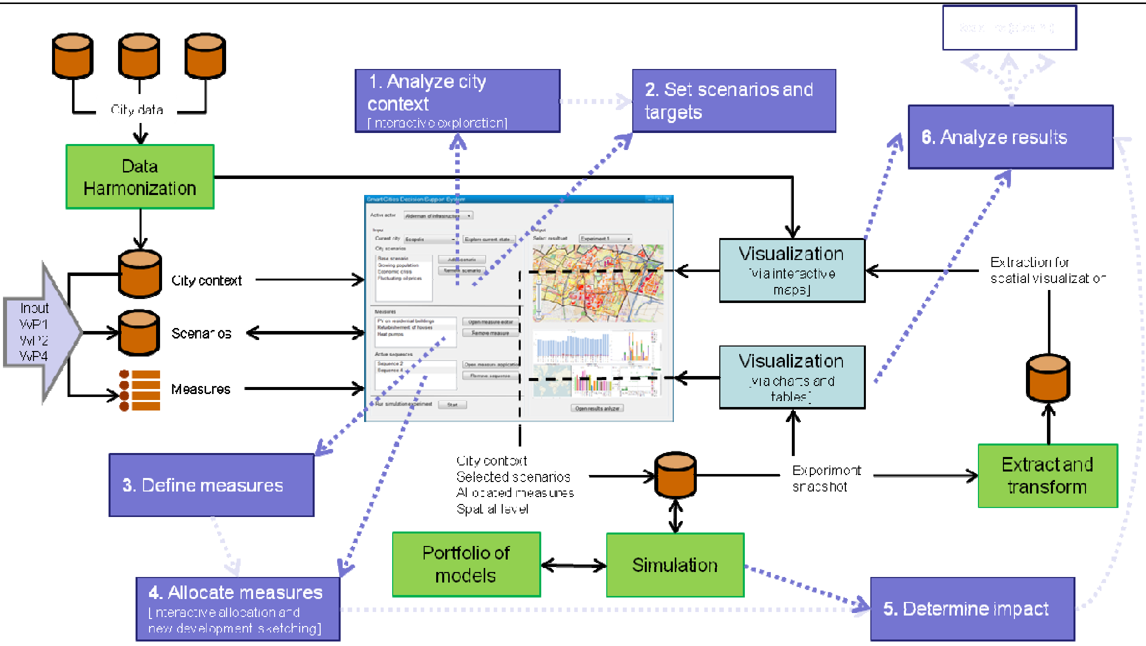

Figure 2: Concept of the Decision Support Tool and the related Usage Flow

Repetition and modification of simulation runs

The DSE will allow modifications at each step of the usage flow: changing the city context, the scenarios, the targets, and the measures or measure combinations. In the final version of the tool the parameters for the simulation runs be stored in log files which allow modifications of single parameters without entering all items again- aiming in a repetition of the simulation through batch model runs.

5 TOOL DESIGN

The DSE tool is developed by AIT and Accenture with strong involvement of the cities during the meetings and the visits, particularly of Amsterdam as project coordinator. The software is finally installed on a Web server at AIT allowing access as mutually committed – either public access or access for selected users from the cities, protected through password entry.

5.1 Software architecture and user interface:

The TRANSFORM DSE simulates the energy consumption and production and the related greenhouse gas emission depending on certain preconditions. The decision support refers to changes in the system with respect to changing energy efficiency in the building stock, changing of energy carriers for heat and cooling as well as for power generation (shift from fossil fuels to renewables) to changing energy supply (shift from central power supply to distributed, individual supply e.g. through PV). The changes are calculated in a spatial explicit way and the impacts regarding energy consumption by carrier and greenhouse gas emission are estimated for spatial entities and for the entire city.

The software is designed through modules working together within the LIFERAY ® portal - an open source user interface appropriate to add, merge and control different functions within one web-site window which allows individual user interface design. An overview of the architecture is shown in Figure 3. A flexible geodata base structure based on PostGreSQL and OpenGIS contains finally the (harmonized) data of all six cities hre the sub set of the selected city is activated.

The graphical user interface (GUI) with control, retrieval and display functionalities has been developed by using standard Web server components such as Apache webserver as HTTP server, the PostgreSQL/PostGIS database and Apache Tomcat as backend for the communication with the database according to the users' queries. Geoserver as map server is used to deliver maps based on the users' requests. In addition, GeoServer provides the ability to integrate data directly into other applications e.g. a desktop-GIS via so-called services (such as Web Feature Service (WFS[1]) and Web Map Service (WMS[2])). The interface is accessible through

[1] http://en.wikipedia.org/wiki/Web_Feature_Service

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every web browser. Using Liferay® , an extensive set of different modules can be flexinle integrated in the interface. A Redmine ® system has been setup to support the software development by monitoring and documenting its progress.

To cover all steps described above the software architecture consists of several modules – a city context explorer, a scenario editor a measure editor and sequence editor for defining the temporal development. Some of these modules are related to the GIS component for spatial retrieval and visualisation. The database layer is the core where the simulation components refer to.

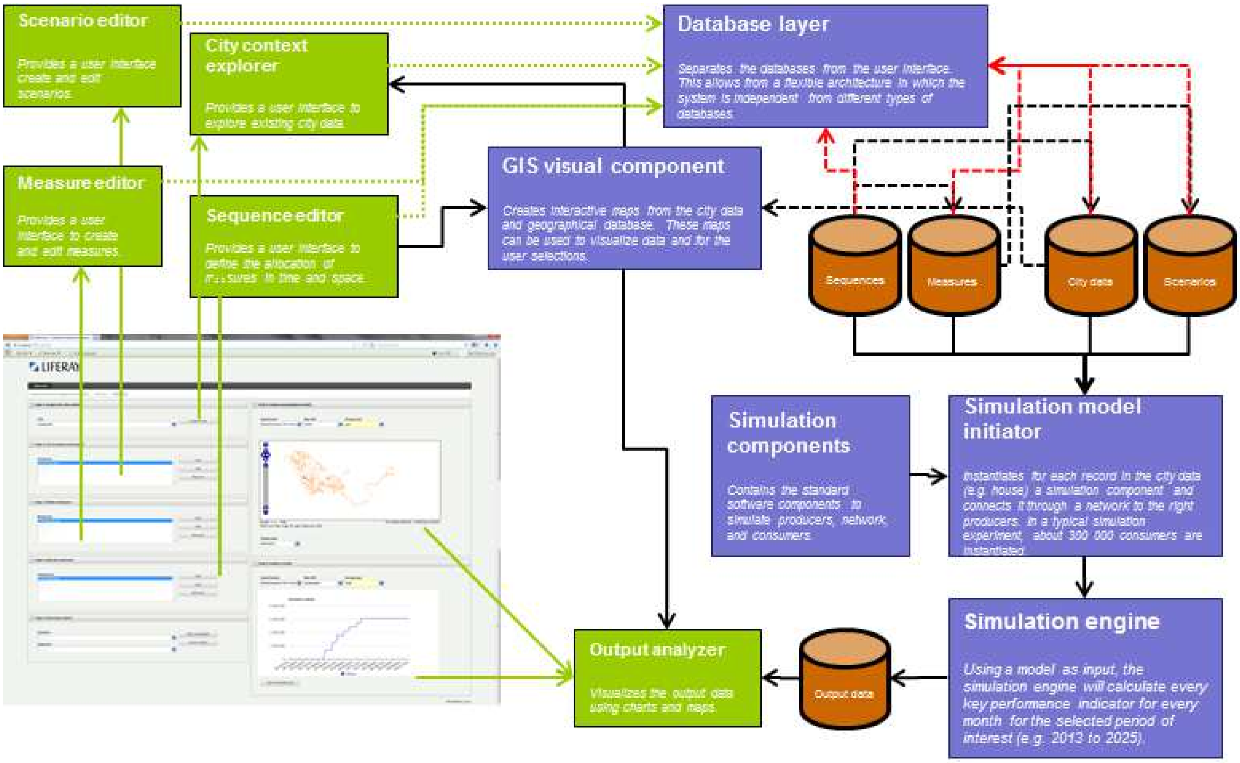

Figure 3: Architecture of the decision support tool

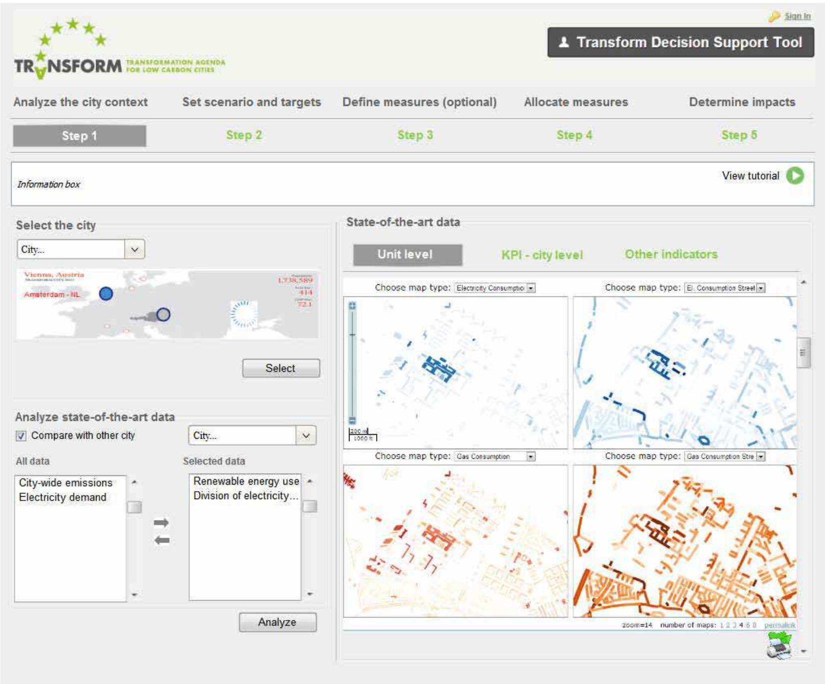

Figure 4: Graphical user interface – initial page

[2] http://en.wikipedia.org/wiki/Web_Map_Service

5.2 Application interface

The application accompanies the six steps (described in 4.2) to make decisions regarding measures to be implemented for improving smart city properties of the respective city. The initial screen is shown in figure 4. Clicking on each of the step-buttons leads to the next step on the way to achieve a decision.

The initial step 1 screen allows the selection of the city, a comparison with the partner cities in the project and the exploration of the characteristics of the selected city or a particular district or neighbourhood, as seen in figure 4. The mapping control and spatial retrieval functionalities which play a particular role are addressed in a section 5.4.

The step 2 screen allows selecting and adapting future scenarios by changing the framework conditions through entry fields, sliders, etc. and shows the development over time of the different framework-describing indicators through diagrams. Screen 3 is dedicated to the definition of measures (see section 5.4)

5.3 Database design and processes

Due to fact of highly dispersed data sets across the cities taken into account with respect to structure, content and availability, the topic of data integration, management and storage is a big challenge. As the data gathering is still ongoing it has been learned that the best approach for minimizing the time to make the data available to the application and to cope with less resources, a more flexible approach has to be chosen. So in contrast to traditional software development processes especially in the field of data warehouse projects where all the available data sources have to be screened and analysed in advance and the strategy and methods for cleaning up, harmonizing and integrating the data is created afterwards, the given data sets are loaded as they are to the city related stage areas within the database at first.

After cleaning and norming the city stage data the queries are developed and provided as views to generate the information needed to realize the as it is situation for the particular city, this is related to decision step 1 of the application (city context).

The information which has to be processed within the database encompasses the following categories:

(a) Geospatial datasets as polygons, lines or points

(b) Statistical datasets describing energy related properties of the physical entities in terms of

- Characteristics influencing energy consumption (e. g. for heating and cooling [building quality influencing energy efficiency])
- Activities demanding energy (e. g. power demand of households, services, production), time series data

(c) Parameters which provide the scenario background

- Population growth factors, energy prices
- Public transportation costs and modal split fractions

(d) Parameters which provide factors to estimate local energy production, energy consumption, energy savings potential, supply costs, environmental impact etc.

- Electricity generation factors (e. g. for PV panels/m²)
- Energy demand factors, (e. g. heating demand for houses by age class, electricity demand for households or flats by size class)
- PV installation costs per kWh, energy consumption in kWh per flat in density classes Greenhouse gas factors (e. g. for different energy carrier and heating or production systems)

(e) Specification of scenarios based on a), b) and c)

(f) Specification of measures (i.e. formulas to be calculated) based on a), b) and d) and auxiliary information required to carry out a simulation experiment.

The basic data structure as it will be used during the project is summarized in the following figure 3. As it is shown and described above each city dataset is transferred to the city related database scheme. This is done by usage of DB maintenance tools and especially for GIS based datasets the data can be loaded by open source software tools e. g. QGIS to the database. After cleaning the data and applying a common naming

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definition the data is available for further usage. Regarding to the measures definitions which are worked out together with the cities as much as possible data which is needed as basis for the realization of the measures is generated based on the given data and provided to the application layer. It has been shown that this is still high effort task due to very different data sets and measures to be implemented.

The implementation of a centralized data store according to data warehouse standards is currently not possible due to lack of resources and missing accurate specifications regarding measure definition and available data. So the strategy is to create this step by step or at least describe the situation based on the given and still evolving status to have a guideline by the end of the project in place which can be handed over to the cities as basis for further development of data process and governance standards within the cities organization. The data structure and retrieval process is summarized in the following figure 5:

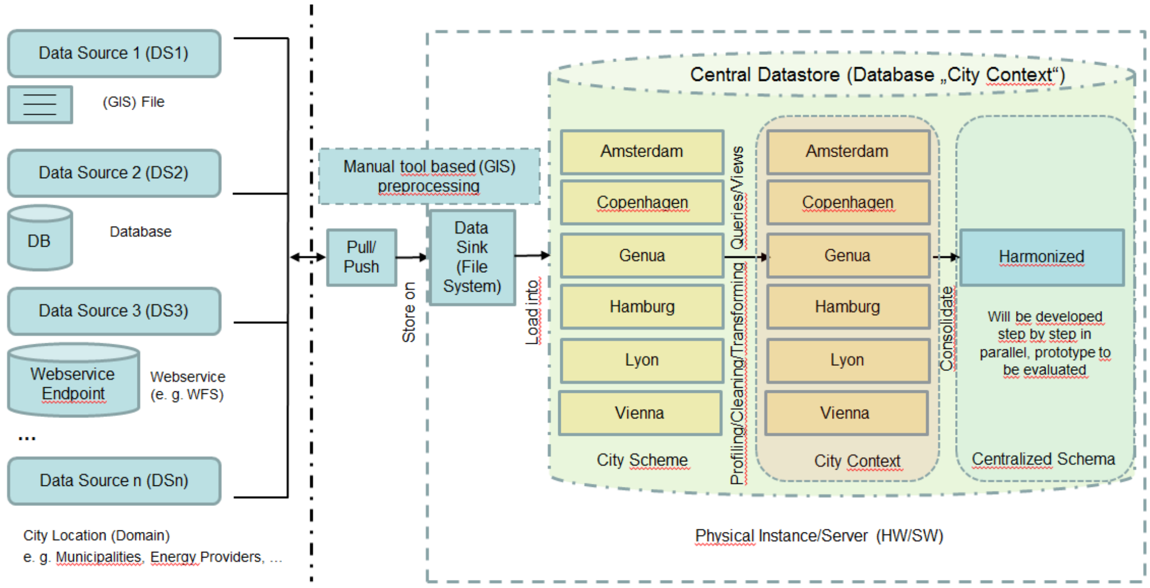

Figure 5 - Data retrieval and storage

5.4 Mapping and spatial retrieval functionality

The mapping module of the DSE tool consists of a server backend and a client front end. The backend is based on PostGIS spatial datasets translated from datasets delivered by the participating cities. The client is based on Open Layers and features a so called free hand selection feature which has been developed for the TRANSFORM DSE. Selected functionalities of a standard desktop GIS are provide in order to give also non-GIS experts the possibility to make use of these functions. The interface design is simple and gives the users a similar experience known from e.g. Google maps. The mapping functionality allows interactive exploration of physical and socio-economic framework conditions of the particular district and also all energy related data for single elements (e.g. buildings, blocks) or aggregates (e.g. blocks, wards, districts) or for the entire city. The spatial retrieval functionality allows the selection of geometric entities through mouse cursor or on a touchscreen. Thus interactive placement of possible measures at block-scale or district-scale is possible, allowing for an ex-ante assessment of effects of those measures (e.g. energy-efficiency improvement or technology & control improvement of blocks, fuel mix optimized towards GHG reduction, household and business electricity consumption reduction etc.).

The following figure 6 shows the free hand selection application in Amsterdam which allows allocating measures to certain areas or blocks and leave out the rest.

5.5 Measure editor

Measures are defined in equations that model the infidel change on production, consumption, costs and emissions of an entity. Each equation is individually calculated during simulation experiments and fed back to the system (being the entire system) through energy networks. Using this method, users have to follow a bottom-up approach where they need to define the changes on an individual level to be able to calculate the aggregated impact over time on a city level.

Currently only a limited set of measures are established and a limited set of inpout data. If additional data are provided and futher measures are suggested by the citiies' stakeholders and coded to allow an impact assessment further measures can be integrated.

Figure 6: Spatial retrieval – free hand selection of areas of interest.

5.6 Results and presentation

The results are presented using geographical visualizations as shown above and using SpagoBI, business intelligence software. The latter allows for a thorough exploration of the output data by allowing the user to define charts other than the predefined ones. The latter is important as the detailed KPIs change depending on the stakeholders that are using the tool. Figure 7 shows an example of the usage of SpagoBI integrated in the decision support tool. Besides SpagoBI also other charting tools are in discussion which can be easily exchanged within the Liferay® environment.

Figure 7: An example of output using SpagoBI

6 CONCLUSIONS AND OUTLOOK

The tool development was a challenge as the different stakeholder groups in the partner cities have been quite demanding regarding usability, functionality and flexibility.

The integration of a measure editor and the interactive spatial retrieval features makes the DSE tool attractive and provides flexibility unknown until now. Although we as developers have been working hard to establish high usability the application requires still some training due to the complexity of defining scenarios and measures and to understand the principles of the simulations in terms of spatial relation, temporal sequence and interdependencies within the urban system.

For the future it is planned to extend the usage of the DSE to be applied in a serious simulation game. One distinct property of a simulation game is to create shared intelligence by helping us enable social construction of meaning, propagate ideas and skills, and enhance and facilitate communication (Gillert, 2008). This advantage shall be finally achieved to enhance the decision support of the DSE towards smart cities.

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reviewed paper

The Use of Social Media in Public Transit Systems: The Case of the Gautrain, Gauteng Province, South Africa: Analysis and Lessons Learnt

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1 ABSTRACT

The use of public transit systems is still in its infancy in Gauteng, South Africa. Commuters still prefer using private motor vehicles. However the introduction of the first efficient high speed train in Africa (The Gautrain) during the 2010 world cup was thought to change perceptions of the public on transit systems. The Gautrain was also thought to enhance Johannesburg as a smart city. Social media has proved to be useful in proving user information, which can be use to improved services. The study is an exploratory study, which analyses how commuters feel on the effectiveness of the Gautrain by analysing posts on social media before and after completion of construction of the Gautrain system. Emerging findings reflect that although the Gautrain has positively changed the publics' perception on public transit systems, the Gautrain system still needs to be improved for the South African public to embrace fully public transit systems.

2 INTRODUCTION

Social media is an interactive community built on internet and mobile platform technology (referred to as Web 2.0). It is a technological platform that allows people to write, share, evaluate, and discuss content that creates User Generated Content (UGC) (Zhang and Wang, 2014). The use of social media for communication, amongst people has become almost ubiquitous the world over. Social media has influenced how people relate, communicate, and voice their opinions the world over with Africa being a major player in the social media revolution. The cultural revolution of social media is the first of the 21st century (DuBose, 2011) and it is described as a crucial pillar of the new Information Age (Castells, 2011).Content generated on social media plays a key role in service delivery, politics, urban planning, and business. Therefore, it is only natural that it has also extended to the transport sector (Tzure et al., 2014). The public and institutions, organisations and companies can harness social media. Meanwhile, the public would voice their concerns on quality of service being offered, whereas organisations can employ social media as a marketing strategy and a way of engaging with citizens.

Initially social media was applied for mundane communication between friends and colleagues, of late government officials are starting to view social media posts critically as a way to enhance their services (Picazo-Vela et al., 2014). Social media has enabled massive generation of information online, which was impossible before from conventional research methods. However, a critical challenge is deciding if the information can be usable for policymaking and facilitating decision-making (Kavanaugh et al., 2012). Although information on the citizen's perception on public services is vast on social media a major challenge is identifying data mining techniques which can which facilitates in making sense of all the noise on the perception of the citizens on public services. Information on social media can be used by government officials to improve service delivery, getting insights on the public's perception and mood with regards public service as well as a marketing strategy (Zhou and Wang, 2014). These perceptions and moods would be very cumbersome and difficult to collect if conventional research methods such as surveys are used. Moreover, traditional methods are incapable of providing material in real time as social media (Mergel, 2013). In addition, unlike traditional research methods the costs associated with collecting information from social media are relatively minimal. Moreover, social media has an almost global outreach, which is impossible to obtain from conventional methods. Given this potential, perhaps one can say that use of social media can enable government officials and city planners to collect information that can be used to plan for smart cities.

The use of the social media also has several advantages such enhancing free public participation as well as allowing feedback to public officials on the public's perception on service delivery. Appropriate use of social media can also potentially improve the level and quality of collaboration between government and citizens (Picazo-Vela et al., 2014). It has been argued that the use of social media tends to elicit more honest and non-coerced opinions from the public as compared to other research methods. Posting concerns on social media may also lead to prompt reactions in providing solutions. Lastly, it can also promote transparency.

Governments and public officials have recognised social media's potential and have made bold attempts to be present on social media platforms. In the US The President instructed government officials to harness the potential of social media in the following statement (Mergel, 2013).

"Harness new technologies to put information about their operations and decisions online and readily available to the public" (Obama, 2009).

In the US, each government department has a dedicated social media director. There are various reasons for governments presence on social media namely (1) representation of the agency (2) engaging with citizens and (3) networking with the public (Mergel, 2013). Likewise, the South African government has embraced the use of social and has produced a policy guide for its use (Government Communications, 2011). The South African guidelines acknowledge the potential of social media use as well as its pitfalls.

South Africa has seen a significant rise in social media use by the public in the past 3 years. In 2013, Twitter users grew by 125% while Facebook grew by 83%, which are huge increases (Table 1), particularly for Twitter (Blue Magnet, 2013). In total South Africa had 31.2 million users' that is 57% of the population. This percentage could supply potentially valuable information to government officials and urban planners on the public's perception on service delivery.

Social Media platform	**Users**
Facebook	9 600 000
Mxit	7 400 000
Twitter	5 500 000
You Tube	4 700 000
Linked in	2 700 000
Pint Interest	930 000
Google Plus	460 000
Total	30 830 000

Table 1: Top social media sites South Africa

From Table 1, it is clear that Facebook, Mxit and Twitter have the largest following and the total number of users on social media is 57% of South Africa's total population of 54 000 000. Therefore, social media is an opportunity, which should be tapped by organisations and the public. Federicks and Foth (2013) note that social media platforms has brought about a significant shift towards more participatory qualities as it encourages ordinary users to foster their knowledge and help collective intelligence to be fostered. It is often argued that the conventional public participatory planning process is often hierarchical and top-down which hampers public participation. Conversely social media follows a more a communicative structure that is based on dialogue, relationships and peer-to-peer network interaction (Federicks and Foth 2013). Nevertheless, there has to be caution because this communicative flow may be compromised. Therefore, social media should be seen as complimenting the conventional face-to-face public participation rather than usurping it.

2.1 Study Area

The Gautrain is located in the Gauteng province of South Africa (Figure 1). Gauteng is the smallest province in South Africa yet it is the economic hub of the country and the fastest growing province. The Gautrain project spans through three metropolitan areas in Gauteng namely Johannesburg, Pretoria, and East Rand. These three municipalities form a city region, which is the economic heartland of South Africa.

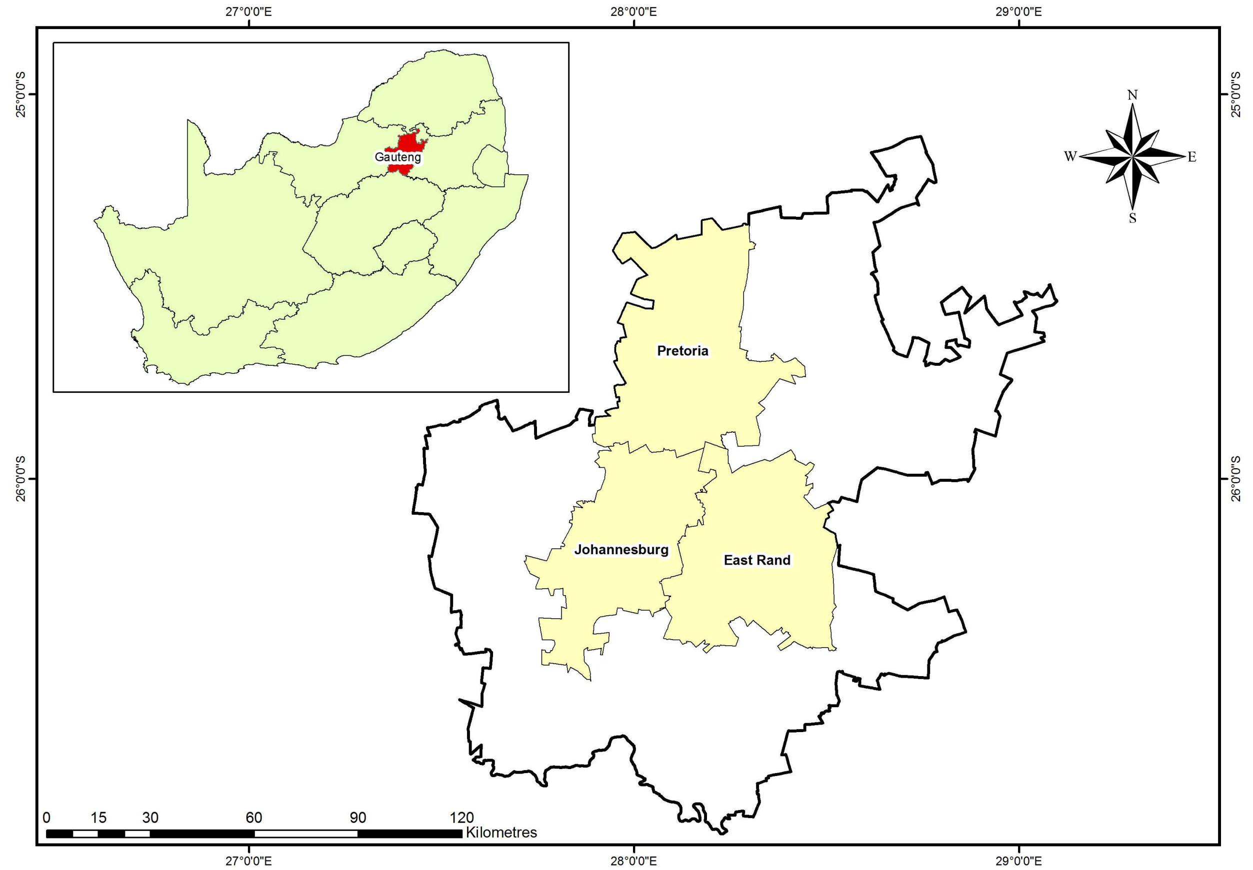

Fig. 1: Location of Gauteng Province, South Africa.

2.1.1 The Gautrain project

Gautrain is Africa's first world-class, modern rapid rail and bus service (Figure 2).

Fig. 2: Gautrain. Source (GMA 2013).

Gautrain is more than just a train. It is one of several strategically integrated Gauteng Provincial Government projects to meet future transport demands anticipated because of economic and population growth (Gautrain Management Agency (GMA), 2010a). It is also referred to as a mega-engineering project. It is a state-of-the-art rapid rail connection between Johannesburg (Africa's business capital) and Pretoria (Donaldson and Van De Merwe 2011). Gauteng, the country's economic hub currently experiences traffic congestion on its major routes, especially between Pretoria and Johannesburg. The current transport facilities and services between these two cities are mainly road based. Accordingly, the Gautrain was supposed to ease this traffic

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congestion, in an attempt to create a smart city based on mixed land uses and development corridors. The Gautrain project is also meant to promote rejuvenation of central Johannesburg and Pretoria (GMA, 2010b). Construction of the Gautrain is informed by spatial planning embedded in two parallel strategies that were initiated by the Gauteng Provincial Government namely the Gauteng Spatial Development Framework (GSDF) 2000 and the Gauteng Spatial Development Initiatives (SDI's). Consequently, it is envisage that the Gautrain will promote, mobility and accessibility, redirection of urban growth, contained urban growth, resource based economic development and rural development beyond the urban edge.

The Gautrain has two routes the South-North and West-East routes (Figure 3).

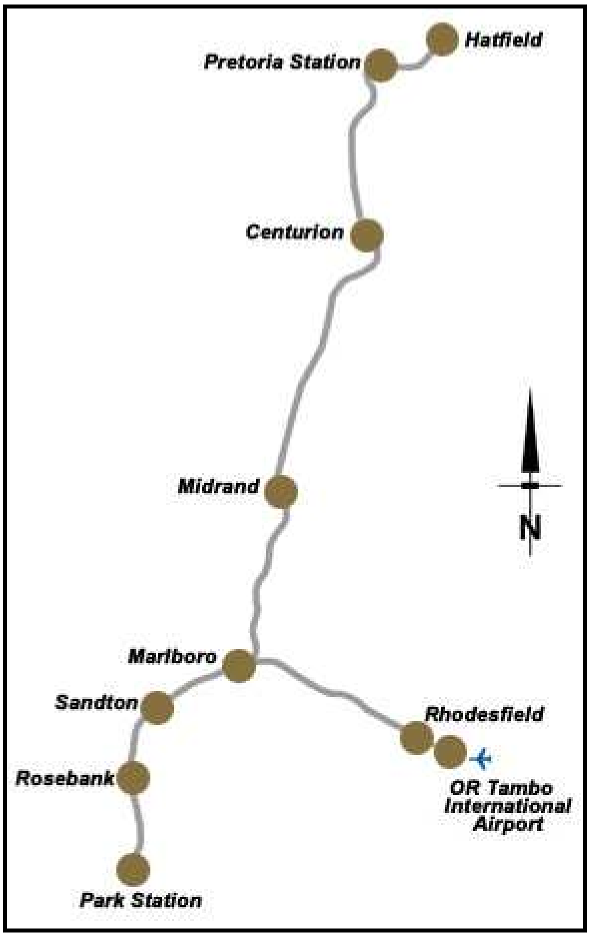

Fig. 3: Gautrain Routes Source (GMA 2013)

The North South route begins at Johannesburg Park Station in central Johannesburg to, Sandton and Pretoria and Hatfield in the north cutting across Johannesburg and Pretoria metropolitan municipalities. The West-East route will take passengers from Sandton Station, via Marlboro, to Rhodesfield Station in Kempton Park. From there it connects to a station built within the airport terminal complex at OR Tambo International Airport (GMA, 2010b).

2.2 Study methods

The study is exploratory as it seeks to determine how the GMA uses social media and how commuters perceive the Gautrain system through use of social media. Three key informant interviews were conducted with key personnel in the GMA to ascertain how the GMA employs social media. Secondary data in the form of media reports from February 2011 to September 2011 were also gathered. These reports were analysed thematically broadly into positive and negative feedback on the Gautrain, focusing mainly on the GMA's official Facebook page and the GMA official Twitter handle.

Semantic analysis was also carried out to identify what commuters most post about the Gautrain using twitter analysis software namely https://www.tweetarchivist.com and http://www.twitonomy.com/ as well as http://hellopeter.com/. This semantic analysis was compared with monthly Gautrain reports on social media by the GMA. Analysis on twitonomy.com allows analysis from August 2012 to March 2014 whereas analysis on tweetarchivist.com focuses on current data (March 2014) as it does not allow historical analysis. Meanwhile hellopeter.com is a South African social media platform where the public post complaints and compliments on service provision. Analysis on hellopeter.com ranges from June 2010 to March 2014, covering the entire time Gautrain has been in operation.

The study also utilised observation as a research method. The study period is 2010 to 2014 which coincides to when the Gautrain system started operating.

3 SOCIAL MEDIA USE AT GAUTRAIN

The key informant interviews revealed that the Gautrain management Agency has a strong presence and utilisation of social media with a dedicated secretariat on harnessing social media (Pers Communication). As part of its mandate, the social media secretariat gathers the public's perception on the Gautrain and reports to the management for action to be taken. Changing attitudes and behaviour required the use of integrated social media tactics in support of GMA's communication strategy. The GMA's social media programme is integrated with its integrated communication and marketing strategy (Pers Communication). Under this strategy, the GMA seeks to position and portray the Gautrain as a smart transport alternative, efficient, safe, reliable, secure, predictable, and comfortable transit system. Moreover, the GMA sought to use social media aggressively to quell negative perceptions around the Gautrain, as money spent on the project would be better allocated to the poorest of the poor and other social ills facing South Africa as a developing country. The GMA also seeks to leverage social media, as it is where relevant stakeholders converge without the traditional boundaries that segment content consumers and content creators. This creates an opportunity for social media users to collaborate in the production of content and in the process become brand advocates for Gautrain.

By listening and participating in social media conversations, Gautrain has the opportunity to build authentic, two-way relationships with social media users – including mainstream media users and social media opinion leaders - who require content to be instantly available, mobile and shared in social networks. In addition, this shows that the GMA views social media information as a critical tool in improving its brand name. It is also important to note that the GMA is proactive as it began using social media even before the construction phase in an attempt to change the public perceptions on the Gautrain. Accordingly, social media facilitates increased and novel public participation in the planning process (Fredericks and Foth 2013). Consequently, social media is a conduit of dealing with the limited public participation process that currently exists.

Presence on social media peeked in activity during the FIFA 2010 world cup, as there were concerns about readiness of the system before the world cup (Pers Communication). After the world cup, the GMA employed its social media presence to glean information from commuters on issues such as delays, faults, complaints and queries as well as routine day-to-day operations. Consequently, the GMA utilises social media as a monitoring and evaluation tool. Furthermore, an opportunity exists to extend online relationships to real life relationships to reinforce authenticity, transparency, and accountability.

As part of the strategy to gain advantage, using social media the GMA employs a brand-marketing agency that produces reports on the GMA activities on social media. This approach seeks to bolster the Gautrain's positive image as a smart public transit system. It can be argued that this strategy has reaped fruits as evidenced by the trains being filled to over capacity during the week. Perhaps attitude are starting to change as people begin to switch from commuting in private cars and opt for the Gautrain. Moreover, the park and ride system of the Gautrain appears to be changing attitudes as the parking bays are often filled to capacity during peak hours. This could perhaps mean that commuters want to be associated with the Gautrain brand. However, one cannot purely ascribe growing numbers of commuters on the Gautrain on the social media marketing strategy. This is despite the Gautrain being often cited as expensive and only for the middle to upper class. Other factors that explain why numbers of commuters are increasing include the recently introduced e-tolls in Gauteng, which can be a deterrent for using private vehicles as well as the recent fuel price increases.

3.1 Commuters use of social media

Commuters play a critical role in judging whether the Gautrain is a safer, reliable, dependable, and smart transit system. The publics sentiments on the Gautrain is produced as monthly reports which glean public posts on social media (Facebook, Twitter etc) on the Gautrain. In these reports, the public's perception is classified as positive and negative. In these reports, it was observed that sentiment on the Gautrain is mostly positive. A scan of the reports indicates that overally 80% mentions on social media where positive while only 20% where negative. Negative mentions relate mostly to time delays, faults and cost of using the system. The majority of positive mentions could mean that the public is now embracing public transport. However, it was noted that content on social media decreases during the weekend. Consequently, it is suggested that Gautrain should conduct more research to understand its commuters and possibly reduce price fares on weekends as well as introducing the Gautrain bus service to encourage more use of the system during weekends.

Analysis on hellopeter.com revealed interesting results where almost 75% of consumer's mentions on the Gautrain are negative with 25% being positive. This is in sharp contrast with the monthly GMA reports. One can therefore assume that if social media content requires filtering for useful information. On hellopeter.com, the Gautrain is listed as a company that hardly responds to queries. Consequently, more research is required to explain discrepancy in social media mentions in Gautrain reports and on hellopeter.com. A possible explanation could be perhaps hellopeter.com is biased towards complaints.

The twitonomy.com analysis also shows that there have been 3200 tweets from July 30 2012 to March 30, which also indicates a steady increase on posts about the Gautrain on twitter (Figure 4). Most of the Gautrain comments on twitter increase significantly during the festive season (December 15 to January 31). This is because it coincides with a period when Gautrain, parking, and bus fares are drastically reduced, therefore most comments are positive. Consequently, it is the most retweeted comment (103) during December 15 to 31 January. Therefore, the GMA can use the positive feedback to attract more commuters through aggressive marketing and perhaps reduce fares given that users comment positively on the Gautrain during fare reduction promotions.

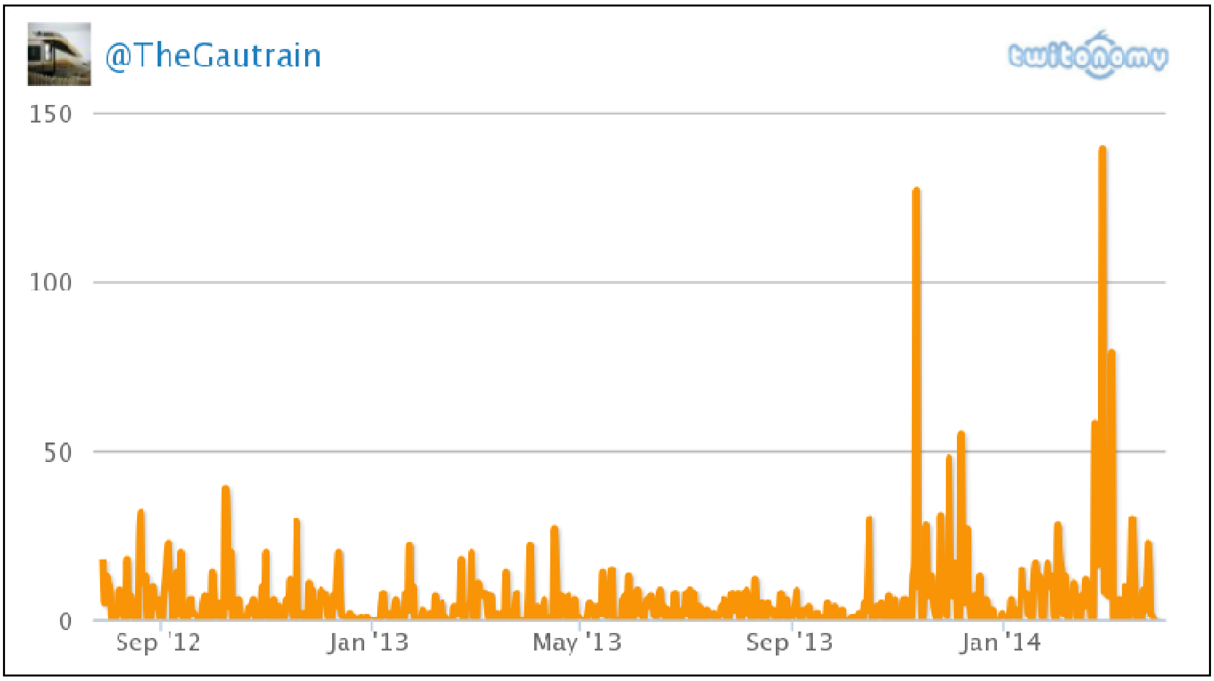

Fig. 4: Gautrain http://www.twitonomy.com/ analysis from August 2012 to March 2014

Besides positive feedback on Gautrain fare promotions useful information on trip disruptions because of faults due to stolen cables, load shedding that happened in March 2014 and other general delays are the second most common tweets about the Gautrain. From Figure 4 it is clear that during February 2014 and March 2014 there was a peak in activity on twitter because of load shedding in South Africa that disrupted the Gautrain timetable. Such posts are useful in that they inform connected commuters to make travel changes. Analysis on tweet archivist for the same period also highlighted common key words such as load shedding and power outage, which coincides with a peak on activity on twitonomy.com. Nevertheless, the power outage was beyond the GMA's control. This analysis point out that social media is a valuable tool in dissemination information relating to public transit as it informs commuters who then make alternative travel arrangements. Accordingly, social media use has gone beyond the social realm to providing operational information in real time.

From both the Gautrain monthly reports and semantic analysis of hellopeter.com. , it can be noticed that social media posts hardly focuses on how the Gautrain affects the spatial pattern of the city. Consequently, a further study is required to ascertain how the Gautrain has had an impact on urban form and achieving the goals set in the GSDF and SDI of promoting a smart city. One can therefore say social media can hardly replace conventional scientific research methods but should be used in conjunction with other participatory research methods. However, they can also form an important component of research or a debate on how the Gautrain affects spatial form. Similarly, reliability of social media can also be questioned and influenced by influential users. For example, analysis on hellopeter.com is mostly negative as it mainly focuses on negative aspects, meanwhile one can conclude that analysis on twitonomy.com, and tweet archivist is relatively balanced, however influential users still can manipulate it.

4 CONCLUSION

The use on public transit systems such as the Gautrain were supposed to change the public‘s attitude towards use of public transport in South Africa. Lessons learnt in this study include that perhaps attitudes have changed on use of public transit given that the Gautrain is normally filled to capacity during peak hours as well as the parking facilities. Consequently, one can conclude that the brand marketing strategy of the GMA through social media platforms has been successful. However, other factors have led to commuters opting for the Gautrain.

With regards commuters use of social media various social media analysis yields different results. One can conclude that social media increases public participation and it is an invaluable tool in disseminating important information in public transit systems. More importantly, social media use can also mean increased public participation in the planning process. However, social media does not replace the conventional face-to-face public participation rather it enhances the whole participation process. Social media has immense of potential; however, it often contains lots of noise that prevents critical use. Consequently, there is need to instigate a more critical debate on social media particularly on whether the Gautrain project is shaping the spatial structure of Gauteng. Social media therefore cannot replace conventional scientific research; however, it can be a useful platform to obtain useful information if structured properly.

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TRANSFORM – Governing the Smart City by Projects

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1 ABSTRACT

With the recent ascendance of a sociology of public policy instruments (Le Gales & Lascoumes 2007), particular interest has been devoted towards understanding the emergence of the project as broadly indicative of wider transformations in strategic urban policy making (Pinson 2007, 2009, Beal 2010). Many Smart Cities are governed by research projects, and these are practically marked by an inherent tension. On one hand, the Smart City research project has the purpose of shaping consensus around acceptable “smart” urban futures, instituting new pluralist political spaces, in which scientific targets are always practically reversible if they do not fit consensus. On the other, the Smart city research project aims to scientifically evaluate what “right” choices have to be made to lead the city towards effective Smart City development in line with supranational targets and climate wisdoms. How can the Smart City research project shape consensus among a multiplicity of institutions, actors and groups while not compromising the scientific validity of the set targets and strategies? Drawing on the experiences of the project TRANSFORM in monitoring and shaping the transition strategies of six European cities, the aim of this paper is to elucidate some of the logics of strategic urban policy processes in their peculiar pathways towards the Smart City. In the course of the paper we would like to show how some of the tensions inherent in the role of Smart city research projects are practically addressed in the local framework of the project TRANSFORM and give a first tentative evaluation whether this has been successful so far.

In the context of stagnant growth prospects and increased territorial competition, the urban project has become a primary vehicle for the promotion of local development. Newly build urban districts, such as Hamburg Hafencity or Aspern Seestadt in Vienna, mega events like the London Olympics, large scale revamps of urban public spaces such as the pedestrianization of Times Square, or the proliferation of cultural venues from the London Megadome to the old butcheries of Casablanca are prominent examples for the spread of the project form in urban policy making. Yet, while the urban project has become a preferred instrument of contemporary urban policy, it cannot be conceived of as a mere effect of the strategies it is embedded in but should be seen as a marker of the very advent of a project-based polis (Boltansky 1999) in which urban governance assumes the logic of the project itself. As has been argued elsewhere((Pinson 2005;2006; Brake 2000) it is a form of metropolitan governance whose primary purpose it is to shape consenus to scientificically elaborated urban development goals by substantively linking urban strategy and its implementation through the social mobilization of different actor constellations, thereby flexibly adjusting the strategic environment to changing external and internal circumstances, and monitoring the actions of local actors and their interests where they are generally segregated.

Smart Cities are governed by research projects, and these are marked by an inherent tension. On one hand, the Smart City research project has the purpose of shaping consensus around an acceptable “smart” urban future instituting new pluralist political spaces, in which scientific targets are always practically reversible if they do not fit consensus. On the other, the Smart city research project aims to scientifically evaluate what “right” choices have to be made to lead the city towards effective Smart City development in line with supranational targets and climate wisdoms. How can the Smart City research project shape consensus among a multiplicity of institutions, actors and groups while not compromising the scientific validity of the set targets and strategies? Drawing on the experiences of the project TRANSFORM in monitoring and shaping the low-carbon transfromation strategies of six European cities, the aim of this paper is to elucidate some of the logics of strategic urban policy processes in their peculiar pathways towards the Smart City. Drawing on the experiences from the TRANSFORM cities in general and particularly from Vienna in formulating and experimenting their Smart City strategy, we would like to show how some of the tensions inherent in the role of Smart city research projects are practically addressed in the framework of the project TRANSFORM.

In the first part we will provide a general theoretical background to the sociological analysis of the urban project, with particular focus on the challenges on the governance of local climate affairs. In the second part, we shall illustrate this by looking at the TRANSFORM project, first form a European perspective, then from the viewpoint of Vienna.

2 DEFINING THE SMART CITY THROUGH ITS PROJECTS

2.1 The logics of the Urban Project

Since the early 1980s, the Project has consequently substituted the strategic plan as the principal tool for urban policy making. Bounded rationality and uncertainty about the future are endemic conditions of the project-based polis. The Project is thus first and foremost to be considered as an instrument of social mobilization. The determination of objectives and policy goals, rather than from the scientific knowledge of a few experts, engineers and scientists, results by definition from a deliberative, open-ended process of tit-for-tat interactions between a multiplicity of local groups and institutions, private and public perspectives and resources. With the ascendance of the Project, the goal of urban planning has hence markedly shifted from product to process- a concern for the question of what objectives are scientifically accurate and probable is more and more displaced with a concern for what objectives can be consensually agreed upon by a constantly changing actor-network(Healey 1992; 1997). The Project has become a sort of consensus – making machine in which process has as important a role to play as concrete material results or regulatory effects, and in which the "right" choices, rather than emanating from a technocratic definition of truth, are those that permit to ally the greatest amount actors and resources possible around a locally acceptable vision of the urban future (Pinson 2005 p. 199-233). The rise of the Project thereby illustrates a so-called "non-standardization" of planning practices. The focus lies on a spatially and thematically selective development strategy in which the primary interest consists in the integration of various different actor-projects in an overarching spatial and thematic context, and the creation of a reference framework for the multiplicity of decisions that influence urban and regional development (Altrock et al 2004). In this context, the Project as a form of metropolitan governance is essentially marked by a temporal coexistence of strategic orientation and implementation (Brake 2000, 285), and characterized by the fact that it leaves actors many liberties for self-responsible actions and initiative (Frey et al 2003). In this context the Project on the local as well as on the European level, can be defined as a form of metropolitan governance whose purpose it is to shape consenus to scientificically elaborated urban development goals by substantively linking urban strategy and its implementation through the social mobilization of different actor constellations, thereby flexibly adjusting the strategic environment to changing external and internal circumstances, and monitoring the actions of local actors and their interests where they are generally segregated. The Project is the name of a mode of governance in pluralistic urban societies of which the projects in the plural, whether the construction of a new urban quarter, the design of a database tool for the evaluation of urban CO_2 emissions, or the set up of a participation process for sustainability management on the district level, are the local manifestations of.

2.2 Project and projects: some contradictions of metropolitan governance

While projects in the plural have at once become the adapted institutional solutions and instruments to solve the strategic and political problems of today´s fragmented metropolitan areas, the Project in the singular embodies thus on the other their very mode of local governance. If metropolitan areas are shaped by strong interdependencies combined with the fragmented geography and roles of agencies that govern them, the reduction of complexity through the stabilization actor-networks has become the sole end and virtue of metropolitan institutions (Rawls 1999). As Storper argues, metropolitan fragmentation "is not an accident. It responds to the underlying differences in the preferences of constituencies, the scale of provision of public goods and regulation, and the bundling of attributes of the city into jurisdictions". From an economic viewpoint, there exists no "pareto-optimal" solution to the large scale principal-agent problem that metropolitan governance is the name of. Some form of bricolage and tinkering is thus a necessary and common feature of all urban governance processes. But bricolage also creates an omnipresent risk – namely:

"that neither public officials nor citizens generally know who does what, why they do what they do, and how much it costs, as well as what isn't getting done" (Storper 2013). Pluralisation is thus "not synonymous with the non-governability or absence of a capacity to act within urban areas" (Pinson 2006, p. 619). Rather, pluralisation gives rise to new modes of governance of which the Project is the primary example of. Yet, this pluralisation of planning processes is not generally synonymous with a greater democratization of planning processes, but may very well consolidate pre-existing power asymmetries in urban governance networks.While the Project´s aim is to reduce metropolitan fragmentation,it can never do this totally, so that certain actors and interests essentially escape the found consensus.. If we can attribute this impossibility to totalize to the "natural" sorting effect of fragmented metropolitan areas as described by Storper, they are in much the same manner the result of deliberate political choices that illustrate concurring and conflicting strategies, alliances and sectoral visions(Brand&Gaffikin 2007).The realm of metropolitan governance is thus marked by a fundamental contradiction between the desire for the taming of contingency through an all encompassing a framework strategy defining how to set targets and how to achieve them, and the very creation of contingency through the coexistence of a multiplicity of frameworks – metropolitan governance is defined by a constant tension between the Project and the projects that makes it "neither completely ungovernable nor necessarily more democratic" (Pinson 2006, p. 620)

2.3 Smart City: a vehicular policy ideal defined through local projects

This tension described above is particularly difficult to solve in areas where costs and benefits are not immediately clear and reasonably widespread among actors- the coordination of local climate change policy and Smart city development in the European context being an excellent example thereof. Local climate change policy is not a sector like any other; it is a domain of public action characterised by weak institutionalisation determined by a rather uncertain definition of problems, little horizontal integration of actors, and a generally contestable character of the right scales for intervention and measures, that more often than not have to be invented from scratch. Smart City policy is marked by the absence of clear rules, of strong routines present through time. Unsurprisingly, Smart City policy may be nowadays conceived as something like the prototype of project-based governance (Béal 2010, p. 540-543).With the 20/20/20 goals, the European Union has provided local actors with a strong common normative framework for the alignment of Smart City and climate change policies and strategies. Energy targets set by the European Union for 2050 overcome the 20-20-20 goals, aiming at an 80% reduction in greenhouse gas emissions and a near-zero carbon energy system. These targets are as ambitious as they are necessary and will require fundamental transformation of our society. Urban areas, currently responsible for three-quarters of the global energy demand, are the logical starting point for intervention to transform urban areas into resource efficient, low carbon places. Places that use their energy in an optimal way.

However, recent work suggests that local elected officials and local government administrators define and pursue these policies in very different ways (Feiock&Coutts 2013). Similar Smart City projects can operate in very different formal government and legal arrangements. Conversely, very different kinds of applications of Smart City projects can coexist under one similar discursive and formal consensus. Policy ideals, such as the Smart City function if they can engage a range of policy actors and institutions across institutional and spatial contexts. They must "exhibit a certain quality of practical portability and adaptability in their associated formulations and frames, while enabling at least the impression of local political 'ownership' (Peck 2012, p. 464)." In terms of Peck, the Smart City is a "vehicular" idea:

"Vehicular policy ideas (…) are constructed for travel. They may themselves have a transitory existence, as straws in the policymaking wind, but they can also function as facilitative frames, working around blockages, disarming opponents, enabling new projects to move forward. As such, they are formulated with purposive ambiguity/mutability (rather than as a fixed template), so as to move swiftly and smoothly between policymaking sites, and to lubricate new (or rebadged) initiatives in distant locales (…) (Peck 2012, p. 464).

If the Smart City is a vehicular idea that is continually defined and reframed in terms of local projects adapted to local politics, the governance of the Smart City assumes the form of a meta-project itself, closely following its interactionist and procedural logics. As such, the Smart City may best be defined as a municipal change management process, allowing for certain particular interest coalitions and clusters to be formed and new governance practices to be developed, rather than others.

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2.4 The Smart City as a municipal change management process

For municipal governments the decentralization of control functions that the project is the indicator of is not followed by a necessary weakening of their power. Municipal governments have become less central in urban policy making processes because they do not possess the adequate resources on their own to entirely control the policy process and the projects they are involved in. But they have become more nodal because they control the resources that allow them to join what is generally disjointed, to construct actor-networks and provide coherence to their work through an all encompassing framework- notably through a shared Project that we will name Smart City, but that also fits to other urban ideals such as the Creative City. As Pinson argues, "if there is control it is less in the definition of the substance and content of the projects than on the level of providing a general framework in which all operating actors are included"(Pinson 2006 pp 634). While the governance of Smart Cities by projects has thereby the potential of reducing fragmentation in metropolitan areas while preserving a degree of democratic accountability and organizational flexibility, it may just as well be at the source of the dysfunctionalities that it tries to prevent.. The Project as a meta-logic can potentially fulfil a practical role in Smart City governance if it can contribute to the finding of common ground by successfully monitoring the plurality of interest-driven projects within a commonly acceptable framework strategy. More so, it consists de facto in the set-up of practical expiration dates for governance agencies, contracts and organizations that are part of the bricolage, keeping agencies from perpetually reproducing themselves. At the same time, municipalities are for their financing of the Smart City development, themselves dependent on the acquisition of a multiplicity of project funding sources, only aggravated in the context of the crisis. Different projects may exhibit contrasting if not sometimes rivalling and closed actor-networks, hindering the finding of a consensus that is infinitely postponed within the framework of the meta-project of an all encompassing framework strategy itself. As such, the plurality of Smart city projects may be at the source of greater confusion while running the risk of transforming governance into an opportunistic power trade-offs and hostage-taking, and thereby introducing new dysfunctions into the metropolitan governance system (Storper 2013). The incremental and procedural character of the Smart city project should ideally foster greater identification of the actor-network with the objectives set out in the local strategy- the action of stabilising the urban actor-network being as or even more important than the concrete, objective content of local and international targets in CO_2 reduction, energy efficiency or energy production stemming from renewable sources.The incremental nature in the setting of strategic policy goals presumes therefore always their partial reversibility in case the defined goals do not stick anymore to what allows for consensus to take place (Pinson 2006, p. 635). While political alliances and interest coalitions are infinitely reversible in the way the Smart City is governed, the exigencies of climate protection and justice in Europe are not so. As such, the project-based governance of the Smart City proves to become particularly difficult when frameworks, in an attempt to align multiple strategies with supranational and European climate goals, aim to set precise quantitative targets for the pathway of local urban energy efficiency, renewables or energy consumption.

Thoroughly comparing these dynamics in becoming the Smart City described above in different European cities would greatly overcome the extent of this paper. In the following section our aim will be to give a brief account of the experiences that 6 European cities had in formulating and organizing their Smart City strategy through and within the project TRANSFORM so far. At this point it needs to be emphasized that we are not even half through the project; that means that results can at best be considered as preliminary. After presenting the European project, we would like to show how some of the tensions related to climate change policy in metropolitan areas are addressed in Vienna, within the local mirror project TRANSFORM+, demonstrating how project-driven governance practically shapes Smart City development in the Austrian capital city.

3 TRANSFORM AND TRANSFORM+

Everywhere around Europe, the work of actor stabilization described above in the setting of strategic energy targets is embedded in a context of segregation, conflict and struggle between different interests in the urban policy apparatus. Yet, it seems fair to believe that particular local planning cultures are more adapted towards the interactionist processes of horizontal and vertical integration that Smart city projects necessitate. As Storper puts it, "(T)hough all cities share common problems of the urban land nexus, and the common situation of fragmentation and principal-agent de-alignment, they are not identical in the public goods they provide and the mixture of governance instruments they deploy"(Sorper 2013, p. 13). The target population and instruments of Smart City projects may for instance be quite different. They can be directed to individuals and individual behavior or to organizations and firms, and they may be geared more to transforming the supply (energy production technologies of utilities and municipal governments).or the consumption (taxes and other incentives, or they can mandate behavior with regulation) of the urban environment. They may be directed inward towards the transformation of government institutions and buildings or outward to the actions of non-governmental actors (Evans et al 2013). How can these policies be harmonized and coordinated in order to achieve the 20-20-20 targets?

3.1 TRANSFORM- convergence and divergence patterns in making the low carbon city

3.1.1 A Project enabling the definition of the Smart City in terms of local projects

The FP7 funded project TRANSFORM aims at supporting different European municipalities in the development of their Smart City Agenda to meet the 2020 and 2050 targets set by the European Union. In this context, six European cities (Vienna and Amsterdam, Copenhagen, Hamburg, Genoa, Lyon) are working on city-wide as well as city-quarter level ("Smart Urban Labs") strategies and implementation plans for the local development of the Smart City strategy, as well as on common frameworks and templates to compare and harmonize the respective strategic orientations. In this process, TRANSFORM relies on a vast actor network of both municipalities, major scientific, knowledge based institutions and industrial partners, and is backed, in most of the participating cities, by mayoral or high level political support. However, the extent of this commitment, the way that partners are involved and the role that TRANSFORM should play in assisting the different cities- the appropriate degree of paternalism- is generally contested within the project. While TRANSFORM sets the template for comparison, harmonization, and mutual learning, what should be compared and harmonized, how it can be, and what we can be learned from that is itself a contested outcome of the project. Within TRANSFORM, the Smart City presents itself thus essentially as part of a set of vehicular policy ideals, whose main role is to function as "facilitative frames, working around blockages, disarming opponents, enabling new projects to move forward (…) formulated with purposive ambiguity/mutability (rather than as a fixed template), so as to move swiftly and smoothly between policymaking sites, and to lubricate new (or rebadged)(PECK 2012: p. 464). As such, TRANSFORM enables the definition of the Smart City in terms of contrasting local projects and path dependencies, giving many liberties to the different cities in doing so, while at the same time trying to scientifically guide them towards the achievement of 20-20-20.

3.1.2 Transformation Agenda and Implementation plan: on the coexistence of strategic orientation and implementation in Smart City development

TRANSFORM is best understood as a set of procedures marked by the temporal coexistence of strategic orientation and implementation (Brake 2000, 285), characterized by the fact it leaves actors many liberties for self-responsible actions and initiative on the local level. It practically illustrates the tension in contemporary strategic planning processes between the desire to harmonize and tame local contingent developments, while harnessing the creative potential from divergent local pathways.

In TRANSFORM; each city develops a Transformation Agenda, containing energy efficiency measures and actions that need to be taken by stakeholders, in order to make a city smart. The process concerns city regulators and decision makers, private companies, and other relevant stakeholders. The Transformation Agenda addresses the main components influencing the chain of energy production and consumption at city level: main infrastructure and sources of energy (thermal energy, electricity, gas) and efficiency potentials. It also addresses the possible energy efficiency in flows of water, waste, IT and mobility. It includes urban planning & regulation and the participation of end users. It is based on qualitative and quantitative insights and contains a strategic financial strategy. The Transformation Agenda is brought to the operational level in the form of an Implementation Plan, which is being drawn up for specific city districts. These districts are selected for this project under the name of "Smart Urban Labs". Morphology, urban density, functional mix, demographic aspects, (energy-) infrastructures vary from district to district. This requires more specific Implementation Plans to take them into account to find an optimal mix in terms of production of energy, storage, reduction and exchange, supported by feasible business plans. Each Implementation Plan is a product made in a joint effort by all relevant local stakeholders and includes for example renovation of the building stock, heating and cooling possibilities, use of intelligence on both electric and thermal networks, the potentials of existing water systems, innovative (electrical) transportation possibilities and urban green. The Implementation Plans relate district scale with the city and metropolitan scale to scan for possibilities, relate local developments with strategic choices made on the (energy) infrastructures.

3.1.3 Contrasting strategic environments for the development of the Smart City through TRANSFORM

In practice, Smart City development greatly varies between the different TRANSFORM cities. Existing Transformation Agendas and Smart Urban Labs insert themselves in very contrasting strategic environments, both as to what concerns culture, economic and energetic challenges and local political traditions. While districts where the Smart Urban Labs are located are transformation areas undergoing redevelopment at the moment, the stages of relative development are varying. Where with some SULs we are at the stage of brainstorming about urban futures like Genova or Liesing, others are already implemented or pretty advanced in implementation (for instance Hamburg, Copenhagen or Amsterdam). Hamburg, for instance has been a frontrunner in the sense that the city through its successful engagement in the IBA process has practically achieved what other cities are still looking a political mandate for. Political commitment to this status as an environmental frontrunner has been manifest well before TRANSFORM, so that the project often at best retroactively justifies what has already been put in place. In Genova, by contrast, at the moment of writing, political commitment for the SUL Mela Verde has still to be secured. It can also be shown that contrasting environments can coexist within a similar cultural and political framework- the divergent development patterns of the Greenfield development aspern Seestadt and the brownfield development Liesing Groß Erlaa being an excellent example thereof. If actor networks evidently overlap for both SULs in Vienna, there exist important differences, especially as to what concerns the divergent challenges of Brownfield and Greenfield sites in terms of integrated planning, but also in terms of the political commitment. These differences are illustrated in a graphic in the Annex, showing that issue definitions and their political salience vary strongly between local contexts in the different TRANSFORM cities.

3.1.4 Taming metropolitan fragmentation on the European level through TRANSFORM? A first tentative answer

What all local contexts share through, whether they are located on the city or SUL level, is a high degree of pluralization and fragementation. In monitoring conflicting interests, Transformation Agenda and Implementation plan are two features of TRANSFORM for the potential shaping of greater consensus about local urban futures, while enabling a real comparison of the way the Smart City is developed in different settings. As such the involved municipalities can ideally use TRANSFORM as a way to integrate where local actors and projects are generally segregated; to harmonize policy goals in the context of widespread strategic and territorial competition on the European level and contrasting planning cultures and path-dependencies; and finally to ensure implementation beyond the timeframe of a particular project.

In practice, while TRANSFORM can work as an external reference point for the stabilization of local actor-networks, finding consensus within the project on a standardized framework procedure that would provide such reference has proven very difficult so far. An example is the difficulty in finding a template for the way that the local Transformation Agendas should be structured- should they make reference to quantitative targets and if yes, on what basis are they calculated? What thematic areas should they cover? How should progress be monitored? There is much to debate about, so that the main role of the project, rather than providing scientific content for Smart City development has become the shaping of consensus between varieties of actors and interests.

3.2 From Transform to Transform+:

3.2.1 The emergence of Smart City Vienna

In many ways the antinomies between the general framework of TRANSFORM and the different local Transformation Agendas, is reproduced on the local level between city-specific Transformation Agenda and the multiplicity of local projects and actors that it aims to frame. In looking at the special case of Vienna, we will argue that the aforementioned tensions are exalted by the very organizational conditions in which the Smart City policies emerge. Starting as a mayoral project, the Smart City institutions are by definition at the interstice between the sectoral departments of the municipal planning apparatus. Not being allocated a budget from a specific resort and due to a general resource scarcity aggravated in the context of the crisis, municipalities are for their financing of the Smart City development, themselves dependent on the acquisition of a multiplicity of project funding sources. This introduces a further complication into the process of finding “common ground”, adding to an already present contingency that climate change targets are subjected to in the context of project-based governance.

The governance of local climate change in Vienna is as fragmented as anywhere else in the European metropolis. The coexistence of different sectoral strategies, various scales, contrasting target groups is a recognizable feature of Vienna´s metropolitan governance processes in this particular subject area. Concurring strategies exist both at the level of Energy Planning, Mobility, Buildings and Infrastructure, as can be illustrated in Chart 2 below showing sectoral strategies and their origin within the municipal apparatus.[1] For the purpose of developing and coordinating the Smart City in Vienna an ad-hoc entity has been set up within its municipal governance, in the Department MA18 for Urban development and planning, named “Smart City Wien”. The tasks of this organisation are threefold: (1) providing a comprehensive framework for Smart City Development for the multiplicity of sectoral approaches in Energy, Mobility, Buildings or Infrastructure, (2) providing strategic and expert impetus to Smart City development through the involvement with several research projects on the European level and (3) communicating the Smart city as brand both internally and externally so as to assure greater awareness of the Vienna´s position as a Smart City. Furthermore, Smart City Vienna is at the origin of the Smart City Vienna Framework strategy, providing a common framework for all the different sectoral strategies with attempt to harmonize them towards a common pathway.

3.2.2 Transform+: an instrument of social mobilization

The local mirror project Transform+ directly supports Vienna’s roadmap to a Smart City. The project´s aim is to enable the work done in the European FP7 project TRANSFORM. As such, Transform+ is first and foremost to be considered as an instrument of social mobilization affiliated to the Smart City Wien. Its principal mission is to shape consensus for an acceptable local vision of the Smart City, by coordinating a communication process between a multiplicity of local groups and institutions, private and public perspectives and resources. Transform+ brings on the table several municipal departments of different level and status, Vienna´s energy service and utility companies, industry partners and specialized research organizations.

The process of actor network stabilization is coordinated on several levels. On the city level, the project provides a practical input into the Smart City Vienna Framework Strategy (local version of the Transformation Agenda in Vienna), and helps to advance the development of Transformation Agenda for the EU project. On the level of the city district, the project defines Smart Urban Labs (SUL) in aspern_Seestadt and Liesing Groß-Erlaa, with the aim of making them models for the way Smart City planning can practically be implemented in the future. Within these SULs, it coordinates two pilot projects, one tackling the question of e-mobility for delivery uses, the other focussing on creating a digital interface between consumer and energy data. In the process of making the SULs in aspern_Seestadt and Liesing Groß-Erlaa, bringing together different municipal departments and external actors is of practical necessity in order to successfully integrate the energy and the planning side in the implementation of a sustainable city district. For the determination of future housing needs and supplies in Liesing for instance, coordination has been set up both with the municipal management for the district, the municipal energy department, its energy service provider, construction companies as well as the local population. Transform+ has thus helped to bring together sectorally and hierarchically distinct actors, opening up a space for the discussion of what the Smart Ciyt should be.

[1] This chart does not incorporate the strategies that are produced by the different organizations of the Energy Service provider Wiener Stadtwerke. These strategies are equally if not more important than those produce within the municipality, but as such theses are no less fragmented.

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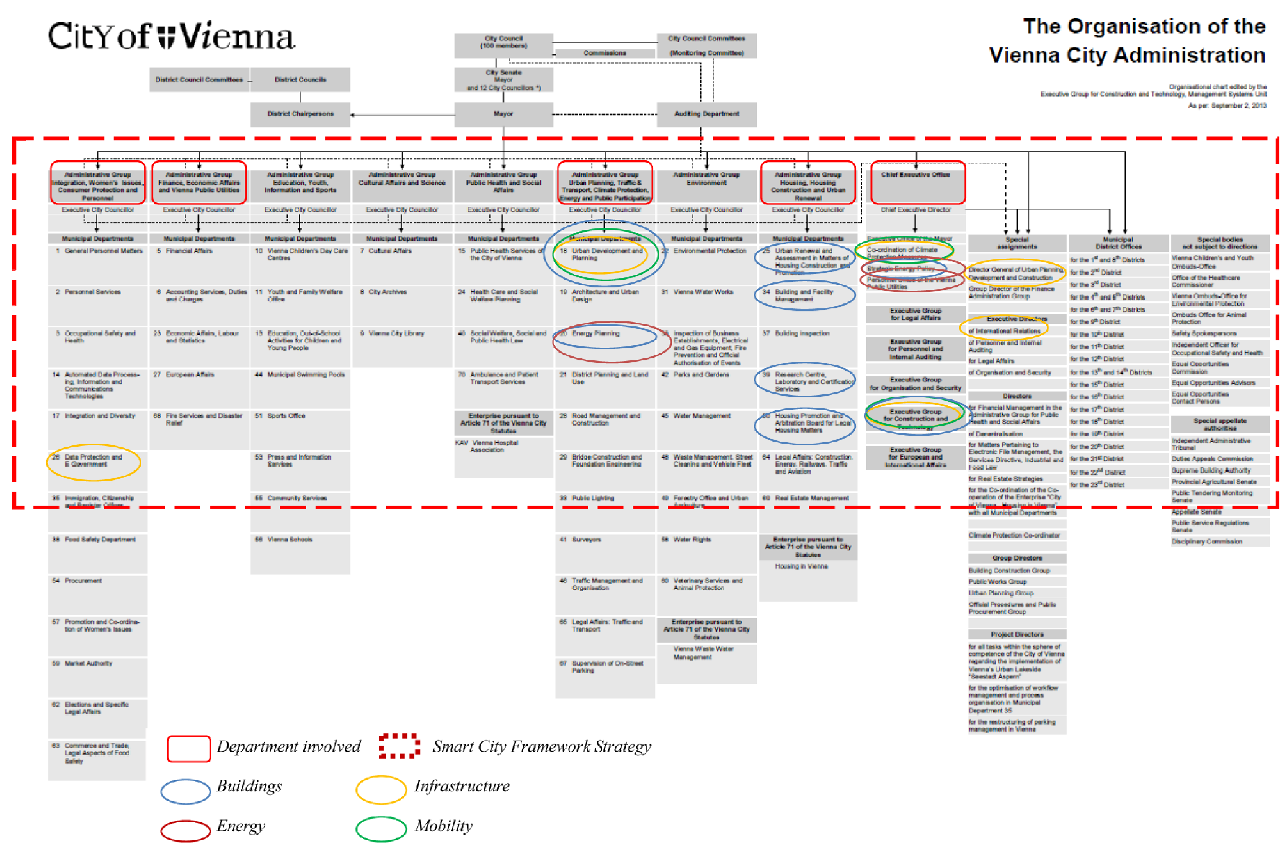

Chart 2: Sectoral Strategies and their place origin within the municipal body (source ÖIR).

3.2.3 Urban public sector change management in Vienna through research projects: a tentative assessment of the governance of Smart City policies

In the process of institutionalizing the Smart City Wien new practices of approaching the question of strategic policy making have been experimented in Vienna, bringing together actors that have not collaborated in the same way before. TRANSFORM and Transform+ have supported the city of Vienna in this process. A practical example of this is a workshop on the strategic priorities and issue definition in energy planning which was held in Vienna under the presence of various different stakeholders from the city´s planning regime. As a neutral forum, behind the veil of the research focus, the project has already successfully steered the horizontal integration and vision building different sectoral streams within the municipal body from the bottom-up, while continually up-and down streaming the results on different levels of the policy-making a11pparatus both locally and internationally.

While this practically illustrates how a research project can steer organizational change management processes within the municipal governing body, Transform+ and TRANSFORM are only but two of several projects in a network of different European and local research projects through which the Smart City mission is regulated and financed. These projects represent varying and overlapping actor networks on the local and international level. The roles of Smart City Wien and Transform+ are in this context of a two-fold character: while Smart City Wien and Transform+ proceed as a consensus making machine, as a Project, fostering greater identification of the actor-network with the objectives set out on the local level, they are also at the source of a multiplication of various different projects whose boundaries strategically overlap, but whose interest coalitions and aims are potentially conflicting.

If Transform+ aims at providing coherence between a plurality of conflicting strategies, it is practically operating in a challenging environment dominated by competing strategic frameworks at different levels of the municipal apparatus. This becomes particular evident when it comes to the question of setting strategic quantitative targets as a frame for the various sectoral strategies internal and external to municipal energy governance. Practically speaking, the complexity of setting a C02 or a retroffiting target presents itself both as an organizational issue- of knowing what is done by others and reviewing what is done by them- and a question of power constellations- of making different parties comply with a hypothetical contract about the future goals in urban development, be they in the area of energy, buildings or infrastructure. The process of reviewing while essential for establishing coherence both at the local and European level, has a paradoxical incentive built into it: as Storper puts it “if agencies know they are being reviewed, they tend to increase the resources devoted to self-perpetuation. And if we ask them to participate in their own benchmarking, there is a serious opportunity cost with respect to their basic mission, the resources and attention devoted to obsessional benchmarking can arguably crowd out the core mission”(Storper 2013, p. 21). While we are, at the time of writing, only half way through TRANSFORM and Transform+, we can see these institutional dynamics at play in the metropolitan governance of Smart Cities in Vienna and all around Europe.

4 CONCLUSION

What does the research project TRANSFORM tell us about governance processes of Smart Cities in Europe? In this paper we showed how the process of Smart city governance through different projects, be they on the local or European level, is effectively institutionalizing “new pluralist political spaces associating different actors, groups, elites and institutions linked through relationships of mutual interdependence” (Pinson 2006 pp 649), thereby activating new types and potentials for collective action in local climate change policy. In an era of non-standardization in strategic planning practice, the best a research project can do is instituting a temporary monitoring system of local interest coalitions, thereby reducing complexity in the fragmented whole that the Smart City is the name of. Yet, as we have also seen the process of what a research project should monitor and how they should approach the question of monitoring is contested between different interest groups and local projects. The Smart City is thus very far away from the institutionalization of a public urban space, a common democratic forum accessible to all urban residents in the same way. So far the EU project TRANSFORM has not been able to provide the input necessary for establishing a common reference framework for all actors that need to be involved and informed in the process of effective climate change policy, citizens included. For on the European level, finding “common ground” is as difficult as on the local level- the hypothesis of Pinson that today´s metropolitan governance is essentially the work of elite interest coalitions mutually legitimating themselves through a shared Project cannot be readily thrown overboard- even if new coalitions and relations have been created giving a life to the Smart City, this does not make this urban vision necessarily more democratic, and more accessible to the Smart Citizen.

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6 ANNEX

Topic/issue	Amsterdam, Energiek Zuidoost	Copenhagen, Nordhaven	Genova, Mela Verde	Hamburg, IBA / Wilhelmsburg	Lyon, Part Dieu	Vienna, aspern Seestadt	Vienna, Liesing Groß Erlaa
Low energy demand, energy efficiency	targets and strategies	binding targets and measures	ideas	binding targets and measures	targets and strategies	targets and strategies	some measures / projects
Energy systems	objectives defined	targets and strategies	ideas	binding targets and measures	objectives defined	some measures / projects	ideas
Renewable Energy	pilot actions	targets and strategies	ideas	binding targets and measures	binding targets and measures	pilot actions	ideas
Mobility	some measures / projects	binding targets and measures	-	targets and strategies	some measures / projects	binding targets and measures	some measures / projects
Water	ideas	guidelines	ideas	-	ideas	ideas	-
Waste	ideas	guidelines	-	-	some measures / projects	-	-

Qualitative legend on the priority of respective topics

no priority (or not yet decided during the planning process)							**very high priority**
no activity	ideas	some measures / projects	guidelines	pilot actions	objectives defined	targets and strategies	binding targets and measures
no objectives, no measures foreseen	some ideas are being discussed	some measures / projects are foreseen	general guidelines/ qualitative objectives, some measures	pilot projects, priority actions	guidelines/ qualitative objectives and measures	quantitative or qualitative targets and strategies	binding quantitative targets plus aligned measures (with defined effects)

Source: OIR

Unort Gewerbegebiet? Qualitätsvolle Freiräume als Grundlage für Arbeitsorte

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1 ABSTRACT

Freiraume - Straßen, Wege, Plätze – kurz alles das, was zwischen den Gebäuden ist - sind die Grundlage für städtisches Leben (vgl. Gehl, J., 2010) – in erster Linie denkt man dabei an fußläufige Stadtquartiere, Nutzungsvielfalt, öffentliche Räume als attraktive lebendige Orte der Begegnung. In Wien tauchen Bilder der Freiräume des ersten Bezirks auf, oder die Lebendigkeit in Freiräumen der Gründerzeitvierteln.

Allerdings: Der moderne funktionalisierte Städtebau mit der Trennung von Wohnen und Arbeiten prägt auch Wien (Charta von Athen, 1933). Neben Wohnsiedlungen sind Gewerbegebiete Ausdruck des monofunktionalen Städtebaus mit ihren typischen Charakteristika wie der Erzeugung von (meist motorisiertem) Verkehr zwischen den einzelnen Stadtteilen zur Bewältigung des Alltags (Arbeiten, Einkaufen, Behördenwege, Kinderbetreuung, soziale Kontakte) und wenig einladenden Freiräumen.

Der vorliegende Beitrag beschäftigt sich mit der Frage, wie, am Beispiel des Gewerbegebietes Liesing, in monofunktionalen Stadtteilen eine „smarte“ Stadtentwicklung aus der Perspektive der integrativen Freiraumplanung aussehen kann.

Diesem Beitrag liegt die freiraumplanerische These zu Grunde, dass die Freiräume die Grundlage der Stadt sind, auch der Gewerbegebiete. Freiräume im Gewerbegebiet sind gekennzeichnet vom Wirtschaften – auf den Betriebsparzellen wie in den öffentlichen Freiräumen.

Es finden sich Freiräume für Produktion und Lagerung, für Kundinnen und Kunden für Mitarbeiterinnen und Mitarbeiter – Freiräume werden genutzt beim Hin- und Rückweg zur Arbeit, während des Arbeitstages für Pausen, Besprechungen im Freien. (vgl. Ruland, G., 2012)

Mit der Funktionalisierung des Stadtteils geht eine vermeintliche Funktionalisierung der Nutzerinnen und Nutzer und ihrer Alltage einher. Aber der Blick auf den Alltag im Gewerbegebiet zeigt, dass und wie vielfältig Lebens- und Wirtschaftsalltage stattfinden: Das Wirtschaften der Betriebe unterliegt zeitlichen und räumlichen Rhythmen und wird entlang sozialer, ökologischer und ökonomischer Kreisläufe entwickelt. Die Mitarbeiterinnen und Mitarbeiter kombinieren an ihrem Arbeitsort die Erwerbsarbeit mit Einkäufen, mit Freizeitaktivitäten oder sozialen Aktivitäten. Nicht zuletzt ist das Gewerbegebiet ein (Querungs-)Raum auf den alltäglichen Wegen der Bewohnerinnen und Bewohner sowie Nutzerinnen und Nutzer des gesamten südlichen Wiener Stadtteils.

Es wäre verschwendetes Potential, ein Gewerbegebiet nur als auf die Nutzung „Gewerbe“ beschränkt wahrzunehmen. In der bereits gelebten Nutzungsvielfalt steckt Potential, dass es, im Sinne einer Smart City-Entwicklung ausgehend von den Gegebenheiten des jeweiligen Ortes, zu entwickeln gilt.

Der Beitrag diskutiert Projektideen wie auf Ebene der öffentlichen Freiräume und auf Ebene der betrieblichen Freiräume durch integrative Freiraumplanung die Standortqualität gesichert und verbessert, aber auch den Herausforderungen des Klimawandels begegnet werden kann (vgl. Saarbrücken, 2012).

2 AUSGANGSLAGE

2.1 Gewerbegebiet Liesing

Das Gewerbegebiet Liesing hat eine Größe von ca. 240 ha und liegt im 23. Wiener Gemeindebezirk umgeben von Wohnnutzung. Die Achsen des Verkehrs sind die Perfektastraße und die Brunnerstraße, die Erschließung durch den öffentlichen Verkehr erfolgt über die U6 (Perfektastraße und Siebenhirten) und den S-Bahnhof Liesing. Aktuell sind ca. 7000 Arbeitnehmerinnen und Arbeitnehmer in 563 Betrieben (Stand 2011) beschäftigt. Die Betriebsstruktur weist einen sehr hohen Anteil an Klein- und Kleinstunternehmen, oftmals auch Familienbetriebe, auf, neben den Branchen Handel, Transport und Produktion sind auch Dienstleistungsunternehmen wie Labors und Consultingbüros vertreten. An der West-Ost-verlaufenden

Perfektastraße befinden sich zwei Supermärkte mit PKW-Parkplätzen. Es findet sich auch Wohnnutzung im Gebiet. Es handelt sich dabei vorwiegend um Einfamilienhausparzellen, entstanden ab ca. 1950, mit 2011 739 gemeldeten Bewohnerinnen und Bewohnern (vgl. Emrich Consult, 2011).

Es handelt sich um ein Gewerbegebiet mit den Widmungen Industriegebiet und gemischtes Baugebiet-Betriebsbaugebiet, das seitens der Stadt und der involvierten Stakeholder Wirtschaftskammer und Wirtschaftsagentur als Gewerbegebiet erhalten und mit den ansässigen Unternehmen ressourcenschonend entwickelt wird. Das Projekt „Ressourcenschonendes Betriebsgebiet Liesing" ist ein von der EU gefördertes Projekt, dessen Durchführung eine Steuerungsgruppe aus Stadt Wien, Wirtschaftsagentur und Wirtschaftskammer begleitet. Es wurde ein Quartiersmanagement eingerichtet, welches für Information und Vernetzung sowie für Kommunikation und Diskussion der Ergebnisse mit den ansässigen Unternehmen zuständig ist.[1] (vgl. Faast, A., Maierbrugger, G., 2012)

Die Stadt bekennt sich dazu – trotz steigendem Druck – die wachsende Stadt erzeugt hohen Bedarf an Wohnraum – dieses Gewerbegebiet zu erhalten, Einzelhandel und Wohnnutzungen nicht weiter zuzulassen. Eine Stadt der Zukunft braucht das Wirtschaften, darunter auch die sog. „nicht-mischfähigen" Betriebe, die aufgrund der Betriebsanlagengenehmigung auf einen Standort mit Widmung Industriegebiet angewiesen sind und die in einem gemischten Wohn- und Gewerbegebiet keine langfristige Standortperspektive haben.

2.2 Methoden

Der vorliegende Artikel basiert auf der Expertise Freiraum, welche im Zuge des Projektes "Ressourcenschonendes Betriebsgebiet" beauftragt und von der ARGE Jauschneg-Kutzenberger durchgeführt wurde. Dabei wurden folgende Methoden verwendet: Es erfolgte eine Begehung des Gebietes und eine Kartierung der Freiräume mit einem vom Ort aus entwickelten Kartierschlüssel. Es wurden eine Wegesystemkartierung und eine Freiraumnutzungskartierung erstellt, welche den Ist-Zustand abbilden und einen Überblick über die Situation im Gebiet geben. Zudem wurden zu mehreren Zeitpunkten und über das Jahr verteilt, Nutzungsbeobachtungen durchgeführt, welche in Form von Fotos und Nutzungsprotokollen dokumentiert wurden. Gespräche mit Vertreterinnen und Vertretern von Betrieben, mit Fachleuten und Bezirksvertreterinnen und Bezirksvertretern waren eine weitere Informationsgrundlage. Ergänzend dazu wurde im Rahmen einer Betriebs-Befragung auch nach der Bedeutung von Freiraum in der Umgebung des Arbeitsplatzes gefragt (Emrich Consult, 2001). Im Rahmen einer Lehrveranstaltung an der BOKU Wien beschäftigte sich ein Gruppe Studierender eingehender mit den Mitarbeiterinnen- und Mitarbeiter-Freiräumen, auch hier wurde mittels eines eigens erstellten Kartierschlüssels kartiert, einzelne Freiräume zeichnerisch aufgenommen und Gespräche mit den Mitarbeiterinnen und Mitarbeitern geführt.

3 ANALYSE UND MASSNAHMEN

3.1 Analyse

Dieses Kapitel zeigt die aktuelle Nutzungsvielfalt im Gewerbegebiet auf. Es wird dazu die Analyse ausgewählter Freiräume im Gewerbegebiet wie die Freiräume der Straßen und Wege, die betrieblichen Freiräume und die Freiräume der Feldgärten vorgestellt und in Hinblick auf die Nutzungsqualitäten diskutiert. In Kapitel 3.2. werden planerische Ansatzpunkte mit dem Oberziel der langfristigen Entwicklung als Gewerbegebietes und vor dem Hintergrund des Klimawandels und der Smart City-Entwicklung herausgearbeitet.

3.1.1 Freiräume der Straßen und Wege

Die einzigen öffentlichen Freiräume im Gewerbegebiet sind Straßen und Wege. Die Kartierung des Bestandes zeigt neun unterschiedliche Straßen-Typen, die Bandbreite reicht von vierstreifigen Haupterschließungsstraßen über zweistreifige Straßen mit Baumreihen bis hin zu unzonierten Stichstraßen und Radwegen sowie Trampelpfaden. Deutlich zu erkennen ist, dass zwei- und vierstreifige Straßen mit Straßenbäumen dominieren. Fuß- und Radwege sind nur marginal, an den Rändern des Untersuchungsgebietes, vorhanden. Im Zentrum des Gebiets dominiert ein 900 m langer Gewerbeblock die Struktur.

[1] Siehe www.standpunkt-liesing.at

Der hohe Ausstattungsgrad mit Baumreihen täuscht über die nicht so gute Aufenthalts- und Nutzungsqualität hinweg: Baumstreifen sind (vor allem in den Nebenstraßen) oftmals mit PKW oder LKW beparkt, in den, die Wohngebiete erschließenden, Straßen finden sich keine oder zu schmale Gehsteige, die zudem nicht ausreichend beleuchtet sind. Durch extrem lange Blöcke sind die Fußgängerinnen und Fußgänger zu langen Wegen gezwungen. Zudem ist durch grenzständige Hallenbebauung ohne Bezug zur Straße am Weg wenig bis nichts „los".

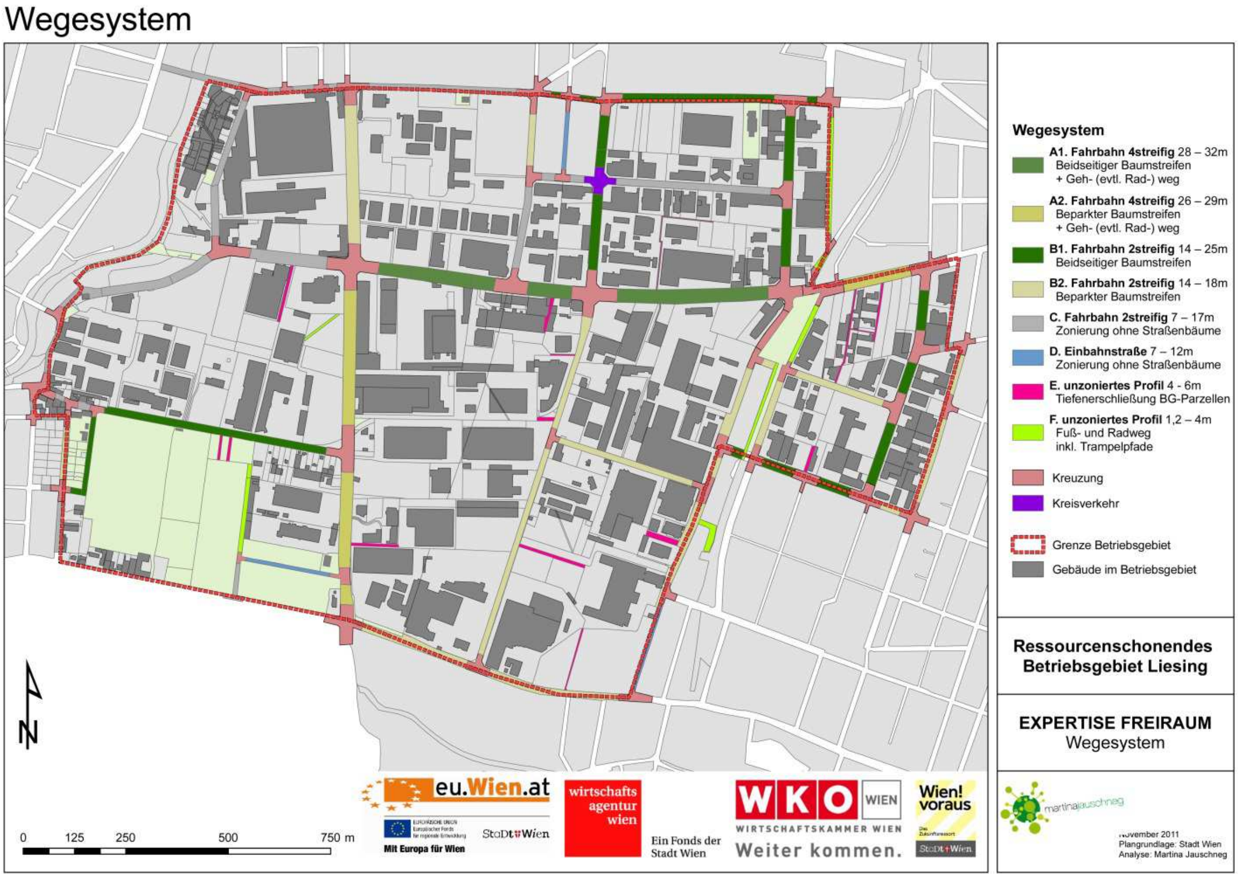

Abb.1: Kartierung der Straßen und Wege im Gewerbegebiet (© Jauschneg 2011)

Die Nutzungsbeobachtungen im Herbst 2011 und im Frühjahr 2012 zeigten, dass die Nutzung der Straßen und Wege starken zeitlichen Intervallen unterliegt, welche mit den Beginn- und Schlusszeiten der Betriebe korreliert. An Werktagen ist Mittags eine erhöhte Aktivität zum Jause kaufen bei den Supermärkten festzustellen, dabei lassen so manche Einkäufstaschen aufgrund ihres Volumes auf durchaus größere Einkäufe, etwa für zu Hause, schließen. Unter der Woche wird das Gewerbegebiet als wichtiger Verbindungsraum zwischen den hochrangigen Verkehrsmitteln U-Bahn und Schnellbahn genutzt. Dabei wurden Radfahrerinnen und Radfahrer aller Altersgruppen gesichtet. Auffallend ist eine starke Nutzung der Straßen und Wege des Gewerbegebietes an den Wochenenden durch Anrainerinnen und Anrainer. Es wird gejoggt, man ist auf dem Weg zum Café, man geht Spazieren, fährt mit dem Rad und Roller …

In den Gesprächen und Beobachtungen wurde auf eine informell genutzte Fußwegeverbindung im größten Gewerbeblock hingewiesen, die zeigt, dass sich Nutzerinnen und Nutzer, vor allem die Mitarbeiterinnen und Mitarbeiter der Betriebe – auch unter widrigen Umständen – ihre kurzen Wege selbst suchen. Dies ist ein Indiz für die Umwegesensibilität von Fußgeherinnen und Fußgehern und den Bedarf an durchlässigen fußläufigen Stadtstrukturen. Im Sinne der Selbstorganisation sind solche Initiativen zu begrüßen und zu sichern. Unterstützend wäre es wichtig, rechtliche oder Haftungsfragen zu klären.

3.1.2 Freiräume der Betriebe

Die Karte der Freiraumnutzung zeigt betriebsbezogene Freiräume, wohnungbezogene Freiräume und funktionsbezogene Freiräume. Der überwiegende Teil der betriebsbezogenen Freiräume sind befestigte, mit weniger als 50 % Grün ausgestattete, Flächen. Weiters dominieren Brachen und Lagerplätze.

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Die betrieblichen Freiräume sind nach der Wirtschaftslogik der Betriebe genutzt und ausgestattet. Beispielsweise findet sich dort eine gärtnerische Gestaltung, wo es zu Kundinnen- und Kundenkontakten kommt. Bei reinen Transport- und Logistikunternehmen wird nicht oder nur sehr wenig ins „Grün fürs Auge“ investiert. (vgl. Trolf, N., 2009)

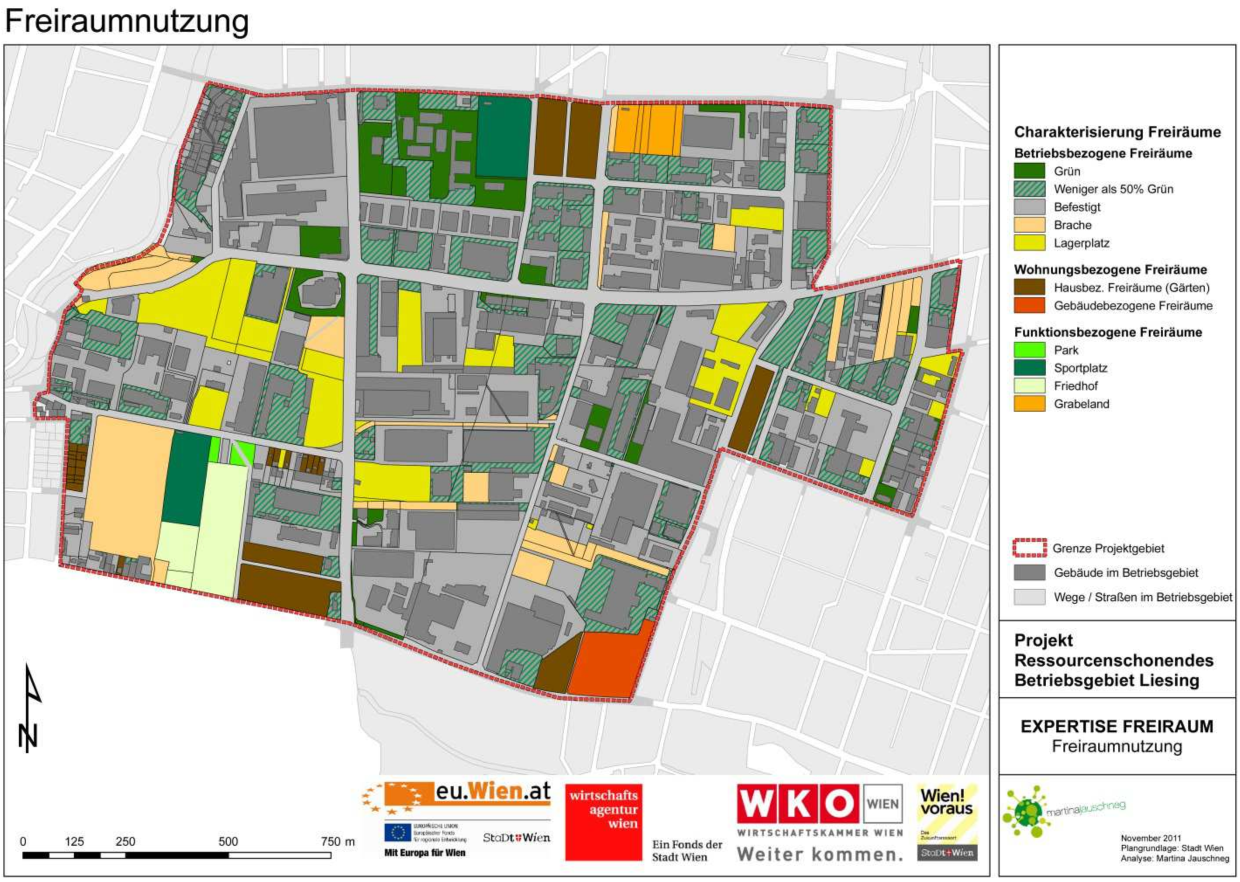

Abb.2: Freiraumnutzung im Gewerbegebiet (© Jauschneg 2011)

Im folgenden wird auf zwei Spezifika im Gewerbegebiet Liesing eingegangen: Die Mitarbeiterinnen- und Mitarbeiterfreiräume und die Feldgärten. Die Kartierung von Mitarbeiterinnen- und Mitarbeiterfreiräumen von Studierenden der BOKU Wien zeigen drei Kategorien von Mitarbeiterinnern- und Mitarbeiterfreiräumen: Mikro-, Makro- und Superfreiräume (siehe Abb. 3). Mikrofreiräume auf den Betriebsparzellen liegen im Nahebereich der Ein- und Ausgänge. Diese werden vorwiegend zum Rauchen genutzt und sind – bestenfalls – mit Aschenbecher und oder Mistbehälter ausgestattet. Diese finden sich bei fast allen Betrieben und sind als minimale Ergänzung zu den innen liegenden und vorgeschriebenen Sozialräumen zu sehen. Es gibt auch Makrofreiräume, das sind eigene kleine Pausenplätze im Freien. Betriebe wie Kyocera, Niedermaier und Spitalsbedarf-Handel KCI Austria verfügen darüber. Diese liegen entweder im Bereich des Abstandsgrüns zur öffentlichen Straße oder im hinteren, halböffentlichen Bereich der Betriebsparzelle und sind unterschiedlich ausgestattet mit Sitzgelegenheiten, Tischen, Wetterschutz, befestigter Fläche (Holzterrasse, Pflasterung); ein Beispiel verfügt über einen Griller und Bepflanzung mit Ziergehölzen. Das Labordiagnostikunternehmen Velalab besitzt eine eigene, für Mitarbeiterinnen und Mitarbeiter und Besprechungen ausgestattete, Terrasse; Positiv hervorzuheben ist, dass die Freiräume von Kyocera, Niedermaier und KCI Austria auf Initiative der Mitarbeiterinnen und Mitarbeiter entstanden sind und in der Ausstattung auf zum Teil recycelte Materialien zurückgegriffen wurde. Die Nutzungsbeobachtungen zeigten, dass diese Freiräume häufig genutzt werden und dass sogar nach Betriebsschluss – vor allem bei schönem Wetter – freiwillig Zeit im Gewerbegebiet verbracht wird, etwa um auf dem Betriebsgelände Fußball zu spielen oder mit den Kolleginnen und Kollegen zusammenzusitzen und Kaffee zu trinken.

Diese bestehende Praxis sollte bei der weiteren Entwicklung des Gewerbegebietes verstärkt aufgegriffen werden. Die Vorteile von Mitarbeiterinnen- und Mitarbeiterfreiräumen sollte den Betrieben als Beitrag zur sozialen Nachhaltigkeit, als Verbesserung des Arbeitsumfeldes vermittelt werden. Qualitätsverbesserungen im Arbeitsumfeld haben wesentlichen Einfluss auf den Standortfaktor Zufriedenheit und tragen dazu bei, gute Mitarbeiterinnen und Mitarbeiter zu halten und zu gewinnen. (vgl. Ruland, G., 2012)

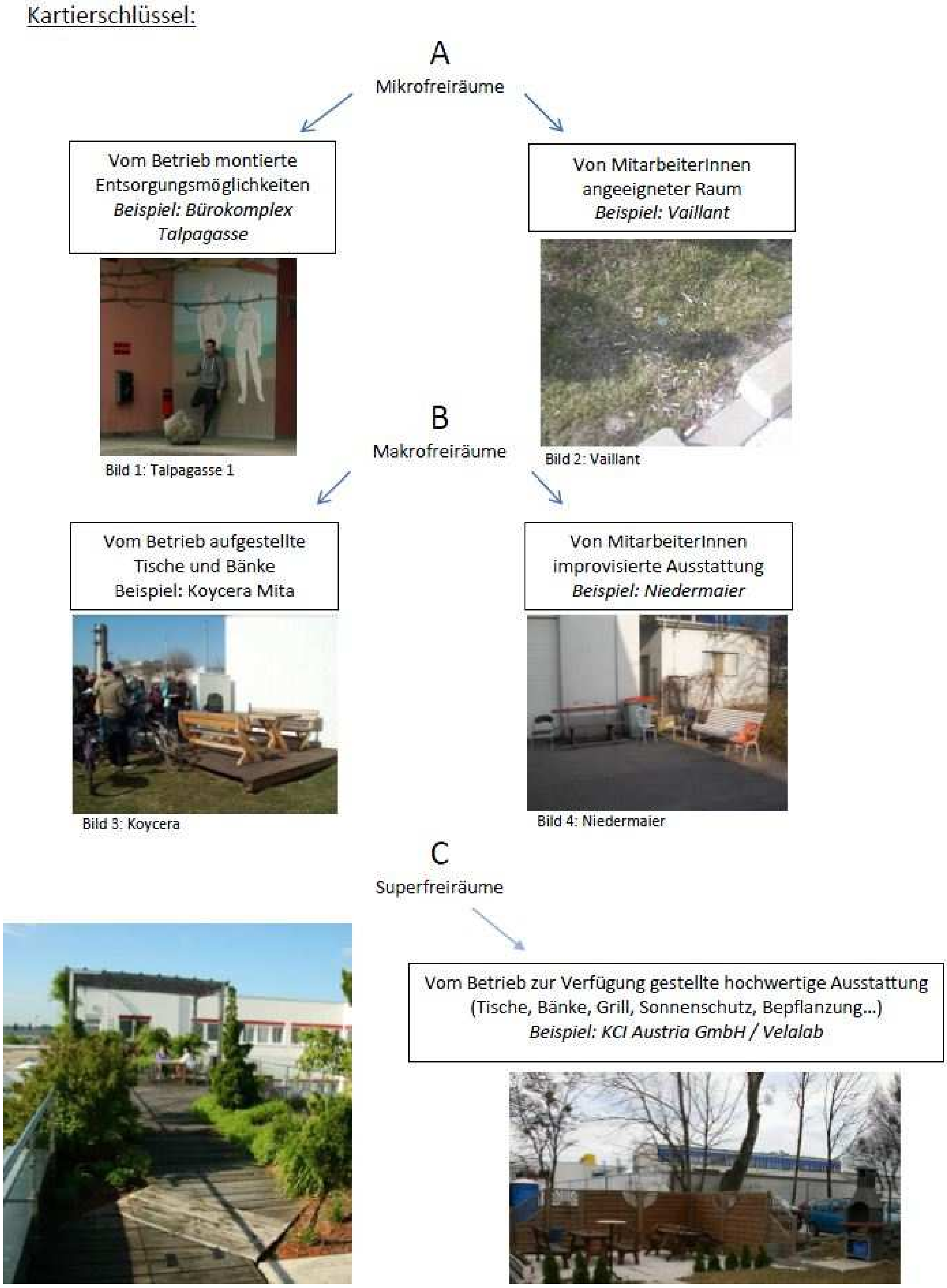

Abb. 3: Mitarbeiterinnen- und Mitarbeiter-Freiräume auf den Betriebsparzellen (© Studierende BOKU Wien, 2012)

3.1.3 Freiräume der Feldgärten

Wie Abb. Freiraumnutzung zeigt, finden sich im nördlichen Teil des Gewerbegebietes Feldgärten (in der Legende: orange „Grabeland"). Dabei handelt es sich um Gartenstreifen, die von Menschen aus der Umgebung ganzjährig bewirtschaftet werden. Die Fläche wird in dieser Form schon seit 20 Jahren genutzt. Die Widmung der Fläche gemischtes Baugebiet-Betriebsbaugebiet. Die Eigentümer halten diese vor und haben nun schon eine langjährige „Zwischennutzungsform" etabliert. Die konstante Bewirtschaftung durch Bewohnerinnen und Bewohner aus der Umgebung und die steigende Nachfrage an privaten Gärten, Freiräumen, Selbsternteparzellen, ist ein Indiz für den Bedarf an Gärten und privaten Freiräumen in der Stadt – für die Versorgung wie auch für die Freizeitgestaltung! (vgl. Ziegler, R., 2010) Diese steigende Nachfrage sollte auch in der Stadtentwicklung Berücksichtigung finden, im Gewerbegebiet wird die Möglichkeit diskutiert, etwa „Gärtnern in der Mittagspause“ für die Mitarbeiterinnen und Mitarbeiter der Betriebe anzubieten.

3.2 Vorgeschlagene Maßnahmen und Beispiele für Projektideen

Die Smart City ist ein langfristiges Projekt, das multidimensional gedacht und diskutiert werden muss und das jede Stadt gemäß ihrer Dynamik und Voraussetzungen entwickeln und auch an jeweiligen Stadtteile anpassen muss. Trotz „unsmarter“ Voraussetzungen im Gewerbegebiet Liesing soll eine smarte Entwicklung hinsichtlich der Freiräume befördert werden.

Auf Basis der Analyse werden in diesem Kapitel Visionen dargestellt, Planungsziele formuliert und beispielhaft Maßnahmen zu deren Umsetzung beschrieben. Im Sinne der Smart City-Entwicklung ist das Oberziel integrierte Maßnahmen der Bereiche Freiraum, Raumplanung und Verkehr/Mobilität zu formulieren. Die Planungsziele für den Bereich Freiraum sind der Erhalt und die Verbesserung der Freiräume und des Freiraumangebotes zur langfristigen Sicherung und Entwicklung des Gewerbegebietes als Gewerbegebiet.

3.2.1 Vision Park

Abb.4: Visualisierung der Vision einer öffentlichen Parkanlage (© Jauschneg, 2011)

Es fehlen qualitätsvolle öffentliche Freiräume im Gebiet. Die Vision öffentlicher Park zeigt, wie auf einer Brachfläche mit Trampelpfad ein Stadtteilpark aussehen könnte. Die Fläche bleibt eine Kaltluftentstehungsfläche, die Bäume speichern CO2, zusammen mit Regenwassermanagement verbessern sie das Mikroklima und binden den Feinstaub. Regenwasser wird oberflächlich zur Versickerung gebracht und als Gestaltungselement inszeniert. Die gute Windsituation wird für kleine Windräder zur Energiegewinnung genutzt. An den Rändern befinden sich attraktive Radabstellanlagen. Für Nutzungsqualitäten sorgen offenere und geschlossenere Teilbereiche und verschiedene Sitzgelegenheiten. Verschiedene Studien belegen den ökonomischen Nutzen von Grünflächen/Parks. Laut Trolf erhöhen Grünflächen/Parks im Radius von 300 m einer Immobilie den Immobilienpreis um 1,43 % (Trolf, N., 2009)

3.2.2 Vision Sonnenschutz und Energiegewinnung

Abb. 5: Visualisierung der Vision Sonnenschutz in Kombination mit erneuerbarer Energie (© Jauschneg 2011)

Die Integration von erneuerbarer Energiegewinnung im (öffentlichen) Freiraum kann zu Nutzungskonflikten mit bestehenden Nutzerinnen- und Nutzergruppen führen. In einem Gewerbegebiet gibt es häufig PKW-Abstellanlagen, welche sich für eine Mehrfachnutzung anbieten: Sonnenschutz könnte mit der Produktion erneuerbarer Energie kombiniert werden. In dieser Vision steuern begrünte Dachflächen Hitzeinseln entgegen und helfen Kühlenergie zu sparen.

3.2.3 Maßnahmen

Die Maßnahmen lassen sich in strategische Maßnahmen, Maßnahmen im öffentlichen Raum und Maßnahmen auf den Betriebsparzellen und Maßnahmen der Beteiligung einteilen. Charakterisiert werden sie in Bezug auf die zeitliche Umsetzbarkeit (kurz, mittel- und langfristig), auf den Ressourceneinsatz (gering, mittel, hoch) und hinsichtlich der Prioriserung bei Dialogveranstaltungen durch die Betriebe. Es wurden weiters der Nutzen, die Kosten und die Akzeptanz sowie die wichtigsten Akteurinnen und Akteure beschrieben.

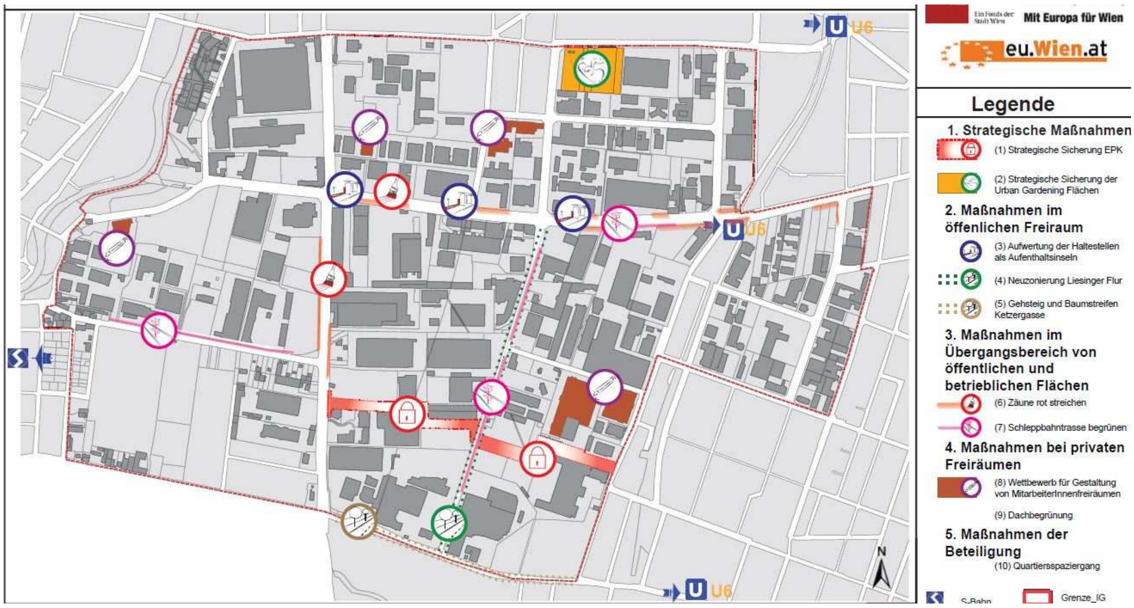

Abb. 6: Überblick über alle zehn Maßnahmen (© Jauschneg 2013)

Die Maßnahmen umfassen die Schaffung einer besseren Durchwegung, die Sicherung der Urban Gardening Flächen, die Aufwertung der ÖV-Haltestellen, die Neuzonierung Liesinger Flur Gasse, die Gehsteigverbreiterung Ketzergasse, Zwischennutzungen an Zäunen und der ehemaligen Schleppbahntrasse, auf Ebene der Betriebe einen Wettbewerb zu Mitarbeiterinnen- und Mitarbeiterfreiräumen und Dachbegrünung sowie last but not least Quartiersspaziergänge als Beteiligungs- und Vermittlungsform zwischen Betrieben, Bewohnerinnen und Bewohnern und Anrainerinnen und Anrainern.

Beispielhaft wird auf die Begrünung der ehemaligen Schleppbahntrasse eingegangen, weil diese im Sinn der integrativen Planung eine mehrere Perspektiven einbeziehende Maßnahme darstellt. Mit einer temporären Begrünung rückt ein bislang wenig beachteter Schatz mit historischem Bezug des Gebiets ins Rampenlicht. Es wird der öffentliche Raum aufgewertet, es löst Diskussionen über die Wieder-Inbetriebnahme der Schleppbahn unter neuen Voraussetzungen etwa als Personen- und Gütertransportmittel (vgl. Käfer, 2013) aus. Mit der Einbeziehung von z. Bsp. Schulen bei der Begrünungsaktion kann das Wirtschaften in der Stadt thematisiert werden.

Abb. 7 +8: Visualisierung der temporären Begrünung (© Jauschneg 2013)

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Eine zweite Maßnahme wird vorgestellt, weil sie eine hohe Priorisierung bei den Dialogveranstaltungen mit Mitarbeiterinnen und Mitarbeitern und Betrieben erhielt: die Neugestaltung der Liesinger Flur Gasse mit einem Baumstreifen und Fußweg. Damit soll eine für den gesamten südlichen Wiener Stadtteil wichtige Fuß- und Radwegeverbindung aufgewertet werden und zukünftig eine qualitätsvolle Grundlage für das zu Fuß Gehen und Radfahren sein.

Abb. 9: Visualisierung des Gestaltungsvorschlages für die Liesinger Flur Gasse (© Jauschneg 2013)

4 CONCLUSION

4.1 Klimawandel, Hitzeinseln, Feinstaub – Grün als smarte Technologie

Die alte Forderung „Mehr Grün statt Beton“ wird durch neue Studien in Bezug auf Anpassungen an den Klimawandel bestätigt (vgl. Saarbrücken, 2012, CABE 2008, 2009, Forum 2008). Als Folge des Klimawandels (vgl. IPPC, 2013) werden Hitzetage mehr, der Aufenthalt im Freien und in Gebäuden wird insbesondere für jüngere und ältere Personengruppen problematischer. Frei- und Grünräume können zur Anpassung an den Klimawandel in vierlei Hinsicht beitragen: Kaltluftbildungsgebiete, passiver Sonnenschutz, CO2-Speicher, Wasserrückhalt, Feinstaubfilter u.v.m. Durch attraktive Freiräume kann der nicht-motorisierte Verkehr wie Radfahren und zu Fuß Gehen und der ÖV als wesentlicher Beitrag in der Mobilität zur Redultion von Treibhausgasen gefördert werden.

4.2 Müssen Gewerbegebiete städtische Unorte sein?

Die Stadt ist nicht nur das Gebaute, sondern entsteht durch das Handeln der Menschen – sie stellen durch ihr alltägliches Tun die Stadt her (vgl. Gehl, J., 2010). Die Freiräume sind dafür Voraussetzung. Ob es qualitätsvolle Freiräume sind, hängt davon ab, ob auch zusätzliche (optionale) Aktivitäten zum alltäglich Notwendigen möglich sind. Die Möglichkeit zu „Social activities“ macht eine Stadt oder ein Stadtquartier aus. Diese entstehen, wenn sich Menschen sich treffen, wenn man im öffentlichen Raum Platz nehmen kann, ihn sich aneignen kann.

Im Gewerbegebiet Liesing sind die öffentlichen Freiräume für die notwendigen täglichen Aktivitäten nur in einem Mindestmaß vorhanden und wenig attraktiv, da öffentliche Räume durch PKW- und LKW-Verkehr dominiert werden. Die Nutzungsanalyse zeigt auf, dass in der alltäglichen Praxis etwa ein informeller Weg durch die Nutzung entsteht oder sich Mitarbeiterinnen und Mitarbeiter selber Freiräume schaffen.

Es werden seitens der Stadt und der Wirtschaftskammer große Anstrengungen unternommen, um das Gewerbegebiet zu erhalten und gleichzeitig zu verbessern. Konkrete Umsetzungen sind dennoch bislang wenig erfolgt. Was steht dem entgegen? Zum einen ein starkes Eigentumsrecht – viele Flächen sind in privater Hand und nicht für die Stadt verfügbar. Hier müssen die Eigentümerinnen und Eigentümer der Flächen aktiviert und in die Entwicklung einbezogen werden – was durch das Quartiersmanagement und die

Steuerungsgruppe erfolgt. Dennoch ist es ein langwieriger Prozess. Mit Blick auf die bestehende Nutzungsvielfalt erscheint der kooperative Steuerungs- und Planungsansatz sinnvoll, in dem Grundstückseigentümerinnen und Grundstückseigentümersich die Verantwortung über die Nutzung der Fläche mit Stadtplanung und Nutzerinnen und Nutzern teilen. Dies erfordert kontinuierliche Vernetzungsarbeit und Aushandlungen über die Entwicklung.

Zum anderen sind Gewerbegebiete oftmals nicht im Fokus der Politik. Die Verbesserung des Freiraumangebotes im Gewerbegebiet Liesing ist in ihren Wirkungen nicht nur auf das Gewerbegebiet als solches begrenzt. Es wäre eine für den gesamten südlichen Wiener Stadtbereich wichtige Aufgabe, da durch die aktuellen Wohnbautätigkeiten und den Zuzug in der unmittelbaren Umgebung des Gewerbegebietes auch der Druck auf öffentliche Freiräume steigen wird und Bedarf noch zusätzlich entsteht.

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Urban Development Simulator: An Interactive Decision Support Tool for Urban Planners Enabling Citizen's Participation

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1 ABSTRACT

The Urban Development Simulator is currently under development within the FP7 EU project urbanAPI (2011-2014). The simulation tool is developed for the city of Ruse in remote northern Bulgaria at the Romanian border as a support for the local urban planners and politicians to evaluate high level planning decisions defined as use cases.

The tool is developed as generic simulation framework, thus the framework can be applied for other cities too, to generate tailor-made urban planning support tools, if the necessary geospatial data about future planning scenarios and related statistical data describing the socio-economic state and future expectations are available.

The tool enables urban planners to estimate the impact of different urban development scenarios and visualises spatial changes through dynamic GIS maps depicting the results of the simulations. It is based on the analysis of geospatial data and uses an Agent-based modelling approach to simulate the development in the city. While other urban development simulation tools usually model urban growth in the urban fringe, the Urban Development Simulator concentrates on intra-urban development, as the City of Ruse turns out as a shrinking city which is starting to recover since the last years – reorganizing the intra-urban structure.

The tool has a complex user interface and a web interfaces to interact with the local citizens. Thus different planning scenarios and their effects can be visualized (also in 3D) via the web interface and the opinion of the local residents can be involved into the planning decisions by voting for selected planning decisions as preference of the citizens. The spatial pattern of the preferences serves as an input for the parameterization of the Agent-based model to simulate the development trends within the different areas of the city. Scenarios can be simulated what would be, if the urban planners would follow the citizens' preferences. This enables the decision makers to adapt their urban development plans by considering the preferences of the citizens. Effects on e.g. the final energy demand and CO2 emissions for residential buildings are further calculated for the different development scenarios.

The model runs as a Java web-start application and is hosted on a server at the AIT with remote access for the Ruse users. For the model development the simulation platform MASGISmo (Multimethod Agent-based (ABM) System dynamics (SD), GIS modelling platform) has been applied, a framework originally developed during several prior projects to combine a bottom up agent-based simulation method (ABM) with a top down – system dynamics (SD) approach. This platform is programmed in Java connected to several external tools as a PostgreSQL (PostGIS) database, Vensim a (SD) tool and uses RepastJ as core ABM tool. For the purpose of the Urban Development Simulator the GIS capability of the platform was enhanced with more powerful GIS features, thus new planning scenarios can directly be introduced within the tool by the urban planners.

The paper will concentrate on the description of the structure of the Urban Development Simulator, further more explain the participatory citizen's integration.

2 INTRODUCTION

Urban areas are aimed to be innovation ecosystems[1] wherein important solutions are created or deployed to accelerate the necessary transition to a more sustainable, resource efficient urban system. More often citizens act as proactive catalyser of innovation, shaping cities, shaping as actors of change. Decision support environments as the following aim to facilitate the integrated urban planning bringing the citizen's view closer to the local government and their development plans of the city.

[1] Innovation ecosystems are characterized by a combination of top down and bottom up initiatives, leading to networking and collaboration among stakeholders, which eventually extend to real innovation communities..p.6 http://www.openlivinglabs.eu/sites/enoll.org/files/FIREBALL%20White%20Paper%20Final.pdf

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Urban modelling can defined after Batty as: the process of identifying appropriate theory, translating this into a mathematical or formal model, developing relevant computer programs and then confronting the model with data, so that it might be calibrated, validated and verified prior to its use in prediction. (1976, p. 3).

Evolving regions or cities are often based on an interaction between top-down planning decisions and bottom-up processes. This interaction allows stable structures to develop, with a complex organisation and a connectivity-rich network (Salat & Bourdic, 2012 p.60). Owing to the high complexity present on and between various spatial and hierarchical levels, computer models have proven useful in the analysis of different urban developmental paths. Complexity in this context means a (non-linear) feedback structure connecting the elements within one and on different levels of the system.

Many different urban planning tools exist whereas most often they are not very appropriate to integrate the perspective from different actors as e.g. urban planners or citizens. Tools like UrbanSim (Waddell, 2002), EnerGIS (Girardin, 2010) or SynCity (Keirstead et al., 2010) and others have their fields of application, (Connolly et al., 2010). Main challenges of many of them are to get the necessary data for parameterization and to create a user interface thus urban planners are able to use the tools. Timeseries from the past most often are analysed to forecast the future trends, however for many cities the needed data is either not available or not in the right format.

The UDS was built based on requirements of the urban planners. Citizen’s integration into urban planning is one of their main requirements, thus for the UDS a new approach for the interaction with the local residents was developed (see below).

3 URBAN DEVELOPMENT SIMULATOR

The Urban Development Simulator (UDS) is currently under development within the FP7 EU project urbanAPI (2011-2014). The simulation tool is developed in close cooperation with the city of Ruse in remote northern Bulgaria at the Romanian border as a support for the local urban planners and politicians to evaluate high level planning decisions.

The UDS is developed as generic simulation framework, the concept can be applied for other cities too, to generate tailor-made urban planning support tools, if the necessary geospatial data about future planning scenarios and related statistical data describing the socio-economic state and future expectations are available.

The UDS enables urban planners to estimate the impact on e.g. energy demand or land use changes due to different urban development scenarios. It visualizes spatial changes through dynamic GIS maps depicting the results of the simulations. It is based on the analysis of geospatial data and uses an Agent-based model approach to simulate the development in the city. While other urban development simulation tools usually model urban growth in the urban fringe, the Urban Development Simulator concentrates on intra-urban development, as the City of Ruse turned out as a shrinking city, which is starting to recover since the last years – reorganizing the intra-urban structure. To generate the UDS a model development platform called MASGISmo (developed at the AIT) was used and enhanced enabling to integrate the main features which have been requested by the local urban planners. With this development platform the core UDS module was programmed in JAVA. To integrate all the requested features several Open Source tools have been used as a Geoserver,[2] an online questionnaire software called LimeSurvey[3] and a web portal software called Liferay[4] to collect all the information needed for the UDS and to provide a common entry point to all the features. For training and documentation online tutorials, as training-videos and annotated screenshots, can be used.

3.1 MASGISmo

MASGISmo the so called Multimethod Agent-based (ABM) System dynamics (SD), GIS modelling platform was originally developed within several projects to combine a bottom up simulation method (ABM) with a top down method (SD) and the input as well as output of GIS data. This platform is programmed in

[2] http://geoserver.org/display/GEOS/Welcome
[3] http://www.limesurvey.com/
[4] Liferay Portal is a web platform with features commonly required for the development of websites and portals. http://en.wikipedia.org/wiki/Liferay

JAVA connected to several external tools as a PostgreSQL (PostGIS) database, Vensim a (SD) tool and uses RepastJ[5] as core ABM tool. Several other connections (e.g. R-Statistics[6], GAMS[7] (TIMES) are integrated but not fully elaborated). A Graphical User Interface and the flexibility by JAVA programming enables to generate User defined interfaces to steer and analyse the developed models.

In the beginning of ABM, spatial modelling of an agent did not include geographic information. The same was the case in the beginning of combined SD modelling and ABM (Gebetsroither, 2009). Geographic information is, however, important in the simulation of, e.g., regional development, especially if local stakeholders are involved in the discussion of the result: Geographic information may enable local stakeholders to intensify their engagement in the discussion of simulation results. Therefore, especially when local stakeholders (e.g., within a participatory urban planning process using modelling) are involved, the inclusion of data from Geographic Information Systems (GIS) represents a major advancement. Nowadays, people are used to easily accessible geographic data, thanks to ubiquitous services such as Google Maps or Open Street Maps.

Today, multimethod modelling including GIS data is possible through specifically designed software tools like Anylogic[8], Netlogo[9] or Repast Symphony.[10] MASGISmo however makes use of GIS data for complex spatial analyses, while the other software tools use their GIS functionality mainly for obtaining information about the agent's location. MASGISmo in turn enables users to analyse the environment of an agent in manifold ways within the platform, e.g., the location can be used to estimate its influence on the agent's behaviour. It was developed at the Austrian Institute of Technology (AIT), the author's affiliate institution, especially to enable multimethod modelling.

MASGISmo combines SD modelling, ABM, and GIS data analyses. Combining SD and ABM is based on the pioneering works of Akkermans and Scholl (Akkermans 2001, Scholl 2001a, and Scholl 2001b) and Pourdehnad, Schieritz, and Milling (Pourdehnad 2002, Schieritz & Milling 2003, and Schieritz & Groessler 2003). Enhancing the spatial capabilities of the ABM module has enabled the inclusion of GIS data analyses within the multimethod platform. The calculation of new geographic maps out of the existing ones can be performed by using simple arithmetic operations and the agents' spatial movement by transforming land-use of single cells into steady land-use transitions.

The development of the simulation platform MASGISmo is predominantly determined by the requirements of the projects it serves, i.e., the objects to be modelled and the modelling purposes. Almost with every model built up with MASGISmo, new functionalities for the platform are developed, serving other future modelling purposes.

The screenshot below presents the GUI of one model developed with MASGISmo. Three main parts characterize MASGISmo's GUI: first the general simulation controls, second the interactive toolset and third the illustration tools such as dynamic results map, GIS layer legend and the overview map. This depicted GUI is, on the one hand, an example of the current stage of MASGISmo's development while, on the other hand, it was explicitly built for the specific purpose of the simulation of different urban development scenarios. In this use case, importing GIS data of, e.g., different urban zoning plans, new infrastructure, or shopping centres and companies enables decision makers to simulate different spatially explicit development scenarios.

[5] RepastJ: Recursive Porus Agent Simulation Toolkit, http://repast.sourceforge.net/repast_3/index.html, tested Feb. 28, 2014

[6] http://www.r-project.org/

[7] http://www.gams.com/

[8] http://www.anylogic.com/

[9] http://ccl.northwestern.edu/netlogo/

[10] http://repast.sourceforge.net/

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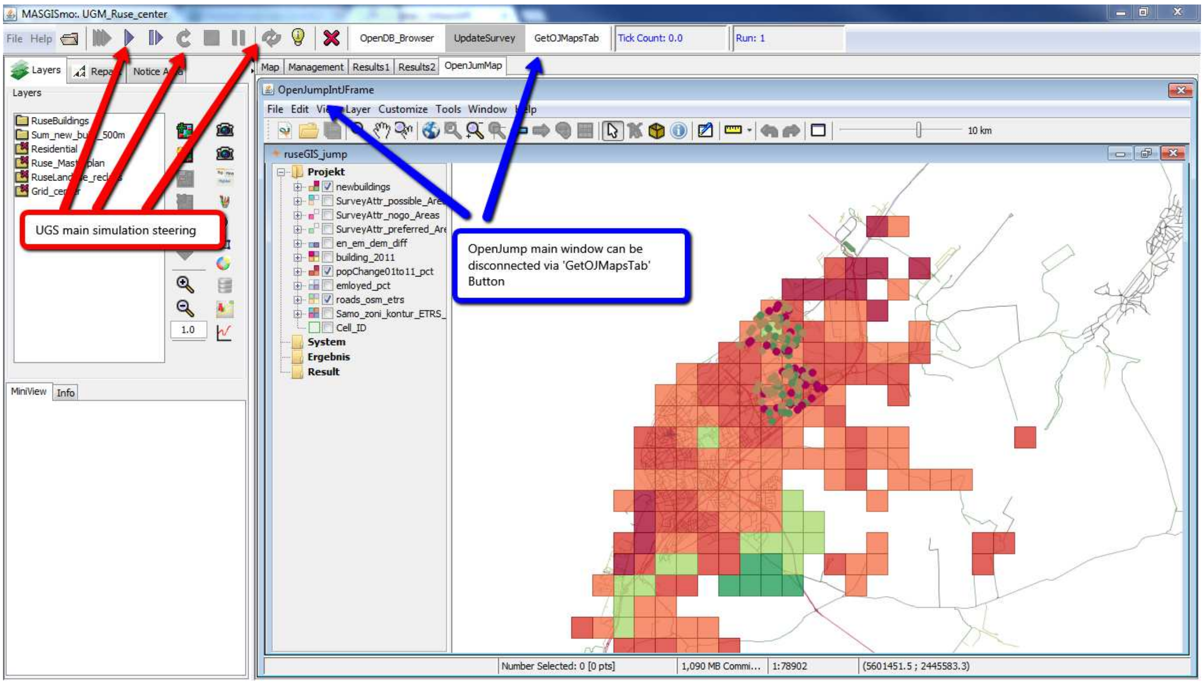

Fig 1.: Screenshot of MASGISmo's current GUI enhanced within the urbanAPI project, © AIT

For the current UDS the platform was extended in several directions. The former developed PostgreSQL connection was enhanced to use PostGIS data and functionalities. MASGISmo could not use ESRI-shapefiles before, neither as input nor to export the simulation result. Within the urbanAPI project was this ability added due to several different steps. One main step was to develop a connection to be able to use OpenJump.[11] Thus the interactivity for urban planning processes e.g. to change urban zoning plans, integrate new roads etc., combined with the visualization possibilities could be significantly enhanced. Furthermore the GIS maps stored within the PostgreSQL (PostGIS) database can be exported to new formats.

Further details on building models using MASGISmo are detailed elsewhere (Gebetsroither 2009, pp.63)

3.2 Agent-based modelling

Agent-based models (ABM), also sometimes called individual-based models (IBM) or multi-agent systems modelling (MAS), has gained increasing importance in the studies of social and economic systems. It has often been used to improve the understanding of a wide range of problems and to help forecast the effects of top-down decisions on the micro-level. Applications include the emergence of cooperation (Holland & Miller 1991) and the influence of expectations, e.g. on the stock market (Axelrod 1997a and 1997b).

A famous early example of ABM used in urban modelling concerned the emergence of racial segregation in cities. However, only over the last five to ten years has ABM been receiving increased attention from the spatial development modelling community (land-use modelling as well as urban planning). It has been recognized that ABM offers a way of incorporating the influence of human decision making on land-use in a formal and spatially explicit way, taking into account social interaction, adaptation, and decision-making on different spatial and (or) hierarchical levels (Matthews et al. 2007, p. 1448).

In contrast to SD models, which are composed of stocks and flows, the building blocks of ABM and in particular the concept of agents itself are not clearly defined. However, it is argued by Jennings et al. (1998, p. 8) that ABM uses three key terms: (i)'situatedness', (ii)'autonomy', and (iii)'flexibility'. Here, 'situatedness' means that an agent receives information about the environment from sensors and, subsequently, can perform actions, which, in turn, can influence the environment. 'Autonomy' means that an agent can act solely based upon its objectives and the system's internal state, without any direct external influence. 'Flexibility' means that the agent has the ability to change its behaviour, for instance when it

[11] OpenJUMP is an open source Geographic Information System (GIS) written in the Java programming language. It is developed and maintained by a group of volunteers from around the globe. OpenJUMP started as JUMP GIS designed by Vivid Solutions. http://www.openjump.org/

needs to adapt or learn from others. Hence, in summary we can say that agents are situated in and interacting with their environment and are capable of changing their behaviour to reach their individual objectives.

3.3 Simulation environment

As already mentioned above is the core module (UDS core in the figure) of the urban development simulator (UDS) is embedded within a complex environment combining different tools. The figure below shows that the environment is located at a server of the AIT, at least at the moment, but this could be changed e.g. to directly deploy it on a server within the city using the UDS (in our case Ruse-Bulgaria). Due to connection over the Internet all the data from the server can be used and changed. A negative influence of this constellation is that depending on the Internet connection speed of the client using the UDS the simulation might slow down. However current tests for the city of Ruse, which has not the best Internet connection speed, showed that a simulation can be performed normally in the rage of 2 to 5 minutes. The core UDS module programmed in JAVA runs with JAVA web-start[12] and is thus platform independent. The internet questionnaire using the software LimeSurvey stores the results in a PostgreSQL database too, thus with MASGISmo's database connection the information can be used in the simulation (details are given below).

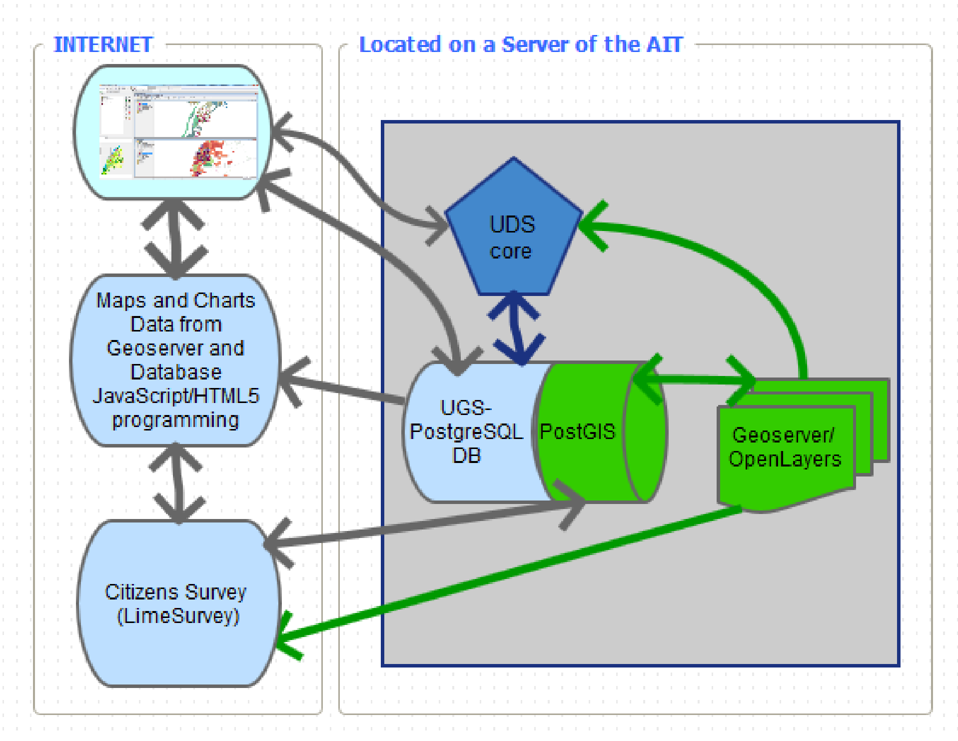

Fig. 2: Complex simulation environment. © AIT

3.4 Graphical user interface of the core UDS

MASGISmo provides a standard user interface (Gebetsroither, 2009), but it is flexible and the GUI developed for the UDS was adapted for the needs of the urban planners in Ruse. The most specific interface is the 'Management tab' which is shown in the figure below (centre). Here the urban planners can decide for which main scenarios they want to perform new simulations. Parameters can be changed to create new scenario simulations and results exported in different formats (e.g. to create a 3D view with X3DOM[13]).

[12] Using Java Web Start technology, standalone Java software applications can be deployed with a single click over the network. Java Web Start ensures the most current version of the application will be deployed, as well as the correct version of the Java Runtime Environment (JRE).
http://www.oracle.com/technetwork/java/javase/javawebstart/index.html
[13] http://www.x3dom.org/

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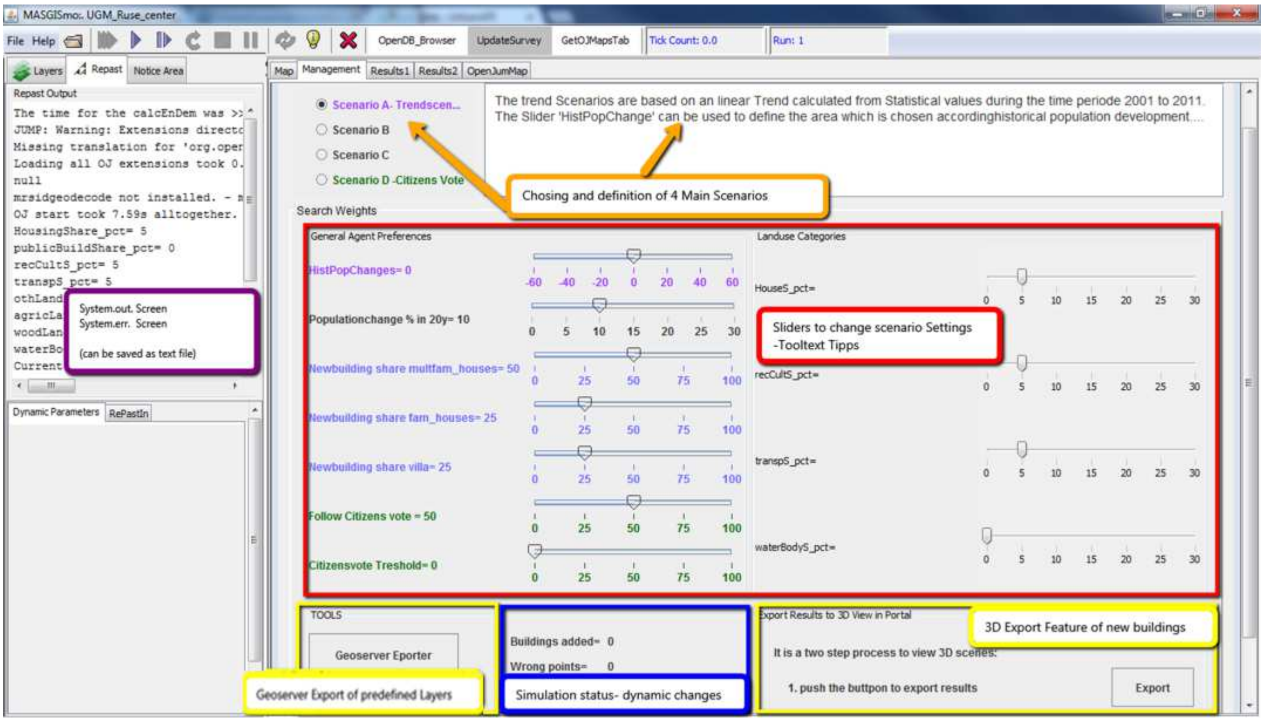

Fig. 3: Annotated screenshot of the SCENARIO MANAGEMENT TAB © AIT

3.5 Citizens participation via Internet questionnaire

One main requirement for the urban planners of the city of Ruse was to get a better knowledge of the preferences of their citizens. Within the project a new approach was developed to combine online questionnaires e.g. asking the citizens in which areas they would like to move within their city. The figure below shows on the left side a screenshot of the online questionnaire in which each citizen can vote for areas (500m raster cells) they like most or never would want to live. The right side of the figure shows how the votes in the UDS are depicted as maps, whereas red colours show so called no-go areas and the green cells indicate the most liked areas. This kind of attractiveness maps for the city can be used within a scenario simulation as target or repelling areas. For examples questions as what would be the impact on the land use or local energy demand, if the assumed population development (increase) could evolve along the preferred areas. Furthermore the citizen’s attractiveness maps joined with the current development plan (“master plan”) for the city delivers important input for the local urban planners to evaluate (adapt) their development plans. The user of the UDS can simulate different scenarios combining new development plans (zoning maps), which can be uploaded to the database, with different strength following the preferences of the residents.

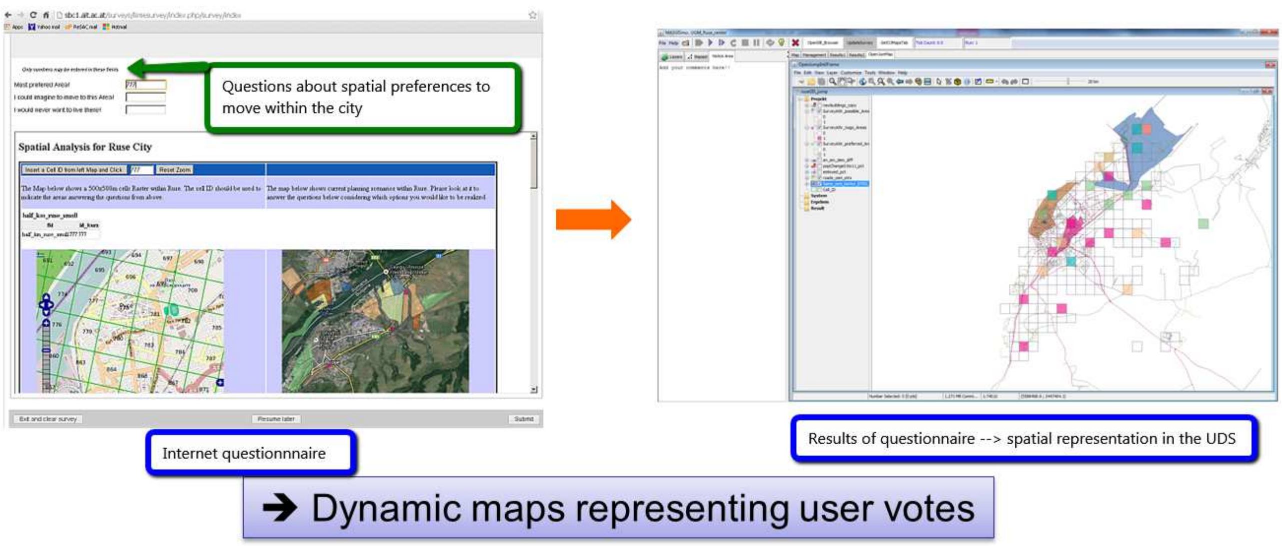

Fig. 4: Schematic model of the citizens participation © AIT

Further questions have been asked about characteristics in the neighbourhood of their residents, what is important to them. For example if they are looking for a well-developed public infrastructure, recreational areas, density of kindergarten, the driving time to the centre of Ruse or to the country side. All the answers of the citizens are collected and user preferences as shown in the bar chart in the figure below derived. This information can be used for the local search of each agent in the simulation, to find the most suitable place within the city. Furthermore the information can deliver valid input for the urban planners how the citizens would like that their city evolves.

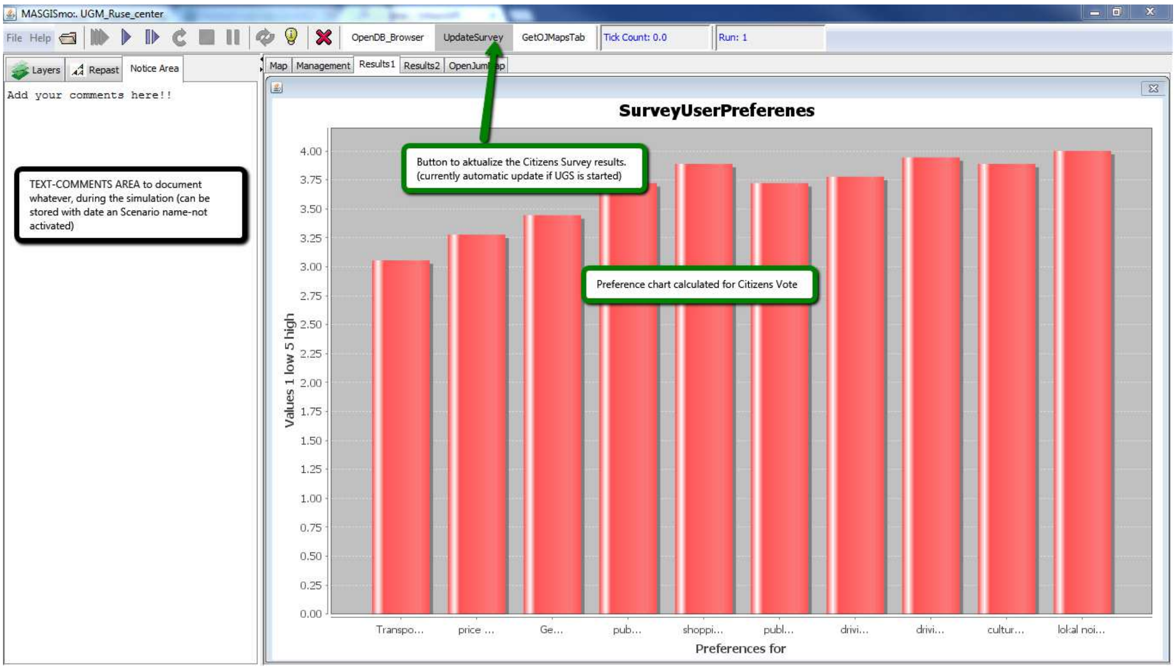

Fig. 5: Annotated screenshot from the UDS of the Citizen's Survey “live results”© AIT

4 CONCLUSION

The UDS is developed during a FP7 project called urbanAPI within the years 2011-2014. It will be finished this summer; the first evaluation cycle with the local urban planners has shown that the tool can support their work. It is based on the former work developing a modelling platform called MASGISmo which was enhanced and adapted to the local requirements for the city of Ruse. Many different tools have been combined within a complex simulation environment. The citizen participation was one of the most demanded features, whereas the UDS has many more features, which can support the urban planners. Due to the high complexity of the UDS it was quite difficult to engage with the tool and further training is one of the most often mentioned outcomes of the first evaluation cycle. The results of the participatory process can be feedback to the citizen on the one hand side to give them an impression how the collective view of their city is and on the other hand side can serve as an important communication channel from the urban planner, the local government, to the people living in the city. For the future it is planned to use the generic simulation framework of the UDS to develop other models for different locations, cities or regions. This would include enhancing the features of the UDS as well as the user-friendliness. For this step it is important that close cooperation to urban planners, local government or other potential users is part of this process.

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Urban Green Infrastructure Planning as a Contribution to the Smart "Green" City

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1 ABSTRACT

The urban green infrastructure is getting due to the strong growth of the City of Vienna under increasing pressure. A foresighted planning of green and open spaces is necessary to obtain the different "Ecosytem Services" - provision-related services, regulatory services, cultural services and support services (MEA 2005). Additionally an increase in the number of hot days and thus an increase of the heat load in the city is predicted for Vienna (ZAMG 2012). Again, making a foresighted planning of green and open spaces is a significant contribution to meet these climatic challenges (Kuffner A. 2012, Hagen et al. 2010). Based on the concept of "green infrastructure" (Pauleit et al. 2011) and the ecosystem services of these, it is shown which contribution - in particular to reduce the heating of the city - they can make to the Smart City concept.

2 DEFINING A SMART CITY

The City of Vienna has successfully positioned itself in the international competition of cities as a Smart City (first place under „The Top 10 Smart Cities on the Planet 2011", Number 3 of the "10 Smartest Cities in Europe 2013").This includes in particular the combination of urban density with a high quality of life (first Place in this ranking and in the Mercer 2012 study). Cities have to become smarter to overcome actual challenges such as climate chnge. Many actors from different disciplines tried to define or answer the question: What makes a City to a smart City? There exist many definitions of Smart City. The aim of the paper is to look at the Smart City concept from a "green point of view" on the example of the urban heat island effect. The article outlines how the planning of urban green infrastructure contributes to the Smart City concept.

2.1 Smart City – the new Sustainable City?

The idea behind "Smart City" is that by using innovations and technologies resources can be used efficiently. The term has a technological background and origin. Recently more and more aspects and spheres of activity are subsumed under the term Smart City. Quality of live is the aim, which is found within most Smart City strategies. Technology is just a part of the strategy.

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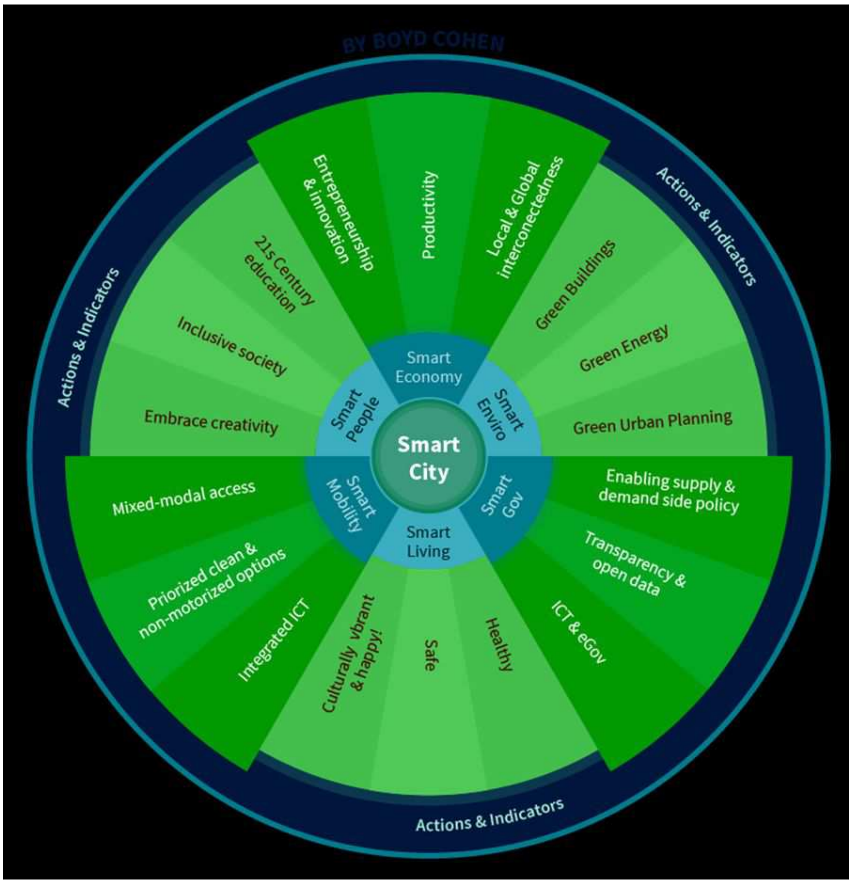

Fig. 1: Basic Smart City Indicators (Source: http://www.boydcohen.com/smartcities.html)

Boyd Cohen uses six smart categories - People, Mobility, Living, Government, Economy and Environment - for an international ranking of Smart Cities. This typology has also been used by Giffinger since 2007. According to his approach a Smart City includes not only smart technologies but also smart residents, smart mobility, smart economy, smart housing, smart management and the smart environment (Giffinger R. 2007).

Also the European Union is using these categories (GD IP 2014). A city could be classified as a Smart City if they have at least one initiative which addresses at least one of the above mentioned topics – using ICT. Their working definition of a Smart City is: "As a result, this study's working definition of a Smart City is 'a city seeking to address public issues via ICT-based solutions on the basis of a multistakeholder, municipally based partnership" (GD IP 2014: 24). They also made an overview of different definitions of what a Smart City is. The spectrum is broad. They also see overlaps of the Smart City concept with other concepts such as "'Intelligent City', 'Knowledge City', 'Sustainable City', 'Talented City', 'Wired City', 'Digital City' 'Eco-City'" (ibid. 22). Also natural resources and the smart handling of these is often part of the definition of a Smart City.

They also define six Smart City characteristics. For the focus of the paper – the urban green infrastructure and the link to the Smart City concept – the definition of the "Smart Environment" is most relevant: "By smart environment we include smart energy including renewables, ICT enabled energy grids, metering, pollution control and monitoring, renovation of buildings and amenities, green buildings, green urban planning, as well as resource use efficiency, re-use and resource substitution which serves the above goals. Urban services such as street lighting, waste management, drainage systems, and water resource systems that are monitored to evaluate the system, reduce pollution and improve water quality are also good examples" (ibid. 28). A combination of measures regarding climate change adaption and mitigation, ICT, energy efficiency and urban ecology are mixed and merged within this category. So urban green infrastructure planning as a mean to counteract UHI effects should be a contribution to the Smart City concept.

Let us have at last a look on the Viennese definition and understanding of a Smart City. Climate change and shortage of resources are the first topics which are mentioned looking at the "Smart City Homepage" (smartcity.wien.at). A Smart City is "a city that is fit for the future and geared towards opportunities and that is capable of producing credible perspectives for its people" (smartcity.wien.at). The aim is to improve the ecological, economic and social performance. Also the strong growth of the City of Vienna is mentioned which is a driving factor for rising energy consumption. Within six categories different projects are summarized which are making Vienna a Smart City (Education & Research, Building Activity & Living, Transportation & Urban Planning, Environment & Climate Protection, People & Society, Politics & Administration). Building projects, city development projects but also strategies like the new City Development Plan (STEP 2025) are mentioned.

This short overview of criteria, which define Smart Cities, shows that they are manifold and different within the cities. Going back to the categories of Boyd Cohen, the aspect "Smart Environment" covers three categories: green buildings, green energy and green urban planning. Let us see if and which aspects urban green infrastructure planning can contribute to the Smart City concept.

3 UHI AND URBAN GREEN INFRASTRUCTURE

The urban heat island effect is one of the challenges cities are facing due to the strong growth of the cities and the climate change. The urban green infrastructure is getting under increasing pressure due to the strong growth of the City of Vienna – the latest data from Statistics Austria predict a rise up to two million people in the years 2030-2035 – Additionally, an increase of hot days and thus an increase of the heat load in the city is predicted for Vienna (ZAMG 2012).

These two factors are the driving forces for an increase of the so called urban heat island effect. The urban heat island describes the effect of the temperature differences of urban and rural areas. The UHI effect is not a new phenomenon. It has been known since the 19th century (Howard 1820). Over the past few years, summer heat waves occurred more often throughout Europe and an increased attention in the European media was noticeable (Allex et al. 2011). Usually, the intensity of this difference is about 1 to 3 degrees kelvin, but can rise up to 12 degrees kelvin (Kiesel et. al 2014). It depends of course on the local climate and the spatial situation of a city. But the UHI effect is triggered by dense building and high degree of soil sealing. That means the loss of urban green infrastructure which supports the mitigation of the UHI effect throughout evapotranspiration (and shading) leads to higher temperatures within the City. A foresighted planning of green and open spaces is necessary to obtain not only the different "Ecosytem Services" – provision-related services, cultural services and support services (MEA 2005) – but especially the "regulatory services" of urban green infrastructure. The City of Vienna therefore takes part in a European wide project to reduce the UHI effect. The article is based on the experiences and results of the project "Urban Heat Islands – Strategy Plan Vienna" which is part of the international CE (Central Europe) project "Urban Heat Islands – Development and application of mitigation and adaptation strategies and measures for counteracting the global Urban Heat Islands phenomenon" (duration 2011-2014). The aim of the project "Urban Heat Islands – Strategy Plan Vienna" is the identification of measures to reduce the negative aspects of urban warming and evaluate the different steering and control levels to implement measures.

3.1 Measures to reduce UHI effects

Measures to reduce the UHI effect could roughly be separated in strategic approaches and city scale planning measures as well as concrete technical and building measures. A third category is public relation and information measures – which is not the focus of the UHI project. Throughout a comprehensive literature research a broad spectrum of measures counteracting the UHI effect were selected and analyzed by a simplified SWAT analysis (Strengths, Weaknesses, Opportunities and Threats) (e.g. Terrados et.al., 2005). Additionally the effectiveness of the measures were analyzed using different categories – influence on meso-climate, micro-climate, biodiversity, quality of life, economical aspects like building and maintaining costs, feasibility and acceptance by different stakeholder groups (e.g. politicians, administration, developer…). The analysis showed that only green urban infrastructure and with some restriction blue urban infrastructure have effects at least on the micro climate. They reduce the heat impact throughout evapotranspiration and especially the planting of trees also provides shading. The "smart" solutions and technologies which were developed –for example the active and passive cooling of buildings, smart meters to monitor the energy consumption – are influencing the wellbeing of the people, but do not have an effect on the micro and meso-clima. In case these systems use air conditions they are worsening the situation in the urban fabric because they emit additional heat (anthropogenic heat) and need energy. In an iterative process with scientific experts and in close cooperation with the responsible city administration departments mostly measures within the urban green infrastructure were selected to be part of the "Urban Heat Island Strategy Plan of the City of Vienna". The measures are reaching from the conserving and maintaining of fresh air corridors (green corridors) over additional green spaces down to the intensified planting of trees within the street canyons.

3.2 Urban green infrastructure and ecosystem services

Urban green infrastructures (UGI) are providing a lot of different so called "ecosystem services" (Parlow 2011). The urban areas and the inhabitants benefit ecologically, socially and economically from UGI. They provide provision-related services, regulatory services, cultural services and support services (MEA 2005, Colding 2011).The influence on the urban climate is – together with other mitigating effect on various incidents and catastrophes like heavy rain or floods – a regulatory service (Gomez-Baggethun et al. 2012). Due to the other ecosystem services of urban green infrastructure measures in this sector are very efficient, because they show synergies with other urban planning strategies such as the increase of biodiversity. The ecosystem approach is discussed since the 1990ies and the services provided are crucial for the quality of life of a city (Colding 2011). Important within this approach is, that urban green infrastructure has the same value and significance like other urban infrastructure (e.g. water supply and management or the traffic system) (Pauleit et al. 2011). Urban green infrastructure like other infrastructures has to be handled on different levels – from green corridors which support City wide the air circulation and ventilation down to a tree which provides shading (STEP 2005, Hagen et al. 2010, Proksch et al. 2011). That implies that the implementation of urban green infrastructure has to occur on different spatial layers.

3.3 Urban green infrastructure planning, a longitudinal and cross-sectional topic

Another focus of the UHI project is the analysis of different planning levels, tools and instruments. As the planning of urban green infrastructure needs a mulit-scalar and multi- disciplinary approach a lot of different planning levels and stakeholders are involved (Reinwald et. al 2013). Legally binding instruments, master plans and urban development concepts and – what is new for the City of Vienna – also on the basis of private-law contracts are the tools to implement the strategies. Between these planning instruments a balance between the (partly competing) aims of the urban development of the City of Vienna has to be accomplished.

Green spaces have to fulfill more requirements and have to accommodate more functions than they used to. A lot of different measures and projects were developed and implemented regarding city development approaches such as the Smart City, Energy Efficient City, Ecological City etc. These are for example the increase of the energy efficiency or the production of renewable energy. Some of them are mutually exclusive – for example the use of a flat roof for roof greening to reduce the UHI effect or to produce energy by using solar panels. Additionally facilities for example the use of geothermal energy or wind power need space, changes the airflow etc. That means a lot of counteracting aims have to be balanced.

Making a foresighted planning of urban green infrastructure is a significant contribution to meet the different needs (Kuffner A. 2012, Hagen et al. 2010). Not only different planning levels are concerned, but also different types of urban green infrastructure – public, institutional, and private – have to be taken into account. According to the many different stakeholders involved a communicative planning process is needed (Healey 2007) – an aspect which is also mentioned within the Smart City Concepts.

Additionally the implementation of the measures has different time horizons. Short-term preventive measures such as heat warning systems and information campaigns – how to behave during heat periods – can be implemented fast. Also technical measures for example a sun screens for windows can be implemented within a reasonable time frame. On the other hand, large-scale strategic measures to increase the amount of urban green areas take a long time.

4 URBAN GREEN INFRASTRUCTURE AND THEIR CONTRIBUTION TO THE SMART CITY CONCEPT

Coming back to Boyd Cohans "Smart City Wheel" the starting point of the paper and the search for the link of urban green infrastructure and Smart Cities: One (the only one) indicator for the "working are" sustainable urban planning within the "smart dimension" environment is the urban green open areas per capita in square meters – an easy to use indicator, with low significance. The City of Vienna has approximately 50% green spaces. If you divide this area by the number of inhabitants everybody has 120 square meter green spaces (http://www.wieninternational.at/de/content/umweltstadt-wien-5050-gruen-de). But this number does not take the distribution, the type of green infrastructure or the area which is selected for the calculation into account. The amount of green areas which could for example mitigate the UHI effect or support renewable enrgy production depends on the type of urban fabric. An evaluation from City of Vienna showed, that the amount differs within the inner city districts between 5,8 up to 25 square meters (ÖBIG 2002: 15). So this number does not really tells us something about the "smartness" of a City. But it indicates that green infrastructure contributes to the Smart City concept. Effort should be set on the indicators selected to incorporate the manifold ecosystem services which are provided by urban green infrastructure.

The point is not to forget on the urban green infrastructure while developing a Smart City. Urban green infrastructure – as shown on the example of the urban heat island phenomenon – can provide solutions for the future city nevertheless green infrastructure is mostly (with some exceptions like green facades or green roofs) "low-tech" and therefore not recognized as "smart". The urban green infrastructure approach – to see green structures equivalent to other "smart" infrastructures within a city – can help to fulfill this task.

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Use of ICTs and Mass Media in the Planning Processes: the Two Sides of the Same Coin

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1 ABSTRACT

In recent years, Information and communication technologies (ICTs) and mass media are increasing used by governments within the decision-making processes, changing the modalities to involve citizens. Moreover, these types of tools entail different benefits, such as greater transparency and the promotion of participation. In particular, the research work focuses on planning processes at the regional scale, analysing the case study of the Sardinian Regional Landscape Plan (RLP). Indeed, during the elaboration and implementation of the RLP, Web sites, blogs and mass media have been used to encourage new forms of institutional communication and participation. On the other hand, political issues have negatively influenced the outcomes of planning processes. For example, newspapers and television have represented the political arenas where officials of the local and regional governments clashed over the modalities of implementation of the RLP. As a consequence, the specific purpose of the regional government policy has been to legitimate its supremacy over the planning choices at the local level, utilizing tools that should grant a greater transparency and involvement on behalf of the local communities within planning processes.

2 WEB 2.0 AND E-GOVERNMENT

Nowadays, the use of ICTs and mass media within decision-making processes represents an undeniable opportunity for governments at any level. Before introducing the use of the Internet and personal computers, governments have used technology in order to enhance the managerial effectiveness of public administrators and to increase productivity (Yildiz, 2007). In the recent decades, governments, at any level, have changed the way to involve citizens within decision-making processes, introducing two important concepts, such as Web 2.0 and e-government.

First of all, it is appropriate to define what the term Web 2.0 means. According to Chang and Kanan (2008, p. 10), Web 2.0 "…is a networked world supporting individual users creating content individually and collectivelly, sharing and updating information and knowledge using sophisticated, diverse sharing devices and tools, and remixing and improving on content created by each other. It is a network platform that allows high levels of user interactions…". Moreover, using Web 2.0 tools allows to display information, provide particular services and, in a wider perspective, to encourage and promote greater participation and collaboration (Sandoval-Almaza et al. 2012). In addition, Bertot et al. (2012) identify three important opportunities for the use of technology in governments: democratic participation and engagement, co-production and crowdsourcing solutions and innovations. The first is related to the opportunity to provide a voice in discussions of strategies and policies; the second concerns the improvement of service quality and responsiveness. The third entails the development of innovative solutions in relation to societal questions. Indeed, the use of Web 2.0 tools has transformed power relationships between citizens and governments, facilitating openness, transparency and democratization (Picazo-Vela at al., 2012).

As a consequence, the term "government" assumes the meaning of electronic government (e-government), which, as suggested by Gil-Garcia et al. (2006, p. 639) is "…the selection, implementation, and use of information and communication technologies in government to provide public services, improve managerial effectiveness, and promote democratic values and mechanisms, as well as the development of a regulatory framework that facilitates information-intensive initiatives and fosters the knowledge society". From the methodological perspective, Layne and Lee (2001) define a model that describes the e-government projects in relation to four stages. Although this model was developed in 2001, it remains extremely actual. In particular, the first phase, called cataloguing, concerns the provision of information through web sites. The second entails online transactions with government agencies. The third stage concerns the integration of government services within functional subjects; meanwhile the last phase regards horizontal integration. As a result, the first and the second stages focus on provision of government information and services, guaranteeing a unidirectional information flow and a two-way communication respectively. On the other hand, the last two phases concern the integration of e-government services and activities within the existing governmental framework.

From this conceptual perspective, the upcoming of computers and particularly of the Internet, with the consequential use of ICTs has entailed a wider potential contribution to transparency and participation in the planning processes (Bonsón et al. 2012). Indeed, the last two concepts, transparency and participation, represent two of the eight characteristics that a good governance should have in terms of free availability, direct access to information and freedom of expression and association (UNESCAP, 2011). In particular, transparency concerns the right to access government information, entailing important benefits, such as democratic participation, trust in government, accuracy of information and prevention of corruption (Cullier and Piotrowski, 2009). Moreover, the use of the Internet has reduces the costs of collecting, distributing and accessing information (Bertot et al., 2012).

On the other hand, although theoretically the use of ICTs and mass media within the planning processes should increase and promote transparency and public involvement, the real benefits of their utilization are related to forward-looking intentions and strategies. From this viewpoint, this paper aims at analysing the pros and cons of the use of ICTs and mass media within regional and urban planning processes. Moreover, this study attempts to answer the following research question: do regional governments use these tools whether to promote participation and enhance transparency or to obtain a greater consensus among local municipalities and citizens? In particular, the study intends to interpret the two sides of this issue through the analysis of a case study related to the Sardinian Regional Landscape Plan (RLP). In particular, the research work focuses on the use of ICTs and mass media within the participatory processes used during the elaboration and revision phases of RLP.

3 RESEARCH STRATEGY, DESIGN AND METHODS

The research is based on a qualitative strategy and a case study design with a triangulation of different methods that traditionally are included in qualitative or quantitative research approaches. The study intends to analyse the specific case of participatory approaches used during the elaboration and revision phases of Sardinian RLP. In particular, the research focuses on the landscape area number one called "Gulf of Cagliari" due to the size of region. Indeed, Cagliari represents a critical case study in the Sardinian context owing to complexity of interests at stake.

In addition, data have been collected through semi-structured interviews and self-completion questionnaires. The choice to use semi-structured interviews reflects the purpose of obtaining information without influencing the answers of the interviewees. Indeed, in qualitative research, the approach is not so much structured because the interviewees' viewpoints are the main focus. Moreover, the semi-structured interviews allow obtaining further information that is not strictly connected with the used schedule or model. Indeed, in this way it is possible to ask new questions in relation to the interviewees' replies. Therefore, the semi-structured interview method represents a more flexible instrument that allows obtaining subjective answers from the interviewees. In addition, semi-structured interviews have involved four members of the academic field and four officials of the regional government, in order to get in depth information from two different perspectives: the authority, which organizes the participatory process, and the experts in planning and participatory processes. In particular, the category of academicians includes different educational figures, such as PhD student, professor, and researchers. The choice of these specific scholars is related to their knowledge about the specific case study of the Sardinian RLP due to their researches or personal interests. From this perspective, their levels of experience in the planning field and the age are different from each other.

The self-completion questionnaires have involved nineteen people who are: officials of local and provincial governments, practitioners, technicians of building enterprises, members of environmentalist organisations and other public institutions. All the officials have an experience of more than five years in the regional government and their age varies between forty and sixty. On the other hand, this information is not detailed because the interviews have to be anonymous without the possibility of recognizing the interviewees. Indeed, the collection of personal information does not guarantee the anonymity of involved people, in particular in relation to technicians of small municipalities. Moreover, the questionnaires identify response sets in a likert scale from one to five. The number five and four represent satisfaction in relation to different aspects of participatory processes. Meanwhile, low numbers, such as one and two, indicate a low satisfaction. In addition, self-completion questionnaires were administered by email through the use of the Internet. This choice arises from both time and economic considerations. First of all, the use of the Internet entails immediacy of responses from participants. Secondly, no money was spent as in the case of postal questionnaires. However, this type of instruments implies an intrinsic uncertainty about the effective responses of participants.

For what concerns the analysis of data, the results of the semi-structured interviews are interpreted through a thematic analysis. Meanwhile, the results of questionnaires have been analysed through a statistical analysis in order to confirm or reject the concepts, and data of interviews.

The participation relating to interviews has been complete. However, the participation concerning the questionnaires has been only partial due to different reasons, such as lack of time or disinterest. Despite this failed participation, the interviewees have highlighted important and significant aspects that have balanced the problems of partial involvement of questionnaire's respondents.

4 CASE STUDY: SARDINIAN REGIONAL LANDSCAPE PLAN

Sardinia is one of the two main Italian islands with a population of around 1.8 million people in 2011 (Istat, 2011), with a rather low density (SardegnaStatistiche, 2008). In this section, the elaboration and revision phases of RLP are analysed in order to define the two participatory approaches and to identify the main problems.

The RLP was elaborated in 2005. The participatory approach was based on 24 co-planning conferences that involved local municipalities, provinces and organizations and associations relating to industry, commerce and craft (Regione Autonoma della Sardegna, 2006a). Moreover, information was guaranteed through two websites, the RLP website and the thematic website "Sardinia Territory", and the mass media.

First of all, the RLP website aims at releasing information in order to implement a new form of institutional communication. The website is composed of six sections: procedure, reports, regulations, cartography, conference and schedule of meetings. Moreover, each part contains information in relation to specific subjects. Indeed, for example, the "Procedure" section provides modalities and timetable of the elaboration and approval of the RLP. Secondly, only after the RLP was made available to the public was the website "Sardinia Territory" published on the Internet. On this platform, it could be possible to consult geographical information, aerial pictures and regional, provincial and local planning tools, through the use of GIS-based tools. Thirdly, mass media such as regional television channels and newspapers, represented important sources of information, as the mass media followed the entire process of elaboration of the RLP. Moreover, although the participatory process used during the elaboration phase aimed at defining a new planning tool that could be shared by local municipalities and the community in general, the approaches did not guarantee a real inclusive process due to a lack of effective participatory techniques or methods. In addition, a plan proposal has been elaborated yet and, for this reason, the participatory process was not directed to build sharing objectives and strategies that have already been identified by local government. Indeed, the implementation process was a failure that made it necessary to revise the RLP.

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Fig. 1: Landscape areas in relation to RLP (adapted from Regione Autonoma della Sardegna, 2006b)

From this perspective, the RLP has been subject to many criticisms in terms of contents, modalities to analyse the region, administrative competences and participatory approaches. In relation to these problems, the regional government has activated a revision phase of RLP, where the participation of stakeholders has acquired a fundamental importance through a participatory process called "Sardinia New Ideas". The aim of this process has been to build a multidirectional dialogue among regional government and other stakeholders (Regione Autonoma della Sardegna, 2010a). The new participatory process has been organized through operative and informal meetings called "landscape workshops", where representatives of coastal local municipalities have been involved (Regione Autonoma della Sardegna, 2010c). In addition, the information was disseminated through the website "Sardegna Territorio" [Sardinia Territory] and mass media as in the case of the elaboration phase. However, in the website "Sardegna Territorio" a tool "Sardegna Geoblog" [Sardinia Geoblog] was available in order to support the dialogue among different authorities which govern the territory. In a nutshell, this tool allowed the continuation of the participatory process. Moreover, it was possible to collect and share observations and suggestions in relation to planning (Regione Autonoma della Sardegna, 2010b).

In conclusion, the new participatory approach has solved some problems of the first phase, building a sharing scenario of region's values. However, even in this phase, the participatory process has been intentionally directed to public institutions without a direct involvement of citizens, contravening the normative approach of the European Landscape Convention to participation (Council of Europe, 2000).

5 DATA ANALYSIS

The participatory processes, used during the elaboration and revision phases have involved different problems in terms of ICTs and mass media. From this perspective, this section describes these negative elements in order to understand their implications for the participatory processes. Moreover, the data analysis intends to identify the benefits of the use of ICTs and mass media within the planning processes in order to understand if regional governments use these tools whether to promote participation and enhance transparency or to obtain a greater consensus among local municipalities and citizens.

The appropriate use of participatory tools can influence the effectiveness of participatory processes. In particular, the use of ICT tools and mass media could promote transparency of the participatory processes and public involvement. During the elaboration phase, the regional government used the RLP website, the thematic website called "Sardinia Territory" and mass media. Meanwhile, during the revision phase, the regional government used "Sardinia Territory", the "Sardinia Geoblog" tool and mass media.

First of all, the majority of interviewees argue that methods ant tools to involve stakeholders, used during the elaboration and revision phases, have influenced, in negative terms, the effectiveness of the participatory processes. These results are confirmed by the analysis of questionnaires (see figure 2), where around 77 percent of respondents consider the impact as whether "strong negative" or "negative".

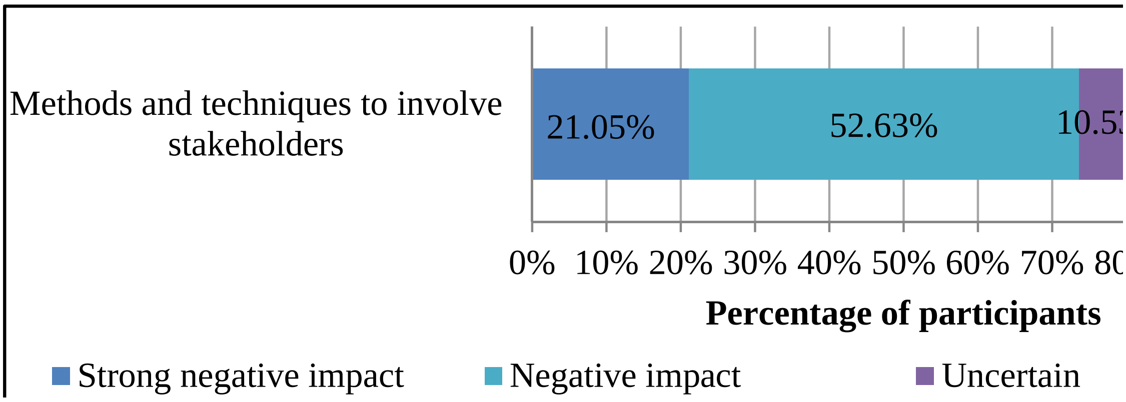

Fig. 2: Level of agreement in relation to methods and techniques to involve stakeholders, which have influenced in negative terms the effectiveness of the participatory processes used during the elaboration and revision of RLP.

In relation to the specific tools, the website Sardinia Territory and mass media were used in both elaboration and revision phases. All interviewees agree that this website should be useful in order to inform the local communities on the plan's contents. An academician argues that "...The website Sardinia Territory is an innovative tool. However, the utility of some functionality is poor. Indeed, the financial resources, which were spent to develop it, were ten times bigger than other European cases. In conclusion, Sardinia Territory represents an informative phase, not a real participatory tool..." On the one hand, the information was unidirectional without allowing having feedbacks from participants. On the other hand, the information was technically complex, not allowing a real understanding of the plan's contents. In other words, Sardinia Territory was a helpful tool for participation, but it did not guarantee a real participation. These observations are partially confirmed by the questionnaires. Indeed, the respondents of questionnaires highlighted a difference in the use of the tool Sardinia Territory between the elaboration and the revision phases. Indeed, in the first case, the most part of the respondents, around 37 percent, (see figure 3) consider this tool as either absolutely not appropriate or inappropriate. Moreover, the percentage of uncertain respondents is quite high, representing 32 percent. On the other hand, in the revision phase, 53 percent defines the website as either appropriate or absolutely appropriate, emphasizing an improvement with respect to its contents and use.

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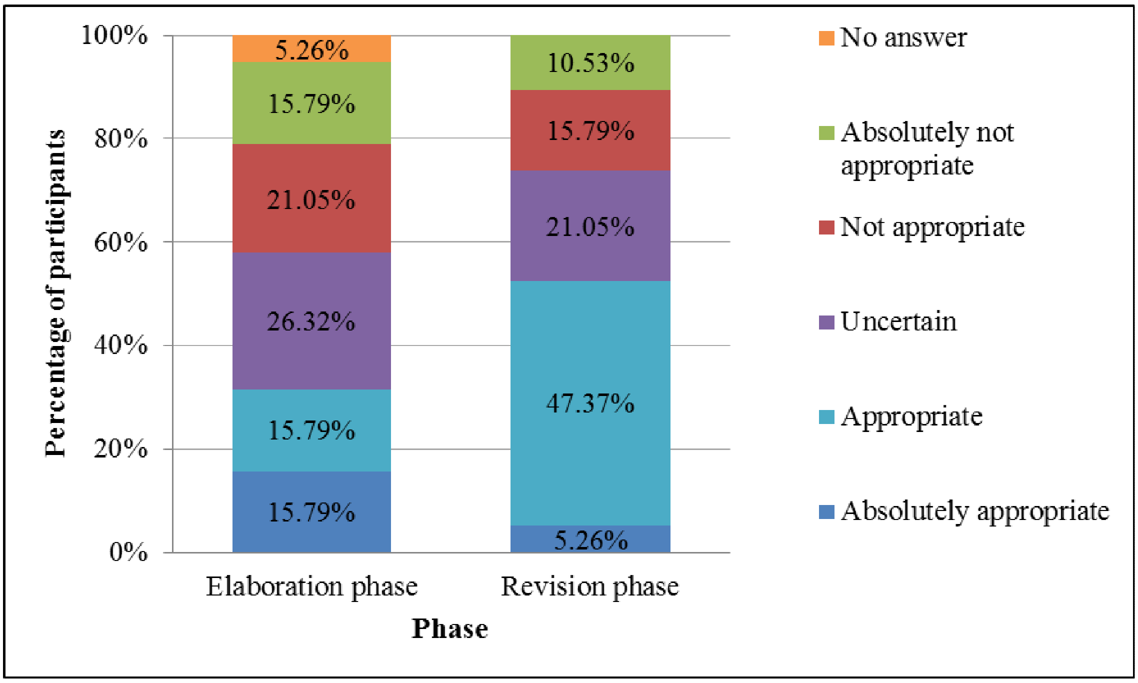

Fig. 3: Level of agreement in relation to the appropriateness of the tool Sardinia Territory in the elaboration and revision phases

In relation to mass media, the majority of interviewees agree that the elaboration of RLP has sensitized public and political opinion about the importance of landscape protection in relation to the sustainable development. Indeed, for example, an official of the regional government argues "...Although the participatory process is not defined as real and inclusive, it informed local community on the qualitative and quantitative values of a good landscape. Indeed, the regional government has conducted advertising campaigns through mass media, and the press...". From this perspective, one of the main goals of the regional government was to present the planning process and the plan as innovative. From this view, advertising campaigns through newspapers, television and the Internet, echoed on public opinion, which become more conscious of the landscape as a common good that need to be protected. On the other hand, some interviewees argue that despite this undeniable benefit, mass media, such as regional television channels and newspapers, demonstrated the controversial relationship between the regional government and local municipalities. Indeed, newspapers and television represented the political arena where officials of the local and regional governments clashed over the modalities of implementation of the RLP. The results of questionnaires partially confirmed this controversial opinion on the use of mass media in the elaboration and revision processes of RLP (see figure 4). Indeed, around 30 percent is uncertain in relation to the apropriateness of the mass media in the elaboration phase and around 10 percent does not answer. In relation to the revision phase, the percentage of uncertainty increases, achieving around 40 percent.

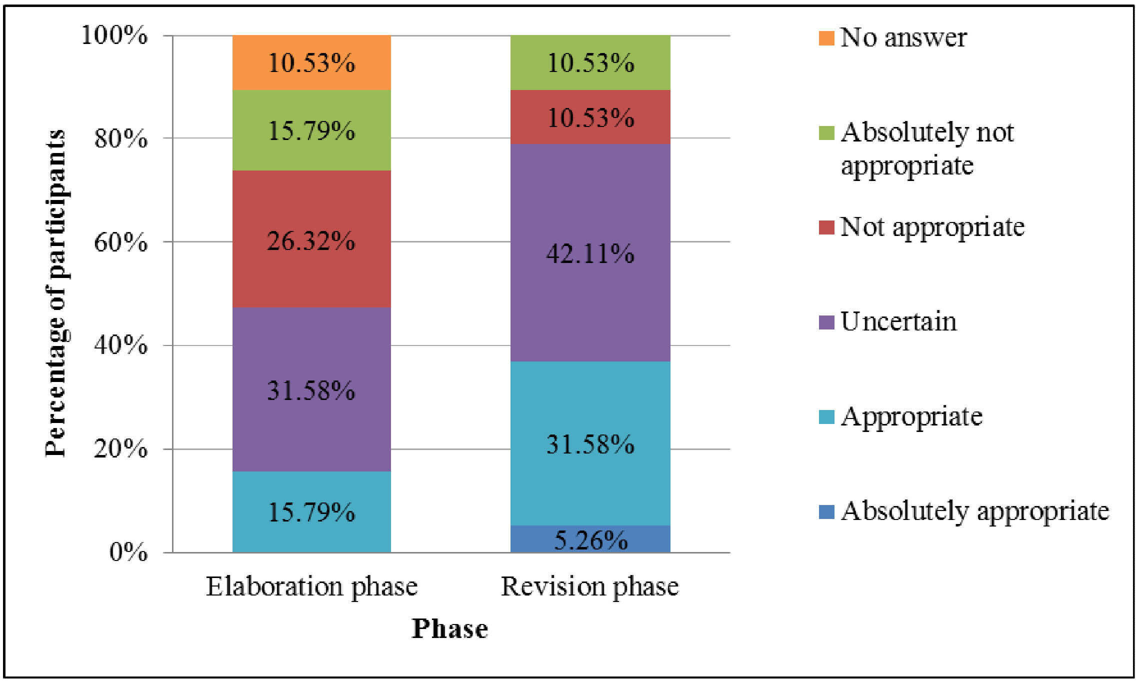

Fig. 4: Level of agreement in relation to the appropriateness of the mass media in the elaboration and revision phases

In relation to Sardinia Geoblog, it was used only in the revision phase and an official of the regional government considers this tool absolutely appropriate. However, the most part of interviewees argue that Sardinia Geoblog was not effective for two reasons, as follows. First of all, there was probably distrust with respect to the regional government's actions. Secondly, the officials of the local municipalities did not have enough time to interact through this new tool. Moreover, an academician argues that "... The technological platform of Sardinia Geoblog is efficient even if it copied the free functionalities of Google map. However, there were some management problems, such as the lack of a prior guideline on data elaboration in order to allow the integration among geographic information coming from different sources. Indeed, for example, a church can be represented by a point or a polygon. In addition, there was not a strong connection to the real planning processes..." These data are not confirmed by the questionnaires. Indeed, 42 percent of the respondents (see figure 5) argue that Sardinia Geoblog was either appropriate or absolutely appropriate in order to guarantee a real participation. On the other hand, the percentage of this uncertainty is significant, reaching around 37 percent. Moreover, in the technological platform there are not any posts that should prove the real change of information. From this perspective, it is easy to understand that although this kind of tool shows strong future potentialities, its real use created some management problems.

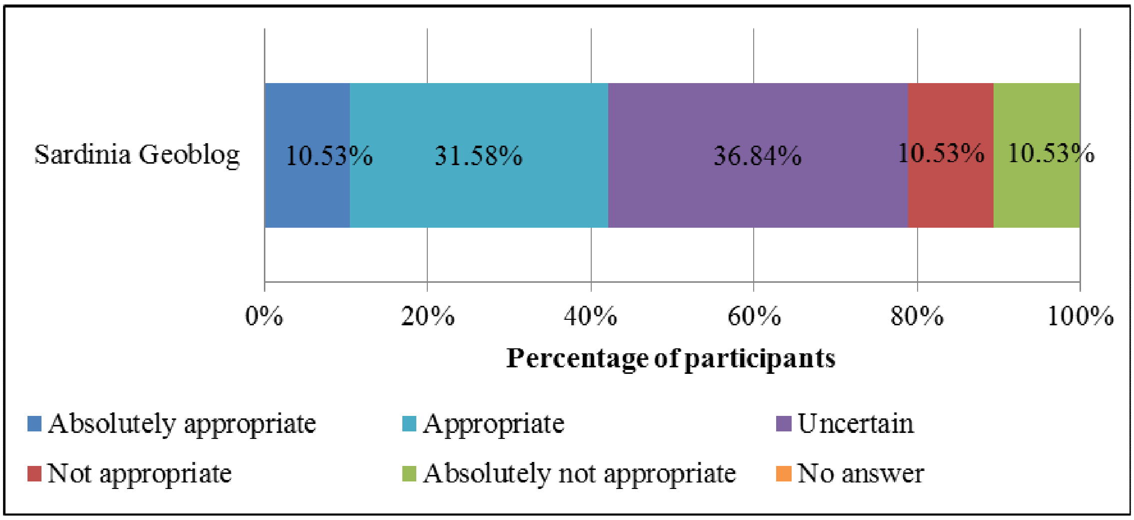

Fig. 5: Level of agreement in relation to the appropriateness of the tool Sardinia Geoblog, used during the revision phase

In conclusion, in the elaboration phase, ICTs and mass media were used to inform citizens about plan's contents without guarantee a real participation, due to a unidirectional communication flow. On the other

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hand, in the revision phase, despite its limited use, Sardinia Geoblog should guarantee a certain degree of interactivity. From this perspective, a more conscious awareness and culture of the importance of participation would be necessary in order to take further steps forward. Indeed, ICTs and mass media are useful tools if their use is inspired by forward-looking intentions.

6 CONCLUSION

The research work concerns the analysis of the participatory approaches in support of the decision-making processes. In particular, the case study of the Sardinian RLP is analysed in order to identify the pros and cons of the use of ICTs and mass media within regional and urban planning processes. In particular, the study intends to interpret these controversial aspects that characterised the use of ICTs and mass media within the planning process, providing the final considerations and recommendations coming from the research work.

The data analysis has emphasised the undeniable dualistic nature of ICTs and mass media. Sardinia Territory, Sardinia Geoblog and mass media represent tools, and for this reason, the appropriateness of their use is influenced by intentions and aims that inspire their utilization. As a consequence, the data analysis point out a main theme concerning the impact of political ideas on the planning decisions. Indeed, the appropriateness of tools can be connected with political and management issues. The analysis highlights that the main problems of tools are linked to incapacity or not will of the regional government to conduct a real participatory process. This situation is clearly traceable in the elaboration phase; meanwhile, in the revision phase political influences seem less important. For example, respondents of questionnaires underline an improvement in the appropriateness of Sardinia Territory, from the elaboration to the revision phases.

From this perspective, in the elaboration phase, the aim of the process aimed at establishing the supremacy of the regional government over the planning choices at the regional and local levels. In no way was the participatory process conducted to build a multidirectional dialogue between the regional government and the local municipalities, where the individuation of the communities' needs and the definition of sharing strategies and objectives could represent two important priorities. Moreover, during the elaboration phase, the power relationships were imbalanced. Indeed, the strong and managerial regional government structured the participatory process in relation to the idea that local municipalities did not have skills, competences, capacities and culture in order to take part in the planning process in an efficient way. However, the regional government not conduct effective information campaigns in order to train technical personnel in the local municipalities, and did not elaborate strategies for enhancing skills and competences in order to enable participation.

In relation to the revision phase, the absence of a shared awareness on the importance of participation in support of the decision-making processes entails, as a consequence, that practitioners and politicians do not have enough skills to apply participatory methodologies in an efficient way. On the other hand, the new participatory process sought to compensate for the problems of the elaboration phase. This improvement could be entailed by an increased attention and awareness of the importance of participatory practices. However, these apparently forward-looking intentions could be ensued by a specific idea. Indeed, the RLP established in the first phase, was elaborated by a regional government which belong to an opposite political alignment. Therefore, this increased awareness may conceal a specific political aim to represent itself as a forward-looking administration in order to increase consensus among citizens, local and provincial administrations, practitioners and the economic and productive sectors. On the other hand, this hypothesis could be confirmed or rejected only by the new RLP that will demonstrate whether the participatory process influenced the planning process.

Moreover, analysing the Sardinian planning situation in Sardinia in its entirety, the lack of communication and coordination between regional and local governments is exacerbated in relation to the contrast between coastal and inland areas. In the case of inland areas, the lack of communication and coordination has entailed a "hole" in the planning system that should govern the territory. The Sardinian regional planning system assumes the form of a "doughnut". The coastal areas are regulated by the RLP, whereas in the inland municipalities, only the historic centres are analysed in the RLP.

The essay focuses on the use of ICTs and mass media by the regional government. On the other hand, Sardinia Territory and newspapers are tools to involve citizens that are not experts. As explained in the data analysis, the electronic and not article, used to inform local communities, were technically complex. It could be necessary a sort of facilitator in order to guarantee that all citizens could understand. Moreover, rarely do the older citizens use websites and other tools on the Internet. In this way, the use of ICTs could exclude all those citizens who do not use these kinds of technology.

In conclusion, by recognizing the intrinsically dualistic nature of the use of ICTs and mass media within the planning processes, the appropriateness of their utilization concerns the intentions and aims that inspire this specific planning process. As a result, "learning from failing" represents an important lesson of the research work. Indeed, despite the undeniable failures that characterise the current use of ICTs and mass media within the planning processes, these tools remain significant elements that could give a decisive contribution to the effectiveness of planning decisions.

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reviewed paper

Virtuelle Leerstandsbespielung – „Pop-Up-Zwischennutzung“ mittels Augmented Reality

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1 ABSTRACT

Seit Jahrhunderten ist die europäische Stadt im Wandel. Für Stadtquartiere und Bauwerke müssen immer wieder neue Nutzungen gefunden werden. Neue Technologien, Wirtschaftsformen oder kulturelle Vorlieben lösen einen Strukturwandel aus, der dazu führt, dass Gebäude ihre eigentliche Nutzung verlieren und leer stehen (Langenbrick et al. 2012:8).

Leerstände von Geschäfts- und Wohnräumen waren schon immer ein Problem innerhalb des Stadtgefüges. Aufgrund knapper Ressourcen als auch regionaler Disparitäten rücken sie zunehmend in das Blickfeld der räumlichen Planung. Wichtig ist es, Zukunftsperspektiven für den jeweiligen Standort zu erkennen und von Anfang an in die Planungen und Maßnahmen mit einfließen zu lassen.

In diesem Kontext können Augmented Reality Technologien als Kommunikations- und Informationstools in der Leerstandsbewältigung eingesetzt werden. Augmented Reality spielt digitale Informationen auf eine reale Umwelt, so dass Smartpones mit den realen Objekten in Kommunikation treten können. Zukünftige Ladenkonzepte können so in einer Art augmentiertem Pop-Up-Store schon zum Zeitpunkt der Konzeption sichtbar gemacht werden.

Mobile Partizipation mittels Augmented Reality kann als zusätzliches Informationstool dazu beitragen, ein Projekt der Bevölkerung zu kommunizieren. Die Begeisterung für die Technik soll Ideen in die Köpfe der Menschen „pflanzen“. Augmented Reality bietet einen niedrigschwelligen Zugang zum Thema Leerstand, mit Spaß, kreativen, witzigen und spielerischen Ideen.

Das vorliegende Paper erörtert die Methode der virtuellen Leerstandsbespielung und demonstriert anhand eines praktischen Beispiels, wie diese in der Realität umsetzbar ist. Ziel des umgesetzten Projektes war es, neben der Visualisierung zukünftiger Potenziale das Thema “Bespielung von Leerständen” in einer spielerischen Art so zu vermitteln, dass eine reale Umsetzung angeregt wird.

2 PROJEKTIDEE – LEERSTÄNDE THEMATISIEREN, ÖFFENTLICHKEIT EINBEZIEHEN

Als Planer laufen wir durch die Geschäftsstraßen der Innenstadt und unterziehen diese mit unserer Wahrnehmung, meist unbewusst, einer Bewertung. Wir entdecken gestalterische, funktionale oder strukturelle Defizite und malen uns in unseren Gedanken aus „was wäre wenn”? Was wäre wenn in dem seit Jahren leer stehenden Kaufhaus auf der Ecke wieder reges Treiben herrschen würde? Menschen würden aus- und eingehen, die Laufkundschaft würde sich auch auf die anderen Geschäfte übertragen. In unseren Gedankenspielen produzieren wir uns „Scheinwelten“ in denen wir die Innenstadt lebendiger und lebenswerter machen. Diese Gedanken gilt es festzuhalten und zu visualisieren, um sie der Öffentlichkeit mittels Augmented Reality zu kommunizieren.

Genau an diesem Punkt setzt das Projekt der virtuellen Leerstandsbespielung an. Mittels Augmented Reality (AR) - Methoden sollen diese Gedankenspiele als digitale Pop-Up-Stores festgehalten und kommuniziert werden. Denn die Entwicklung von Leerständen und deren Zwischennutzung soll möglichst von vielen Akteuren getragen und unterstützt werden. Interessierte Bürger und urbane Aktivisten sollen daher stärker in diese Prozesse eingebunden werden. Smartphones und mobiles Web bieten mittels AR die Möglichkeit, einen neuen Informationskanal zu nutzen, der einen spielerischen Ansatz eröffnet. Es ist eine neue Form, die „Stadt im Konjunktiv auszumalen” (Rauterberg 2013:102), um Visionen für die Zukunft des urbanen Raums zu entwickeln. Pop-Up-Stores zeichnen sich durch zeitlich begrenzte Öffnung, kulturelle Veranstaltungen, Kombination mit einem Café oder einer Bar, geringes Budget, Werbung durch Mund-zu-Mund-Propaganda, oder dem Ruf als Geheimtipp aus. Sie sind mittlerweile in vielen Städten als Zwischennutzung erprobt.

Abbildung 1: „Pop-Up-Zwischennutzung“ mittels Augmented Reality (Eigene Darstellung)

Übertragen auf das Konzept der Virtuellen Leerstandsbespielung bedeutet dies, dass die Ideen und Konzepte spielerisch umgesetzt werden, um möglicherweise Nachahmer - gerade außerhalb der Fachdisziplin - zu finden und hierdurch den Ansatz zu verfestigen. Der spielende Mensch als medial kompetenter Akteur einer neuen Auffassung von Stadtplanung (Streich 2011:217). Unter dem lateinischen Ausdruck Homo (Mensch) ludens (spielend), versteht man den spielenden und dadurch schöpferischen Menschen (Academic 2012). Der bedeutende Spieletheoretiker Johan Huizinga erhebt das Spiel zur Grundlage jeder Kultur und prägt den Begriff Homo ludens. Huizinga stellt Recht und Krieg, Wissenschaft und Dichtung, Philosophie und Kunst unter das Vorzeichen des Spiels (Huizinga 1956:20). Das Spiel ist nach Huizinga eine kulturschaffende menschliche Aktivität, welche freies Handeln erfordert, nicht an ein materielles Interesse geknüpft, sowie zeitlich und räumlich begrenzt ist (Prill 2002:14-15). Gerade hinsichtlich mobiler Kommunikationsgeräte werden diese Ansätze unter dem Begriff der „Gamification” diskutiert. Die per AR visualisierten Ideen sollen ein Bild des Möglichen entwerfen und die Betrachter zu neuen Ideen und deren Umsetzung in die Tat inspirieren.

3 GRUNDLAGEN

3.1 M-Partizipation

Die mobile Partizipation (M-Partizipation) ist ein Teilgebiet der E-Partizipation und die Weiterentwicklung von der Desktop-basierten Beteiligung hin zur mobilen Beteiligung. Diese kann daher wie folgt definiert werden: „Der Oberbegriff M-Partizipation umfasst sämtliche Initiativen, Maßnahmen und Methoden, welche auf mobilen Endgeräten (z. B. Mobiltelefonen, Smartphones und Tablets) via drahtloser Kommunikationstechnologie erfolgen, um die Mitwirkung von Bürgern und anderen Akteuren an stadtplanerischen Prozessen zu erweitern.” (Höffken 2014:106). Sie erweitert und vertieft die Beteiligung der Bürger und Akteure dadurch, dass sie in einer neuen zeitlichen und räumlichen Dimension untereinander in Verbindung treten können, um Informationen auszutauschen, zu kommentieren und abzustimmen (Höffken, Streich 2013:225).

Der Informations- und Datenaustausch findet nicht nur über Text statt, integrierte Kameras und Mikrofone ermöglichen die Aufnahme von Bild, Ton und Video. Die GPS-Komponente der mobilen Geräte erlaubt einen Raumbezug auf Basis von digitalen Karten herzustellen, um zusätzliche Informationen, (bspw. 3D-Modelle) hinzuzufügen.

3.2 Augmented Reality

Augmented Reality oder zu Deutsch „Erweiterte Realität“ lässt sich den realitätsvirtualisierenden Methoden zuordnen. Unter dem Begriff kann man alle Techniken zusammenfassen, die mit Hilfe von Computersystemen eine Verbindung zwischen einer simulierten und einer realen Umwelt herstellen (Streich 2011:229). Bei der Augmented Reality wird die Realität durch Bilder, Videos oder 3D Modelle des Projektes überlagert. Eine Kombination von virtuellen und realen Objekten entsteht. Hierfür benötigt ein System vier Komponenten (Zeile 2012):

- Die Recheneinheit oder auch Renderer projiziert den virtuellen Inhalt in Echtzeit auf den richtigen Platz.
- Die Anzeigeeinheit, eine spezielle Brille oder ein Display, stellt die Inhalte dar.
- Die Trackingeinheit erfasst den Standort des Benutzers und errechnet außerdem dessen Blickrichtung, wird jedoch nur bei sensorbasierten Methoden benötigt – siehe Abschnitt „Visuell- vs sensorbasierte Methoden".
- Die Aufnahmesensorik in Form einer Kamera erfasst die realen Objekte.

Dass Augmented Reality mittlerweile immer alltagstauglicher wird, geht vor allem auf den Siegeszug der Smartphones zurück. Die handlichen Geräte bieten alles, was zum Starten von AR-Anwendungen nötig ist: Der integrierte Lagesensor zum Bestimmen des Standorts sowie der Blickrichtung und die Möglichkeit, mittels einer Software virtuelle Objekte über die Kamera in Echtzeit auf die Realität zu projizieren (Zeile 2012:27). Dennoch kämpft diese neue Technologie immer noch mit technologischen Problemen, hohen programmiertechnischen Anforderungen und einer teilweise schlechten Darstellung der virtuellen Inhalte. Diesen Problemen wird im Kapitel „Technische Umsetzung" begegnet.

AR ist ein modernes Format, dass das Potential hat vor allem bei jungen Leuten Interesse zu wecken. Beispielsweise stellt die erweiterte Realität eine gute Möglichkeit dar, jungen Menschen die Leerstandsbespielung zu kommunizieren. Sie assoziieren die schicken Bilder von kreativen, kulturellen Nutzungen mit Spaß und werden so dazu motiviert, selbst aktiv zu werden. Angebote sollen über AR vermittelt werden und zu kulturellem Aktivismus aufrufen.

3.3 Leerstand und Pop-Up-Stores

„Leerstand ist ein Naturgesetz – oder zumindest ein kulturelles Phänomen, genauso wie die Brache in der Landwirtschaft. Dort wird Brache nicht als Schande oder Problem interpretiert, sondern als notwendige Erholungsphase vor der nächsten Saat" (Bürgin zitiert nach Langenbrick et al. 2010:9). Viele Städte haben heute, vor allem in den 1b-Lagen, mit Ladenleerständen zu kämpfen. Sie tragen zu einem Attraktivitätsverlust der Standorte bei und können so eine Abwärtsspirale in Gang setzen oder verstärken. Solche Trading-Down-Prozesse umzukehren, stellt die zentrale Herausforderung der Entwicklung von innerstädtischen Geschäftsbereichen und Stadtteilzentren in der Zukunft dar (Froessler 2009:13). In Bezug auf Ladenleerstände sind Zwischennutzungen ein erster Schritt zur Verbesserung des Erscheinungsbildes eines Ladenlokals und dienen auch zur Stabilisierung des Umfelds. Von ihnen geht die Botschaft aus, dass dieser Standort nicht aufgegeben wird (Bentler 2003:11).

In der heutigen Zeit wird Pop-Up im alltäglichen Umgang vielfach mit „visuellen Elementen eines Computerprogramms" – den sogenannten Pop-Up-Fenstern – in Verbindung gebracht. Im Bereich der Architektur spricht man von Spontan- oder Pop-Up-Architektur, während im Kontext von Zwischennutzungen – gerade bei Ladenleerständen – vielfach von Pop-Up-Stores gesprochen wird. Als Pop-Up-Stores werden häufig Läden bezeichnet, deren Öffnungszeiten nur über relativ kurze Zeitspannen von wenigen Tagen bis einigen Monaten reichen (Hurth 2010:33). Pop-Up-Stores sind weit mehr als nur temporäre Läden mit schlichtem Design und geringem Investitionsaufwand. Sie haben noch andere, gemeinnützige Eigenschaften, die sie mit der Spontanarchitektur verbinden. Der Architekt und Initiator von „Stuttgart PopUp", Peter Welgand, spricht im Zusammenhang mit Pop-Up Zwischennutzungen von Modellen oder lebensgroßen Prüfständen für urbane Projekte im realen Stadtraum, deren Ziel eine entspannte Labor-Situation ist: „Man kommt mit Bürgern und Nutzern der jeweiligen Quartiere ins Gespräch und gewinnt dabei Informationen über die Interessen der Menschen, die sich „betroffen" fühlen von Bauvorhaben und Entwicklungsplänen." Unter dem Gesichtspunkt der Kommunikation könnten Pop-Up Nutzungen als neues Instrument der informellen Bürgerbeteiligung genutzt werden (Marquart 2012:6-8).

„Die Pop-Up-Stores können gegen den Leerstand helfen" sagt Stephanie Leyser, die Geschäftsführerin der Bundesvereinigung City- und Stadtmanagment. „Bevölkerung und potenzielle Mieter nähmen die Räumlichkeiten ganz anders wahr, wenn sie belebt sind und ganz nebenbei schütze die Nutzung vor Vandalismus" (Haag 2008).

4 TECHNISCHE UMSETZUNG

4.1 Geodatenbank

Eines der Kernprobleme aktueller Augmented Reality Services ist die Verfügbarkeit von Daten. Diese können nur innerhalb dieser Services abgerufen werden und erlauben so nur einen eingeschränkten Zugriff. Auch erweist sich das Erstellen und zur Verfügung stellen von Daten teilweise als sehr komplex. Nutzer müssen eigene Programmierschnittstellen zur Programmanbindung (API) aufsetzen oder es werden nicht standardisierte Metadatenformate verwendet. Außerdem können die Systeme oft nur speziell aufbereitete Daten nutzen, ein Einfügen oder Kopieren von möglicherweise relevanten Daten ist nicht möglich.

Um diese Problematik zu bewältigen, wurde im Kontext des vorgestellten Projekts die am Deutschen Forschungszentrum für Künstliche Intelligenz (DFKI GmbH) in Kaiserslautern entwickelte RADAR-Plattform[1] eingesetzt. Sie realisiert eine webbasierte Infrastruktur, die das Einspielen, Integrieren, Verwalten und Teilen beliebiger Formen von Geodaten erlaubt. Mit Hilfe verschiedenster Adapter können dieses Geodaten auf einfache Weise in anderen Kontexten und Applikationen wie etwa Augmented Reality Services genutzt werden (Memmel 2012). Um digitale Inhalte mittels geobasiertem AR erlebbar zu machen, muss zunächst auf der RADAR-Plattform eine Gruppe mit den Inhalten angelegt werden, die die AR-App abrufen soll. Die Mitglieder der Gruppe übernehmen die Verwaltung der zusammengeführten Daten. Inhalte können von allen Mitgliedern der Gruppe ergänzt und bearbeitet werden. Auf diesem Weg kann nach dem Prinzip des “Crowdfunding” jeder Bürger mit dem Beitritt in die Gruppe seine Ideen einbringen.

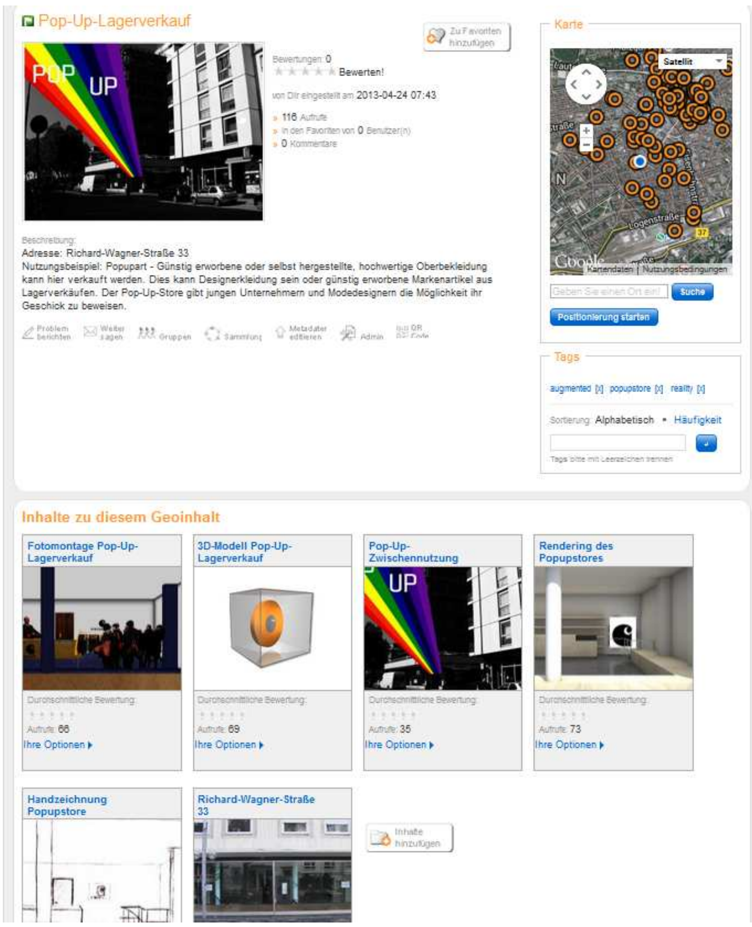

Abbildung 2: Screenshot aus der genutzten RADAR-Plattform (kl.radar-projekt.de)

4.2 Marker vs geobasierte Augmented Reality

Im Planungsprozess stehen dem Nutzer zwei verschiedene Techniken zur Verfügung, um die Position der virtuellen Inhalte in der Realität festzulegen. Diese sind zum einen GPS gestützte Verfahren zur Geolokalisation und zum anderen sogenannte Marker. Die Geolokalisation zeigt Inhalte mithilfe des GPS-Empfangs am Ort an. Prinzipiell können alle mobilen Endgeräte mit GPS diese Inhalte anzeigen. Der Vorteil

[1] http://radar-project.de

der Geobasierten AR ist, das die POIs besser gefunden werden können, da die Layar-App diese inklusive Entfernung anzeigt, sobald der Betrachter sein Smartphone in dessen Richtung hält. Außerdem kann über die Einstellungen eine Liste oder eine Übersichtskarte der POIs angezeigt werden. Negativ für die Leerstandsbespielung sind die ungenaue Verortung, sowie die schlechte Darstellung der virtuellen Inhalte. Marker bieten eine bessere Darstellung der erweiterten Realität durch eine direkte Überlagerung der realen Objekte. Weiterhin müssen sie nicht über GPS verortet werden und sind somit immer auf der gewünschten Position. Dies sind wichtige Eigenschaften für eine gelungene Präsentation der Beispiele für Pop-Up Nutzungen. Negativ ist der teilweise Ausfall der Marker durch äußere Einflüsse, da als zu überlagernde reale Objekte, die Schaufenster der Ladengeschäfte dienen und diese durch Reflexionen temporär unbrauchbar werden können. Dem kann durch das Einpflegen mehrerer Marker, mit unterschiedlichen Lichtverhältnissen, im Layar-Creator entgegen gewirkt werden.

Lösung: Am Besten wäre eine Kombination aus beiden, so könnte man die Vorteile der besseren Überlagerung der realen Welt durch Marker, mit dem einfacheren Finden der verschiedenen virtuell bespielten Leerstände mittels GPS verbinden. Eine solche Kombination bietet Layar Vision aber auch ein Entwickler-Tool von Junaio. Beide sind jedoch kostenpflichtig und finden deshalb in dieser Arbeit keine Verwendung.

Deshalb wurde in dieser Arbeit der Layar-Creator und der Layar Developers Account verwendet – zwei kostenlose Entwicklertools. Über die Navigation des geobasierten Layar Developers Account soll der Nutzer des AR-Kanals zu den bespielten Ladenlokalen geführt werden. Dort weist ihn ein Hinweisplakat darauf hin, dass er das bespielte Ladenlokal erreicht hat und zeigt ein Bild des zu scannenden Markers, welcher über den Layar-Creator eingespielt wurde. Die angezeigten Nutzungsbeispiele werden durch einen Link zur RADAR-Plattform ergänzt, wo weitere textliche Informationen und ein Überblick über die Visualisierungen warten.

5 BEISPIEL POP-UP-ZWISCHENNUTZUNG IN KAISERSLAUTERN

Die Einzelhandelsverträglichkeitsstudie zum Bau des ECE-Centers in Kaiserslautern kam bei ihren Untersuchungen unter anderem zu dem Schluss (Beschlussvorlage 0039/2011): „Es ist bei der derzeitig zu beobachtenden Entwicklung eventuell erforderlich, ein Leerstandsmanagement aufzubauen.“ Um Leerständen entgegen zu wirken muss Kaiserslautern attraktiver werden. In unserer mobilen Gesellschaft zieht es die Menschen dorthin, wo sie die besten Lebensbedingungen vor finden. Deshalb benötigt die Stadt eine buntere, vielfältigere und in der Öffentlichkeit präsentere (Sub-) Kultur. Pop-Up Zwischennutzungen sind bereits in vielen Städten erfolgreich erprobt. Die Idee ist es, diese nach Kaiserslautern zu holen und dadurch einen Beitrag für eine lebenswerte Stadt zu leisten. Mittels Augmented Reality soll das Thema auf eine neue Weise präsentiert werden um Impulse zu geben und möglicherweise eine neue Form kreativer Nutzungen zu etablieren – eine Virtuelle Leerstandsbespielung als Maßnahme zur Standortentwicklung.

5.1 Konzeptidee

Im Rahmen der Arbeit wurden mehrere, nach Thema Zielgruppe und Raumverfügbarkeit unterschiedene Konzepte für mögliche Pop-Up Zwischennutzungen entwickelt.

Das Konzept des Pop-Up Hobby-Shop zum Beispiel sieht vor, dass Bürger im Rahmen ihres Hobbys produzierte Güter verkaufen können. Dies dient der Entwicklung alternativer Ökonomien und ist wichtig zum Ausprobieren von Ideen für junge Kreative.

Weitere Pop-Up-Konzeptideen sind:

- Der Kreativladen - Mitglieder der Kernbranchen der Kreativwirtschaft Kaiserslauterns können hier ihre Produkte verkaufen.
- Der Hobby-Shop - Bürger können hier im Rahmen ihres Hobbys produzierte Güter verkaufen.
- Der Lagerverkauf - Günstig erworbene oder selbst hergestellte, hochwertige Oberbekleidung kann hier verkauft werden,
- Die Soccerarena - Größere Leerstände können temporär durch eine Indoor Soccerarena in Verbindung mit Kleingastronomie genutzt werden.
- Die Leere Küche - Leerstände können temporär durch ein Restaurant mit kleinem, aber hochwertigem Angebot genutzt werden.

- Das Frühstückskino - Zwischen 5 und 8 Uhr morgens werden hier Filme gezeigt und Frühstück serviert.

Abbildung 3: Fotomontage des Nutzungsbeispiels Pop-Up Hobby-Shop (Eigene Darstellung)

Neben der Leerstandsbewältigung weisen Pop-Up-Nutzungen auch andere soziale und ökonomische Aspekte auf, welche das Leben der Menschen in Kaiserslautern bereichern können. Diese lauten im Einzelnen wie folgt:

- Social Networking: Pop-Up-Nutzungen sind ein Forum für Bürger, Kreative, Produzenten und Unternehmer.
- Start-Up-Chance: Sie bieten jungen, kreativen Menschen die Chance mit Geschäftsmodellen zu experimentieren.
- Unterhaltungswert: Sie wirken positiv auf das Image der Stadt Kaiserslautern, da sie durch ihren kulturellen Mehrwert für eine bessere Lebensqualität sorgen.

5.2 Präsentation

Die Virtuelle Leerstandsbespielung wurde mit der markerbasierten und der geobasierten Augmented Reality veröffentlicht. Die geobasierte Variante bietet eine bessere Übersicht über die bespielten Leerstände, die markerbasierte Variante entspricht der Vorstellung einer erweiterten Realität, durch Mischen der digitalen Visualisierungen mit den realen Objekten. Deshalb wurde ein Leitsystem entwickelt, welches die Vorzüge der beiden AR-Methoden miteinander verbindet.

In der Geodatenbank RADAR wurden ausgewählte Leerstände verortet und mit verschiedenen textlichen und bildlichen Informationen versehen. Über den Augmented Reality-Kanal „Pop-Up KL“ wurden diese Informationen dann weiter veröffentlicht. Der Ablauf für den Nutzer gliedert sich folgendermaßen:

- Orientierung: Der Nutzer ruft mit seiner Layar-App den AR-Kanal ab und wird zu den bespielten Leerständen geführt (siehe Abbildung 4) - geobasierte AR.

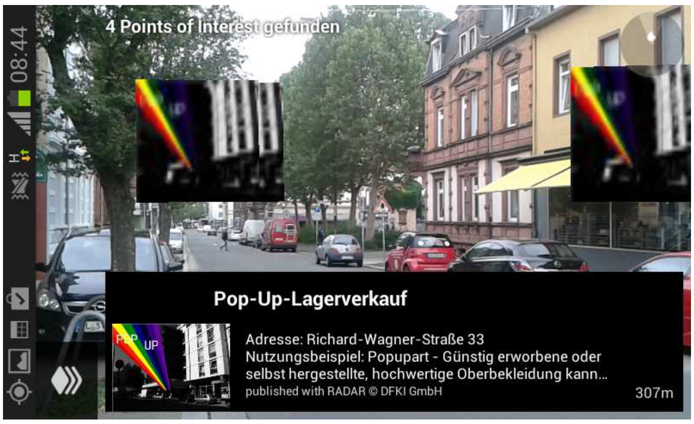

Abbildung 4: Orientierung durch die Geobasierte Augmented Reality (Layar App)

- Scannen: Hat der Nutzer den Leerstand erreicht, wird er von einem dort angebrachten Plakat dazu aufgefordert, das Schaufenster mit der Layar-App zu scannen (marker-basierte AR). Unterstützt wird der interessierte Betrachter dabei durch eine Abbildung des Schaufensterbereichs (siehe Abbildung 5). Das Schaufenster dient der AR-App als Marker, der von der Smartphone-Kamera erkannt wird und den Bezugspunkt für die projizierten Inhalte dient. Damit die digitalen Inhalte angezeigt werden ist es wichtig, dass die Kamera exakt den Bereich des Markers fokusiert. Die Abbildung des Schaufensters dient als Hilfestellung für die Anwender.

Abbildung 5: Der Nutzer hat das Ziel erreicht (Eigene Darstellung)

- Betrachtung: Eine Fotomontage des Konzeptvorschlags Pop-Up Lagerverkauf überlagert den Innenraum eines Gewerbeleerstands. Abbildung 6 zeigt die zusätzliche markerbasierte Veröffentlichung der Ideen.

Abbildung 6: Beispiel Pop-Up-Lagerverkauf - markerbasiert (Layar-App)

Auf diese Weise kann der Nutzer direkt vor Ort unterschiedliche Varianten begutachten und sich im „realen" städtischen Raum die neuen Nutzungen „vor Augen führen". Damit führen solche Visualisierungen zur Inspiration und verändern die Wahrnehmung der Nutzer.

Neben Plakataushängen soll über Mund zu Mund Propaganda und soziale Netzwerke Aufmerksamkeit auf die virtuelle Leerstandsbespielung gelenkt werden. Bei einem Bürgerworkshop im Rahmen eines Straßenfestes kann für weitere Aufmerksamkeit gesorgt werden. Ideen für Pop-Up-Nutzungen können bei solchen partizipativen Projekten skizzenhaft mit Handzeichnungen festgehalten werden, um sie später führ die Öffentlichkeit mittels Augmented Reality zu veröffentlichen. Durch ein Bildbearbeitungsprogramm, lässt

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sich das weiß des Zeichenblattes transparent schalten sowie die Farbe verändern. Die Transparenz sorgt dafür, dass sich die Zeichnungen besser in die Realität einfügen.

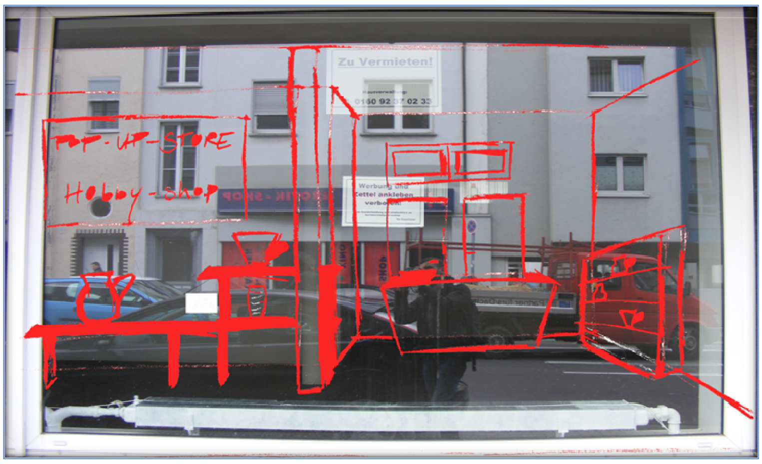

Abbildung 7: Nachbearbeitete Handzeichnung (Eigene Darstellung)

6 ERKENNTNISSE

Die Arbeit zeigt, dass Augmented Reality von technischer Seite aus, wenn auch mit etwas Improvisation, als Informationstool in Planungsprozessen eingesetzt werden kann. Sie setzt eine virtuelle Leerstandsbespielung um, bei welcher Visualisierungen von Pop-Up-Nutzungen auf leerstehende Ladenlokale projiziert werden. Ziel einer praktischen Anwendung ist es, das Thema der temporären, kreativen Umnutzung von Ladenlokalen spielerisch zu vermitteln, als Inspiration zu dienen und zur Umsetzung anzuregen.

Der Beitrag stellt die Werkzeuge für eine Virtuelle Leerstandsbespielung vor und liefert ein umsetzbares Konzept. Es fehlt jedoch noch an der praktischen Anwendung, um Schlüsse über die Effektivität dieses vielleicht neuen informellen Instruments der Raumplanung ziehen zu können. Deshalb lässt diese Arbeit offen, ob Augmented Reality die Leute tatsächlich dazu anregt, eine temporäre Nutzung zu starten. Vorab kann jedoch angenommen werden, dass Pop-Up Nutzungen nicht das alleinige Mittel zur temporären Nutzung von Leerständen sind. Sie sind nur ein kleiner Teil eines Aufwertungsprozesses, der zusammen mit anderen Maßnahmen für eine lebendige Stadt umgesetzt werden kann.

Die Bespielung von Leerständen mittels AR sollte auch auf andere Zwischennutzungen übertragen werden. Durch das breitere Angebot von möglichen Nutzungen wäre es wahrscheinlicher, mögliche Zwischennutzer zu finden.

Die Leerstände sollten direkt und ohne Komplikationen seitens der Stadt oder des Vermieters, bezugsfertig sein. Deshalb sollte die Politik Aufklärungsarbeit bei Immobilienbesitzern betreiben und erläutern, dass Immobilien einen Imagegewinn durch eine Pop-Up-Zwischennutzung erfahren. Ein Eingreifen der Politik ist erwünscht. Außerdem sollte die Stadt bei Mietverträgen zwischen den Akteuren vermitteln, um Vermietern und Zwischennutzern rechtliche Sicherheit zu geben. Viele Städte setzen hierfür eine Zwischennutzungsagentur ein, welche Leerstände für Zwischennutzungen bereit stellt und auf Anfrage, Leerstände an Zwischennutzer vermittelt. Wie im Ausblick beschrieben kann eine Art Zwischennutzungsagentur auch von freiwilligen Initiativen wie den Raumpiraten über eine Geoweb-Anwendung betrieben werden.

7 AUSBLICK

Um die Kommunikation zu verbessern und einen zusätzlichen Effekt - neben der AR-Anwendung - zu generieren, wäre es sinnvoll, das Konzept um Geoweb-Anwendungen zu ergänzen. Auf Basis einer digitalen Karte („mashup”) könnten sämtliche Standorte sichtbar gemacht und mit zusätzlichen Informationen angereichert werden. So könnten offene, d.h. für Zwischennutzungen potentiell nutzbare Leerstände, präsentiert werden. Abbildung 6 zeigt, wie ein solches Portal, in dem Nutzer und Nutzung zusammengeführt werden, aussehen kann. Um nicht Parallelstrukturen zu schaffen, könnte dies auf Basis des von der Initiative Raumpiraten betriebenen Plattform Leerstandsmelder Kaiserslautern geschehen (vgl. Abbildung 7).

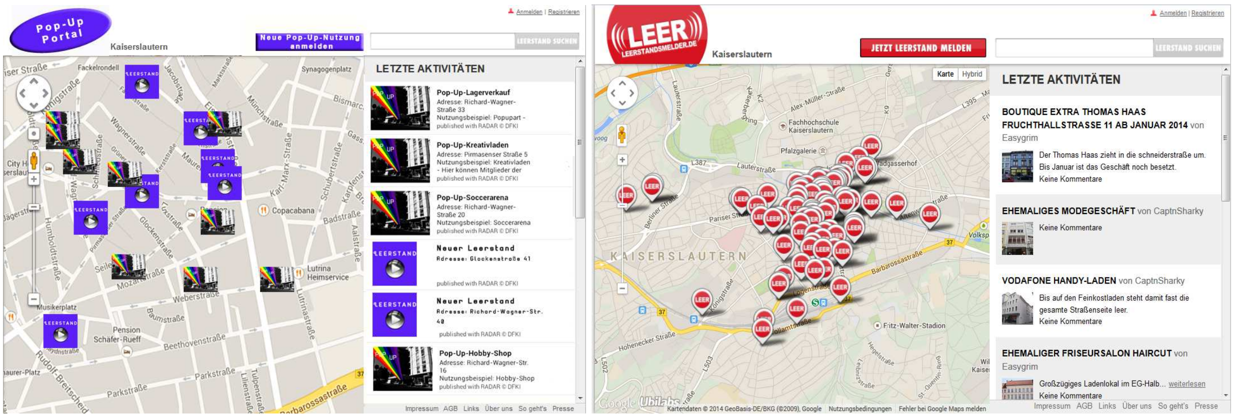

Abbildung 7: Pop-Up-Portal (links) und der Leerstandsmelder als mögliche Ergänzungsplattform (rechts). (Eigene Darstellung)

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Wer plant die Planung? – Widersprüche in Theorie und Praxis

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1 ABSTRACT

Der Schweizer Soziologe Lucius Burckhardt stellte bereits im Jahr 1974 die Frage nach den Verantwortlichkeiten und Rollenbildern im Planungsprozess, insbesondere der Stadtplanung. Zwar wurden seitdem die Prozesse in der Planung adaptiert und in letzter Zeit verstärkt mit Partizipationselementen bestückt, die Frage „Wer plant die Planung?" zu stellen, bleibt bei alldem nicht nur gerechtfertigt, sondern zwangsweise notwendig. Beschleunigungsprozesse und Ökonomisierungszwang beeinflussen möglicherweise Planungsprozesse in einem Ausmaß, die die Kluft zwischen Verantwortung, Verantwortlichkeiten, Bedürfnissen und Notwendigkeiten nicht langsam schließen, sondern diese vergrößern. Maßgeblich für eine (öffentliche) Diskussion ist, dass diese Kluft überhaupt wahrgenommen wird. Eine breite Diskussion der Öffentlichkeit in ihrem Bewusstsein als Öffentlichkeit mit dem Stadtbild findet nach wie vor nicht statt. Die Rollen der Politikerinnen und Politiker und Planerinnen und Planer scheinen klar vorgegeben und stehen oftmals in einem Abhängigkeitsverhältnis (Unabhängigkeit vs. Aufträge). Der Planende muss den Grad der Komplexität zwangsläufig vereinfachen. Dabei reduziert er die Realität auf das (für ihn) „Wesentliche"- er sieht das, was er gelernt hat zu sehen. Aus der Summe des ausgeschlossenen, vermeintlich Unwesentlichen, entstehen jedoch neue Probleme, die oftmals auch außerhalb der subjektiven (und intersubjektiven) Wirklichkeit liegen. Die Relevanz übergeordneter (politischer) Zielsetzungen auf den Planungsprozess und die Notwendigkeit einer Zielhierarchie werden diskutiert.

Eine Rangordnung der Werte wird höchstens implizit auf pragmatischer und projektbezogener Ebene ersichtlich und die Diskussion über eine Veränderung der Wertehierarchie findet - meist konsensorientiert - zwischen Politik-, Verwaltungs- und Planerinne- und Planer-Ebene statt. Das Resultat finden wir zum Teil in Form eines technokratischen Pragmatismus im öffentlichen Raum wieder, der Formen menschlicher Qualitäten und Ansprüche pervertiert.

2 GRUNDPRINZIPIEN DER PLANUNG

Lucius Burckhardt (1925-2003), Schweizer Soziologe und Nationalökonom betont, dass Planung nicht isoliert stattfindet, sondern in einem sozialen Systemaufgehängt ist. Was geplant und was nicht geplant wird, wird durch politische und gesellschaftliche Kräfte bestimmt. Ökonomische Zwänge und Abhängigkeiten verzerren dieses Bild auf der Frage, wer bestimmt, was geplant wird (und was nicht) (Burckhardt, 1980). Das Kräfteparallelogramm der Planung führt von Politik und Verwaltung, den Planenden, der Bauspekulation und Investorenschaft zu den durch die beschlossenen Maßnahmen betroffenen Leuten.

2.1 Was ist Planung?

Planung kann als gedankliche Vorwegnahme von Handlungsschritten, die zur Erreichung eines Zieles notwendig scheinen, bezeichnet werden. Es handelt sich um einen Prozess, der eine abstrakte (vereinfachende) Abbildung oder ein Modell der zu erwarteten Realität zur Folge hat.

Geht man durch die Stadt, so stößt vielen Menschen die Frage auf, wer dieses oder jenes so geplant hat? Eine Frage, die in erster Linie und als Folge der institutionellen Strukturen häufig an sich selber gerichtet wird. Dabei ist das Stellen der Frage schon der Beginn eines Reflexionsprozesses. Sie ist das Ergebnis einer Differenz zwischen eigener Vorstellung und Umsetzung (einer Planung). Dabei kann zwischen Planung und dem Endergebnis als Umsetzung ebenfalls ein bemerkenswerter Unterschied bestehen, wie manche Architektenentwürfe beispielsweise zu Platzgestaltungen und deren Realisierung zeigen (Schwarzenbergplatz oder Praterstern in Wien). Welche Einflüsse und Faktoren zeichnen hierfür verantwortlich?

Burckhardt beschreibt diese Dynamiken zwischen städtebaulicher Wirklichkeit und architektonischer Konzepte zur Gestaltung der Umwelt als Wechselwirkung zwischen Raum und Gesellschaftsvorstellungen um diese beiden Perspektiven mit den Praxen der Nutzerinnen und Nutzer zu verknüpfen (Burckhardt, 1980). Eine Anwendung dieser Prinzipien auf den Bereich der Verkehrsplanung als Teil der Stadtplanung (und in Wechselwirkung mit dieser) gibt Anlass, bestehende Grundlagen der Planung und Entscheidungsprozesse kritisch zu analysieren.

2.2 Regelkreis und Rückkopplung

Der Weg von der Problemwahrnehmung bis zur Lösung eines Problems ist nicht trivial. Selbst wenn ein Problem erkannt wird, ist es nicht immer einfach die Ursachen zu erkennen, da sie oftmals als Symptome oder auch als Syndrome in Erscheinung treten und auch auf dieser Ebene vielfach behandelt werden. Zwar können wir über die Realität in ihrer Gesamtheit keine vollständigen Aussagen treffen, weil wir von der unbekannten Realität immer nur einen bestimmten Ausschnitt wahrnehmen (Knoflacher, 2007), diese wahrgenommene Realität wird aber von der Ausbildung, der Systemkenntnis und dem Sachverstand, also einer gewissen Form von Vorprägung bestimmt (Riedl, 1985). Fasching (Fasching, 2005) spricht in diesem Zusammenhang im wissenschaftlichen Bereich von einer objektiven Illusion, basierend auf einer durch den Methodenkanon der Naturwissenschaften verursachten intersubjektiven Wirklichkeit.

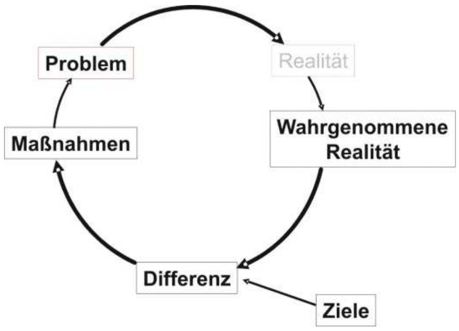

Abbildung 1: Ständiges Durchlaufen des Regelkreises führt zu richtigen Maßnahmen, wenn das Problem kleiner wird und (nachhaltig) verschwindet (Knoflacher, 2007).

2.2.1 Ziele – Leitbilder – Szenarien

Um Herauszufinden, ob Lösungen tatsächlich Probleme behoben haben, gegen die sie gerichtet waren, ist das Durchlaufen eines Regelkreises notwendig. Dabei sind die Definition der Ziele und ihr Vergleich mit der wahrgenommenen Realität ebenso wichtig wie die Maßnahmen. Die Ziele müssen von außen kommen. Gerade im Verkehrswesen liegen die Ziele klar außerhalb des Fachgebietes (z. B. im Sozialwesen, im Wirtschaftssystem, in der Bildung, etc.). Traditionell ausgebildete Planerinnen und Planer neigen oft dazu Verkehr als Selbstzweck zu betrachten und vergessen, dass hinter jedem Weg ein Wegezweck steht, der Ausdruck eines Bedürfnisses ist, das nicht am Ort befriedigt werden kann (Knoflacher, 2007).

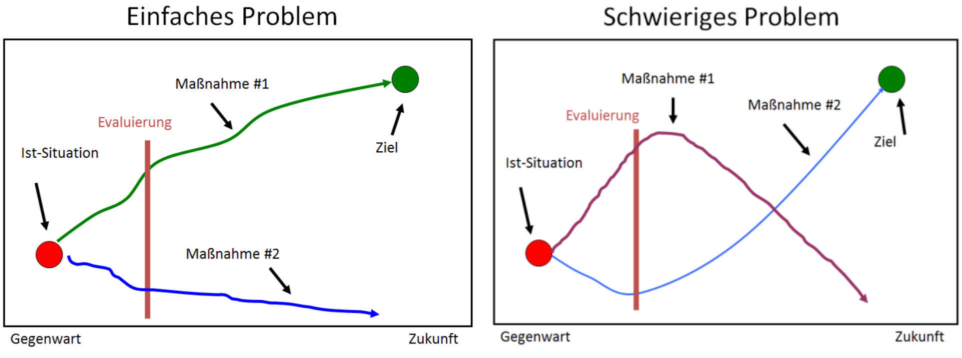

Abbildung 2: Einfache und schwierige Probleme. Systemkenntnis und Systemindikatoren und Zeitpunkt der Evaluierung sind entscheidend (basierend auf Meadows, 2012).

So wie auf Stau im Straßenverkehr in der Vergangenheit mit Ausbau reagiert wurde, so antwortet die Gesellschaft auf das „Altern" mit dem Bau von Altersheimen. Dabei bringt es der Systemcharakter mit sich, dass die direkte Verfolgung gängiger Ziele nicht zu deren Verwirklichung führt, sondern unter Umständen in unerwünschte Zustände umschlägt (Burckhardt 1980). Dennis Meadows (Meadows, 2012) unterscheidet in diesem Zusammenhang zwischen „einfachen" und „schwierigen" Problemen, die sich insbesondere in ihrer zeitlichen Entwicklung unterscheiden können. Der Zeitpunkt einer Evaluierung scheint erheblich. Die Systemkomplexität bringt es mit sich, dass erwartete oder beobachtete Tendenzen der Entwicklung (Daten) plötzlich in eine umgekehrte Richtung, zielgerichtet oder entgegengesetzt der Zielsetzung, wirken können. Systemkenntnis und Systemindikatoren sind notwendig um diese Entwicklungen zu berücksichtigen.

Ziele müssen immer jene Ebene betreffen, auf der unsere Eingriffe in das System Veränderungen erzeugt haben (Knoflacher, 2007). Leitbilder und Szenarien sollen die Ziele im Systemkontext widergeben können. Dabei ist keinesfalls ausgeschlossen, dass die Regeln des konventionellen Ablaufs eines (Teil-)Systems so verändert werden müssen, dass anstelle der prognostizierten eine gewünschte Zukunft eintritt (Burckhardt 1980).

2.3 Planung - Strukturen - Verhalten - Daten

Verhalten ist immer das Ergebnis von Strukturen. Strukturen bedingen daher das Verhalten. Als Strukturen sind alle Elemente zu verstehen, die ein Verhalten bedingen oder beeinflussen (Knoflacher, 2007). Strukturen können bauliche Elemente ebenso sein, wie Ordnungsmaßnahmen, Informationen, soziale oder wirtschaftliche Gegebenheiten. Dazu ist Kenntnis der Beziehungen zwischen Strukturen und Verhalten ebenso wichtig, wie das Bewusstsein, unter welchen Aspekten und mit welchen Methoden Verhalten in Daten abgebildet wird. Die Daten liefern ein Abbild über das Verhalten und mit diesem Abbild im Kopf gestalten die Planenden die Strukturen. Bei komplexen Planungsprozessen liegt die Herausforderung immer stärker auf dem Prozess der Planung, der Planungsbeteiligten, der Formen von Interaktion und Partizipation und oftmals der Einflussnahme und Beeinflussung aufgrund unterschiedlicher Interessen. Der Weg von der Planung zur Umsetzung der Strukturen wird relevant.

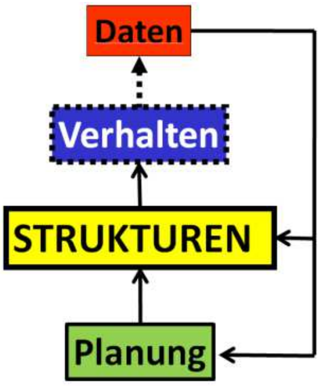

Abbildung 3: Die Strukturen als Ergebnis der Planung. Dort gilt es anzusetzen. (basierend auf Knoflacher, 2007, eigene Darstellung).

2.4 Systemeigenschaften und Wirkungen

Komplexe Systeme kann man nur mit Hilfe von Indikatoren in ihren Verhaltensweisen erfassen. Indikatoren sind dabei Wegweiser zur Beschreibung des Systemverhaltens (Knoflacher, 2007). Als „System" versteht man dabei ein aus mehreren Teilen zusammengesetztes, gegliedertes Ganzes. Aufgrund der Interdependenzen und Wechselwirkungen der einzelnen Teilsysteme gilt dem Systembiologen Rupert Riedl folgend, dass, egal wo man bei einem System beginnt (es zu analysieren), man immer gleich falsch liegt (Knoflacher, 2001).

2.4.1 Systemverständnis oder Symptombehandlung

Mit Systemkenntnis kommt man in erster Näherung zu Maßnahmen. Oftmals werden Probleme durch Maßnahmen kurzfristig gelöst, treten aber zeitverzögert wieder und dann auch verstärkt auf. Fahrbahnbau oder grüne Welle zur Staureduktion sind gängige Instrumente traditionell ausgebildeter Verkehrsingenieure. Selbst wenn das Problem (aus der eigenen Disziplin) reduziert oder gelöst wurde, die Symptome auf anderen Systemebenen wurden oftmals nicht betrachtet. Welche Auswirkungen die Barriere einer mehrspurigen Fahrbahn auf die Sozialbeziehungen der Anrainerinnen und Anrainer hat, wurde jahrzehntelang ausgeblendet und nicht den Ingenieurwissenschaften zugeordnet (Appleyard, 1981). Diese Syndrome wurden abwertend als Nebenwirkungen oder Kollateralschäden bezeichnet, wie sie bei zahlreichen Umfahrungsstraßen auftreten.

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2.5 Prozesse und Methoden

Gestaltung ist ein Prozess, der sich im Dreieck Auftraggeber (Politik) – Gestalter (PlanerIn) – Benutzervollzieht. Versagt der Auftraggeber bei der Analyse seiner Probleme („Gestaltungspolitik") überlässt er sie dem Gestalter. Der Benutzer ist meist machtlos – er darf und kann nicht verändern, was ihm nicht gehört (Burckhardt 1980). Der Mensch befindet sich als handelndes und betroffenes Subjekt in einer gelebten Beziehung zur „Umwelt" und agiert über die Konzeptions-, Verhandlungs- und Umsetzungsstrategien der Politik. Er wirkt über die Politik auf die Umwelt, die Umwelt wirkt über die Politik auf den Menschen. Der Mensch verändert aber auch die Umwelt direkt, so wie diese den Menschen. Für den von der Politik beauftragten Planenden ist ein Bild vom Menschen und Gesellschaft ebenso notwendig, wie die Kenntnisse über die Wirkungen der Eingriffe und Prägungen in und durch ein technisch verändertes Umfeld (Burckhardt 1980).

3 DIE ROLLE DER PLANENDEN

Als Napoleon seine polytechnischen Ingenieure fragte, wie er die Truppen über den Rhein bringen könnten, antworteten sie naturgemäß auf Basis ihrer Ausbildung (Werkzeugkasten), dass sie eine Brücke bauen werden. Burckhardt (Burckhardt 1980) betont, dass sich unsere technische Hochschulen in der Methode noch nicht von diesem Denken entfernt haben. Die erlernten Modelle werden mit der Realität gleichgesetzt, auf Basis derer man nach der „Korrektur" der Wirklichkeit strebt.

3.1 Wir sehen das, was wir gelernt haben zu sehen

Die Prozesse der Ausbildung und (Vor-)Prägung beeinflussen unseren Blick auf die Welt. Insbesondere die Ausbildung, mit der wir uns identifizieren (Beruf), wirkt wie ein Filter. R.Riedl verweist auf das anschauliche Beispiel dreier Personen völlig unterschiedlicher Disziplinen und Ausbildung, die alle erfolgreich einen Wald durchqueren (Riedl, 2000). Dennoch hat jeder etwas ganz anderes gesehen und alles, was der andere gesehen hat, nicht gesehen.

3.2 Modelle als (notwendiges) Werkzeug – aber wer modelliert?

In den Naturwissenschaften greifen Modelle die für eine gegebene Problemstellung als wesentlich erachteten Charakteristika (Eigenschaften, Beziehungen, etc.) eines Untersuchungsgegenstandes heraus und machen diesen so einem Verständnis bzw. einer weiterführenden Untersuchung zugänglich (Hartmann, 2010). Grundidee bei der Formulierung eines wissenschaftlichen Modells ist die Reduktion von Komplexität. Man versucht, Wirklichkeit beschreibbar und damit erklärbar zu machen, in dem man sie vereinfacht.

Hier wird bereits deutlich, dass es sich bei der Modellbildung um keinen „wertfreien" Prozess an sich handelt, da die ausgewählten, das heißt als „wichtig" erachteten Eigenschaften, ausgewählt werden, bzw. ein reduktionistischer Prozess stattfindet (stattfinden muss, da Modelle nur Teilausschnitte der Realität unter vereinfachten Annahmen darstellen). Dabei muss auch der Frage nachgegangen werden, wie Modelle mit unseren prinzipiellen Möglichkeiten der Erkenntnis zusammenwirken. Schlussendlich handelt es sich beim Modell um ein Abbild des Abbildes eines Teilausschnittes der Realität (soweit wir diese als intersubjektive Wirklichkeit erfahren und bezeichnen können) (Frey, 2010).

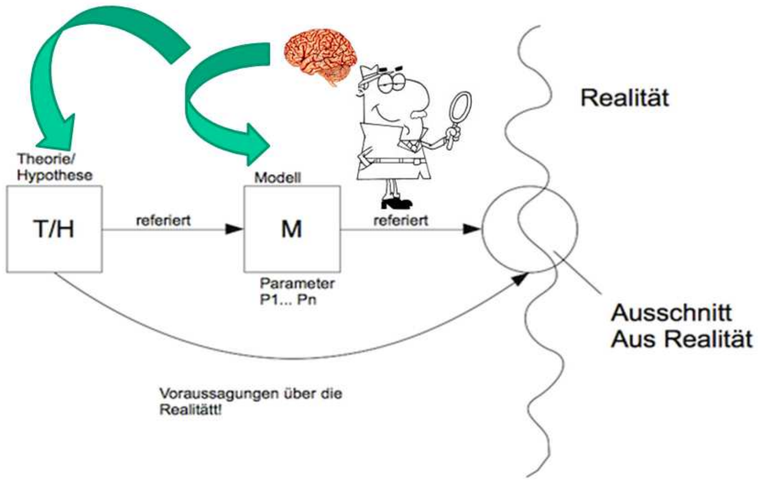

Abbildung 4: Ein Modell ist eine Vereinfachung (Abstraktion) eines gewissen Ausschnitt/Aspekt der Wirklichkeit. In der Regel wird nur der für einen gewissen Zweck relevante Teil der Wirklichkeit in nur der für diesen Zweck notwendigen Genauigkeit betrachtet (Approximation). Es handelt sich also um eine Komplexitätsreduktion um das diffuse System der Wirklichkeit zu strukturieren und begreifen zu können.

Weil diese Eigenschaften sich in naturwissenschaftlichen Modellen zeigen, können Modelle nicht als „wahr" oder „falsch" eingeordnet werden. Das Modell hat lediglich den Anspruch, sich auf einen Aspekt des modellierten empirischen Phänomens zu beziehen. Einer einheitlichen, also nicht funktionsabhängigen und selektiven Erkenntnis sind insofern Grenzen gesetzt, als die Formulierung von Modellen der „Intervention", das heißt der Wertung und Beurteilung, derer bedarf, die die Modelle formulieren und benutzen (Bailer-Jones, 2002). Vielmehr müsste die Modellierung gleichermaßen als die Konstruktion einer Vorstellung über das Original verstanden werden (van Fraassen, 2004; Giere, 2010). Das heißt das Modell wird zur Repräsentation eines Interpretationsprozesses des urteilenden Subjektes. Unter dieser Perspektive wird der Einfluss von Modellen auf die Rekonstruktion von Wirklichkeit deutlich. Modelle bilden keine objektive Wirklichkeit ab, sondern helfen, erfolgreich in der Realität zu operieren oder, noch radikaler, die subjektive Realität zu erschaffen (Bailer-Jones, 2002).

3.3 Wie viel Vereinfachung ist zulässig – und welche?

Modellbildung ist mit dem Prozess der Vereinfachung verbunden. Entscheidend, ob ein Modell reale Verhaltensweisen (vereinfacht) abbilden kann, ist die Berücksichtigung von System-Gesetzmäßigkeiten. Verkehrsmodelle beispielsweise, die keine Verhaltensänderungen und intermodale Verkehrsverlagerungen abbilden können, können wenig Beitrag bei Entscheidungsfindungen oder Bewertungen von Maßnahmen liefern. Die isolierte Betrachtung eines Verkehrsträgers wäre eine klar unzulässige Vereinfachung, wenn Modellergebnisse zur Begründung von Ausbaumaßnahmen herangezogen werden (Mayerthaler, 2013). Gleichzeitig ist eine immer weitere Erhöhung des Detaillierungsgrades sinnlos, wenn die Grundannahmen falsch oder einzelne Systemkomponenten völlig isoliert betrachtet werden.

3.4 Messen – was?

Indikatoren als Messgrößen dienen als Wegweiser in einem komplexen System, müssen Systemverhalten repräsentieren und die Eigenschaften der Struktur so gut wie möglich abbilden. Gerne werden die Planungsobjekte zerteilt und isoliert betrachtet (Burckhardt 1980). Der Trend zur Normierung scheint ungebrochen. Selbst Elemente mit selbstorganisierenden Grundprinzipien, wie Begegnungszonen, unterliegen dem Druck in Richtlinien und Vorschriften gepresst zu werden. Der Beitrag der Generalisierung und Standardisierung zur Erhöhung der Lebensqualität scheint indifferent (sowie die Indeterminiertheit der menschlichen Bedürfnisse). Die technische Unerfüllbarkeit, die Unmöglichkeit für die Bedürfniserfüllung generalisierende Normen festzulegen, steht im Widerspruch zum heutigen Planungs-Mainstream. Eine Kritik, die auf eine sinnvolle Anwendung von Richtlinien abzielt, anstatt den öffentlichen Raum als Ausdruck des Richtlinienkatalogs zu gestalten, scheint notwendig. Nicht mehr eine Zerlegung in messbare Teile in sinnvoll, sondern eine Aufteilung in Subsysteme, die aus Messbarem und Unmessbarem zusammengesetzt ist (Burckhardt 1980).

3.5 Quantität und Qualität

Gerne wird in Leitbilder und Szenarien das Quantifizierbare und Sichtbare stärker berücksichtigt als das Unsichtbare(Burckhardt 1980). Maßnahmen zur Förderung des Wirtschaftswachstums, der Arbeitslosigkeit, oder Entwicklungen in der Verkehrsmittelwahl, etc. sind leichter zu formulieren, als allgemeines Wohlbefinden, Charakterbildung oder Erhöhung der Wohnlichkeit. Viele der Qualitäten können nur indirekt über ausgewählte Indikatoren bewertet werden. So gibt die Aufenthaltsdauer im öffentlichen Raum Auskunft über die Qualität der Gestaltung. Der Mobilitätsaufwand für Freizeitwege ist ein Abbild der Mängel im Freiraum, Naherholungs- und Grünraum im Wohnumfeld. Wenn auch Kausalitäten nicht immer eindeutig darstellbar sind, so sind die Wechselwirkungen (causal-loop) bei der Planung zu beachten.

3.6 Selbsterfüllende Prophezeiungen

Prognosen, die als Grundlage für Planungen herangezogen, unterliegen der Gefahr zu einer selbsterfüllenden Prophezeiung werden. In vielen angewendeten Verkehrsmodellen wird der Motorisierungsgrad als externe Inputgröße vorgegeben, die von den Ergebnissen unbeeinflusst bleibt. Die in den Modellen implizit abgebildete Erwartungshaltung über die Entwicklung des Motorisierungsgrades als vereinfachte Extrapolation der vergangenen Entwicklung kann jedoch nicht als Begründung für Ausbaumaßnahmen im motorisierten Individualverkehr herangezogen werden kann. Betrachtet man die Entwicklung der Prognosen der Motorisierung in den vergangenen Jahrzehnten, sind permanente Überschreitungen der anfänglichen Prognosen festzustellen. Eine wachsende Motorisierung wurde scheinbar als „unveränderbares Naturgesetz" unterstellt und Prognosen mussten permanent nach oben korrigiert werden (Knoflacher, 1997).

Burckhardt (Burckhardt 1980)betont, dass durch die Extrapolation der Zukunft man einen Zustand festlegt und die Infrastruktur auf diesen Zeitpunkt disponiert. Handlungsvielfalt und Freiheitsgrade werden eingeschränkt, wenn Entscheidungen nicht mehr oder kaum in eine andere Richtung korrigiert werden können. Deshalb muss die Frage lauten, nicht wie viel geplant werden muss, sondern wie wenig geplant werden darf, um gewünschte Entwicklungen einzuleiten, Flexibilität für nachkommende Generationen gewahrt bleibt und die Polyvalenz (Gebrauchs- bzw. Wahlfreiheit) der Nutzungen gewährleistet werden kann (Burckhardt 1980). Bei der Aufteilung der Flächen im öffentlichen Raum sind noch immer Seperationsdenken, Trennung und Maßregelung der Verkehrsteilnehmer als implizites Ordnungsprinzip in den Verwaltungen verankert (z. B. Straße als Begegnungsraum, Aufenthaltsort, Spielstraße, Transit- und Parkraum für den motorisierten Verkehr, Wirtschaftsraum, etc.). Anrainerparken in stark nutzungsdurchmischten Stadtteilen widerspricht dem Polyvalenz-Prinzip. Thematiken der Ausgestaltung von Erdgeschoß- und Sockelzonen im Neubau werden als Nischenthemen diskutiert. Resultat ist deren häufige Ausprägung als Müll- und Technik oder Lüftungsräume oder Garagenausfahrten. Lebendige Straßen werden somit verhindert.

Abbildung 5: Gestaltungen im Widerspruch zu einem lebendigen öffentlichen Raum am Beispiel Nordbahnhofgelände.

4 DER NUTZER UND SEINE BEDÜRFNISSE – EIN FREMDES WESEN?

Dass der Nutzer erst durch Maßregelung zu einem neuen, dem technisch veränderten Umfeld angepassten Verhalten gezwungen werden muss, zeigt die Entwicklung der Massenmotorisierung und die damit verbundene Einschränkung der Bewegungsfreiheit der Menschen in den Städten und Dörfern (Norton, 2008). War das Queren der Straßen an beliebigen Punkten jederzeit möglich, so wurde diese mit der Straßenverkehrsordnung und baulichen Maßnahmen unterbunden. Absperrgitter, Verkehrslichtsignalanlagen und Unterführungen sind nach wie vor als Werkzeuge einer autoorientierten Verkehrsplanung im Einsatz. Der disziplinierende Charakter der Umweltgestaltung bleibt heute unwidersprochen und gesellschaftlich akzeptiert und ist damit Ausdruck der Wertehaltung der Gesellschaft (Moran, 2006).

Der physische Raum, der vom Planer oder der Planerin erzeugt wird, wird von den Nutzerinnen und Nutzern als gegeben hingenommen. Aber was sehen die Leute und warum beschäftigt sich die Öffentlichkeit so wenig als Öffentlichkeit mit dem öffentlichen Raum?

4.1 Nutzerbedürfnisse und Planerinnen- und Planersicht

Der Planendebeeinflusst durch seine Aufgaben Ziele des menschlichen Zusammenlebens. Was zumutbar, was gerecht und welcher Aufwand angemessen ist, ist als Antwort in den umgesetzten Entscheidungen enthalten. Die Kommunikation über solche Fragen steht weder im Blickpunkt der Ausbildung noch ist Teil der alltäglichen Praxis der Planerinnen und Planer. Überrascht reagiert dann der Fachmann, wenn angebotene „Lösungen“ nicht funktionieren. Dabei verhindert der Glaube an die Beständigkeit ökonomischer, technischer und sozialer Randbedingungen über mehrere Jahrzehnte trag- und zukunftsfähige Lösungen.

Abbildung 6: Verlust der Maßstabsgröße Mensch und Flächenfraß als Resultat hoher Geschwindigkeiten (links). Barrieren zur Maßregelung, die menschlichen Querungsbedürfnisse bleiben bestehen – siehe Trampelpfad (rechts).

5 DIE ROLLE DER POLITIK

Gemacht werden kann scheinbar nur das, was „geht“. Was aber gehen kann und was nicht, ist Grundlage der politischen Entscheidungen (Burckhardt 1980). Die wesentliche Rolle der Politik liegt in den Entscheidungen und Vorgaben zu den Rahmenbedingungen und Zielsetzungen, der Abklärung der öffentlichen Wünsche und der Aufstellung einer Rangordnung der vorhandenen und zu schaffenden Werte. Aufgrund der Langfristigkeit von Planungsprozessen und Impulsen zur Verhaltens-, also Strukturänderung, sind Visionen und Leitbilder ebenso notwendig, wie eine Prioritätenreihung. Strategiepapiere müssen auch eine zeitliche Komponente enthalten. Der Politik gehört die Abklärung der öffentlichen Wünsche, die Aufstellung einer Rangordnung der vorhandenen und zu schaffenden Werte und sie muss einen klaren Auftrag zur Ausführung an den Planenden stellen.

Abhängigkeitsverhältnisse und Tendenzen einer betriebswirtschaftlichen Verwertungsökonomie sind anzusprechen. Vergleicht man die sozialen Einrichtungen von Gemeindebauten der Zwischenkriegszeit in Wien mit den heutigen Verhältnissen werden die Unterschiede sichtbar. Der Rabenhof in Wien, eine städtische Wohnhausanlage die zwischen 1925-1929 erbaut wurde enthält neben 38 Geschäftslokalen zahlreiche soziale Einrichtungen (http://www.dasrotewien.at/rabenhof.html).

5.1 Verantwortungsethik oder Meinungsethik?

Jacques Neirynck sieht die Ingenieurinnen und Ingenieure als Kaste, die durch die Ausbildung zu sehr geprägt ist, um die Folgen ihrer Handlungen vorauszusehen, ein entsprechendes Urteil zu fällen oder getroffene Entscheidungen aufzuhalten. In „Der göttliche Ingenieur“ (Neirynck, 2001) betont er, dass die „gefährlichste Formel im Hinblick auf die Technik darin bestünde, sie als neutral zu erklären, dass sie an sich weder positiv noch negativ sei und alles von der Art der Anwendung abhänge, im Sinne einer ethischen Überlegung.“ Für Neirynck handelt ein Ingenieur, eine Ingenieurin ethisch betrachtet wie ein Kleinkind, das für seine Handlungen nicht verantwortlich ist (Neirynck, 2001): „Jedes Bestreben von Seiten eines Technikers, ein Werturteil zu fällen, es öffentlich auszusprechen und dementsprechend zu handeln, wird übrigens mit äußerster Schärfe zurückgewiesen, (…)“. Burckhardt (Burckhardt 1980) zitiert in diesem Zusammenhang Richard Senett, der nachwies, dass die Psychologie von Planerinnen und Planern mit der von Halbwüchsigen verwandt sei: Auch bei diesen habe im Falle des Misserfolges die Modellvorstellung recht und die Wirklichkeit unrecht.

Notwendig wäre eine dem erwachsenen Menschen entsprechende Verantwortungsethik („Man hat für die Auswirkungen der gesetzten Taten auch Verantwortung zu tragen.“), die die Gesamtheit der Folgewirkung

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einer Handlung umfasst. Für den/die gebildete/n IngenieurIn stellt sich die Frage, ob der berühmte "Stand der Technik" auch immer der "Stand des Wissens" ist (Brezina, 2013).

6 DIE ROLLE DER MEDIEN

Der Prozess einer Bewusstseinsbildung der Öffentlichkeit und der Initiierung eines Diskurses kann durch die Medien unterstützt, wie beeinflusst werden. Neue Formen der sozialen Netzwerke werden im Zusammenhang mit Partizipationsprozessen stärker zu berücksichtigen sein. Daraus stellen sich Herausforderungen an die Prozesse der Bürgerinnen- und Bürgerbeteiligung, die sowohl eine Spezifizierung der Methode in Abhängigkeit der Problemstellung notwendig machen, als auch über die Grenzen von Partizipationsprozessen Aufschluss geben.

In der (beschleunigten) Mediokratie (Meyer, 2001) wächst auch der zeitliche Druck auf Politik und Entscheidungsträger. Die Staffelung und das Aufschieben von Entscheidungen, der Umgang mit Zeit in Planungsprozessen und damit das Festhalten an bestimmten (notwendigen) Freiheitsgraden für eine verantwortungsvolle Planung werde schwieriger. Information und Kommunikation bei Planungsentscheidungen führen auch zu einer verstärkten Verantwortung von Medien und Politik.

7 SCHLUSSFOLGERUNGEN

Gebaute Umwelten haben Auswirkungen auf das Verhältnis von Raum und Gesellschaftsvorstellung. Daraus resultiert der Anspruch an den jeweiligen Fachbereich, sich nicht thematisch zu verengen, sondern die wechselseitigen Interdependenzen zu erkennen und zu berücksichtigen. Der Planungsprozess macht die Integration verschiedener Disziplinen notwendig, lässt aber auch Rückschlüsse auf die vorhandenen Defizite in der Ausbildung zu.

Modelle sind Hilfswerkzeuge, um bestimmte Entwicklungen zu testen, daraus sollte keine Anleitung zur Gestaltung der Wirklichkeit direkt abgeleitet werden. Annahmen und Modellgrundlagen sind kritisch zu hinterfragen. Ausgeblendete Aspekte oder nicht unmittelbare Messbares gilt es ebenso zu berücksichtigen. Mit der Methode und dem Verfahren wird der Entschluss schon vorgeprägt. Indem man Nebenprobleme ausfiltert, fällt man unbewusst ständig Entscheidungen. Scheinbar unwesentliche Probleme können zeitverzögert auftreten und sichtbar werden. Die vorgegebenen Ziele bestimmten die Entwicklung und Maßnahmen.

Die Politik muss Visionen und Ziele klar zu definieren. Ihr gehört auch die Aufstellung einer Rangordnung der vorhandenen und zu schaffenden Werte. Sie muss die Verantwortung für die Folgen der Planung übernehmen.

Nicht verwunderlich, fast logisch erscheint retrospektiv, dass Lucius Burckhardt aus seiner These, dass der technische Fortschritt zu einer Entfremdung und Wahrnehmungsveränderung des Menschen in Bezug auf seine Umwelt geführt hat, die Promenadologie (Spaziergangswissenschaft) aus Teilen der Soziologie und des Urbanismus in den 1980er Jahren entwickelt und in den Diskursen der Stadt- und Landschaftsplanung verankert hat. Sein Ziel war das konzentrierte und bewusste Wahrnehmen der Umwelt und das „Weiterführen des bloßen Sehens zum Erkennen“ (Burckhardt 1980). Die Rückkehr zum Maßstab Mensch erfolgt über den Fußgeher und seiner Geschwindigkeit.

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„What is planning for?“ Die Evaluation von strategischer Stadtentwicklungsplanung am Beispiel Wohnen

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1 ABSTRACT

Die strategische Stadtentwicklungsplanung gewinnt seit einigen Jahren (wieder) an Bedeutung – in der Praxis ebenso wie in der Wissenschaft. Auch im Bereich Wohnen werden „clevere Lösungen“ gesucht, die Herausforderungen wie lokale Schrumpfungs- oder Wachstumsprozesse, eine zielgruppengerechte Ausdifferenzierung des Wohnungsangebotes und weitere Veränderungen auf dem Wohnungsmarkt meistern sollen. Unter Einbeziehung der lokalen Wohnungsmarktakteure werden vor allem in größeren Städten Konzepte erarbeitet und Strategien entworfen, die verstärkt einen planerischen Charakter aufweisen. Die Frage ist jedoch, welche Bedeutung die strategische Stadtentwicklungsplanung im Handlungsfeld Wohnen für die Steuerung von Stadtentwicklung und Stadtproduktion besitzt. Welchen Einfluss hat sie auf die räumliche Entwicklung einer Stadt, auf die Stadtentwicklungsprozesse oder das Handeln der unterschiedlichen Akteure? Was bewirkt sie wirklich, und insbesondere wie wirkt sie?

Das vorliegende Paper „What is Planning For?”[1] beschäftigt sich mit der Suche nach den Effekten strategischer Stadtentwicklungs-planung und ihren Einflussfaktoren – aufgezeigt am Beispiel des Handlungsfeldes Wohnen. In der Literatur gibt es mehrere Hinweise auf die Wirkungen von strategischer Stadtentwicklungsplanung, die empirisch jedoch näher zu erforschen und reflektieren sind. Die Einbeziehung theoretischer Ansätze zur strategischen Planung und zur Evaluation von Planung bieten das Potenzial, die methodische Herangehensweise an eine Evaluation der Komplexität ihres Gegenstandes anzupassen. Dadurch könnten fundierte Kenntnisse über die Wirkungen der strategischen Stadtentwicklungsplanung im Bereich Wohnen gewonnen werden.

Das Paper erörtert die Charakteristika und theoretischen Grundlagen der strategischen Stadtentwicklungsplanung im Handlungsfeld Wohnen, ihre vermeintlichen Wirkungen wie auch die Herausforderungen und methodischen Ansätze ihrer Evaluation.

2 STRATEGISCHE STADTENTWICKLUNGSPLANUNG AM BEISPIEL WOHNEN

2.1 Das Aufleben der strategischen Stadtentwicklungsplanung im Handlungsfeld Wohnen

Im Handlungsfeld Wohnen, einer klassischen Aufgabe der Stadtentwicklungsplanung, haben die Veränderungen auf dem Wohnungsmarkt zu einer zunehmenden Weiterentwicklung des kommunalen Steuerungsinstrumentariums geführt. Seit einigen Jahren ist vor allem in Großstädten ein Wandel der Wohnungspolitik „von der sozialen Wohnraumversorgung zu einer strategischen Planungsaufgabe“ (Borchard 2012: 18) zu erkennen. Von der öffentlichen Hand werden insbesondere in größeren Städten kommunale Konzepte zum Thema Wohnen erarbeitet, z. B. kommunale Wohnraumversorgungskonzepte, Handlungskonzepte „Wohnen“ oder Wohnungsmarktkonzepte, um anstehende Aufgaben wie Wohnungsknappheit, sozialräumliche Polarisierungen und die Bereitstellung von preiswerten Wohnraum zu meistern. Die Entwicklung der vermeintlichen Strategie vollzieht sich häufig mithilfe einer intensiven Prozessgestaltung unter Einbeziehung der Wohnungswirtschaft und gesellschaftlicher Akteure. Die Konzepte basieren auf fachlich-analytischen Grundlagen, die Entwicklungstendenzen auf dem lokalen Wohnungsmarkt aufzeigen. Darauf aufbauend werden Zielstellungen für die künftige Wohnungsmarktentwicklung, konzeptionelle Aussagen und unter Umständen auch Maßnahmen zu ihrer Umsetzung formuliert. Ziel ist, zum einen das eigene, kommunale Handeln zu steuern, aber bestenfalls auch, das Handeln weiterer Akteure des Wohnungsmarktes zu beeinflussen. Mancherorts werden sogar Bündnisse geschlossen oder die Zusammenarbeit über Arbeitskreise verstetigt, wie in Münster. Befördert wird das Aufleben der strategischen Stadtentwicklungsplanung im Bereich Wohnen durch die Förderpolitiken der Bundesländer (Borchard 2012, GEWOS GmbH 2010).

[1] Alexander 2009: 234. Dieses Paper ist in Verbindung mit dem laufenden Dissertationsprojekt der Autorin an der HafenCity Universität Hamburg entstanden.

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Das Beispiel Wohnen ist als strategisches Handlungsfeld so interessant, weil eine Vielzahl unterschiedlicher öffentlicher wie privater Akteure am Wohnungsmarktgeschehen beteiligt sind. Neben den kommunalen Wohnungsunternehmen sind maßgeblich die freien Wohnungsunternehmen, Investoren und Projektentwickler sowie eine Vielzahl privater Einzeleigentümer für die Bewerkstelligung von Wohnungsneubau und Bestandsentwicklung zuständig. Um einen strategischen Einfluss auf das räumliche Entwicklungsgeschehen im Bereich Wohnen nehmen zu können, müssen besondere Bemühungen seitens der Kommune unternommen werden.

Wohnungspolitik und Stadtentwicklung werden wieder stärker miteinander verknüpft (Borchard 2012, Kurth, Wiezorek 2012, GEWOS GmbH 2010). Wohnungspolitik gilt – zumindest in Deutschland – seit Jahrzehnten als entstaatlicht und liberalisiert. Durch die Belebung des Wohnungsmarktes seit 2006 ist jedoch der erneute Bedarf nach einer stärkeren gemeinwohlorientierten Wohnungspolitik erkennbar, die auch preiswerten, energieeffizienten und altersgerechten Wohnraum bereitstellt und in einem stadtplanerischen Kontext integriert ist (Kurth, Wiezorek 2012).

2.2 Verständnis von strategischer Stadtentwicklungsplanung

In der heutigen Stadtplanungspraxis existieren aufgrund des informellen Charakters und lokalspezifischer Prägungen von strategischer Stadtentwicklungsplanung eine Vielfalt von Ansätzen, Konzepten, Leitbildern, etc., die eine einheitliche Definition, Charakterisierung und Namensgebung in der Planungswissenschaft schwierig machen.

Nach Kühn wird strategische Stadtplanung oftmals als „Synthese von Integrierter Entwicklungsplanung (These) und Inkrementalismus (Antithese)“, also als Kombination von „großen Plänen“ und „kleinen Schritten“ verstanden. Im Gegensatz zum perspektivischen Inkrementalismus werden diverse Widersprüche im Modell der strategischen Planung gleichwertig vereint: das Ganzheitliche, die flächendeckende Steuerung und Langfristigkeit der integrierten Entwicklungsplanung und die Kleinteiligkeit, Flexibilität und Kurzfristigkeit des Inkrementalismus (Kühn 2008).

Viele Autoren aus dem deutschsprachigen Raum bringen folgende Charakteristika mit strategischer Planung in Verbindung: klare Zielorientierung, diskursive Methodik im kooperativen Prozess, mehrstufiges Verfahren zur Konkretisierung der Programmierung, lernorientierte Kontrolle der Umsetzung, Öffentlichkeitsbeteiligung als Ressource (Fürst 2012).

Um ein konkreteres Bild zu erhalten, was eine Strategie in der Praxis in unterschiedlicher Weise auszeichnen kann, werden folgende idealtypische Elemente angeführt, die auch im Handlungsfeld Wohnen zu finden sind:

- „Leitbild, gemeinsame ‚Vision‘ der zentralen Akteure
- Positivität, Optimismus in einem chancenorientierten Ansatz
- ‚Probleme‘ oder ‚Schwächen‘ werden lösungsorientiert dargestellt
- festgelegte Schwerpunkte, Handlungsfelder
- darin definierte strategische Ziele (Richtung, Schritte)
- Maßnahmenprogramme zur Umsetzung
- strategische Projekte als Impulsgeber für Umsetzung
- Benennung verantwortlicher Akteure der Umsetzung (in Selbstverpflichtung bzw. ‚Übereinkunft‘)
- Partnerschaften (u. a. öffentlich-private Partnerschaft)
- Ausweisung benötigter Ressourcen
- Zeitraum der Umsetzung
- Erfolgsindikatoren
- Monitoring, Evaluierung“. (Pirhofer 2005: 11f.)

Die theoretischen Grundlagen zur strategischen Planung werden bei Wiechmann und Hutter in der Management- und Organisationstheorie insbesondere aus dem angelsächsischen Raum gesehen (Wiechmann 2008, Wiechmann, Hutter 2008). In der Strategieforschung wird zwischen dem linear, rationalistischen und dem adaptiv, inkrementalistischen Strategieverständnis unterschieden. Das linear, rationalistische Strategieverständnis versteht Strategie als Plan, d.h. vorausblickend und bewusst. Das Handeln erfolgt absichtsvoll und trägt zur Erreichung der gesetzten Ziele bei (Mintzberg et al. 1999). Das lineare Strategieverständis entspricht der klassisch traditionellen Definition von räumlicher Planung im synoptisch-rationalen Sinne. Neben dem Verständnis „Strategie als Plan“ gibt es in der Managementtheorie auch die Definition der „Strategie als Muster“. Man blickt zurück und erkennt dabei ein Muster, das sich aus unterschiedlichen Handlungen ergibt. Die Strategie bildet sich erst heraus, sie ist emergent („bottom-up“-Prinzip). Tatsächlich realisierte Strategien gelten in den Managementwissenschaften als Ergebnis der absichtsvollen Planung und den emergenten Entwicklungen. In der Realität ist demzufolge immer eine Kombination der unterschiedlichen Denkrichtungen der beiden Strategiemodelle ablesbar (Mintzberg et al. 1999).

Im Gegensatz zu den Managementwissenschaften beschäftigt sich die Wissenschaft der räumlichen Planung bislang kaum mit ihren Umsetzungs- und Realisierungsprozessen (Krüger 2007). Die Einbindung von Ansätzen der Managementwissenschaften stellt deshalb ein großes Lernpotenzial dar (Krüger 2007, Wiechmann, Hutter 2008).

2.3 Vermeintliche Effekte

„Räumliche Entwicklung resultiert aus dem Handeln vieler. Kein zentraler Plan vermag vorzugeben, wohin die Entwicklung geht.“ (s. Selle 2013: 4)

Das Zitat verdeutlicht, dass der Steuerungsanspruch, den Stadtentwicklungsplanung im traditionellen Verständnis erhebt, angesichts der veränderten Planungs- und Beteiligungskultur zu hinterfragen ist (Fürst 2004). Als informelles Steuerungsinstrumentarium ist strategische Stadtentwicklungsplanung nicht rechtsverbindlich. Es besteht kein Anspruch auf eine Umsetzung. Das direkte Steuerungspotenzial von strategischer Stadtentwicklungsplanung sei deshalb gering. Die Entscheidungsprozesse der Wirklichkeit seien durch Dynamik und Emergenz gekennzeichnet (Wiechmann 2010). Deshalb käme den strategischen Plänen mittlerweile „weniger [eine] Lenkungs- als Thematisierungswirkung“ zu (Altrock 2008: 72).

In der Literatur gibt es viele Hinweise auf die Wirkungen oder Nicht-Wirkungen von strategischer Stadtentwicklungsplanung. Diese sind jedoch eher normativ geprägt. Auch für das Handlungsfeld Wohnen gibt es bislang nur vereinzelt wissenschaftliche Erkenntnisse über die Wirkungsweise von Strategien wie kommunalen Konzepten zum Wohnen (ausgewählte Studien: IfS 2008 mit Bezug auf kommunale Wohnungsmarktkonzepte in Schleswig-Holstein, GEWOS GmbH 2010). Die Defizite in der empirischen Implementations- und Wirkungsforschung aktueller Stadtplanung und insbesondere von strategischer Stadtentwicklungsplanung werden von vielen Autoren angemerkt (u. a. Altrock 2004, Pirhofer 2005, Fürst 2012, Selle 2013).

2.3.1 Direkte Wirkung

Eine direkte Wirkung werde über so genannte „Leuchtturmprojekte“ oder Großprojekte erzeugt, die mit den Strategien verknüpft und so „in einen strategischen Rahmen gesetzt“ würden. Großprojekte dienten dazu, die Leitziele der Stadtentwicklungsplanung zu verdeutlichen und greifbar zu machen (Dangschat et al 2008, Kühn 2008). Beispiele hierfür stellen die Großprojekte der Hamburger Stadtentwicklung, die HafenCity und die kürzlich stattgefundene Internationale Bauausstellung in Wilhelmsburg, dar, die für den „Sprung über die Elbe“ – das Leitziel der „wachsenden Stadt“ Hamburg – stehen.

Eine direkte Steuerungswirkung entfalte strategische Stadtentwicklungsplanung darüber hinaus, wenn ihre Elemente, zum Beispiel Leitbilder oder strategische Konzepte, mit formellen Planwerken wie die Flächennutzungsplanung und Fachplanungen verknüpft würden (Spiekermann 2000). So werden die Erkenntnisse und strategischen Überlegungen der Konzepte zum Wohnen teilweise bereits für andere Fachplanungen und integrierte Stadtentwicklungskonzepte in den Kommunen genutzt (IfS 2008).

2.3.2 Indirekte Wirkungen

Strategische Stadtentwicklungsplanung kennzeichnet sich durch eine starke Prozess- und Akteursorientierung aus. Indirekte Steuerungspotenziale könnten über Kommunikation, Aushandlung und Diskurs erreicht werden. Durch eine intensive Beteiligung unterschiedlicher Akteure bestehe die Möglichkeit, nicht nur die Legitimität der jeweiligen Strategie zu erhöhen, sondern auch die Mobilisierung der Akteure zu erleichtern und ihre feste Einbindung zu erreichen. Die Komplexität von Stadtentwicklung werde reduziert und vereinfachende, handhabbare Strategien abgestimmt (Dangschat et al. 2008, Kuder 2008, Redaktionsgruppe des AK Städtebau der SRL 2013). Dadurch ließe sich die Strategie mediengerecht aufbereiten und sogar einer größeren Zielgruppe näherbringen (Frey et al. 2003).

Durch eine derartige Gestaltung der Strategieentwicklung könnten Bezugspunkte für eine Orientierung des Handelns der Akteure geliefert werden. Über gemeinsame Lernprozesse werde ein kohärentes Verhalten der Akteure bewirkt und eine „Koordination raumwirksamen Handelns“ ermöglicht (Dangschat et al. 2008: 354ff.., Wiechmann 2008). Für den Bereich des Wohnens wurde teilweise bereits nachgewiesen, dass viele Kommunen das Konzept zum Wohnen als Orientierungs- und Argumentationshilfe für weitere Projekte und Planungen nutzen. Auch gibt es Hinweise darauf, dass die Konzeptentwicklung und -umsetzung weitere Prozesse und Kooperationen anschieben sowie überfachlichen Austausch innerhalb der Verwaltung und mit Bezug auf andere Akteure bewirken könne (IfS 2008).

2.3.3 Einflussfaktoren

Die Wirksamkeit strategischer Planung hinge allerdings nicht nur von der Gestaltung ihrer Prozesse und Strukturen ab, sondern auch von den Rahmenbedingungen, die sie umgibt, unter anderem dem politischen Willen (Albrechts 2004). Die Kurzfristigkeit des politischen Geschehens stehe dabei durchaus im Widerspruch zu den langfristig angelegten Zielen der Stadtentwicklungsplanung (Altrock 2008).

In der Alltagswelt sind Einschränkungen der Wirkungen strategischer Stadtentwicklungsplanung sichtbar. Der ideale Prozess der Strategieentwicklung bringe bestimmte (unrealistische) Anforderungen mit sich wie eine vollständige Information der Beteiligten, eine „machtfreie Kommunikation“ und eine „gleichberechtigte Aushandlung“ (Kuder 2008: 185) ohne die Durchsetzung dominierender Partikularinteressen. Eine weitere Herausforderungen bei der Realisierung von strategischer Stadtentwicklungsplanung stelle insbesondere „die ungebrochene Eigenlogik und -dynamik“ (Selle 2013: 8) der Fachressorts in der öffentlichen Verwaltung dar, aber sicherlich auch die anderer Akteure. Im Handlungsfeld Wohnen sind beispielsweise Interessenkonflikte und divergierende Handlungslogiken zwischen den betroffenen Bürgern, der vermeintlich gemeinwohlorientierten öffentlichen Hand, den offensichtlich kurzfristig denkenden Politikern, den oftmals verkaufsunwilligen Grundstückseigentümern sowie den durchaus renditeorientierten Investoren denkbar (vgl. auch Spiekermann 2000).

3 EVALUATION IN DER STADTENTWICKLUNG

Stadtentwicklungsplanung war schon immer mit dem Thema Evaluation verknüpft. Als Voraussetzung für die Handlungsfähigkeit des Steuerungsinstrumentariums galt in früheren Zeiten die Existenz eines Rückmeldesystems, das über nicht-planmäßige Abweichungen im Handlungsablauf berichtete (Hellstern, Wollmann 1984a). Obwohl auch heute noch Evaluation und Monitoring ein Element der strategischen Stadtentwicklungsplanung darstellen (siehe Kapitel 2.2.), scheinen viele Herausforderungen und Anwendungsschwierigkeiten damit verbunden zu sein – insbesondere, wenn nicht nur quantitative, sondern auch qualitative Effekte festgestellt werden sollen.

3.1 Herausforderungen der Evaluation

Umfassende Evaluationen werden in der Raumentwicklung im Allgemeinen eher selten durchgeführt. Die Beurteilung von Plänen und Programmen basiere meist auf „Vermutungen und Vorurteilen“ und kaum auf systematischen empirischen Untersuchungen (Einig 2012). Evaluationen und speziell Wirkungsanalysen werden vor allem dann eingesetzt, wenn es darum geht, die Effekte von Förderprogrammen zu beurteilen. Die Implementation formeller Planungen wie auch informeller Entwicklungspläne, insbesondere Stadtentwicklungspläne, werde allerdings kaum untersucht (Kühn 2004). Auch im Handlungsfeld Wohnen gibt es nur wenige empirische Studien aus den letzten Jahren, die sich mit den Wirkungen von kommunalen Konzepten zum Wohnen beschäftigen (siehe Kapitel 2.3). Dafür gibt es viele Gründe. Der zeitliche und finanzielle Aufwand für die Durchführung von Evaluationen ist generell hoch. Darüber hinaus sind Evaluationen von Plänen generell unbeliebt, da die Planverantwortlichen sich nicht gerne mit dem Erfolg oder Misserfolg ihres Steuerungsbestrebens auseinandersetzen (Einig 2012). Eine Evaluation ist auch ein politisches Handlungsmittel, das durchaus einen „Störenfried vorhandener Macht- und Vorteilsverteilung“ (Hellstern, Wollmann 1984b: 46f.) darstellen kann.

Die Durchführung von Evaluationen besitzt bislang erhebliche theoretische, methodische und anwendungsbezogene Mängel (Kühn 2004; Einig 2012). Besonders strategische Stadtentwicklungspläne, so auch kommunale Konzepte zum Wohnen, beinhalten meistens offene, nicht operationalisierte Ziele. Die Adressaten, Umsetzungs- und Finanzierungsinstrumente werden eher selten bestimmt. Darüber hinaus zeichnet sich strategische Planung – verstanden als sozialer Prozess – durch eine hohe Komplexität aus. Die Messbarkeit von nicht-intendierten Wirkungen, prozessbezogenen Effekten und qualitativen Veränderungen erscheint generell eher schwierig (Kühn 2004). Die Erkenntnisse aus bisherigen Studien zu den Wirkungen von kommunalen Konzepten zum Wohnen bestätigen zum Großteil diese Problematik (IfS 2008, GEWOS 2010). Insbesondere die methodische Herangehensweise und daraus folgende Stichhaltigkeit der Aussagen erscheint forschungswürdig.

3.2 Funktionen der Evaluation

Definiert wird Evaluation als „systematische Untersuchung des Nutzens oder Wertes eines Gegenstandes“ (Deutsche Gesellschaft für Evaluation 2002: 13 nach Sedlacek 2004). Evaluationen besitzen unterschiedliche Funktionen, die je nach Kontext und Gewichtung Evaluationsdesign und -ablauf bestimmen (Stockmann 2010). Es wird zwischen vier Funktionen unterschieden:

- „Gewinnung von Erkenntnissen
- Ausübung von Kontrolle
- Auslösung von Entwicklungs- und Lernprozessen
- Legitimation der durchgeführten Maßnahmen, Projekte und Programme“ (Stockmann 2010: 73)

Gerade der Lerneffekt von Evaluationen kommt einer strategischen Stadtentwicklungsplanung zugute, da der gemeinsame Lernprozess hier im Vordergrund steht (siehe Kapitel 2.3.). Das gemeinsame Lernen der beteiligten Akteure hat an Bedeutung gewonnen, während früher die Erfolgskontrolle im Vordergrund stand. Evaluationen hätten sich dadurch deutlich an die Alltagspraxis der Akteure angenähert. Die Rahmenbedingungen für das Handeln der Akteure, aber auch die Handlungen selbst, das Wissen und die Erfahrungen der evaluierten Akteure geriete in den Fokus der Betrachtung. Dadurch werde das Handeln der Akteure nicht nur „reflektierbar“, sondern auch „reformierbar“ (Sedlacek 2004). Der Einsatz von Evaluationen kann demnach die Prozesse der strategischen Stadtentwicklungsplanung befördern.

Evaluation wird in diesem Zusammenhang auch als ein Handlungsmittel der Politik angesehen, das den Handlungsspielraum erweitere (Hellstern, Wollmann 1984b). "Tatsächlich wird hier […] überwiegend an einem Politikkonzept festgehalten, wonach politische Entscheidungen und ihre Durchführung insofern ‚rational‘ anzuleiten sind, als im Entscheidungsprozeß die unterschiedlichen Folgen, Nutzen und Kosten verschiedener Entscheidungsvarianten und Handlungspfade empirisch fundiert abgeschätzt und während und nach dem Verwirklichungsprozeß (Implementation) Wirkungsverläufe und Ergebnisse beobachtet und erfasst werden sollten, sei es, um korrigierend eingreifen zu können, sei es, um weitere Politikschritte empirisch fundiert vorzubereiten." (s. Hellstern, Wollmann 1984b: 46f..). Evaluationen seien bedeutend für die (politische) Entscheidungsfindung, gerade wenn es sich um komplexe Problemlagen handele (Oliveira, Pinho 2011). Da der politische Wille für die Umsetzung von strategischer Stadtentwicklungsplanung auch im Handlungsfeld Wohnen mitentscheidend ist, können Evaluationen unterstützend wirken.

3.3 Analyseperspektiven der Evaluationsforschung

Es gibt unterschiedliche Analyseperspektiven, die im Rahmen einer Evaluation eingenommen werden können und die Konzeption des Evaluationsansatzes bestimmen. Im Allgemeinen wird zwischen Ex-ante-Evaluationen im Vorfeld von Programmen und Projekten (u. a. Ziel- und Mittelwahl, Chancen der Zielerreichung), on-going bzw. begleitende Evaluationen (u. a. Dokumentation der Umsetzung) sowie Ex-post-Evaluationen nach oder als Abschluss von Programmen und Projekten (u. a. Erfolgskontrolle) unterschieden (Gornig/Toepel 1998 nach Sedlacek 2004).

Darüber hinaus bieten weitere Evaluationsansätze der räumlichen Planung aus dem angelsächsischen Raum interessante Analyseperspektiven, die im Rahmen dieser Forschungsarbeit angewendet werden. Es bestehen zwei maßgebliche Evaluationsdimensionen, die die on-going und ex-post-Dimension aufgreifen: die Konformität („Conformance“) und die Leistungsfähigkeit („Performance“). Hinzu kommt die Ex-ante-Rationalität des Plans als dritte Dimension (Alexander 2009, Alexander, Faludi 1989, Oliveira, Pinho

2010/2011). Die unterschiedlichen Perspektiven spiegeln die grundlegenden planungstheoretischen Denkrichtungen und Strategieverständnisse (linear, rational und emergent, inkrementalistisch) wider, die im Rahmen von strategischer (Stadtentwicklungs)Planung eine Rolle spielen (Wiechmann 2008). Dadurch eignen sie sich in besonderem Maße für die Bewertung der Effekte von strategischer Stadtentwicklungsplanung im Rahmen einer Evaluation.

Das Prinzip der Konformität („Conformance“) überprüft die Übereinstimmung der auf den Plan folgenden Entscheidungen, Planungen und realen Veränderungen im Raum mit den Planzielen. Die Kontrollfunktion steht hier im Vordergrund, weshalb in diesem Zusammenhang auch häufig der Begriff Erfolgskontrolle verwendet wird (Zweck-Mittel-Logik) (Alexander 2009, Oliveira, Pinho 2010). Das Prinzip der Konformität ist dem linearen Strategieverständnis („Strategie als Plan“) zuzuordnen, in dem das absichtsvolle Handeln die Erreichung der formulierten Ziele gewährleistet.

Das Prinzip Leistungsfähigkeit („Performance“) versteht Planung als einen Bezugsrahmen für operative Entscheidungen und bewertet diese entsprechend ihrer Nützlichkeit und Qualität als ein solcher. „[…] The quality of strategic plans must be measured in terms of the performance of plans in facilitating decision making.“ (Faludi 2000:305). Diese Form der Evaluation ist explizit für strategische Pläne konzipiert, bei denen Planung insbesondere als sozialer Prozess des Lernens verstanden wird (Faludi, Altes 1994). Das Prinzip der Leistungsfähigkeit spiegelt das emergente, inkrementalistische Strategieverständnis („Strategie als Muster“) wider, in dem sich Strategien erst herausbilden.

Die Evaluation der Ex-ante-Rationalität fokussiert sich auf das Potenzial eines strategischen Plans, umgesetzt und angewendet zu werden und die gesetzten Ziele zu erreichen. Es geht um die Rationalität, aber auch die Qualität des Plans, die mit seiner Entstehung und Ausgestaltung zusammenhängen.

4 EVALUATIONSANSATZ FÜR STRATEGISCHE STADTENTWICKLUNGSPLANUNG AM BEISPIEL WOHNEN

4.1 Kombination der Analyseperspektiven

Um die Wirkungen von Strategien zum Wohnen in der Stadt hinreichend untersuchen zu können, sollte ein Evaluationsansatz genutzt werden, der die unterschiedlichen Analyseperspektiven (Konformität, Leistungsfähigkeit, Ex-Ante-Rationalität) miteinander kombiniert. Es wird angenommen, dass die Verknüpfung der unterschiedlichen Evaluationsansätze innovative Potenziale der Evaluation von strategischer Stadtentwicklungsplanung bietet und die beiden wesentlichen Sichtweisen, Konformität und Leistungsfähigkeit, so voneinander profitieren können (vgl. auch Oliveira, Pinho 2011). Die Charakteristika und Besonderheiten der strategischen Stadtentwicklungsplanung – ihre zweiseitige, lineare und emergente Ausrichtung – werden dabei berücksichtigt.

4.2 Evaluationskriterien

Es gibt eine Vielzahl von Untersuchungs- und Bewertungskriterien, die mit den drei Analyseperspektiven verbunden sind. Die Gewichtung der Kriterien hängt allerdings stark mit der exakten Fragestellung im Rahmen der Evaluation zusammen. Für das gewählte Thema, die Evaluation von Strategien zum Wohnen, sind folgende Kriterien relevant:

Die Prüfung der Zielerreichung (u. a. Vergleich wesentlicher Indikatoren der Bevölkerungs- und Wohnungsmarktentwicklung) und der Übereinstimmung der nachfolgenden Entscheidungen und Aktivitäten mit der Strategie (u. a. teilräumliche Wohnungsentwicklungskonzepte, Wohnungsbauprogramme) sind wesentliche Bewertungsaspekte der Konformität.

Im Rahmen der Leistungsfähigkeit werden beispielsweise die Einflussfaktoren für Entscheidungen (z. B. Änderung gesetzlicher Regelungen wie Mietpreissbremse), die Bezugnahme nachfolgender Entscheidungen und Aktivitäten auf die Strategie (z. B. in Begründungen der Bebauungsplanung) sowie die Selbstbindung der Akteure (z. B. Einbeziehung der Wohnungsunternehmen in Strategieentwicklung, Haltung der Akteure zu den Strategien) beleuchtet.

Abb. 1: Kombination der Evaluationsperspektiven, Quelle: eigene (Bild rechts, Bild unten), verändert nach FHH 2011 (Bild links)

Mit der Perspektive Ex-ante-Rationalität sind unter anderem die Erwartungen der Akteure an den Plan (z. B. Chance oder „Papiertiger"), die Zielsetzungen (u. a. Steigerung des Wohnungsbaus, zielgruppenspezifische Qualifizierung des Wohnungsbestandes), die Relevanz und Verhältnismäßigkeit der Planung (z. B. Zielgruppen und -größen im Abgleich mit Bevölkerungsentwicklung), der Entstehungsprozess (u. a. Beteiligungsmöglichkeiten der wohnungsmarktrelevanten Akteure wie Wohnungswirtschaft oder Interessenvertretungen der Bürger) und die strategische Qualität des Plans (z. B. Ausweisung prioritärer Wohnungsbauprojekte im Rahmen einer Gesamtstrategie).

4.3 Bedeutung eines Methoden-Mixes

Um allen drei Analyseperspektiven – Konformität, Leistungsfähigkeit und Ex-ante-Rationalität – gerecht zu werden, wird im Rahmen der Evaluation von strategischer Stadtentwicklungsplanung im Handlungsfeld Wohnen eine Mischung aus qualitativen und quantitativen Methoden (Methoden-Mix). Nur so kann ein weitreichendes Verständnis der Wirkungen und Wirkungszusammenhänge erreicht werden. Zudem erhöht ein Methoden-Mix die Stichhaltigkeit der Aussagen, weil die Wirkungen aus unterschiedlichen Perspektiven betrachtet werden (Triangulation). Strategische Stadtentwicklungsplanung ist ein sozialer Prozess, der sich nicht ausschließlich mit quantitativen Methoden darstellen lässt, sondern auch qualitative Methoden erfordert. Um Effekte und ihre Einflussfaktoren hinreichend beurteilen zu können, müssen die Methoden der Komplexität von Planung gerecht werden (Kühn 2004). Eindeutige Ursache-Wirkungs-Zusammenhänge abzubilden, ist allerdings auch bei dem vorliegenden Ansatz schwierig. Gewisse Grenzen der einzelnen Methoden bleiben trotz ihrer Kombination und Ergänzung bestehen.

Der Einsatz von qualitativen Methoden wie Experteninterviews in Fallstudien trägt dazu bei, „Wirkungsprozesse detailliert herauszuarbeiten und hierbei das Handlungswissen und die Erfahrungen der Akteure selbst intensiv zu nutzen" (Hellstern, Wollmann 1984b: 40). Insbesondere für die Begutachtung der Leistungsfähigkeit von Planung, der Entscheidungsprozesse und Handlungspraxis (siehe Kapitel 3.3) ist dies von Bedeutung. Geeignete Interviewpartner stellen Vertreter/innen der am Wohnungsmarkt beteiligten Akteure dar, die den drei „Sphären", Markt, Staat (Politik und Verwaltung) und Gesellschaft angehören (Selle 2012).

Der Einsatz quantitativer Methoden wie die Erhebung und Auswertung statistischer Daten, die unter anderem für die Prüfung der Konformität genutzt werden, ist in der strategischen Stadtentwicklungsplanung und insbesondere auch im Bereich Wohnen verbreitet. Viele Kommunen pflegen ein Monitoring im Bereich Stadtentwicklung und Wohnen (u. a. mit den Indikatoren Baugenehmigungen und -fertigstellungen, Wohnungsbestand, Miet- und Kaufpreise). Teilweise werden auch Bevölkerungsbefragungen (z. B. zur Wohnzufriedenheit oder zu den Wanderungsmotiven) durchgeführt, die repräsentative Informationen aus Sicht der Nutzer/innen liefern. Auch diese können in die Evaluation einfließen.

5 FAZIT UND AUSBLICK

Strategische Stadtentwicklungsplanung im Handlungsfeld Wohnen kann eine Rolle für das Handeln unterschiedlicher Wohnungsmarktakteure und für die reale Entwicklung in der Stadt spielen. Die Frage ist allerdings, welchen Beitrag sie in der Praxis leisten kann. Das Paper hat gezeigt, dass es für eine systematische Untersuchung der realen Effekte hilfreich ist, die theoretischen Ansätze zum Forschungsgegenstand und zur Evaluation selbst in die Entwicklung des Untersuchungsdesigns miteinzubeziehen. Es wurde ein Evaluationsansatz erarbeitet, der drei Analyseperspektiven berücksichtigt – die Konformität, Leistungsfähigkeit und Ex-ante-Rationalität. Allerdings ist noch eingehend zu prüfen, welche Möglichkeiten und Grenzen die Anwendung des Evaluationsansatzes bietet. Es zeigt sich bereits, dass der umfassende Kriterien- und Methodeneinsatz einen hohen Arbeitsaufwand bedeutet, der, wie dargestellt, grundsätzlich ein Hemmnis für die Durchführung von Evaluationen darstellt. Der Mehrwert einer solchen Herangehensweise wie eine potenziell höhere Stichhaltigkeit der Erkenntnisse über die Wirkungszusammenhänge wird sich noch herausstellen. Sicher ist, dass die Auseinandersetzung mit den Effekten strategischer Stadtentwicklungsplanung dazu beitragen kann, die Umsetzungs- und Anwendungschancen in der Planungspraxis zu erhöhen sowie die planungstheoretischen Ansätze in diesem Forschungsfeld weiterzuentwickeln.

6 QUELLEN

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Application of Aggregated Indices Randomization Method for Prognosing the Consumer Demand on Features of Mobile Navigation Applications

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1 ABSTRACT

The issue of this paper is to implement aggregated indices randomization method for prognosing the consumer demand on features of mobile navigation applications. Modern consumers are eager for the applications to provide them with more vast and sophisticated set of options than just building a shortest rout from A to B. Our goal is to analyse and compare the market leading navigating products and to compile the number of necessary and useful features the future product ought to possess for it to be competitive and profitable. After we examined a set of competing products we distinguish the most popular properties they possess. Using the „NNN-information“ from several groups of experts, we then range this properties according to their „value“ to the predicted success of future application.

2 INTRODUCTION

One of the most relevant products on navigation market are mobile applications [8]. The market is full of vast selection of various navigating applications by different developers for any sort of devices [2]. Yet mobile apps producers are mostly focused on development aspect of their product [4, 6, 7]. Many articles dealing with app development pay much more attention to the technical side of the process [9, 10, 11], rather than exploring what features of the popular products make them market-leaders. In our paper we focus on the matter of developing of new mobile navigation application, competitive and able to satisfy a growing consumer demand, based on the analysis of distinctive features of existing successful products.

Research ProblemConsidering the fact that navigation application market is already quite full [3, 5], in order to successfully win over the market niche for a new application, the idea behind new GIS navigation product should be to satisfy more vast and sophisticated set of consumer needs than building a shortest rout from A to B. We shall use the aggregated indices randomization method to make the closest to accurate prediction about the short-term future needs of the consumers. We shall analyse the number of most popular navigation apps existing (see part IV), and single out the most distinctive features of each product. Then, according to the method given in part III, using the “expert data”, we shall range the features according to their “relevance”. Thus yielding the set of features our future product ought to possess in order to be commercially successful.MethodIn this project we regard the stage of designing features our product shall hold. The method we use is based on the Bayesian model of uncertainty randomization [1]. Additional non-numeric, non-exact, and non-complete expert knowledge (NNN-knowledge, NNN-information) is used for final estimation of the alternatives’ probabilities.

General scheme of the method [1]:

Consider at a present time-point t_1 a complex system, which can proceed to one of the finite number of alternatives $A_1,\dots,A_r$ at a future time-point t_2. Suppose that a decision maker has m different sources of information (experts) about probabilities $p_i = P(A_i), i = 1,\dots,r, p_i \geq 0, p_1 + \dots + p_r = 1$ of the system transition into alternative states $A_1,\dots,A_r$ at the time-point t_2. The decision maker obtains NNN-knowledge I_j from “experts”, which can be presented as a vector $I = (I_1,\dots,I_m)$ that consists of systems of equalities and inequalities for probabilities $p_1,\dots,p_r$. The decision maker has NNN-knowledge J about the comparative ‘‘weights” of the sources of information. So, the whole NNN-knowledge constitutes vector $(I;J) = ((I_1,\dots,I_m);J)$ $(I;J) = ((I_1,\dots,I_m);J)$, where I_j, is information obtained from jth source, and system J is NNN-knowledge that expresses preferences of the decision maker about the comparative significance of sources of information. If we take into account information I_j, we can form a set $P(r;I_j)$

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of all admissible (according to information I_j), probability vectors $p=(p_1,\dots,p_r)$. Modelling uncertain choice of vector $p=(p_1,\dots,p_r)$ from the set $P(r;I_j)$ by a random choice, we obtain random probability vector

$\tilde{p}_1(I_j)+\dots+\tilde{p}_r(I_j)=1$ $\tilde{p}(I_j)=(\tilde{p}_1(I_j),\dots,\tilde{p}_r(I_j)),\tilde{p}_i(I_j)\geq 0,$ which has uniform distribution

on set $P(r;I_j)$. Component $\tilde{p}_i(I_j)$ of random vector $\tilde{p}_i(I_j)$ represents random estimation of probability of alternative A_i according to information I_j , obtained from jth source. Vector of mathematical expectations $\bar{p}(I_j)=(\bar{p}_1(I_j),\dots,\bar{p}_r(I_j))$ we will interpret as numerical image of NNN-information I_j . In other words, vector $\tilde{p}_i(I_j)$ is a result of information I_j quantification. In these terms random vector $\tilde{p}_i(I_j)$ is a stochastic quantification of NNN-information I_j .

3 IMPLEMENTATIONFOR DESIGNING OUR APPLICATION USING METHOD ABOVE, WE ANALYSE MOST POPULAR NAVIGATION PRODUCTS OF THE COMPETITORS.

Top apps for Android:

1. Google Maps [12]

The app allows you to see your location on a map, even if you don't have GPS, load offline maps, shows traffic, brows for local places of interest and rate and review them, can get you routes and schedules to travel via subway, bus, bike, or on foot and provides street view imagery, indoor maps, and 3D maps and etc.

2. Navfree [13]

Allows instant rooting and offline maps, option of viewing the map in 2D, 3D or a safety screen, automatic switching to Day & Night maps, browsing for POI, provides in-app purchasing of additional options (safety camera data, live parking information) and etc.

3. TomTom [14]

This app supplies offline maps, stored on your phone, and free lifetime maps, biggest database of real travel time, spoken instructions include street names, supports multitasking capability, 2D and 3D view, browsing for POI, provides lane guidance and in-app purchasing of additional options (speed cameras location, live traffic) and etc.

4. Sygic [15]

Provides up-to-date reports on traffic jams, road works and incidents, shows speed limit, current speed and speed cameras.

5. Waze [16]

Is a community-based traffic and navigation app (drivers in your area share real-time traffic and road information). Provides alerts before you approach police, accidents, road hazards or traffic jams, gas prices. Coordinates with Facebook and provides information about your friends vehicles, helps coordinate arrival time.

After analyzing and comparing the market leading products, we compile the list of features necessary for any future competitive app.

Our next step is contemplating which options existing in competitors' products are most significant for the future app.

We consult several groups of “experts” to range the features according to their relevance.

The NNN-information one group provides as an example:

Street view representation:

2D street view ≥ 3D street view ≥ imagery street view

According to the method above, numeralization of experts' estimations looks as follows (Table 1):

	2D street view	3D street view	Imagery street view
Means	0,5345	0,3103	0,1552
Dispersions	0,0209	0,0278	0,0209
Correlation matrix	1,0000	0,5000	0,3333
	0,5000	1,0000	0,6667
	0,3333	0,6667	1,0000
Covariance matrix	0,0209	0,0139	0,0070
	0,0139	0,0278	0,0139
	0,0070	0,0139	0,0209

Table 1: Distribution Estimations

Suppose, we have our experts divided into three groups according to the level of trust we hold in them.

$w(1), w(2), w(3); w(2) \geq w(3) > w(1)$

Numeralization of expert groups are presented in Table 2.

	First group	Second group	Third group
Means	0,1452	0,5000	0,3548
Dispersions	0,0183	0,0183	0,0243
Correlation matrix	1,0000	0,3333	0,5000
	0,3333	1,0000	0,5000
	0,5000	0,5000	1,0000
Covariance matrix	0,0183	0,0061	0,0122
	0,0061	0,0183	0,0122
	0,0122	0,0122	0,0243

Table 2: Distribution Estimations

We execute a correction of our earlier estimation of means of distribution in accordance with the ranking of our experts. (Table 3)

	2D street view	3D street view	Imagery street view
Means	0,5122	0,1792	0,3086
Dispersions	0,0397	0,0135	0,0194
Correlation matrix	0,0397	0,0159	0,0221
	0,0159	0,0135	0,0119
	0,0221	0,0119	0,0194
Covariance matrix	1,0000	1,1771	1,1366
	1,1771	1,0000	0,6096
	1,1366	0,6096	1,0000

Table 3: Resulting Estimations

Executing our method yields list of results as follows:

Street view representation:

(1) 2D street view

(2) Imagery street view

(3) 3D street view

These are some of the qualities, ranked by preference, that, according to our “experts”, can guarantee the profitability of future navigation application. This set was selected and sorted by relevance by using experts' NNN-information and applying aggregated indices randomization method.

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ConclusionAggregated indices randomization method has shown accurate and consistent results. By using it it is possible to distinguish quite successfully between a number of similar alternatives. Yet the main imperfection of this method is that we wholly on our chosen experts and their opinion. Thus for this method to be consistent the chosen experts have to be highly qualified in the field of sturdy.

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Beiträge innovationsorientierter Unternehmensförderung zur Umsetzung des Smart-City-Konzepts am Beispiel Wien

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1 ABSTRACT

Ausgehend vom spezifischen Kontext Wiens argumentiert der vorliegende Artikel, dass die städtische Wirtschaftspolitik durch konsequent innovationsorientierte Unternehmensförderung unverzichtbare Impulse für die Umsetzung des Smart-City-Konzepts setzen kann: Im ersten Teil wird das Verständnis von bzw. der Zugang der Wiener Stadtverwaltung zum Thema Smart City präsentiert. Darauf aufbauend präsentiert das zweite Kapitel die Wiener Unternehmen als unverzichtbare Akteure für die Umsetzung dieses Konzepts: Sie schaffen nicht nur Arbeitsplätze und damit die Basis für den materiellen Wohlstand der städtischen Bevölkerung, sondern gestalten mit ihren Produkten, Dienstleistungen und ihrer Präsenz bzw. der Präsenz ihrer Produktionsprozesse die Stadt. Der dritte Teil ist der Wiener Wirtschaftspolitik gewidmet, und dabei besonders den von der Wirtschaftsagentur Wien angebotenen Instrumenten der Unternehmensförderung. Aufbauend auf dem aktuellen Stand der wissenschaftlichen Diskussion, jüngerer Evaluierungen sowie ausgewählten Förderprojekten wird die konsequente Fokussierung der Instrumente auf die Initiierung von Innovation als zentrales Erfolgskriterium identifiziert. Im abschließenden vierten Kapitel werden die angestrebten Wirkungen dieser wirtschaftspolitischen Ausrichtung zusammengefasst: (1) Beiträge der Unternehmen zur erfolgreichen Umstetzung des Smart-City-Konzepts auf Basis von lokal entwickelten Lösungen, (2) nachhaltige Unternehmensentwicklung u. a. aufgrund des Auftritts auch auf internationalen Märkten sowie (3) verbesserte internationale Sichtbarkeit des Wirtschaftsstandorts Wiens aufgrund von lokal entwickeltem Know-how und ihrer zukunftsweisender Umsetzungen durch die Stadtverwaltung.

2 UMSETZUNG UND BEDEUTUNG DES SMART-CITY-KONZEPTS AM BEISPIEL WIENS

2.1 Herausforderungen/Ausgangslage/Notwendigkeiten

Der Klimawandel und eine drastische Verknappung natürlicher Ressourcen, vor allem fossiler Energieträger, kennzeichnen große globale Herausforderungen der kommenden Jahrzehnte. Sie bestimmen vor allem die künftige Gestaltung des Lebensraums Stadt. Bereits seit dem Jahr 2007 leben mehr als 50 Prozent der Weltbevölkerung in urbanen Siedlungsgebieten. Diese absolute Zahl von 3,3 Milliarden wird sich in den nächsten Jahrzenten voraussichtlich verdoppeln (Statista GmbH 2014, online). Der Umgang der Städte mit einer stetig steigenden Bevölkerung im Zusammenhang mit notwendigen adaptierten Investitionen im Bereich von Infrastruktur, Energieversorgung, Mobilitätsaufkommen, wirtschaftlichen als auch sozialen Komponenten wird das zukünftige Bild der globalen Entwicklung prägen.

Städte stehen vor großen Herausforderungen, besitzen aber auch die entscheidende Rolle und Chance zur Lösung dieser. Urbane Ballungsräume bilden die Wachstums- und Entwicklungsmotoren der Zukunft und müssen im Rahmen einer nachhaltigen und intelligenten Stadtentwicklung die notwendigen Aussichten zur Lösung gesellschaftlicher, wirtschaftlicher, ökologischer und politischer Probleme aufzeigen. Den Städten kommt somit eine tragende Rolle in der Gestaltung der Zukunft zu. Die Transformation hin zu erneuerbaren Energien in Städten bildet im Zusammenhang mit dem Klimawandel und dessen Konnex zu steigenden CO2 Emissionen und der absehbaren Einschränkung natürlicher Ressourcen eine der größten aktuellen Herausforderungen. Derzeit werden in Städten durch die Verbrennung fossiler Energien etwa 75 Prozent der weltweiten CO_2-Emissionen verursacht (tina vienna o.J., 3).

2.2 Internationale Ebene/Europäische Ebene

Auf europäischer Ebene ist man sich dieser Kohärenz bewusst und hat bereits die ersten entscheidenden Schritte zur gemeinsamen Lösungsfindung aufgezeigt. Die Europäische Kommission hat gemeinsam mit den Energieministern den Mitgliedsstaaten im Jahr 2011 die Europäische Energy Roadmap 2050 publiziert. Eine Senkung der CO_2- Emission pro Kopf um 80 Prozent bis 2050, im Vergleich zu 1990, steht im Zentrum der ausgearbeiteten Zielvorgaben (Europäische Kommission 2011). Intelligente Technologien, Systeme und

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Konzepte sind die Antwort auf die Herausforderungen der Zukunft, indem sie systemische Lösungsansätze nutzen, um eine zukunftsfähige, energieeffiziente und nachhaltige Wirtschaft in der Stadt zu verwirklichen. Smart City – eine intelligente, zukunftsfähige Stadt – ist damit der Leitfaden in ein neues Energie-, Mobilitäts- und Wirtschaftssystem, das die Lebensqualität der Bürgerinnen und Bürger langfristig sicherstellen soll. Auf dem Weg zur emissionsarmen Wirtschaft werden der ökologische Fußabdruck und damit die Umweltbelastung reduziert. Smart Cities sind ein stark wachsender Markt, doch auch zwischen den Städten herrscht ein Wettbewerb um Wirtschaftsstandort, Innovation, „smarter" Stadttechnologien, Arbeitsplätze sowie Förderungen durch die Europäische Union.

2.3 Der Weg Wiens/Smart-City-Wien-Initiative

Wien zählt in Bereichen wie Lebensqualität, Infrastruktur und Innovation bereits jetzt zu den erfolgreichsten Städten der Welt und nimmt somit auf internationaler Ebene eine wichtige Vorreiterrolle im Bereich der Umwelt- und Lebensqualität ein (Madreiter, Thomas/Haunold, Veronika 2012, S.37). Diesen Status gilt es für die Zukunft zu sichern. Um seinen Bewohnerinnen und Bewohnern glaubwürdige Perspektiven zu bieten, setzt die Stadt auf das Konzept der “Smart City”, der intelligentenund zukunftsfähigen Stadt. Die oberste Maxime ist die Sicherstellung und kontinuierliche Verbesserung der ökologischen, wirtschaftlichen und sozialen Leistungsfähigkeit. Die Stadt Wien steht dabei vor schwierigen Herausforderungen. Die Bevölkerung der Bundeshauptstadt wächst, der Großraum Wien wird in den nächsten Jahren zur Zwei-Millionen-Metropole. Diese Expansion ist mit einem steigenden Bedarf an Energie, Arbeitsplätzen, günstigem wie zweckmäßigem Wohnraum sowie zukunftsorientierten Verkehrskonzepten verbunden.

Bereits im Jahr 2011 initiierte Bürgermeister Dr. Häupl die “Smart-City-Wien-Initiative”. Ziel dabei war es, Wien in einem ersten Schritt auf die Herausforderungen der Zukunft vorzubereiten. Diese zielgerichtete Zusammenarbeit zwischen öffentlichen und privaten Institutionen, der Wiener Stadtverwaltung, Forschungsinstitutionen und Unternehmen weist für den von Wien eingeschlagenen Weg eine besonders hohe Erfolgsaussicht auf. „Smart City Wien ist somit nicht ein Projekt Einzelner, sondern ein gemeinsames Konzept der Stadt unter Beteiligung aller Bürgerinnen und Bürger“, so die Geschäftsführerin von tina vienna Veronika Haunold (Stadt Wien MA 53 Presse- und Informationsdienst 2013/14, S. 7). Die Initiative Smart City Wien hat sich dem Anstoß der politischen Führungsebene folgend, der konsequenten und kontinuierlichen Modernisierung der Stadt verschrieben, um Energieverbrauch und Emissionen signifikant zu senken, ohne dabei auf Konsum oder Mobilität verzichten zu müssen. Smart City Wien ist in seiner Definition eine langfristige Initiative der Stadt Wien zur besseren Gestaltung und Entwicklung der Bundeshauptstadt. Als Querschnittmaterie umfasst Smart City Wien alle Bereiche des städtischen Lebens, Beruf wie Freizeit gleichermaßen, und reicht von Infrastruktur, Energie, Mobilität bis hin zur gesamten Stadtentwicklung. Im Detail bezeichnet Smart City Wien die Entwicklung einer Stadt unter den Prämissen radikaler Ressourcenschonung, ganzheitlicher Betrachtungsweisen, hoher, sozial ausgewogener Lebensqualität und den produktiven Einsatz von Innovationen/neuen Technologien.

2.4 Schwerpunktsetzung/Ziele

Die Zielsetzungen der Smart-City-Initiative sind in die grundsätzliche Ausrichtung der Wiener Stadtplanung eingebettet und lassen sich folgendermaßen darstellen (Magistrat 18 – Stadtentwicklung und Stadtplanung 2012, 17ff):

- Signifikante Reduktion der Emissionen ($CO2$, Treibhausgase und so weiter) und dadurch Erreichung der EU-Klimaschutzziele. Fernziel: Nullemissions-Gebäude (Zero Emission City, Zero Emission Buildings) als Standard
- Signifikante Reduktion des Energieverbrauchs. Fernziel: Nearly Zero Energy-Standards im Neubau/Bestand bis 2020
- Signifikanter Anstieg beim Einsatz erneuerbarer Energien (zum Beispiel bei öffentlichen Gebäuden)
- Bewusstseinsbildung in der breiten Öffentlichkeit zum verantwortungsvollen Umgang mit Ressourcen (Energie, Wasser)
- Aktive Rolle der Bürgerinnen und Bürger (vom Consumer zum Prosumer) im Sinne einer Steuerung zusätzlicher Bereiche des täglichen Lebens

- Multimodale Verkehrssysteme mit Ausbau des Öffentlichen Personennahverkehrs, bessere Vernetzung zwischen unterschiedlichen Verkehrsträgern und signifikante Reduktion des motorisierten Individualverkehrs
- Internationale Positionierung Wiens als europäische Umweltmusterstadt sowie als führende europäische Metropole bei Forschung und Technologieentwicklung

2.5 Rahmenstrategie

Es existieren bereits zahlreiche Pläne und Programme in Wien sowie Strategien auf internationaler und nationaler Ebene, die größere Einzelbereiche abdecken. Ziel ist es „das vorhandene Know-how in den unterschiedlichen städtischen Bereichen miteinander zu vernetzen und intelligente Antworten auf die aktuellen Herausforderungen zu finden“, so Wiens Bürgermeister Michael Häupl (wien.at o.J, online). Eine Strategie Smart City Wien will einen förderlichen, strukturierenden und vor allem legislativen Rahmen bilden, der ein zielgerichtetes Handeln der Akteure fördert. Neben der Vision sollen Ziele bzw. Zielhierarchien, konkrete Strategieansätze, Smart City Wien Projektbewertungskriterien erarbeitet sowie ein koordiniertes Politikhandeln ermöglicht werden.

Die Stadt Wien versucht also das Thema ganzheitlich zu fassen und im Rahmen einer Strategie zu verschriftlichen. Diese zukünftige Smart City Wien Rahmenstrategie ist als Dachstrategie zu sehen, welche einen förderlichen, langfristigen und strukturierenden Rahmen neben anderen bestehenden Dokumente, Plänen und Programmen schafft. Die Strategie einer smarten Stadt ordnet sich folgend in die bestehende Landschaft von Dokumenten, Aktionen und Akteure ein. Die Aufgabe einer Smart City Wien nimmt die wichtigsten nationalen und europäischen Dynamiken auf und übersetzt diese in Aktion für die Stadt. Im Gegensatz zu den sehr detaillierten Handlungsanweisungen der Planungsdokumente der Stadt sollen die großen Linien vorgezeichnet und auch verbindlich gemacht werden. Im Laufe des Prozesses bei der Erstellung der Smart City Wien Rahmenstrategie wurden eine Definition für Smart City Wien festgelegt, die Hauptfokuspunkte präzisiert, eine Vision erstellt sowie Ziele und Aktivitäten definiert. Grundlage dafür bilden Gruppendiskussionen, Themenworkshops und Interviews, in denen verschiedene Themenfelder detailliert erarbeitet werden.

3 DIE UNTERNEHMEN DER LOKALEN WIRTSCHAFT ALS ZENTRALE AKTEURE IN DER UMSETZUNG DES SMART-CITY-KONZEPTS

Um diesen seitens der Wiener Stadtverwaltung definierten Anforderungen (MA 27, EU-Strategie und Wirtschaftsentwicklung 2006, online; MA 18, Stadtentwicklung und Stadtplanung 2005, online; Magistrat der Stadt Wien, MD-KLI 2009, online) gerecht zu werden, ist die Beteiligung einer möglichst großen Breite an Akteuren erforderlich. Erste Grundvoraussetzung ist die umfassende Involvierung aller Teile der Stadtverwaltung sowie eine übergreifende Kooperation mit den verbundenen Unternehmen der Stadt (zu bedeutenden Beteiligungen der Stadt Wien siehe etwa Wien Holding 2013, S.20ff. oder Wiener Stadtwerke 2013, S.61ff.), um die kohärente Ausrichtung der Aktivitäten der öffentlichen Hand zu gewährleisten. Darüber hinaus wird jedoch auch und besonders die Einbeziehung privater Akteure in diese Strategie als zentral angesehen: die Wiener Smart City Agentur stellt etwa fest, dass die „gezielte forschungs- und technologiepolitische Schwerpunktsetzung der Stadt und eine breite Einbindung der Bevölkerung, der Industrie, der Forschung und der Wiener Unternehmen in den Smart City Wien Prozess für eine erfolgreiche Transformation unabdingbar“ seien (smartcity.wien.at, online). Das bedeutet, dass für die Implementierung einer Smart City Strategie im Sinne des oben beschriebenen Ansatzes unter der strategischen Leitung der Stadtverwaltung eine große Anzahl an Stakeholdern in den Smart City Prozess involviert werden müssen, damit dieser sein volles Potential umsetzen kann. Am deutlichsten wird dieser Zugang in dem Slogan „Wien hat 1,7 Millionen Gehirne. Nutzen wir sie.“ (wien.at 2013, S.1), der explizit die Bedeutung aller Wienerinnen und Wiener für die Umsetzung dieser Strategie anspricht.

3.1 Smarte Projekte brauchen smarte Unternehmen

Auf Ebene der konkreten Projektumsetzung gilt, dass smarte Projekte nur durch smarte Anbieter umgesetzt werden können, da überwiegend know-how intensive und systemische Lösungsansätze zum Einsatz kommen. Die öffentliche Hand kann dabei als Regulator, Initiator oder Projektverantwortliche Stelle auftreten, selten jedoch als schlussendlich ein Projekt umsetzende Institution. Diese Rolle – von der

Projektplanung über die Herstellung der eingesetzten Materialen und Produkte bis hin zur Implementierung von Softwarelösungen oder die laufende Betreuung der Nutzerinnen und Nutzer – fällt in aller Regel Akteuren aus dem Unternehmenssektor zu. Das bedeutet, dass diese Unternehmen zentrale know-how-Träger für die Umsetzung von Smart City Projekten sind.

Als Beispiel dafür kann etwa das von einem Tochterunternehmen der Wirtschaftsagentur Wien im Plusenergiestandard errichtete Technologiezentrums „aspern IQ“ (aspern-iq.at 2014, online) angeführt werden. Diese erste im Wiener Stadtentwicklungsgebiet Seestadt Aspern eröffnete Immobilie repräsentierte zum Zeitpunkt ihrer Eröffnung im Oktober 2012 den modernsten Stand der Technik. Die unverzichtbare Bedeutung, die hochspezialisierte Unternehmen für seine Errichtung spielten, wird etwa im Projektbericht deutlich, wo in den Schlussfolgerungen etwa festgestellt wird: „Eine weitere wichtige Erkenntnis aus dem Projekt aspern IQ war die Notwendigkeit eines umfangreichen Expertenteams, welches bereits am Anfang des Planungsprozesses gemeinsam die Lösungsvorschläge für die Erreichung der Planungsziele erarbeitet. Aufgrund der höheren Komplexität eines so innovativen Gebäudekonzeptes, ist die frühe Einbindung der diversen Sonderkonsulenten wie beispielsweise Haustechnikplaner, Beleuchtungsplaner, Hydrogeologe oder Simulationsexperte bereits in der Phase des Vorentwurfs unbedingt erforderlich.“ (bmvit 2014, S.31).

3.2 Unternehmen zugleich Träger von Know-how als auch Treiber der Entwicklung

Das Beispiel aspern IQ illlustriert, in welchem Ausmaß die Umsetzung dieses Teilprojekts der Wiener Smart City Strategie von der Verfügbarkeit hochspezialisierter Produkte und Dienstleistungen abhängig ist. Eine den Ansprüchen des oben formulierten Wiener Zugangs zum Thema Smart City entsprechende Umsetzung kann damit nur auf der Basis von intensiver Kooperation mit vor Ort verfügbaren know-how Trägern umgesetzt werden. Im Idealfall wird diese Rolle in bedeutendem Ausmaß von Unternehmen übernommen, die eine intensive Beziehung zum Projektstandort aufweisen. Eine Smart City benötigt also smarte Unternehmen am Standort, denn erst dadurch kann diese gegenseitig befruchtende Kooperation zwischen öffentlicher Hand und Unternehmenssektor langfristige Wirkung tragen. In diesem Sinne können Unternehmen im Smart City Kontext keine passive Rolle einnehmen. Ganz im Gegenteil besitzen sie das Potential, durch die von ihnen entwickelten Produkte und Dienstleistungen zu aktiven Treibern der Entwicklung zu werden. Diese Rolle wird dem Unternehmensbereich auch von Seiten der Europäischen Union zugewiesen, die etwa in einer Mitteilung zu ihrer Smart Cities-Partnerschaft feststellt, dass diese „auf industriegetriebene Innovation als Hauptmotor des wirtschaftlichen und sozialen Wandels in städtischen Gebieten [setzt] und Maßnahmen entlang des gesamten Innovationszyklus und in verschiedenen Sektoren“ fördert (Europäische Kommission 2012, 2).

3.3 Weltmarkt “Smart City”

Diese Lösungen werden weltweit nachgefragt, und stellen damit für innovative Unternehmen einen globalen Zukunftsmarkt dar. Sichtbar wurde das nicht zuletzt im Rahmen der Umstrukturierung des Siemens-Konzerns im Jahre 2011 und der damit einhergehenden Etablierung der Sparte „Infrastructure & Cities“ als eine von vier Geschäftsbereichen des Weltkonzerns. Bereits heute werden 51% der globalen Wertschöpfung in den 600 vom Beratungsunternehmen McKinsey als „bedeutendste Städte weltweit“ definierten Metropolen erwirtschaftet (Siemens 2013, S.5). Siemens, der größte private Arbeitgeber am Standort Wien, identifiziert hier einen adressierbaren Markt mit einem Volumen von 236 Mrd. Euro, der darüber hinaus in den Jahren 2011-17 von überdurchschnittlichem Wachstum gekennzeichnet sein soll (Siemens 2013, S.6).

Eine urbane Wirtschaftspolitik, die Initiativen setzt um Unternehmen am Weg in Richtung smarte Produkte und Dienstleistung begleitet, verspricht die Chance auf eine „doppelte Dividende“: einerseits trägt sie dazu bei, smarte Projekte auf Basis von lokalem know-how umzusetzen. Das garantiert nicht nur die Nachhaltigkeit der einzelnen Projekte, sondern lässt auch vor Ort neue Ansatzpunkte für zukünfte Weiterentwicklungen entstehen. Hier liegt ein Unterscheidungsmerkmal zwischen tatsächlich „smarten“ Städten, die ihre Entwicklung aus sich heraus steuern, und „nur“ modernen Städten, die internationale Trends vor Ort zur Anwendung bringen. Andererseits werden auf diesem Weg die lokalen Unternehmen unterstützt, das international wachsende Marktsegment Smart City zu bearbeiten. Insbesondere über die Ausrichtung ihrer Beschaffungspolitik können Städte dazu beitragen, den Betrieben einen kaufkräftigen Heimmarkt für ihre innovativen Produkte und Dienstleistungen die Basis für Expansionen auf internationale Märkte zu bieten.

4 DIE WIENER WIRTSCHAFTSPOLITIK

Im österreichischen Kontext nimmt die Stadt Wien als Bundeshauptstadt, eigenständiges Bundesland und Gemeinde eine Sonderrolle ein. Mit dem Sitz der obersten Organe der Republik (Parlament, Staatsoberhaupt, Bundesregierung, Höchstgerichte) ist Wien ein politisches Zentrum der Republik. Aufgrund der Stellung als Bundesland ist Wien im Bundesrat vertreten und hat zudem das Recht einer eigenen Gesetzgebung und einer eigenen Landesvollziehung. Auch auf wirtschaftlicher Ebene ist die Bundeshauptstadt mit über einem Viertel der gesamtösterreichischen Wertschöpfung und dem höchsten Einkommensniveau aller Bundesländer klares Zentrum des Landes (vgl. MA23, 2012). Zur Illustration der Bedeutung des Standorts Wien, seit 2014 der siebtgrößten Stadt der Europäischen Union (Wikipedia, online) und auf Rang zehn der wohlhabendsten Regionen der EU (Eurostat 2013, 2), sind nachstehend einige zentrale Kennzahlen angeführt (Wirtschaftsagentur Wien 2014a):

- Bruttoregionalprodukt (2011, Mio. €): 77.942
- Bruttoregionalprodukt/Kopf (2011, €): 45.600
- Prognose reales Wachstum Bruttoregionalprodukt (2014, %): 1,2
- Prognose Wachstum unselbstständige Beschäftigungsverhältnisse (2014, %): 0,5
- Aktive Mitglieder der Wirtschaftskammer Wien (2012): 99.281
- Zahl der Arbeitgeberbetriebe (2012): 55.941
- Zahl der Ein-Personen-Unternehmen (2012): 57.569
- Unternehmensneugründungen (2013, vorläufig): 8.403
- Bevölkerung Wien (1.1.2014): 1.765.649
- Bevölkerungswachstum (2013, %): 1,4
- Standardbeschäftigungsverhältnisse (2012): 786.384
- Arbeitslosenquote nach EU-Methode (2012, %): 7,9

4.1 Die Wirtschaftsagentur-Wien-Gruppe

Die Unternehmensförderung der Stadt Wien wird durch die Wirtschaftsagentur Wien abgewickelt. Die Mission dieser 1982 auf Basis des Wiener Landes-Stiftungs- und Fondsgesetz eingerichteten städtischen Institution ist die Stärkung und Entwicklung des Wirtschaftstandorts Wien (Wirtschaftsagentur Wien 2013, 6). Damit stellt die Wirtschaftsagentur Wien, gemeinsam mit ihren Tochterunternehmen ZIT, der Technologieagentur der Stadt Wien, sowie departure, der Kreativagentur der Stadt Wien, das zentrale wirtschaftspolitische Instrument der Stadt Wien dar. Für die Umsetzung ihres Auftrags agiert die Gruppe innerhalb folgender strategischer Leitplanken (Wirtschaftsagentur Wien 2013, 6):

- Wachstum und Innovation forcieren
- Moderne Infrastruktur zur Verfügung stellen
- Bewusstsein für Unternehmertum und Forschung stärken

4.2 Die Instrumente der Wirtschaftsagentur Wien Gruppe

Die Instrumente, die von der Wirtschaftsagentur Wien Gruppe zur Umsetzung ihrer Mission eingesetzt werden, lassen sich in die drei Säulen Förderungen, Immobilien sowie Services und Beratungen gliedern. Mit den Förderungen von Wirtschaftsagentur Wien, ZIT und departure wird das Ziel verfolgt, innovative Projekte von Unternehmen auszulösen und so Wertschöpfung und Beschäftigung am Standort Wien zu steigern (Wirtschaftsagentur Wien 2013, S.7). Zentraler Mehrwert wird dabei aus der integrierten Kombination von Angeboten der drei Säulen gezogen.

4.2.1 Programme der montetären Unternehmensförderung

Im Rahmen der von der Wirtschaftsagentur abgewickelten Förderprogrammen werden jährlich rund 40 Millionen an Unternehmensförderungen ausgeschüttet. Im Jahr 2013 wurden mit diesen Mitteln „rund 640 Wiener Unternehmen in der Umsetzung ihrer Projekte gefördert und dabei 110,5 Millionen Euro zusätzlich in den Standort investiert. [...] Die Förderangebote der Wirtschaftsagentur Wien Gruppe zielen flächendeckend auf Innovation und Wettbewerb ab. Hochdotierte Fördersummen von bis zu einer halben Million Euro ermöglichen die Umsetzung von forschungsintensiven Projekten am Standort. Mit dem Schwerpunkt "Urban Needs" wird [2014] durch die ZIT, ein Tochterunternehmen der Wirtschaftsagentur Wien, im Technologiebereich gezielt Wissen und Know-how abgefragt, das Lösungen für Großstädte der Zukunft anbietet. "Wir wollen das gebündelte Wissen in der Stadt auch für Zukunftsfragen nützen, die sich Wien als schnell wachsender Metropole stellen. Wir schlagen mit unserem Schwerpunkt somit zwei Fliegen auf einen Streich - Unternehmen können ihre Projekte umsetzen und wir generieren Lösungen, die der nächsten und übernächsten Generation in Wien das Leben erleichtern", so [Anm.: Vizebürgermeisterin] Brauner weiter.“ (Rathauskorrespondenz 2014, online).

Eine Reihe von Evaluierungen haben in den letzten Jahren diese Ausrichtung der Wiener Förderpolitik bestätigt. So kommt Synthesis Forschung (2012, S.4) anlässlich der 30-Jahr-Feier der Wirtschaftsagentur Wien im Jahr 2012 zu folgendem Ergebnis bezüglich der Effekte der monetären Förderungen: „Die Wirtschaftsagentur Wien Gruppe hat seit dem Startjahr 1982 rund 633 Millionen Euro an finanziellen Fördermitteln vergeben. Davon wurden 498 Millionen Euro im Rahmen von wertschöpfungsorientierten Förderungsprogrammen ausgeschüttet; teils als kriteriengebundene Breitenförderung (etwa der Jungunternehmerförderung oder der Exportförderung), teils im Vergabewettbewerb von „Calls“ (etwa Media Vienna oder Green Innovation). Um die von diesen finanziellen Förderprogrammen ausgehenden Impulse zu erfassen, hat Synthesis Forschung eine kontrollgruppenbasierte Wirkungsanalyse auf mikroanalytischer Basis durchgeführt. Zu diesem Zweck wurden 3.120 Fälle bewilligter Förderung (in wertschöpfungsorientierten Programmen) des Zeitraumes seit 2001 einbezogen. Die Wirkungsanalyse weist nach, dass von der finanziellen Förderung ein quantitativ erheblicher Impuls auf die unternehmerische Initiative der geförderten Unternehmen ausgeht.

Im Vergleich zu den Referenzbetrieben der Kontrollgruppe gelingt den geförderten Unternehmen ein rascheres jährliches Wachstum

- der betrieblichen Wertschöpfung,
- des Umfangs an Beschäftigung.

Zudem erweisen sich die geförderten Betriebe im Konjunkturaufschwung als „beweglicher“ (was die Aufstockung ihrer Personalstände betrifft), ohne deshalb im Konjunkturabschwung „standfester“ (im Halten des Personalstandes) gewesen zu sein. Eine quantitative Bilanzierung der seit 1982 insgesamt eingesetzten Fördermittel (498 Millionen Euro) ergibt ein „Gegenwartsäquivalent“ von

- 2,58 Milliarden Euro an zusätzlicher Wertschöpfung und
- 54.300 zusätzlicher Beschäftigung.“ (Synthesis Forschung 2012, S.4)

Die Studienautoren kommen daher zu folgendem Schluss: „Aus der Sicht des Auftrages an die Wirtschaftsagentur Wien Gruppe hat sich der Einsatz der finanziellen Mittel und der sie begleitenden organisatorischen Anstrengungen gelohnt.” (ebd.)

4.2.2 Immobilien

Die Wirtschaftsagentur Wien ist eine der größten Grundstückseigentümerinnen der Stadt und damit eine zentrale Anlaufstelle für Wiener Unternehmen und internationale Investoren in Fragen von Betriebsansiedlungen, -umsiedlungen oder -erweiterungen. Zu den Kernaufgaben der Wirtschaftsagentur Wien im Liegenschaftsbereich zählen Ankauf, Aufschließung und Parzellierung sowie die Vergabe von Betriebsflächen. Darüber hinaus entwickelt und errichtet sie maßgeschneiderte Technologie- und Spezialimmobilien für Unternehmen und Forschungseinrichtungen. Vorrangiges Ziel dieser Aktivitäten ist es, Wiener Unternehmen durch die Bereitstellung von betrieblicher Infrastruktur optimale Rahmenbedingungen für ihr wirtschaftliches Handeln zu bieten. Die Wirtschaftsagentur Wien Gruppe bietet Firmengründerinnen und -gründern, Kleinstbetrieben, Klein- und Mittelbetrieben, beschäftigungsintensiven Produktions¬betrieben sowie Forschungseinrichtungen die dafür maßgeschneiderten Immobilienlösungen an. Außerdem setzt sie mit der Entwicklung und Errichtung von Spezialimmobilien Akzente in jenen Bereichen, die vom Immobilienmarkt aufgrund hoher Risiken nicht ausreichend bedient werden. Bei all diesen Aktivitäten werden städteplanerische Überlegungen intensiv in die Ausrichtung der Angebote einbezogen, was die Wirtschaftsagentur zu einem wichtigen Instrument der Stadtentwicklung macht. (Wirtschaftsagentur Wien 2013b, 7f.)

4.2.3 Services und Beratungen

Mit einer Vielzahl an verschiedenen Serviceangeboten unterstützt die Wirtschaftsagentur Wien Gruppe die Wiener Unternehmen mit dem Ziel der Stärkung und Entwicklung des Wirtschaftsstandorts. Die ist damit Informationisdrehscheibe und Servicestelle für Gründerinnen und Gründer sowie Unternehmen jeder Größe und Branche in Wien. Das Spektrum reicht dabei von der Unternehmensgründung bis hin zu internationalen Kooperationsprojekten. Ein im Kontext von Smart City besonders nennenswertes Angebot ist das von der Technologieagentur ZIT angebotene Service WienWin. Es bringt Wiener Unternehmen und die Stadtverwaltung zusammen, wobei zwei Ziele im Vordergrund stehen: den von der ZIT geförderten Unternehmen soll der Markteintritt erleichtert werden mit dem Ziel, dass neue Technologien möglichst rasch eingesetzt werden können. Zum anderen wird die Wiener Stadtverwaltung dabei unterstützt, ihre Services durch den Einsatz innovativer Technologien „made in Vienna“ kontinuierlich zu verbessern. WienWin ist damit ein spezielles Service für die smarte Stadtverwaltung. (ZIT 2013b)

4.3 Verstärkte Orientierung der Förderpolitik auf das Auslösen von Innovationen

Eine umfassende Evaluierung sämtlicher monetärer Förderprogramme der Wirtschaftsagentur Wien Gruppe sowie seiner Schwestereinrichtung, dem Wiener Arbeitnehmerinnen- und Arbeitnehmerförderungsfonds (waff), kommt bezüglich der Bewertung dieser Innovationsorientierung zu folgendem Ergebnis: „Die innovationsorientierten Programme haben Impuls- und Folgewirkungen: in zahlreichen Fällen wurden in den Unternehmen durch die Förderung erstmalige Innovationsaktivitäten angestoßen, die zusätzlich auch zu an die geförderten Vorhaben anknüpfenden Aktivitäten führten. Durch die erzielten Kooperationswirkungen der innovations-orientierten Programme, die in Relation zu Ergebnissen vergleichbarer Programmevaluierungen als außerordentlich positiv eingestuft werden können, wird u. a. der Anspruch einer gewissen Verhaltensänderung bei den Unternehmen durch diese Programme deutlich.“ (KMU Forschung Austria 2012, S.3). In den letzten Jahren hat sich daher Fokus der direkten Wiener Wirtschaftsförderung noch stärker als zuvor auf die Unterstützung von Innovationen in den Wiener Unternehmen fokussiert. Damit wird den oben angeführten Schlussfolgerungen der Evaluierungen ebenso Folge getragen, wie der grundsätzlichen Ausrichtung der aktuellen wissenschaftlichen Diskussion entsprochen.

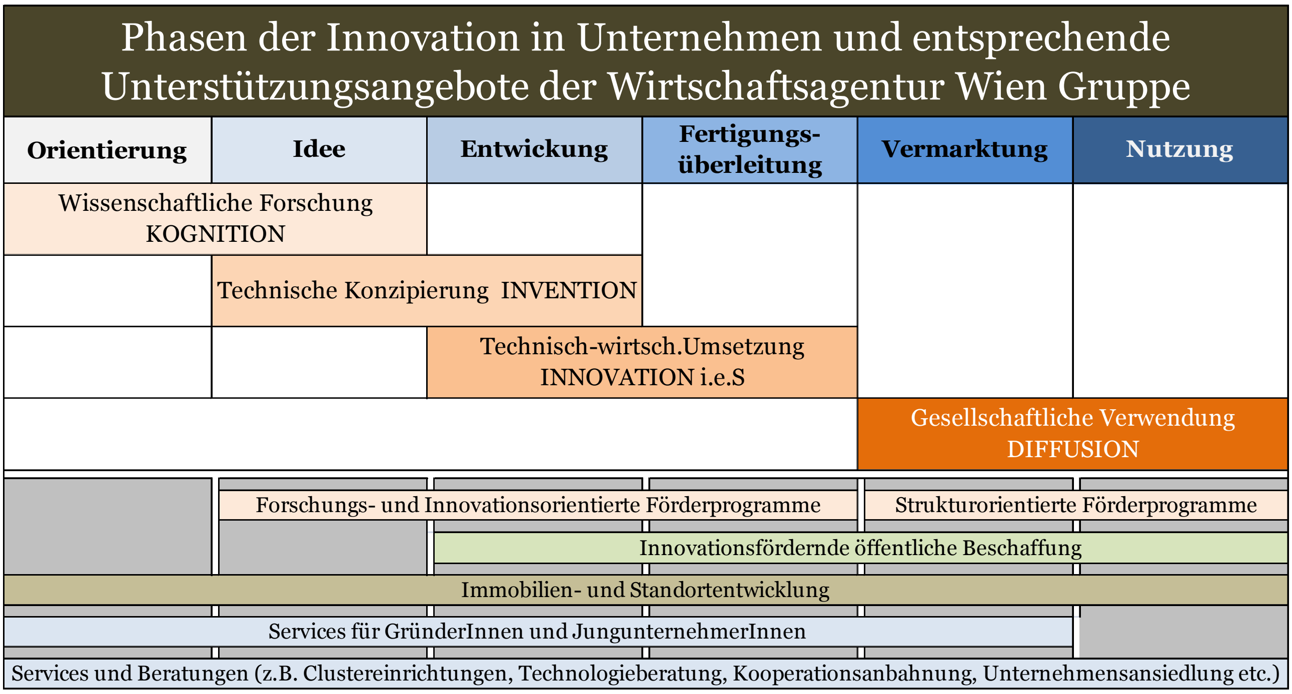

Abbildung 1: Phasen der Innovation in Unternehmen und entsprechende Unterstützungsangebote der Wirtschaftsagentur Wien Gruppe (eigene Darstellung auf Basis von ZIT 2013c)

Ziel dieser Ausrichtung ist es, die Wiener Unternehmen mit integrierten Unterstützungsangeboten in allen Phasen der Innovation zu begleiten und zu unterstützen. Die angestrebten Effekte können sich auf

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unterschiedliche Weise konkretisieren: So können Unternehmen bereits geplante Innovationen schneller und/oder umfangreicher durchführen. Durch das Setzen von Themen, insbesondere im Rahmen von Fördercalls, werden Unternehmen angeregt, ihre Innovationsaktivitäten in diese Richtung zu fokussieren. Angebote im Bereich der Kooperationsanbahnung und –unterstützung helfen dabei, neue Innovationsprozesse in Gang zu setzen. Und durch Maßnahmen im Bereich der verstärkt innovationsorientierten öffentlichen Beschaffung wird für die lokalen Unternehmen ein starker Heimmarkt etabliert, der die Basis für weitere Innovationen und Expansionen bildet. All das sind Entwicklungen, die das in Wien lokal vorhandene Potential für fortgeschrittene Smart City Projekte langfristig heben.

Abbildung 1 veranschaulicht schematisch die Verbindung zwischen den verschiedenen Stufen des Innovationsprozesses und den Angeboten der Wirtschaftsagentur.

4.4 Beispiele eines Förderprojekts: Vertikale Produktion in Smart Cities

Das Wiener Traditionsunternehmen Josef Manner & Comp AG, Hersteller von Süßwaren und laut Eigendefintion „Spezialist für Waffeln, Schaumzuckerwaren und Dragees" (manner.com) liefert ein Beispiel für Lösungs- bzw. Reformansätze zum Themas „Produktion in der Stadt". Mit dem von der Wirtschaftsagentur-Tochter ZIT geförderten Kooperationsprojekt „Vertikale Produktion" in Smart Cities will Manner ein validiertes Referenzmodell für „vertikale Produktion" im urbanen Raum entwickeln, einführen und demonstrieren. Anhand dieses Projektes soll bewiesen werden, dass die „vertikale Produktion" zumindest in der Schüttgutproduktion vergleichbare gesamtheitliche Effizienz erreicht wie die derzeitigen horizontal angeordneten Produktionen. Forschungspartner ist das Institut für Fertigungstechnik der TU Wien. Durch das Projekt entsteht ein Dienstleistungskonzept für die Umsetzung von vertikalen Produktionen in Städten. Es gibt grundsätzlich zwei direkte Kundengruppen für die Multiplikation: Produzierende Unternehmen, Massengutproduzenten, Städte sowie die ihnen zugeordneten Organisationen für Bezirksentwicklung, Unternehmensansiedlung und Wirtschaftspolitik sowie Nachhaltigkeit. Es entsteht ein komplett neues Modell der Nahversorgung, in Rahmen dessen Landwirtschaft, Produktion und Dienstleistung – also alle drei Sektoren – auf engem Raum zusammenarbeiten. Daraus resultieren neue Arten von Vernetzungen, die der Stadt wiederum eine neue Dynamik verleihen." (zit.at 2014).

5 ZUSAMMENFASSUNG

Dieser Beitrag argumentiert auf Basis der aktuellen Smart-City-Initiative der Wiener Stadtverwaltung, dass die konsequente Ausrichtung der städtischen Wirtschaftsförderung auf die Unterstützung von Innovation in Unternehmen zentrale Beiträge zur erfolgreichen Umsetzung dieser Strategie liefern kann. Unternehmen werden nicht nur als zentrale Träger von für diesen strategischen Zugang wichtigem know-how präsentiert, sondern ihnen auch sie die Rolle von potentiellen Treibern dieses Zugangs zugeschrieben. Daher erscheint es möglich, eine „doppelte Dividende" der Wirtschaftsförderung zu lukrieren: einerseits durch Beiträge zur Umsetzung und Dynamisierung der Smart City Strategie, andererseits durch die Unterstützung der lokalen Unternehmen bei der Positionierung in einem globlen, wachsendem Marktsegment. Dies wurde als Grundlage für die authentische Positionierung des Standorts Wien im internationalen Umfeld als Smart City mit globaler Strahlkraft– auf Basis von lokal entwickeltem Know-how und zukunftsweisenden Impulsen durch die Stadtverwaltung.

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Blue City Mannheim – innovative Konzepte für Konversionsflächen in Mannheim

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1 KURZFASSUNG/ABSTRACT

Im Rahmen der Konversion von 510 ha US-Militärflächen entsteht für die Stadt Mannheim die Chance Zukunftsthemen der Stadtentwicklung intensiv aufzugreifen. Stadterneuerung, Energieeffizienz, Infrastruktur und Mobilität sowie Innovationen und Entfaltungsmöglichkeiten heimischer Unternehmen stehen hierbei gleichermaßen im Fokus. Zur Entwicklung innovativer Ansätze wurde die AG Ingenieursmeile gebildet, in der Themen wie Neue Mobilität, Elektromobilität und Smart Grids herausgearbeitet wurden.

Für die Weiterentwicklung und Integration dieser Ansätze hat der Fachbereich Wirtschafts- und Strukturförderung der Stadt Mannheim das themenübergreifende Konzept von MVV Enamic Regioplan erarbeiten lassen. Der Schwerpunkt des Konzeptes „Blue City Mannheim“ liegt auf der Ableitung konkreter Maßnahmen, die in den nächsten Jahren schrittweise umgesetzt werden sollen. Ein wesentliches Ziel ist die Reduktion der CO_2-Emissionen im Verkehrssektor durch den Einsatz emissionsarmer (Elektro-) Fahrzeuge und die Umgestaltung des Modal Split.

Die Maßnahmen wurden mit den strategischen Zielen der Stadt Mannheim, der wirtschaftspolitischen Strategie und den Anforderungen der Klimaschutzkonzeption 2020 abgestimmt.

Als Grundlage werden zunächst vier übergeordnete Maßnahmen definiert:

- Vernetzung/Öffentlichkeitsarbeit,
- Masterplan Ladeinfrastruktur,
- Masterplan Green Logistik sowie
- Masterplan blue_village_franklin.

Hierauf bauen 21 Einzelmaßnahmen in den Bereichen Fahrzeuge/Fuhrparks, Logistik, Verlagerung Modal Split, Intelligente Netze, Ladeinfrastruktur und Wissenstransfer auf. Als Einzelmaßnahmen werden beispielsweise Einsatzbereiche für emissionsarme Fahrzeuge bei der Umstellung von Fuhrparks und Flotten aufgezeigt. Im Bereich Logistik steht der innerstädtischen Liefer- und Güterverkehr im Mittelpunkt. Maßnahmen betreffen hier z. B. die Umstellung von innerstädtischen Transportverkehren auf Elektrofahrzeuge. Ziel hierbei ist neben der Einsparung von CO_2-Emissionen insbesondere auch eine Verkehrslärmreduzierung im Stadtgebiet. Für eine Umgestaltung des Modal Split wird die Verknüpfung von Motorisiertem Individualverkehr (MIV) und ÖPNV an attraktiven Umsteigestationen vorgesehen.

Weitere Maßnahmenschwerpunkte liegen in den Bereichen Energieerzeugung, speicherung und -verteilung, durch welche die Umweltpotenziale der Elektromobilität erst vollständig aktiviert werden können. Eine Optimierung von Verbrauch und Erzeugung erfolgt durch Einsatz von IT-Lösungen in intelligenten Netzen (Smart Grids). Maßnahmen für den Ausbau von Ladeinfrastrukturen im gesamten Stadtgebiet sowie die Einrichtung von Multi-System-Tankstellen für unterschiedliche Antriebstechniken ergänzen das Gesamtkonzept. Für den Wissenstransfer und für die öffentliche Wahrnehmung sollen Fachtagungen und Kongresse zu Themen der Neuen Mobilität und der Energieeffizienz durchgeführt werden. Der Maßnahmenkatalog ist nicht abschließend und kann bei Bedarf um weitere Maßnahmen ergänzt werden.

Als Akteure für die Umsetzung dieser Maßnahmen sind sowohl Fachbereiche und Betriebe der Stadt Mannheim als auch Mannheimer Unternehmen, Einzelhandel und Handwerk angesprochen. Weiterhin werden die Mannheimer Hochschulen ebenso wie Verbände, die Kammern bis hin zu Privatpersonen in die Umsetzung einbezogen.

2 AUSGANGSSITUATION

Durch das Freiwerden der Militärflächen der US-Amerikanischen Streitkräfte im Stadtgebiet von Mannheim wurde ein enormes Potenzial für die Stadtentwicklung erschlossen. Um diese große Aufgabe zukunftsgerichtet anzugehen und die Chancen für eine innovative Entwicklung zu ergreifen, hat die Stadt Mannheim einen übergreifenden Ansatz gewählt, der auf die Einbeziehung von Bürgern, Wirtschaft und

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Institutionen aufbaut und einen breiten Konsens für die zukünftige Entwicklung schaffen soll. Hierbei gilt es insbesondere bereits jetzt zukunftsgerichtete Themen wie Energieeffizienz, Nachhaltige Mobilität und intelligente Vernetzung (Smart Grids) für die Gestaltung und neue Nutzung der Konversionsflächen in die Überlegungen einzubeziehen. Diese Überlegungen werden von der Bürgerschaft mit getragen.

2.1 Kurzvorstellung Mannheim

Zunächst eine Kurzvorstellung der Stadt Mannheim:

- 293.000 Einwohnern, Mannheim ist zweitgrößte Stadt des Bundeslandes Baden-Württemberg
- 173.500 Beschäftigten in 8.600 Unternehmen
- Universitätsstadt, Geburtsstadt von Fahrrad und Automobil
- Verkehrsknotenpunkt für Bahn, Schifffahrt und Straßen von bundesweiter Bedeutung

2.2 Vorstellung der Konversionsflächen

Die Entwicklung smarter Stadtquartiere auf den Konversionsflächen wird insgesamt als Ausgangspunkt und Wegbereiter für eine gesamtstädtische Entwicklungsstrategie gesehen. Die insgesamt 510 ha Konversionsflächen sind auf sieben Areale im Stadtgebiet verteilt (s. Abb. 1). Aufgrund ihrer Größe, Lage und Ausstattung werden den einzelenen Flächen bestimmte Funktionsschwerpunkte zugeordnet. Die zwei größten Einzelflächen werden nachfolgend kurz charakterisiert.

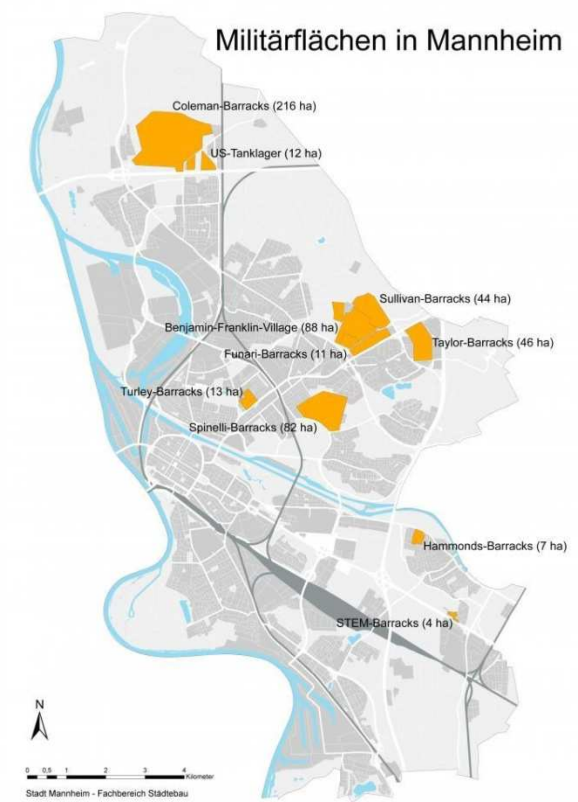

Abb. 1: Militärische Konversionsflächen in Mannheim.

(1) Coleman Barracks (ca. 216 ha) Kasernengelände mit Mannschaftsunterkünften, Werkstätten, Flughafeneinrichtungen (Hangars, Tower etc.) sowie Start- und Landebahn. Aufgrund der Verkehrslage mit eigener Autobahnabfahrt und der Größe der Fläche werden hier Möglichkeiten insbesondere für Innovative Logistik (Green Logistik) sowie in Ansätzen auch für die regenerative Energieerzeugung gesehen.

(2) Benjamin Franklin Village mit Sullivan und Funari Barracks – insgesamt ca. 88 ha voll ausgestattetes Wohnquartier mit ca. 2.000 Wohnungen, Schulen, Kindertagesstätte, Geschäfte, Sport- und Freizeiteinrichtungen sowie ca. 55 ha Kasernengelände mit Büros und Werkstätten. Das Gesamtareal bietet Möglichkeiten zur Entwicklung eines „smarten Stadtquartiers“ mit Wohn- und Gewerbeflächen insbesondere unter Berücksichtigung von Nachhaltiger Mobilität (Verknüpfung mit ÖPNV) und energieeffizienter

Bestandsentwicklung insbesondere hinsichtlich des Bestands an Wohngebäuden, öffentlichen Gebäuden aber auch Infrastruktur wie Fernwärmenetzen.

2.3 Konzeptionelle Rahmenbedingungen

Im Rahmen ihrer Klimaschutzkonzeption (ifeu 2009) hat sich die Stadt Mannheim Ziele für die Reduktion von klimawirksamen Emissionen bis zum Jahr 2020 gesetzt.

Die Klimaschutzkonzeption Mannheim 2020 sieht unter anderem vor:

- Senkung der gesamten CO_2-Emissionen bis 2020 um 40% gegenüber 1990
- Senkung des verkehrsbedingten CO_2-Ausstoßes bis 2020 um 17% unter Einbeziehung aller Mobilitätsbereiche einbezogen werden (Elektromobilität, alternative Antriebstechniken, ÖPNV, alternative Möbilitätsformen – Carsharing etc. sowie Verknüpfung unterschiedlicher Transportsysteme)
- Energetische Gebäudesanierung für private und öffentliche Gebäude

Dieses Konzept wurde insbesondere in den Leitlinien der Stadt Mannheim bereits als Anforderung für die Errichtung (und Sanierung) kommunaler Gebäude umgesetzt und bildet eine wichtige Leitlinie bei der Neugestaltung der Konversionsflächen.

Weitere Rahmenbedingungen werden durch die formulierten strategischen Ziele der Stadt Mannheim gesetzt. Diese Ziele bilden beispielsweise die Leitlinien für Themenfelder wie urbane Gestaltung, Wirtschaftsentwicklung, Integration und bürgerliches Engagement. Sowohl die Ziele des Klimaschutzes als auch die strategischen Ziele der Stadt setzen eine integrierte Betrachtung und eine fachlich übergreifende Herangehensweise bei der Entwicklung von Einzelkonzepten und Maßnahmen voraus.

2.4 Zielsetzung für Konversionsflächen und Gesamtstadt

Als Teile eines Gesamtkonzeptes bieten die Konversionsflächen die Möglichkeit, Maßnahmen für eine innovative, energieeffiziente Entwicklung konkret umzusetzen. Durch die Entwicklung von „smarten Stadtquartieren“ auf den Konversionsflächen sollen Anknüpfungspunkte für die entsprechende Entwicklung in der Gesamtstadt geschaffen werden. Gleichzeitig sollen innovative Kompetenzfelder wie Energieeffizienz, Nachhaltige Mobilität, Smart Grids, und „grüne“ Logistk hierbei vorangetrieben werden. Ein wesentliches Ziel ist es hierbei eine wirtschaftliche Umsetzung solcher Konzeptbausteine und Maßnahmen zu ermöglichen.

Insbesondere das Areal des Benjamin Franklin Village als großes Wohnquartier ermöglicht eine umfassende und für Deutschland ungewöhnliche Modellsituation zur Umsetzung und Erprobung nachhaltiger Konzepte im Sinne eines Living Lab. Im Rahmen eines energieeffizienten Quartierskonzeptes kann dabei aktiv auf die Erreichung der gesetzten Klimaschutzziele in den Bereichen Verkehr, Quartiere und Gebäude hingearbeitet werden. Zur Erreichung von Zielen bei der Verringerung von Lärm- und Abgasemissionen wird insbesondere die Förderung einer nachhaltigen, vernetzten Mobilität als ein zentraler Baustein gesehen.

3 PROZESS BLUE CITY MANNHEIM

Für die Neugestaltung der Konversionsflächen wurde von der Stadt Mannheim ein Beteiligungsprozess mit Experten und Bürgern initiiert. Bestandteil dieses Beteiligungsprozesses ist die AG Ingenieursmeile, welche im Rahmen des Konversionsprozesses ins Leben gerufen wurde. Die AG Ingenieursmeile dient als Forum für die Einbeziehung der heimischen Wirtschaft, von Hochschulen, Kammern und Verbände in die Planungen sowie zur Nutzung der vorhandenen Potenziale durch Wissensaustausch und den Abgleich von Entwicklungsinteressen. Die Ergebnisse der AG Ingenieursmeile wurden in das Strategiekonzept Blue City Mannheim für die Gesamtstadt integriert. Das Gesamtkonzept macht deutlich, welche Chancen durch eine Umsetzung von Projekten auf den Konversionsflächen für die Stadt eröffnet werden.

In den Prozess Blue City Mannheim für eine nachhaltige Stadtentwicklung ist eine Vielzahl von Akteuren eingebunden. Die Koordination erfolgt für die Stadt Mannheim durch den Fachbereich für Wirtschafts- und Strukturförderung unter Einbeziehung anderer Fachbereiche wie insbesondere der Geschäftsstelle Konversion sowie der Klimaschutzleitstelle und der Eigenbetriebe. Ziel des Prozesses ist es umsetzbare Bausteine und Maßnahmen für energieeffiziente Quartierskonzepte („Smart Cities“) herauszuarbeiten.

Zur Vorbereitung der Umsetzung wurden im Prozess zunächst vier übergeordnete Themenschwerpunkte definiert: Masterplan blue_village_franklin, Masterplan Green Logistik , Masterplan Ladeinfrastruktur sowie Vernetzung/Öffentlichkeitsarbeit als themenübergreifender Schwerpunkt. Diese Themenschwerpunkte werden nachfolgend kurz umrissen.

4 MASSNAHMEN "BLUE CITY MANNHEIM"

Die Fortsetzung des Rahmenkonzepts Blue City Mannheim umfasst zunächst mehrere Masterpläne sowie den Bereich Vernetzung/Öffentlichkeitsarbeit als übergeordnete Maßnahmen. Diese werden nachfolgend kurz dargestellt.

(1) Masterplan blue_village_franklin für die Quartiersentwicklung auf der Konversionsfläche Benjamin Franklin Village. Ziel ist die Erstellung eines Integrierten Quartiersentwicklungskonzeptes mit den Schwerpunkten Energieeffizienz und Energieerzeugung sowie Smart Grids und (Elektro-)Mobilität.

Die Erstellung des Masterplanes wurde von der Stadt Mannheim bereits beauftragt und eine entsprechende Arbeitsgruppe zur Begleitung eingerichtet. Bestandteil des Masterplans ist das Erstellen von CO2- und Stoffstrombilanzen sowie eines Quartierskonzeptes für alle Verkehrsträger auf Basis von städtebaulichem Entwurf und Milieustudie.

(2) Masterplan Green Logistik (Green Logistic Park) für die Entwicklung innovativer und nachhaltiger Logistik auf der Konversionsfläche Coleman-Barracks. Als Aufgabenschwerpunkte werden gesehen:

- Errichtung eines Lieferantenparks („Green Logistic Park") mit Bündelung von Inbound-Outbound-Güterverkehren
- Wechsel von Triebfahrzeugen z. B. für den Einsatz von E-LKW für den innerstädtischen Bereich und Einsatz von „Milkruns"
- Schaffung von Flächenpotenzialen für Konsolidierungszentren (Vorfertigung)
- Bauliche Konzeption anhand von Nachhaltigkeitskriterien

Durch das Green Logistic Konzept sollen die Lagevorteile des Colemangeländes zum Vorteil für die Gesamtstadt (geringeres Verkehrs- und Emissionsaufkommen) sowie für Unternehmen unter Berücksichtigung aller örtlichen Gegebenheiten ausgeschöpft werden.

(3) Masterplan Ladeinfrastruktur. Hierbei soll insbesondere geklärt werden, welche Ladeinfrastruktur für unterschiedliche Bereiche urbanen Wohnens (z. B. Geschosswohnungsbau) erforderlich ist und integriert werden kann. In diesem Rahmen erfolgt zunächst eine Bedarfsabschätzung. Ein weiterer Fokus liegt auf den Anforderungen gewerblicher Nutzung (z. B. mobile Dienste, KEP, Personenbeförderung). Weiterhin sind rechtliche und städtebauliche Voraussetzungen zu klären. Technische Fragen wie z. B. konduktives oder induktives Laden oder auch alternative Lösungen (z. B. Wasserstoff) sind ebenfalls einzubeziehen.

(4) Vernetzung/Öffentlichkeitsarbeit. Die Umsetzung der einzelnen Maßnahmen sowie von Blue City Mannheim als Gesamtkonzept erfordert ein hohes Maß an Interaktion und Zusammenarbeit zwischen unterschiedlichen Akteuren. Gleichzeitig wird ein hohes Maß an Akzeptanz und öffentlichem Interesse zur Unterstützung und erfolgreichen Durchführung der einzelnen Vorhaben benötigt. Hierfür ist es erforderlich, den Prozess durch fortlaufende Moderation und Begleitung in Gang zu halten.

Für diese voranstehenden übergeordneten Themenbereiche wurden im Vorfeld insgesamt 21 Einzelmaßnahmen entwickelt.

- Fahrzeuge/Fuhrparks: Als Einzelmaßnahme wird hier z. B. die Unterstützung/Beratung von Unternehmen bei der Umstellung von Fuhrparks, z. B. für den Werksverkehr auf Fahrzeuge mit emissionsarmen Antrieben (insb. Elektroantrieb) angeführt. Die Einführung erfolgt bei Fahrzeugneuanschaffungen und kann sukzessive bei Ersatzbeschaffung erfolgen. Einen wesentlichen Aspekt bilden hierbei auch kommunale Fuhrparks.Weitere Maßnahmen betreffen den Einsatz von Elektrofahrzeugen im Carsharing und in der Personenbeförderung z. B. bei Taxis und Ruftaxis.
- Logistik: Einzelmaßnahmen betreffen hier insbesondere den innerstädtischen Liefer- und Güterverkehr. Durch Umladen von Gütern für die städtische Belieferung auf elektrisch betriebene Transportfahrzeuge werden CO_2- und Lärmemissionen in der Gesamtstadt reduziert. Für die Umsetzung erfolgt eine Bereitstellung geeigneter Flächen für Güterverteilzentren, z. B. im Bereich

der Konversionsflächen. Weitere Maßnahmen betreffen die Einrichtung von Konsolidierungszentren mit Vorfertigung sowie Optimierungsmöglichkeiten für KEP-Dienste.

- Verlagerung Modal Split: Hierbei liegen die Einzelmaßnahmen z. B. beim Ausbau aktueller Mobilitätskonzepte wie P+R/P+B durch Ausweisung attraktiver Flächen und die Einrichtung von „Mobilitätsdrehscheiben“ zur Verknüpfung unterschiedlicher Mobilitätsangebote insbesondere mit dem ÖPNV. Hierdurch soll das Umsteigen zwischen verschiedenen Mobilitätsträgern erleichtert und gefördert werden. Weitere Maßnahmen betreffen das Carsharing sowie die Verknüpfung mit aktueller Informationstechnologie („Touch an Travel“). Öffentlich zugängliche Lademöglichkeiten für Elektrofahrzeuge sowie besondere Anreize und Erlaubnisse wie beispielsweise Park- und Ladezonen für Elektrofahrzeuge bilden weitere Maßnahmen.
- Intelligente Netze (Smart Grids): Maßnahmen im Bereich Smart Grids bauen zum Teil auf den Ergebnissen von Modellvorhaben der MVV Energie wie beispielsweise dem „Energiebutler“ auf. Angestrebt wird hierbei eine optimale Verknüpfung von Erzeugern, Verbrauchern und Verteilnetzen durch intelligente Informations- und Kommunikationssysteme, um Erzeugungs- und Verbrauchsspitzen zu harmonisieren. Hierzu zählt beispielsweise die erzeugungsabhängige Steuerung von Haushaltsgeräten oder die die Aufladung von Elektrofahrzeugen (Modell „Energiebutler“). Voraussetzung hierfür sind IKT-Lösungen, welche die Informationen über Erzeugung, Netzauslastung und z. B. Verbraucherbedarfe ermitteln und durch entsprechende Schaltvorgänge steuern. Der Einsatz entsprechender Anlagen und Infrastruktur soll grundsätzlich in Betracht gezogen werden und ist im Einzelfall zu prüfen. Weitere Maßnahmen betreffen z. B. eine Nutzung von Straßenbeleuchtung für Fahrzeug-Ladestationen sowie den Einsatz dezentraler Lösungen zur Energiespeicherung.
- Aufladeinfrastruktur: Für die Maßnahmenentwicklung in diesem Bereich wird berücksichtigt, dass für die Erreichung der angestrebten Klimaziele unterschiedliche Antriebskonzepte eingesetzt werden können. Der Ausbau der Fahrzeugnutzung mit CO_2-neutraler Antriebstechnik setzt die Verfügbarkeit einer öffentlich zugänglichen (gewerblichen) Ladeinfrastruktur voraus. Die Maßnahmen umfassen daher sowohl unterschiedliche Ladetechniken (Plug-in-Technik, induktives Laden) für Elektrofahrzeuge, als auch die Einrichtung von Auflade- und Tankmöglichkeiten für Wasserstoff bzw. unterschiedliche klimafreundliche Antriebsarten (Multi-System-Tankstellen).
- Wissenstransfer: Zur Unterstützung der Entwicklungen und für die Präsentation der Stadt als Blue City Mannheim werden Fachtagungen und –Kongresse zu (Elektro-) Mobilitätsthemen veranstaltet. Hierbei können auch Konversionsflächen, z. B. als Veranstaltungsorte, einbezogen werden.

Die Liste der entwickelten Maßnahmen ist nicht abschließend und kann bei Bedarf im laufenden Prozess ergänzt werden.

5 AKTUELLER STAND UND AUSBLICK

Die definierten Maßnahmen werden schrittweise umgesetzt.

- Sukzessiver Einsatz von Elektrofahrzeuge in städtischen Betrieben und Fuhrparks.
- Beschlussvorlage für städtebaulichen Rahmenplan einschl. Kapitel Masterplan blue_village_franklin (Beschluss in Vorbereitung)
- Definition von Leuchtturmprojekten zum Masterplan blue_village_franklin.
- Beauftragung einer Machbarkeitsstudie „Green Logistic Park“ an Fraunhofer IAO in Kooperation mit Hochschule Heilbronn zur Klärung der technischen und betriebswirtschaftlichen Machbarkeit (Oktober 2013).
- Workshop mit Logistikern und Umsetzung Verladern (Februar 2014).
- Entwicklung von Betriebskonzepten mit Unternehmen und Bürgern
- Fördermittelakquise

Der Prozess Blue City Mannheim konnte auf den Konversionsflächen eingeleitet werden und schreitet von dort aus für die Gesamtstadt Mannheim voran.

CentropeSTATISTICS – a Tool for Cross-Border Data Presentation

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1 ABSTRACT

CentropeMAP is a geoportal which aims to help planners and stakeholders to get an overview of the Centrope region. It converts statistic data from tables into easily legible thematic maps and various types of charts on the fly. CentropeMAP emphasises on datasets which are of interest for spatial planning and similar professions and visualises statistical data from the regions Vysocina, Jihomoravsky, Bratislavsky, Trnavsky, Győr-Moson-Sopron, Burgenland, Lower Austria, and Vienna. Almost all datasets in the cross-border statistical database are collected in a time series so that the development of the region can be explored in yearly steps since 2001; the data range comprises various fields like population statistics, population development and projection as well as land use, educational statistics, tourism or migration.

2 INTRODUCTION

The Centrope region is situated at the mutual borders of Austria, the Czech Republic, Hungary, and Slovakia. Its aim is to foster cultural, ecologic and economic development in an area that had to suffer enormous disadvantages during the decades of existence of the Iron Curtain and is now ready to catch up.

To help planners and stakeholders to get an overview of the Centrope region, the geoportal CentropeMAP went online in 2005 and was soon extended by a cross-border statistics database which is directly linked to the map view. This powerful tool allows you to convert statistic data into easily legible thematic maps and various types of charts on the fly.

CentropeMAP is an online geoportal, which means it collects web map services (WMS) from all parts of the Centrope Region and presents all these services to the user compiled into one single map. CentropeMAP emphasises on datasets that are of interest for spatial planning and similar professions, comprising multiple data layers from the fields of biota, boundaries, elevation, imagery/base maps, inland waters, planning/cadastre, structure, and transportation.

Planners and stakeholders receive a great help from maps. Also, statistic data is important to analyse a region. So why not combine maps and statistics and create a combined view of statistic data directly in a map? CentropeSTATISTICS joins data from the regions Vysocina, Jihomoravsky, Bratislavsky, Trnavsky, Györ-Moson-Sopron, Burgenland, Lower Austria, and Vienna and features readymade thematic maps as well as an expert mode which gives full access to the whole Centrope cross-border statistics database. Note that you can also download these data and, for example, use it in a spread-sheet. Almost all datasets are collected in a time series so that the development of the region can be explored in yearly steps since 2001; the data range comprises various fields like population statistics, population development and projection as well as land use, educational statistics, tourism or migration.

Parts of this paper are written similar to the style of a user manual; this should encourage the reader to open http://www.centropemap.org and try CentropeMAP and CentropeSTATISTICS themselves!

3 TECHNICAL IMPLEMENTATION

3.1 Server Hardware, Operating System, Software

The CentropeMAP applications and files are hosted on a Linux server. All geodata and viewing applications for CentropeMAP and CentropeSTATISTICS use open source software, for example UMN Mapserver, Geoserver, PostgreSQL (with PostGIS), Mapbender, Typo3, and some in-house developed PHP and Javascript code.

3.2 System Architecture

The Mapbender map viewing client is the heart of the CentropeMAP system. It gives access to all embedded web map services, manages user access rights and hosts the web interface for map viewing. CentropeMAP

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uses Web Map Services (WMS) to access geodata and Web Feature Services (WFS) to access attribute data; Web Catalogue Services (CSW) are currently not in operation.

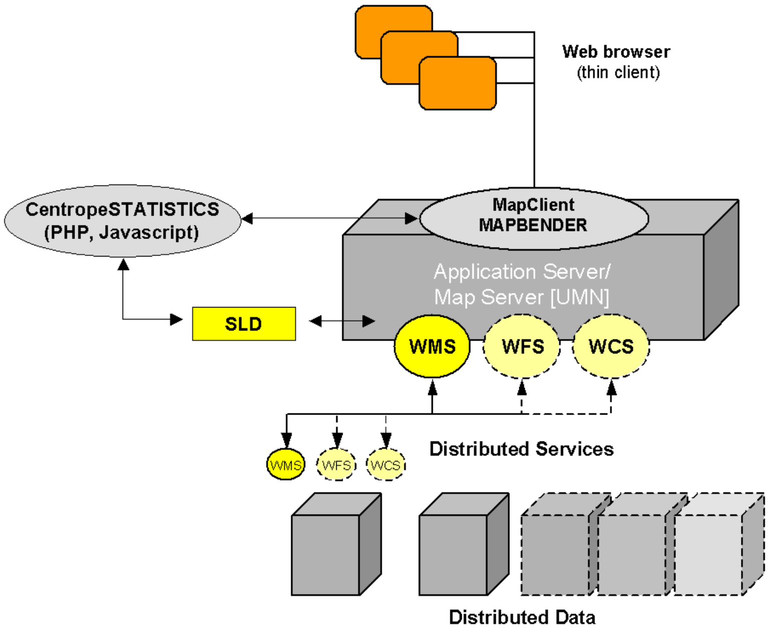

Fig. 1: CentropeMAP system architecture. Source: authors.

Mapbender composes the GetMap requests and sends them either to the own map servers (UMN and Geoserver) or to the distributed servers in other parts of the Centrope region. CentropeMAP's own map servers now also use cascading WMS to interact with the other map servers within the region to return only a single image per thematic map layer. The CentropeSTATISTICS extension is a PHP, SQL and Javascript application interacting with Mapbender. It is developed and kept up to date by CEIT Alanova. Thematic maps are created with Styled Layer Descriptor (SLD) which is an XML standard defined by the OGC (Open Geospatial Consortium) to define the appearance of map layers. The statistic data are linked with an XML generator which allows the user to create chloroplethic thematic maps on the fly.

There are two ways to work with CentropeSTATISTICS: Basic mode: In the basic mode certain maps are predefined. The user selects a theme (e. g. "Age Group Percentage 2008, 80 years and older") and immediately gets a preview. With just one more click the map is created in the CentropeMAP main window. The basic mode is meant for quick access to frequently queried data and for users who do not often work with statistical data. Expert mode: In the expert mode the user selects a theme (e. g. "Population Indicators: Age Group Percentage (by year)"). Then the query parameters have to be defined (in our example, the user would have to select a year). In the next step the table is shown that contains all data from which thematic maps can be created, and, in addition, also other useful data (in our example, the user would find both the absolute and the percentage values of age groups 0 to 14, 15 to 60, 60plus, and 80plus). At this stage the statistic data can also be exported for use outside CentropeMAP in CSV or MS Excel format. The user selects the desired column and can then choose the grouping method, the number of classes, and a colour ramp. Again, a preview is shown like in the basic mode, and with one more click the map is transferred to the CentropeMAP main window (see fig. 2).

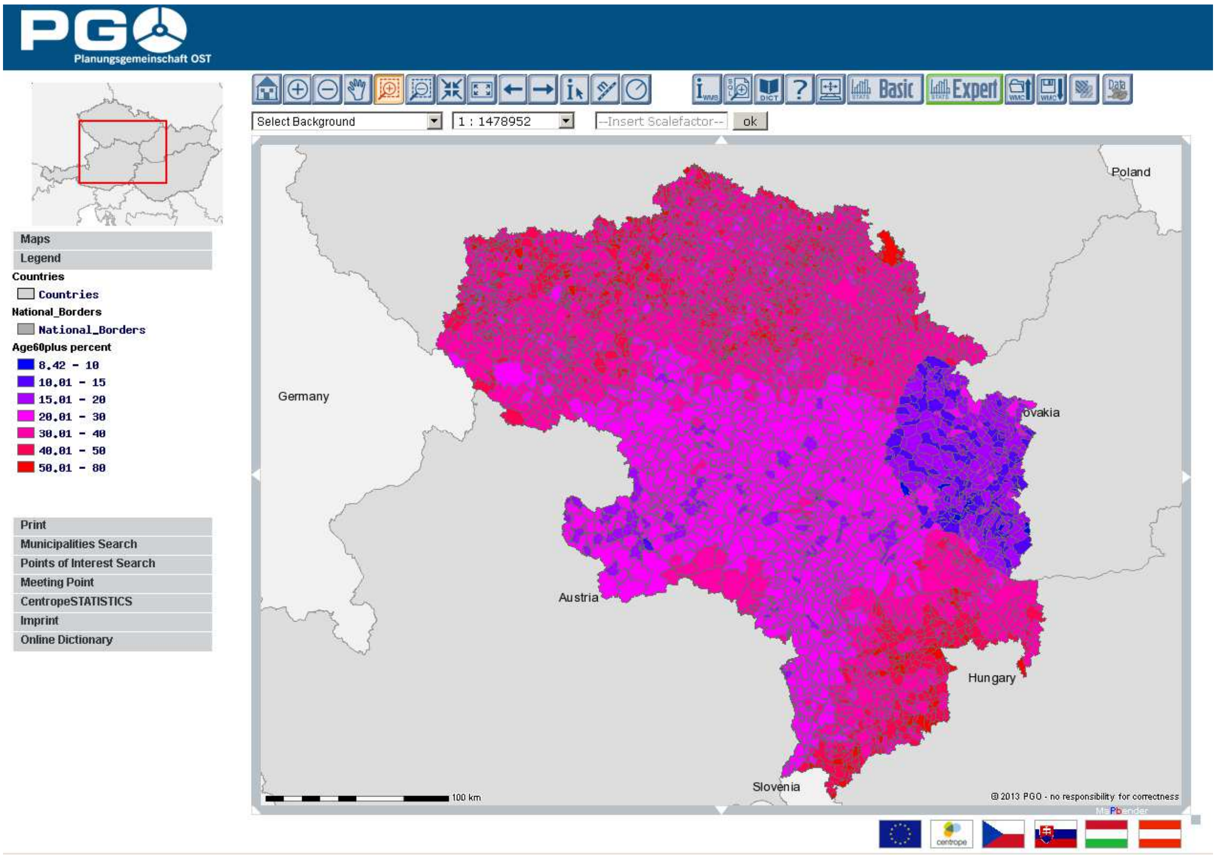

Fig. 2: Statistic map created from census 2011 data with CentropeSTATISTICS (showing percentage of population aged more than 60). Although the boundaries are not shown in the data overlay, you can clearly recognize the countries by their different population structure. Source: www.centropemap.org.

3.3 Styled Layer Descriptor and Web Map Services

SLD describes the appearance of layers in a web map service when the data are delivered to a client. A map layer has a default style which is defined for standard display. However, this style can be overruled by attaching a SLD document to this layer (as far as the map server supports SLD). In the GetMap request, the SLD code can either be directly added to the URL of the request or it can be saved in a separate file of which the URL is referred to in the GetMap request. This may bring along the advantage that a GetMap request always refers to the same URL, but the SLD file at this URL may be altered by user interaction. Of course, the SLD URL can be anywhere, it need not be stored at the same server as the geodata. It is therefore a great advantage of SLD to customise layers of web map services without influencing the way other users see this layer.

However, only a few map servers which are referred to in CentropeMAP accept GetMap requests containing SLD information. If all servers of the CentropeMAP project partners interpreted SLD documents, there would not be any problems matching the styles of layers from different servers containing the same information. If this can be changed, the cross-border geodata integration in CentropeMAP will make a big step forward.

SLD is also the main technique behind CentropeSTATISTICS: The user-defined maps are created through SLD only. The layer containing the geodata for the statistical map has a pre-defined transparent layout so that it is invisible without any attached SLD document. As soon as the user creates their own map layer from statistic data, their selections are converted into a SLD document on the CentropeMAP server. The map view is refreshed then, containing the SLD URL as part of the GetMap request of the statistics layer. Also a timestamp is added to this request. These timestamp characters are ignored by the mapserver, but Mapbender only reloads a layer when the request string has changed, so the timestamp ensures that every GetMap request is different from the one before, causing the client to load the new map on refresh.

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4 WORKING WITH THE BASIC MODE

The CentropeSTATISTICS Basic Mode allows to create a couple of thematic maps which have been predefined by the CentropeMAP team consisting of experts in spatial planning, regional development and statistics. It is mainly for quick queries or for people who do not have much experience in creating thematic maps or charts from statistic tables. All available statistics themes are collected in a menu tree on the left part of the CentropeSTATISTICS window. After selection, it may take a couple of seconds until a map preview appears in the right half of the window. In the meanwhile, the selected theme is prepared to be displayed as web map service image in the CentropeMAP window. As the preview appears, the user can hit the "Create Map" button. The map, which has been precalculated in the background, is now brought into the CentropeMAP window, and the CentropeMAP window is automatically brought to the desktop.

5 WORKING WITH THE EXPERT MODE

5.1 Creating maps and charts

The CentropeSTATISTICS Expert Mode gives full access to the whole Centrope cross-border statistics database, these data can be downloaded and several options can be set while creating a thematic map or chart. The expert mode is meant for planners, statisticians and other professionals who know how to create meaningful thematic maps and charts.

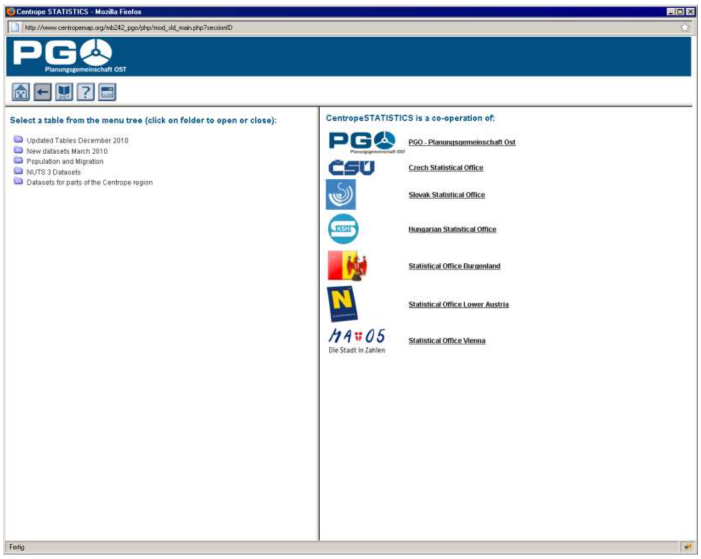

Fig. 3: Start window of the CentropeSTATISTICS expert mode. Source: www.centropemap.org

The CentropeSTATISTICS Expert Mode start screen is divided into three parts. At the top there is the title bar with some buttons, and below the screen is divided into a left and a right half. All available statistics themes are collected in a menu tree on the left part of the CentropeSTATISTICS window. After selecting a theme by clicking on it, the availability form is loaded into the right half of the statistics window. It shows which attributes are available for selection. In most cases, this will be the year only as we tend to prepare the statistics table in a way that similar themes are shown in separate tables and not altogether in one large table. Another example for an attribute to be selected is whether the number should be shown as absolute values or, for instance, per 1,000 inhabitants.

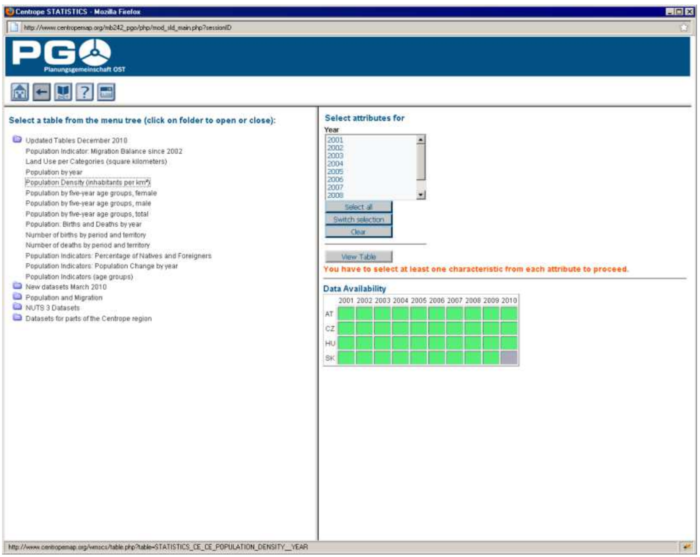

Fig. 4: CentropeSTATISTICS screen after theme selection. Source: www.centropemap.org

A green square means that data is available, a grey square indicated that data is not available in a certain part of the Centrope region for a certain year. Clicking the “View Table” buttons opens the selected table in the statistics window. The division between left and right half of the window does not exist further on. From this point, the user can

- create maps,
- create bar/line/point charts,
- create pie charts,
- create symbol maps.

The result may look like this:

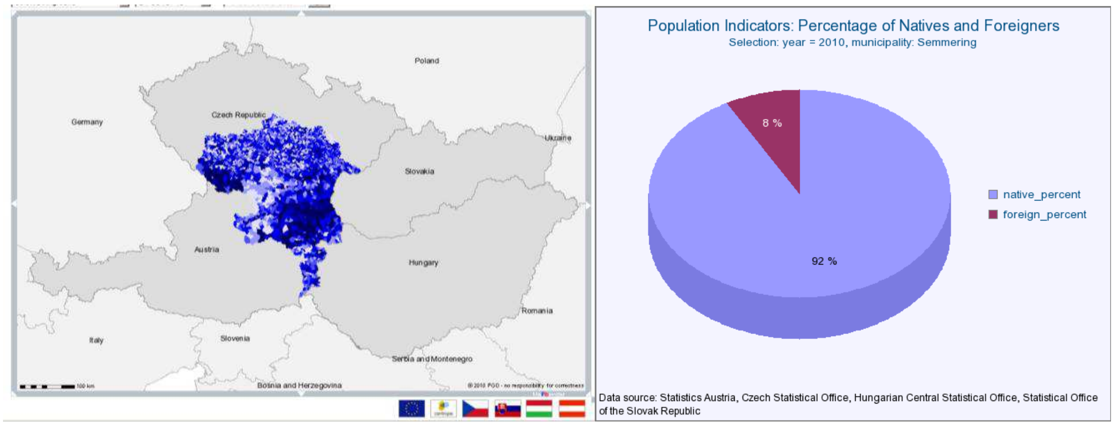

Fig. 5: CentropeSTATISTICS output examples. Source: www.centropemap.org

4.2. Class definition and zero handling

There are several statistical methods for class definition:

- equal interval: The numeric range of all classes has the same size;
- quantiles: The elements are evenly distributed so that each class contains the same number of elements;
- standard deviation: The class ranges are defined according to the standard deviation of the elements;
- equal area: The elements are distributed in a way that each class covers (approximately) the same area (sum of municipality areas in each class is equal);

- natural breaks (ArcView): The natural breaks algorithm minimises the variance within classes and maximises the variance between classes. This option produces an output similar to the algorithm used in ESRI's ArcView GIS;
- natural breaks (Jenks): same as above but using the Jenks algorithm which produces slightly different results than the ArcView method;

If there is data with positive and negative values (e. g. population density increase/decrease) and a dichromatic colour ramp is used, special zero handling can be defined:

- no special zero handling: leave everything as it is;
- treat white as zero only: The class including zero is split into two classes, and a separate class having zero as only value is added. Note: The effective number of classes is higher by 2 than the preselected number of classes;
- use white for class incl. 0: preserve class definition, but shift the colour ramp so that white is used for the class including the zero value;
- no white in legend: preserve class definition, but build a colour ramp with no white class.

Of course all class values and all colours can be set manually if something different than the given options is required.

5.2 Working with user-defined tables

CentropeSTATISTICS is not restricted to the given tables in the cross-border statistics database. There is also a possiblity to combine data from more than one table, put it together in a custom table, and even calculate own values and indicators. First of all, if you want to work with a custom table, you have to create one. The "Create custom table" button is situated below the table tree menu on the start page of the CentropeSTATISTICS expert mode. After table creation, if you press the "View custom table" button, the same happens as if you selected any other table from the menu tree. It is still empty, so in the next step you have to add columns to your custom table. Return to the start page and select any table you want from the menu tree. Open it as usual. You can see that an additional button appears on the top of each column: "Add to custom table". Map calculations and map output are done only for the geographic intersection of the data added to your table. E. g. if you add a column containing data for the whole Centrope region and another column with data for whole Austria, all following operations will only be performed for the Centrope part of Austria. If you try to add a column which would set the intersection to null, CentropeSTATISTICS will notice this and prevent you from adding this column.

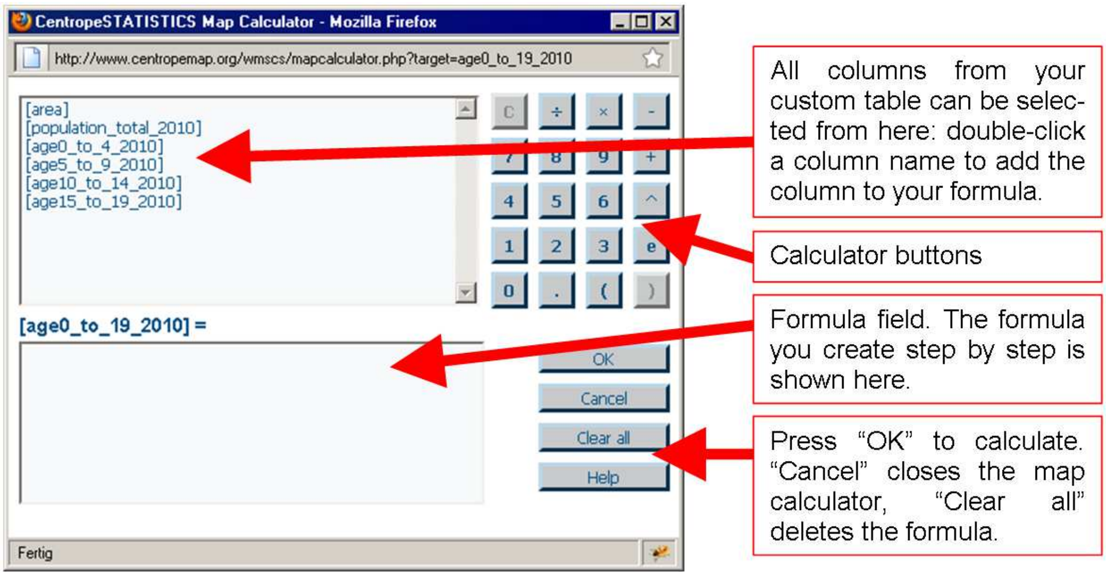

Fig. 6: CentropeSTATISTICS map calculator. Source: www.centropemap.org, authors.

The map calculator works similar to any standard desk calculator. The "C" button lets you undo your last calculator action, i. e. remove a digit, an operator or a column name from the formula field. If you press

"OK", the formula will be checked for errors and executed, resulting in a new column within your custom table.

CentropeSTATISTICS also allows to upload user-generated content into custom tables. Uploaded data may be used for indicator calculation and map creation like any other values – the only difference is that, for reasons of ensuring data quality, user-generated content is only stored temporarily and cannot be accessed by other users through the cross-border database.

There is also a possibility to reclassify data by assigning new values to user-defined attribute ranges. This can be a useful tool to hide or combine certain value ranges as the reclassification also influences the map layout. In case of data reclassification, a new column is created so that the original values are preserved.

6 MULTI-LINGUAL WEBSITE

The CentropeMAP website is available in five languages (German, English, Czech, Slovak, Hungarian). It offers information about the region, the project, and also a lot of downloadable material from maps and tables to workshop protocols. Also the CentropeMAP help ("How to Use" guides for CentropeMAP and CentropeSTATISTICS) are offered multilingually (German and English).

7 CONCLUSION AND OUTLOOK

Behind CentropeMAP and CentropeSTATISTICS there is a cross-border database collecting comparable data from Austria, the Czech Republic, Slovakia, and Hungary. Due to different methods of survey and analysis, only a small number of datasets turned out to be really comparable so that these numbers could be put together in one common table for all four countries. The result of this data compatibility restriction is an emphasis on population data in CentropeSTATISTICS because this is the only group of data so far which is comparable within the Centrope region. Approximately twice a year experts from all partner regions meet to discuss the further extension of this database. The 2011 census data – which will be available soon throughout the whole region – are going to be an important source of information in CentropeSTATISTICS, and they will allow CentropeSTATISTICS to expand the cross-border statistics datsbase onto new thematic fields because the census was done in a way that data become comparable throughout all countries.

Climate Neutral City Districts – the Smartest Form of a City's Districts?

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1 ABSTRACT

This article is about Climate Neutral Urban Districts. It builds upon the conclusions gained in the CLUE-project. The concept of climate neutral districts is a yound field of discourse and a new planning approach facing many challenges. Climate neutral districts can make a valuable contribution to the necessary transformation towards low carbon societies. However, ambitions and reality diverge. Decision-making and practice in cities are not ready yet for a full implementation of the big number of necessary measures.

2 INTRODUCTION TO CLIMATE NEUTRAL URBAN DISTRICTS

The project CLUE, Climate Neutral Urban Districts in Europe (www.clue-project.eu) illustrates the use of innovative and "smart" planning, participation and building concepts, new technologies and methodological approaches in order to reduce the urban carbon footprint to "zero" and at the same time considerably reduce energy and resource use i.e. making a city or an urban district "climate neutral". The guiding idea of the project is that climate neutral urban districts function as test beds for new integrated solutions which lead to a considerably lower carbon footprint or eventually even to a climate neutral level. In the CLUE project the examined districts are new development areas or mixed areas. However, for the sake of clarity it should be said right at the beginning of this article: the biggest challenge of transforming cities into climate neutral areas is the conversion of the existing urban fabrique, this is yet not the main focus of the CLUE project.

The main aim of this article is to highlight the methodological and practical challenges when trying to establish climate neutral urban districts, especially when it comes to:

- Defining of climate neutrality – stuck between ambition and reality
- Finding the scope of CLUEs in terms of being particular ecodistricts
- Evolving road maps for CLUEs from different starting points
- Necessary thinking when making urban policies

The material used and the evidence base of this article chiefly stems from the work of the CLUE-project, but also other related sources and similar projects' results have been used. A central question of this article is if CLUEs really are the best ways of developing sustainable, smart urban districts? The article is more a debate article than a paper delivering answers to the complex issues of CLUEs.

To make another matter clear from the beginning: at present there are neither standards nor a consensus on a definition of what climate neutrality should be or not be. There are no climate neutral urban districts today to be referred to, i.e. much of what the CLUE project produces is based on a patchwork of experiences and good examples which in their totality would leed to climate neutral districts. As a theoretical concept, climate neutrality aims towards a total elimination of green house gas/carbon emissions. The practical use of the concept today is dependent on how cities define system borders concerning time, activities/sectors and geographical areas. Current literature tends to offer different categorizations of concepts like "strictly zero carbon", "carbon neutral" and "low carbon", which is not exactly the same thing as "climate neutral".

3 CLIMATE NEUTRAL DISCTRICTS – AMBITION AND REALITY

There is a strong scientific consensus that greenhouse gas accumulations due to human activities are contributing to global warming with potentially catastrophic consequences (IPCC 2007/2013/2014). Climate change is not 'a problem' waiting for 'a solution'. It is an environmental, cultural and political phenomenon which is re-shaping the way of thinking and handling (Compston and Bailey, 2008; Hulme, 2009). It is seen as one of the most serious set of political challenges ever faced by human society. International and European climate policy discussions have the goal of limiting the global temperature rise to 2°C by cutting greenhouse gas emissions by 80 percent below 1990 levels until the year 2050. whether or not this goal is at all possible strongly depends on the development and mitigation efforts made in cities around the world.

The current generation must adopt strong precautionary principles in framing climate change policies in order to minimise the risks of serious harm from climate change imposed on future generations (McKinnon,

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2011). Avoiding severe climate change means to set a determined agenda of mitigation and socially resilient mitigation applications. This requires that cities, where the big majority of the population will live in the future, understand and play their role as crucial forerunners as long as international institutions fail to set strong targets. In other words, urban development is both a key contributor to climate change and an essential factor in combating it (Ewing et.al, 2008).

The local dimension of urban climate governance, e.g. when aiming towards the creation of climate neutral cities and districts, has to deal with multi-level challenges both in terms of their urban legacy (e.g. existing building stock and technical infrastructure), planning laws and rules, institutional capacities, participation and co-generation possibilities, land ownership and financial potentials. Within these frameworks, cities can operate along different modes of climate governance such as self-governing, governing through enabling, governing by provision and governing by regulation (Newell and Bulkeley, 2010).

Cities are often laboring with their financial possibilities to fight climate change, replacing fossil fuels and saving energy. With a positive attitude, it can be claimed that carbon reduction strategies supported by far-reaching financial investments can have profound boosting implications for interurban competition and urban development itself as there are many positive co-effects of low carbon efforts (see below in chapter of eco-districts). The rise of a distinctive low-carbon urban development can therefore be seen as an important new environmental and social politics of urban development (Gibbs and While, 2011). But as a matter of course, different types of cities (industrial, service, university, port, etc.) must find their own way of making climate mitigation efforts to a success both for citizens, public institutions and business life.

It is however an indisputable fact, that cities have very different starting positions when it comes to mitigation and their striving for low carbon or climate neutral solutions. The European Union has emerged as a leading governing body in the international struggle to govern climate change. The transformation that has occurred in its policies and institutions has profoundly affected climate change politics at the international level, within its Member States and the European cities. But Europe comprises so many levels of government and governance, it has very differing political leadership forms and policy choices are wide spreading. This means that cities stand in front of very complex governance dilemmas associated with climate policy making (Jordan, 2011). In Europe there are cities where mitigation is hardly discussed, cities with business-as-usual ambitions at a level of their governments' regulations, and cities which have very high ambitions. The last mentioned cities often are organised in networks as Convenant of Mayors, ICLEI, C 40, Clinton Climate Initiativ, World Mayor Council of climate change, etc. It can be claimed that this type of cities is determined to considerably reduce their climate impact, but it is not evident that such cities also can become or really have the political determination to strive for CO_2 neutrality in a near future.

Thus, the outcome and relevance of the modes of mitigation policies depend on the governing power of a city, which ranges rom soft forms of influence to forms of strict public intervention. It seems that the development in many countries in Europe suggests that cities often do not fully exploit their authoritative powers and are reluctant to apply authoritative or resolute modes of governing through regulatory measures and strategic planning (Kern and Alber, 2008). In terms of establishing mitigation policies this means that often much more could be done in many cities, of course depending on their national legal framework settings. However, this reluctance can also mean that CLUEs as an appraoch to test new holistic solutions to fight climate change is not used due to hesitant attitudes of decision makers – both public and private.

Another principal problem regarding which there is a need to find a balanced relationship between political ambition and realistic efforts is the question of where to draw borders of the urban mitigation/low carbon efforts. "A large number of communities, new developments, and regions aim to lower their carbon footprint and aspire to become zero carbon or carbon neutral. Yet there are neither clear definitions for the scope of emissions that such a label would address on an urban scale, nor is there a process for qualifying the carbon reduction claims" (Kennedy and Sgouridis, 2011, p. 2559). One way of tackling this problem is to propose three levels of emission categories. This system of Kennedy and Sgouridis was also used in the CLUE project as a guiding principle and is illustrated in the figure below. The three levels, also called scopes, are:

- Internal Emissions based on the geographical boundary of a city/urban district (Scope 1)
- External emissions directly caused by core municipal activities (Scope 2), and
- Internal or external emissions due to non-core activities (Scope 3).

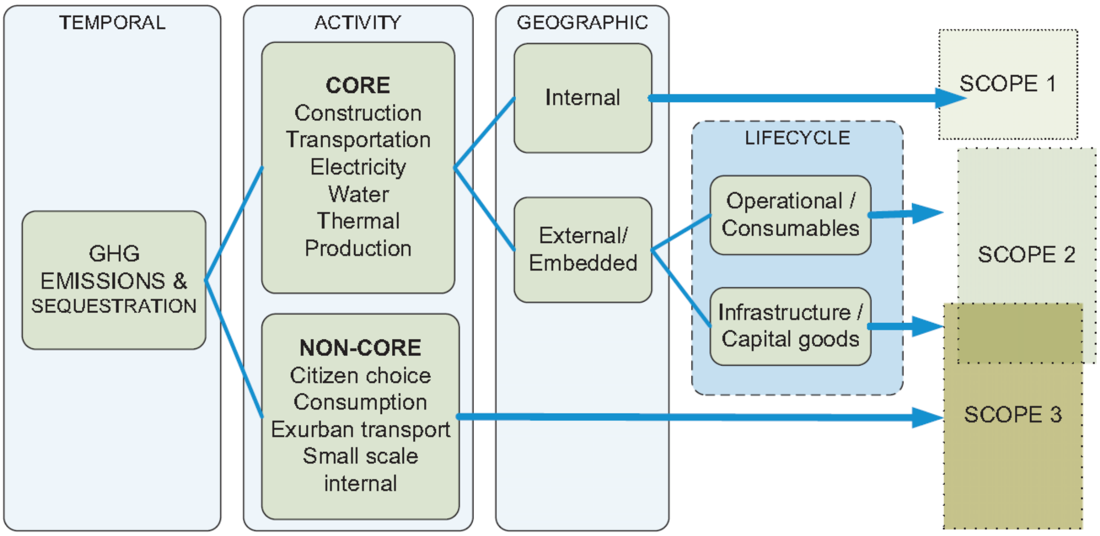

Fig. 1: Urban GHG emissions scoping and boundaries (Kennedy&Sgouridis, 2011).

Each of these levels implies its own carbon management strategy (reduce, eliminate, balance and offset) in order to meet a climate neutral status. However, and the CLUE project experiences prove this, there are many trade-offs and difficulties of implementing these CO_2 accounting and management systems. It can be claimed that no city so far has achieved such a rigorous label of accounting and related decision-making. It should be mentioned that no CLUE project city is using such a broad accounting system. Thus in theory this system could work fairly well but it must be broadly tested before being good enough to become a part of cities' decision and policy-making, benchmarking and implementation.

The boundary problem is probably one of the most important issues to be overcome before a city or an urban district can be defined as climate neutral. So far, the usual accounting schemes as e.g. Greenhouse Gases ISO 14064:2006, ICLEI's Community- Scale GHG Emissions Accounting and Reporting Protocol or ClearPath tool, Covenant of Mayors' emissions inventory guidelines, International Standard for Reporting Greenhouse Gas Emissions for Cities and Regions (by UNEP, UN-HABITAT and the World Bank), the Greenhouse Gas Regional Inventory Protocol (GRIP) developed by the Tyndall Centre, etc. normally only take into account what is happening inside a city, but leaves CO_2 footprints outside a city or an urban district (e.g. long distance travel, imported services, consumption goods, etc.) without significance. It would therefore be necessary to widen the scope and be honest in the accounting.

There has been a great deal of discussion of Kennedy and Sgouridis' proposal in the CLUE project. They suggest four system boundaries for green house gas emissions that go over temporal and geographic borders of a city or urban district. These boundaries are:

- Area's geographical boundaries that distinguish ''internal'' from ''external'' emissions
- Temporal boundaries within which emissions are tracked
- Activity boundary outlining the carbon emitting activities for which a city should be held responsible and that must be accounted for in the city's carbon balance for a given scope (e.g. CO_2-footprints)
- Lifecycle boundary i.e. the degree to which the production and disposal of capital goods required for any activity are included.

Emissions from each urban activity can accordingly be mapped onto the suitable scope according to its location inside or outside each of the four mentioned boundaries. Figure 2 shows a city's metobolism in terms of material, energy and CO_2 flows. For deeper understanding it is suggested to read the original article of Kennedy and Sgouridis. Figure 2 shows that many of the CO_2 and green house gas emissions occur outside a city's own borders. And this is of course outside a city's mandate and decision sphere i.e. cities cannot really influence what is happening outside except by clear climate oriented communication campaigns towards citizens and enterprises as well as of course through procurement of services and goods that take into account the CO_2 emissions in a life cycle perspective.

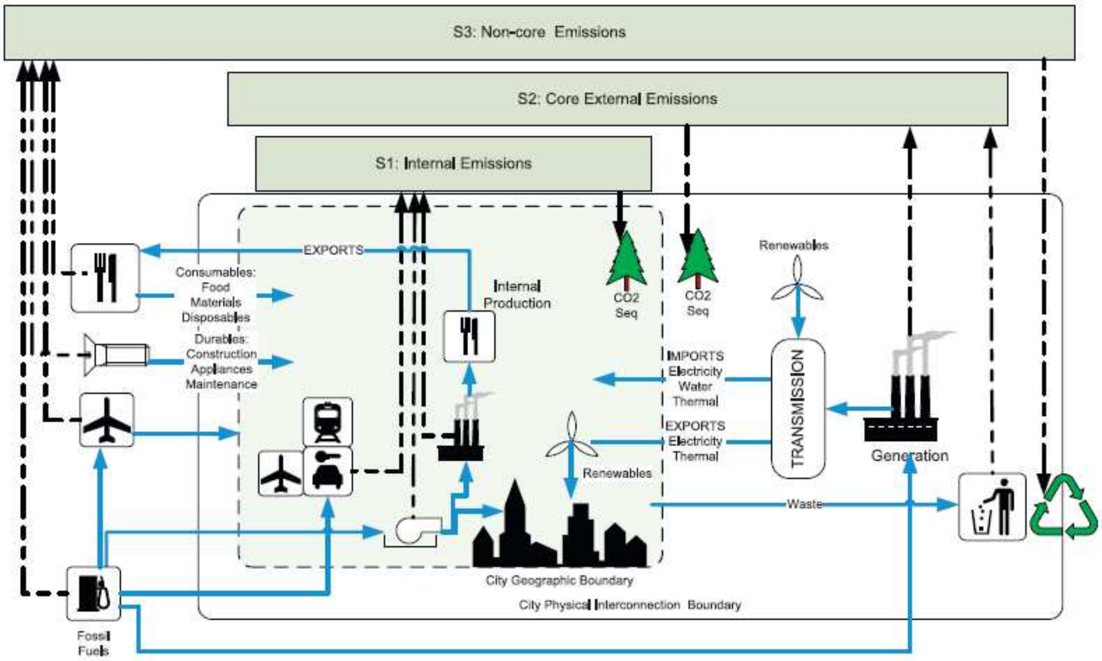

Fig. 2: Urban metabolism related to three scopes of emissions (Kennedy&Sgouridis, 2011).

Currently it is practically impossible for a city or urban district to entirely avoid all carbon emissions within scope 1 or 2. This means that no sufficient balancing or offsets can be made inside the system border. However, for reaching a workable approach to climate neutrality, it is possible to suggest an offset trade in a gradient from little to unlimited. Such a method is therefore crucial for the discussion of climate neutrality in practice. In the definition used by the UK Sustainable Development Commission (SDC 2006) the limitation on offsets are discussed as follows: "one that causes no net accumulation of CO_2 emissions to the atmosphere. Therefore carbon neutrality allows emissions to be netted off in some other location, a process which is called 'offsetting'. However the SDC would caution against a carbon neutrality policy which is focused solely on carbon offsetting. As the aim should be to reduce overall emissions over time, simply offsetting emissions without a carbon management strategy in place is at best misconceived, and at worst counter-productive." This means that cities have to work on their own mitigation strategies first of all and take the off-set possibilities as a way to balance their own emissions – and this not only for statistical and conceptual reasons of reaching climate neutrality.

In the CLUE project many discussions and conclusions found that climate neutral urban development approaches can have positive effects for establishing sustainable urban forms. This is also mentioned in a UNECE report from 2011 which connects climate neutrality to a more holistic view of development: "While climate neutrality is a strategy to be 'climate-smart', it is also a means to address other environmental, economic and social challenges" (UNECE 2011, p. 14). This is a central aspect and tends to reinforce the fundamental message that climate neutrality in cities or urban districts must be connected to the issues of sustainable urban development. This implies to secure participation from a wide range of different stakeholders, to avoid sub optimisation and to create synergetic effects as well as multifunctional solutions.

3.1 CLUEs as particular ecodistricts

Cities plan and work locally with their own approaches to climate mitigation because globally there is no systematic politics of climate change. However, it should be clear to everyone, that politics-as-usual and business-as-usual will not make it possible to deal properly properly with the threatening problems climate change entails (Giddens, 2011). Therefore many cities in Europe aim, based on their own local decisions, to become 100% free of fossil fuels, avoid unsustainable GHG emissions and become energy smart by 2050 or earlier. Similar approaches can be found across Europe. New or renewed urban districts, like the Stockholm Royal Seaport, Wilhemsburg in Hamburg (part of IBA Hamburg), Vienna's Aspern+ and the Vallbona district in Barcelona, are being planned to achieve such goals. They are all part of the CLUE project and will be the basis for the discussion oft he following chapter.

Fig. 3: Overview of Stockholm Royal Seaport, an eco-district with climate positive ambitions (www.stockholmroyalseaport.com).

These districts are thought to be in the technological forefront and a showcase for sustainable urban development with an emphasis on climate mitigation and climate neutral development – i.e. they shall offer many "smart city" solutions. But as a matter of fact and as mentioned above, there are no climate neutral urban districts yet in the world. However such showcases are highly needed in order to guide the enourmous investment decisions to be made in the light of climate change. A recent Bloomberg New Energy Finance report states that global investment in low-carbon clean energy and energy efficiency technologies was US$281 billion in 2013, down 12 percent from 2012, and far short of what is needed. The International Energy Agency believes that to keep the global temperature rise to under 2°C, the level deemed critical by scientists to avoid a global climate catastrophe, some US$36 trillion, or US$1 trillion annually, are needed in clean energy investment by 2050, foremost in cities. Green growth is thus a future key challenge.

What can be said about the "forerunner districts" as mentioned above? They are about smart urban solutions, but cities and their districts are above all about people i.e. daily life, exchange and socializing within a city. Smart solutions are therefore in any case not enough, as they are just one layer of a necessary holistic urban development. The resilient city of the 21st century is hence not only about technological innovations and solutions. The question is rather what institutional structure would be necessary in order to ensure legitimacy, political leadership, long-term commitment to climate change and the indispensable stable socio-economic fundament for transition towards climate neutrality? One way of getting this process started could be CLUEs, working as test beds for physical, economic and social change.

It can be argued that CLUEs are particular urban eco-districts as they stipulate climate neutrality and thereby have many other effects relating to sustainable urban struc¬tures. Such districts create many co-benefits including clever urban solu¬tions (Fitzgerald, 2013). The significance of CLUEs is therefore high, despite the limited geographical scope. This is due to the fact that such districts are investigational areas which in parallel comprise cohesive plan¬ning and system integration (technical and socioeconomic systems). They stand for high sustainable ambitions, especially in the area of environmental efforts. They are fields of experi¬mentation and innovation dissemination whose results can be applied to city overall or in other places. Last but not least such districts can considerably contribute to behavioural changes. These positive factors alone would be enough to motivate the necessary designated urban interventions and related investment costs. However there are risks that such districts also become islands of sustainability with very high standards and therefore high costs for housing (commercial uses are not as affected due to other payment capacities).

However and despite the advantages mentioned, a high-level analysis made in the framework of CLUE shows that the forerunner districts Stockholm Royal Seaport, Wilhemsburg in Hamburg, Vienna's Aspern+ and the Vallbona district in Barcelona are far from being capable to ensure climate neutrality in a mid-term future (2030). Although the CLUE project's urban districts have very high climate mitigation goals compared to ordinary districts or their respective nation states, the implementation of available new technologies, especially when regarding the transport sector, supporting the set climate goals is not enough to come close to very low/zero carbon levels or climate neutrality. The limited handling scope and mandate of cities are two major reasons why this does not work i.e. scopes 2 and 3 as explained above cannot really be influenced. Actually only a small part (20-30%) of all emissions made by households and enterprises can be planned or in certain cases regulated by a city's authorities. Thus there is a big dilemma when working with CLUEs: the biggest problems i.e. the biggest sources of GHG emissions are not really touched upon.

The CLUE project's gathering of good practice examples shows this problem. More than 80 examples were collected in the working areas' regulations, participation, planning strategies, building and transport concepts/technologies. There are many excellent examples of part-solutions. Together they deliver a great patchwork of necessary measures in order to move towards climate neutrality. But despite the high number of measures there are still many things missing. In other words, the huge number of efforts and measures needed in a CLUE make it difficult for any city to cover everything at the same time due to organisation, financial or simply personnel limitations.

3.2 Challenges of finding the right roadmap for CLUEs

It is said that the future has a long history. When it comes to CLUEs it is necessary to regard the legacy of a city and urban heritage both socially, culturally and physically in order to plan for a climate neutral future. One major concern to establish a CLUE is consequently the complexity of setting the right targets, making the right decision at the right time combined with the right measures in the right geographic borders including life cycle and system considerations. Taken together all this requires highly qualified methodological approaches, well reflected planning and foresighted decision-making processes which are not easy to reach for a city's stakeholder community. This multifaceted complex could also be called the challenge to find the right local roadmap for a CLUE.

Such a roadmap proposal is developed by the Clinton Climate Initiative (www.clintonfoundation.org) where the principal idea behind is to co-create socioeconomic values for public and private sector partners by fighting climate change. In the so called "Climate Positive Development Program" (CPDP) local models are created to reduce greenhouse gases and at the same time serve as urban laboratories. This program is linked to the Sustainable Communities Initiative of the C40 Cities Climate Leadership Group and has therefore a high significance in producing climate neutral or even positive urban development. This means that the 18 selected CPDP program cities (one of them is the CLUE partner Stockholm), seek to meet a very ambitious "climate positive" emissions target of net-negative on-site, operational greenhouse gas emissions. This climate positive result is accomplished by reducing emissions on-site and offsetting emissions in the surrounding community. Thus this is a similar approach compared to the model mentioned above. But again, every CPDP project has a unique profile, given their distinct socioeconomic, political and climate challenges.

A roadmap has a start and a finish. The start is to make the required analysis of where the challenges are and what has to be done in a city or an urban district to become climate neutral. The necessary data are collected and a baseline for the further process created. The roadmap isself contains the measures that are vital for the transformation process towards renewable energy use, energy savings and reduced GHG emissions and where to become active outside the city/urban district in order to get the indispensable credits (emission reductions through flexible Kyoto mechanisms such as CDM, JI and ETS are not allowed). In this work visioning processes, stakeholder participation processes with focus on behaviour change, scenario work including forecasting and back-casting as well as future studies can be used. An appropriate accounting tool with a suitable indicator and evaluation scheme has to be worked out. The connection to politics, planning and private investors has to be established. In the end (theoretically) a city or urban district will become climate positive. Figure 4 shows the single steps of such a logic step-by-step approach. As matter of course the roadmap has to be frequently reviewed as such a roadmap stretches over many years or even decades.

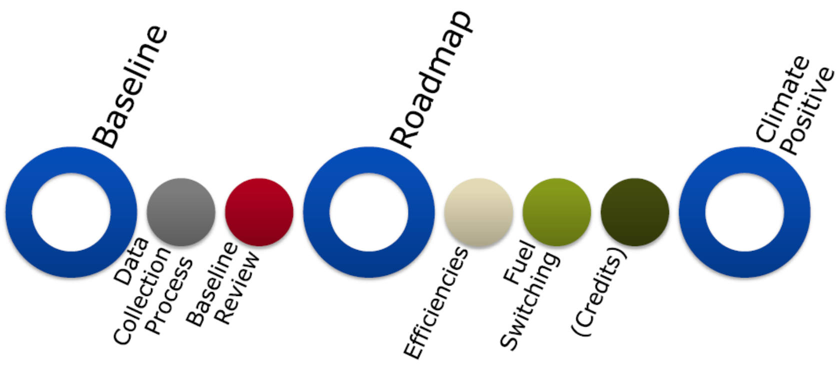

Fig. 4: Roadmap model to become climate positive (based on: Clinton climate initiative).

The Clinton Climate Initiative focuses on low energy use, a high degree of renewables, local energy generation and a system of credits. On an urban district level there are three main emission categories including energy, transportation and waste. It allows for technology and policy actions that reduce emissions in the surrounding areas or globally, called credits. But it excludes GHG emissions from construction etc. (i.e. no life cycle perspective) and consumption of goods and services as well as long distance travel which is a clear weakness.

Compared to many of the other tools, Clinton Climate Initiative has an extremely ambitious and explicit goal – climate positive. Strengths are its transparency which is a key for comparisons between other urban districts and valuable experiences and solutions to be communicated. The process of baseline, roadmap and credits offer a wide variety of different kinds of solutions and also allows a city or an urban district to test how far different actions will lead.

However, the disadvantage of the CCI model is that it does not take into account the important challenge of being people centred in order to function well over time. Demanding technological solutions strongly influence the life styles of people and companies in such districts and need the users' full integration and understanding. High investments and rental costs of CLUEs or even climate positive districts, due to high entailed standards, require careful consideration of social justice and equality.

The social part of CLUEs is as "big" as the economic and ecological parts. Some aspects are crucial whether a CLUE can become a success or not. It is necessary to have deliberative participatory processes and a broad collaboration among stakeholders, i.e. the use of peoples' and institutions' existing knowledge must be included in the transition process from the beginning. Building trust and building up social capital are vital. Social groups that usually are not partaking in dialogues must be reached. In terms of smart solutions, it is crucial to make users understand that the "project" i.e. often smart technologies cannot solve everything.

3.3 No single path to reach 100% climate neutrality in cities

To become climate neutral in a city or urban district, it is necessary to tackle many things in parallel, things that are interlinked with each other. Some important issues for cities to consider are having a coherent vision, sustaining a long-term political commitment, a functioning business plan, allowing long term public financial support, broad coalitions and co-creation (new partnership models are required) and using system thinking and life-cycle perspectives. On top of that it is necessary to proceed with dedicated communication over a long time.

When looking at this long list of necessary considerations and prerequisites, it becomes evident that there is no single path to reach climate neutrality. The cases analysed in CLUE show that being a forerunner costs a lot of time, money and engagement, but it also brings new knowledge, good publicity and substantial improvements in the urban fabrique. However, it also demonstrates that the ways which are able to work on climate neutrality today in cities are not sufficient. As shown above, cties are always dependent on a global interplay in terms of resources, energy and ecosystem services.

4 CONCLUSION – SOME OUTLINES FOR URBAN POLICY MAKING

There are a number of conclusions arising from the statements above that can be summarised as follows:

- It is a fact that there is a growing awareness of low carbon policies in discourses, strategies and struggles around urban development. Important however is that such low carbon and climate neutrality policy considerations are being mainstreamed in urban politics, planning and implementation in order to bring the necessary transformation.
- Climate neutrality is a concept under development – definitions, scopes and boundaries are to be found for each local project. And: there is no climate neutral (or positive) urban district or city in the world yet. This makes it difficult to become more specfic and give advice "how to do it".
- The often experienced gaps between a city's ambition and real world conditions are very hard to overcome. Cities in Europe have very differing starting points. Early adopters, as some of the CLUE partners, might come a faily long way in their transformation within the next decades, while other cities lacking behind have to face a very challenging and long starting phase.
- Eco-disctricts in the form of CLUEs can be very good test beds for new "smart" technological concepts and sustainable urban development, but they are not the only solution for reaching climate neutrality. For reaching such a goal in a city, much more is needed e.g. a supporting/ permitting national framework, sound embedding in regional/national/global systems and last but not least a strong local political commitment. System thinking in a broad sense is absolutely essential in order to avoid imperfect, isolated solutions and costly sub-optimisation.
- Roadmaps as a concept towards climate neutrality seem to be a promising way to achieve more transparency and support around the big number of measures to be undertaken in order to achieve climate neutrality. However, roadmaps in this field need longterm commitment, financial assets and a new way of including sustainable action.
- Cities and decision-makers must become learning organisations combined with new forms of dialogue and engagement. A city and its public institutions have to become open interfaces between citizens and stakeholders developing a city. Especially when working with CLUEs it is absolutely vital to regard social aspects and to bring people and enterprises to a fruitful co-generation of necessary transformative actions and behavioural changes.
- Time is running out, there is no other way than trying to avoid the unacceptable and to accept the unavoidable when it comes to climate change. CLUEs are parts of this important game…

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Daten, Informationen und Wissen zu Alltagswegen – eine Voraussetzung für Smart Cities?!

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1 ABSTRACT

Daten-, Informations- und Wissensinfrastrukturen stellen das Rückgrat von Smart Cities dar. Gerade für die Verkehrsplanung und die Entwicklung von smarten Mobilitätsangeboten und -dienstleistungen sind diese Daten-, Informations- und Wissensbestände eine wesentliche Grundvoraussetzung. „Die Grundlage jeder abgesicherten Planung bilden fundierte, methodisch einwandfrei entwickelte und durchgeführte Erhebungen zur Verkehrsnachfrage." (Steierwald et al., 2005, 80) In der gängigen Verkehrsplanung werden immer wieder sogenannte Kennziffern, wie der Pkw-Besitz, die Pkw-Verfügbarkeit, manchmal auch der Zeitkarten-Besitz und die Verkehrsmittelwahl, der sogenannte Modal Split, sowie vorab definierte Wegezwecke zur Beschreibung des Mobilitätsverhaltens von Menschen herangezogen. Um diese Kennziffern zu erhalten, gilt – gemäß der gängigen Lehrmeinung – zurzeit die Haushaltsbefragung (durchgeführt als standardisierte quantitative Befragung mittels Papier, Telefon oder Web) als das zuverlässigste Erhebungsverfahren im Rahmen der Verkehrsplanung. Bei Haushaltsbefragungen zum Verkehrsverhalten werden die außerhäuslichen Aktivitäten und Wege aller im Haushalt lebenden Personen, meist über 6 Jahren, von ausgewählten Stichprobenhaushalten zu einer bestimmten Zeit (Stichtag oder über einen längeren Zeitraum) mittels Fragebogen erfasst. Im Regelfall werden Daten und Informationen zum werktäglichen und sonntäglichen Verkehrsverhalten von Personen erhoben. Die Erhebungseinheit ist der Haushalt, das heißt, die Befragungsunterlagen werden an die Haushaltsadresse für alle Haushaltsmitglieder verschickt, Untersuchungseinheit ist die individuelle Person. In der Verkehrsplanung wird jede Ortsveränderung zu einem eindeutigen Zweck, die innerhalb eines öffentlichen Verkehrsraums zu Fuß, mit einem oder mehreren Verkehrsmitteln stattfindet, als Weg bezeichnet.

2 DATEN ZU ALLTAGSWEGEN SIND LÜCKENHAFT

Was in der Praxis jedoch oftmals fehlt, ist die kritische Reflexion dieser Daten-, Informations- und Wissensbestände bzw. deren Erhebungsmethoden. Schon der Vorgang des Messens beeinflusst stets das Messergebnis und muss daher in die wissenschaftliche Betrachtung mit einbezogen werden. Messungen beschreiben nie die Realität, es wird immer ein Abbild der Realität gezeichnet, das mehr oder weniger von der Wirklichkeit abweicht. Statistische Angaben, insbesondere, wenn sie auf einem großen Sample beruhen, vermitteln leicht den Eindruck objektive „Tatsachen" darzustellen. Jedoch können mit Statistik – neben der korrekten Darstellung und Auswertung großer Datenmengen – durchaus auch Tatsachen verzerrt oder verfälscht präsentiert werden. (Vgl. Meyer, 1999)

Auch Lücken in der Datenverfügbarkeit werden durch eine kritische Analyse der verwendeten Methoden bei Verkehrs- und Mobilitätserhebungen sichtbar. So fehlen in Österreich, beispielsweise, flächendeckend beim Thema alltägliche Begleitmobilität (Wege, die unbezahlt für und mit anderen Menschen zurückgelegt werden) sowie bei den Alltagswegen und den komplexen Wegeketten entsprechende Daten, Informationen und somit Wissensgrundlagen.

Die Kritik an der Methode der Haushaltsbefragungen wird nicht nur von Genderforscherinnen und Genderforschern formuliert, auch „traditionelle" Planerinnen und Planer stellen fest: „Die Aussagekraft der KONTIV [= eine Form der Haushaltsbefragung, die in Deutschland Verwendung findet, Anm. d. A.] ist aufgrund des geringen Stichprobenumfangs sowie der zeitlichen Anlage als Stichtagserhebung beschränkt […]. Lediglich aggregierte Mittelwerte der Wegehäufigkeit, Verkehrsmittelwahl etc. sind mit ausreichender Genauigkeit ermittelbar; eine Differenzierung des erhobenen Verhaltens nach Wegezweck, Personengruppen und/oder Tageszeit ist jedoch nur sehr eingeschränkt mit einer hinreichenden Genauigkeit möglich." (Sommer, 2002: 6) Die Tatsache, dass bei Haushaltsbefragungen zur Mobilität pro Weg immer nur ein Wegezweck angegeben werden darf („Bitte nur eine Nennung" bzw. „Geben Sie einen Wegezweck an"), führt zu einer Fokussierung auf den „Haupt-Wegezweck". Es werden tendenziell die kurzen Wege sowie die Wegezwecke, die „nebenbei" erledigt werden, wie das „Jause einkaufen" am Weg zur Erwerbsarbeit, der „Sprung in die Apotheke" am Nachhause-Weg oder der „schnelle Kaffee" unterwegs nicht erhoben. Die vielfältigen Wege, die Besorgungen, die im Alltag zu erledigen sind, werden durch das Instrument eines

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Fragebogens, an dem anzugeben ist, um wie viel Uhr ein Weg begonnen wurde, zu welchem einzigen Zweck dieser Weg unternommen wurde, in ihren Qualitäten und Eigenschaften zerstückelt – in diesem Sinne durch die Schrift zerrissen. Die Möglichkeit Wegezweck-Kombinationen anzugeben, fehlt bei den Haushaltsbefragungen gänzlich. (Vgl. u. a. Knoll, 2008)

Was in der Verkehrsplanung und Mobilitätsforschung nur in Ansätzen stattfindet, ist eine Debatte zu den Vor- und Nachteilen von quantitativen und qualitativen Methodenansätzen. (vgl. Knoll, 2014)

3 ALLTAGSMOBLITÄT – ERSTE PROJEKTERGEBNISSE

3.1 Forschungsprojekt „Mobility4Job"

Das Forschungsprojekt „Mobility4Job. Gendergerechte Mobilitätslösungen für bessere Erwerbschancen im ländlichen Raum", das von einem Konsortium bestehend aus der Universität für Bodenkultur Wien, Department für Raum, Landschaft und Infrastruktur, Institut für Verkehrswesen, der Rosinak & Partner ZT GmbH, der Arbeiterkammer Wien sowie dem Büro für nachhaltige Kompetenz B-NK GmbH, bearbeitet wird, beschäftigt sich mit den mobilitätsbedingten Hemmnissen für den Einstieg in die Erwerbstätigkeit identifiziert. Es sollen gendergerechte Mobilitätsvoraussetzungen und Mobilitätsdienstleistungen für den ländlichen Raum definiert werden, die Frauen und Männern mit Versorgungs- und Betreuungspflichten eine chancengerechte Teilhabe am Erwerbsleben ermöglichen. Gendergerecht meint, dass Menschen unabhängig von ihrer sozialen Rolle selbstbestimmt am Erwerbsleben teilnehmen können – mangelnder Zugang zu Mobilität darf diese Selbstbestimmung nicht behindern. In einer qualitativen Mobilitätserhebung wird 2013/14 zu unter anderem folgenden Fragen in einem Untersuchungsgebiet, das im südlichen Niederösterreich liegt und 30 Gemeinden der „LEADER-Region Triestingtal" und „Gemeinsame Region Schneebergland" umfasst, geforscht.

- Wie gestaltet sich das Mobilitätsverhalten von erwerbstätigen Personen bzw. Personen, die erwerbstätig sein wollen und die auch Betreuungs- und Versorgungspflichten im Alltag wahrnehmen?
- Welche mobilitätsbedingten Hemmnisse gibt es?
- Welche Mobilitätslösungen können in ländlichen Räumen die Chancengleichheit von Frauen und Männern unterstützen?

Im Zuge der qualitativen Mobilitätserhebung konnten ausgewählte Aspekte der Mobilität, wie der Pkw-Besitz und seine Bedeutungen sowie Einflussfaktoren auf die Mobilität, wie Berufstätigkeit und Familienzusammenhänge, identifiziert und näher betrachtet werden. Personen mit Betreuungspflichten legen viele ihre Wege innerhalb und außerhalb der Region mit dem eigenen Pkw zurück und weniger mit den öffentlichen Verkehrsmitteln. Laut den Befragten sollte der öffentliche Verkehr (ÖV) bedarfsorientierter gestaltet werden und besonders den Bedürfnissen von Personen mit Betreuungspflichten angepasst werden. Insbesondere wurde die bessere zeitliche Abstimmung der Anschlüsse und der Takte des ÖV angesprochen. Als Beispiele wurden Umsteigeprobleme von Schülerinnen und Schülern und die nicht abgestimmten Schulanfangs- und Endzeiten genannt. Bei einer verbesserten Abstimmung dieser Mobilitätsdienstleistungen werde die Alltagsmobilität der Menschen mit Betreuungspflichten und dadurch auch deren Teilnahme am Erwerbsleben erleichtert. Die komplexen Wegeketten werden zeitlich verkürzt, ein (Wieder-)Einstieg in die Erwerbsarbeit wird leichter planbar und somit wird auch die Organisation der Mobilität des jeweiligen Haushalts bzw. der Familie erleichtert. Besonderes Augenmerk wurde bei der Erhebung auf die Alltagswege der befragten Personen gelegt und über die Visualisierung der „gestrigen Wege" konnten, wie die folgende Abbildung zeigt, die vielfältigen und komplexen Wegeketten auch kartografisch dargestellt werden.

3.2 Gender-Modul zu Österreich unterwegs 2013/14

Um umfassende Daten, Informationen und Wissen zur Mobilität von Menschen, die im Alltag Betreuungsaufgaben übernehmen, zu generieren, wurde das Büro für nachhaltige Kompetenz B-NK GmbH vom österreichischen Bundesministerium für Verkehr, Innovation und Technologie und vom Land Burgenland begleitend zur österreichweiten Mobilitätserhebung „Österreich unterwegs 2013/14" beauftragt, vertiefende qualitative Erhebungen zur Mobilität von Menschen mit Betreuungsaufgaben für Kinder, Jugendliche und ältere Menschen durchzuführen. Es wurden ausschließlich Menschen befragt, die unbezahlt die Betreuung, meist für die leiblichen Kinder, Eltern bzw. Stiefkinder und Schwiegereltern übernehmen. Dabei wurde folgenden Fragestellungen in qualitativen Einzelinterviews und Fokusgruppen-Interviews in sechs Regionen in Österreich nachgegangen:

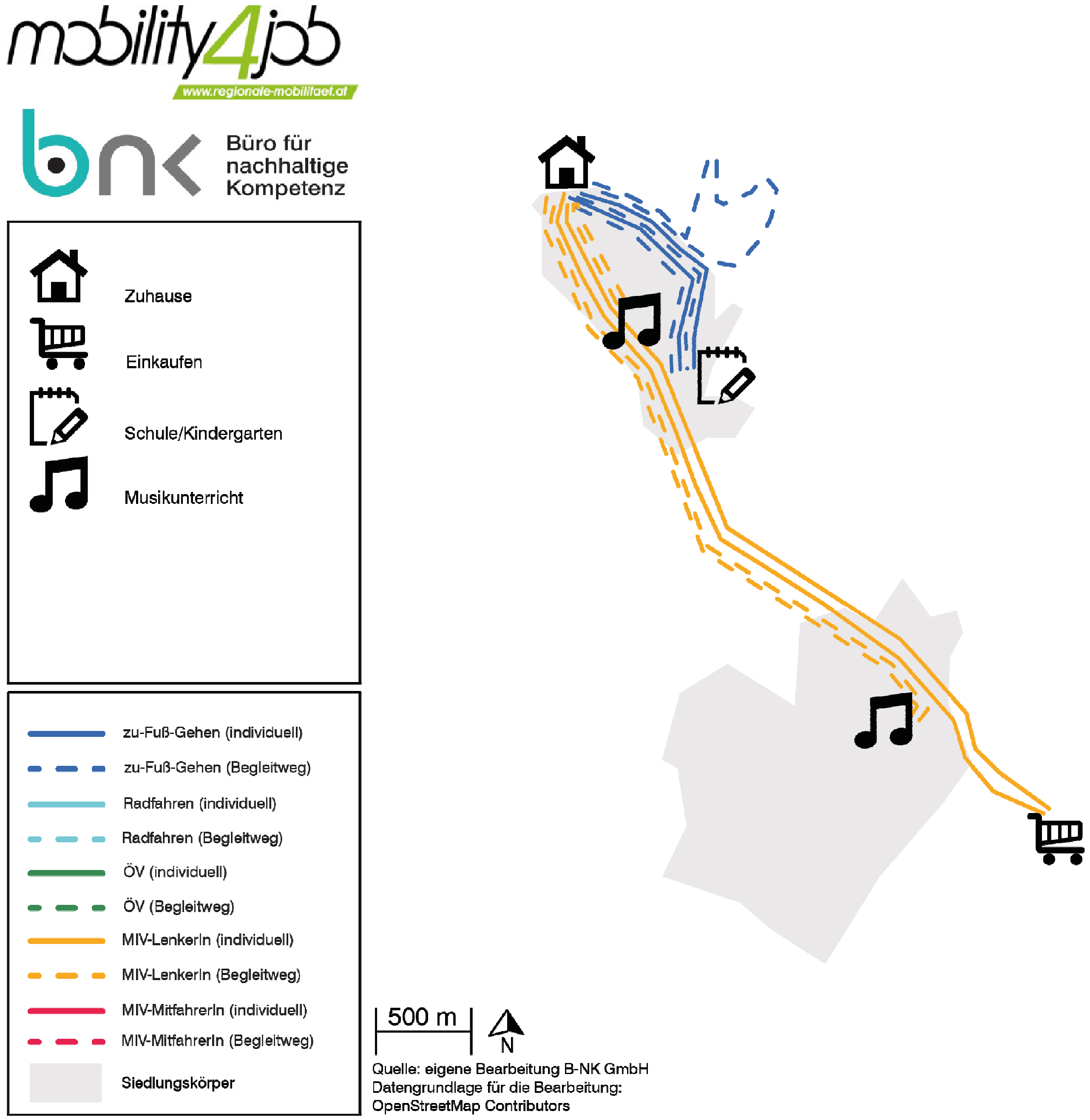

Fig. 1: Ausgewählte Alltagswege im Untersuchungsgebiet LEADER-Region Triestingtal und Gemeinsame Region Schneebergland

- Wie gestaltet sich das Mobilitätsverhalten von Personen in den unterschiedlichen Raumtypen in Österreich?
- Welcher Zusammenhang besteht zwischen den Mobilitätsentscheidungen, dem Gesamtarbeitsalltag und den Haushaltsformen?
- Wie organisieren die Personen ihre komplexen Wegeketten?

Besonderes Augenmerk lag auf den unterschiedlichen Zusammenlebensformen der befragten Personen, wobei die Spannbreite von einem „traditionellen" Lebensentwurf (Kernfamilien mit Mutter-Vater-Kind), über die „Ein-Kind-Familien" (Alleinerzieherinnen und Alleinerzieher) bis hin zu den bislang in der Mobilitätsforschung wenig beachteten „Patchworkfamilien", „Fortsetzungsfamilien" und „multilokalen Familien" (das sind Personen in einer Paarbeziehung mit Kind(ern), die zumindest auch teilweise im gleichen Haushalt leben) liegt. Im Zuge der Forschungsarbeit konnte das Mobilitätsverhalten von Menschen mit Betreuungsaufgaben sowie deren Einstellungen und Werthaltungen zum Thema Mobilität und zu den verschiedenen Verkehrsmitteln erfasst und bearbeitet werden. Die über 120 Einzel- und Fokusgruppen-Interviews wurden in den Städten Wien, Graz, Eisenstadt sowie den ländlich geprägten Regionen Südburgenland, Waldviertel und Defereggental in Osttirol durchgeführt.

Die ersten Zwischenergebnisse zeigen auf, dass alltäglichen Wege von Personen mit Betreuungsaufgaben nicht nur von spezifischen Herausforderungen, die in punktuellen Situationen auftreten, geprägt sind, sondern dass die Mobilität von Personen mit Betreuungsaufgaben generell durch komplexe Wegeabfolgen bzw. komplexe Wegeketten gekennzeichnet sind. Diese komplexen Wegeketten weisen charakteristische Merkmale auf. So handelt es sich dabei um aufeinanderfolgende Wege mit vielen Aufenthalten (= Haltepunkte, Aktivitätsorte) oder mit vielen Etappen (= Wechsel von Verkehrsmittel). Die Komplexität von Wegeketten erhöht sich, wenn den Wegen ein großer Planungsaufwand vorausgeht, wenn große bzw. schwere Transportlasten zu bewältigen sind oder die Verkehrsinfrastruktur von fehlender Barrierefreiheit geprägt ist. Weiters tragen Wege bzw. Begleitwege, die eine erhöhte Achtsamkeit fordern und bei denen vermehrte Verkehrssicherheit erforderlich ist, zur Erhöhung der Komplexität von Wegeketten bei. Das Alltagsmanagement von Menschen mit Betreuungsaufgaben gestaltet sich im Vergleich zu Menschen ohne Betreuungsaufgaben aufwändiger, da mehr Aufgaben und Wege miteingeplant und koordiniert werden müssen. Die zeitgerechte Erledigung von Aufgaben, die meist mit Wegen verbunden sind, wird von Interviewpartnerinnen und Interviewpartnern als Teil ihrer Verantwortung gegenüber der zu betreuenden Personen gesehen. Egal ob sie mit älteren Personen oder Kinder unterwegs sind, die Interviewpartnerinnen und Interviewpartner gaben an, dass sie für Wege und Tätigkeiten, wie z. B. Einkaufen, immer mehr Zeit benötigen, wenn sie eine Person in Begleitung mit am Weg haben als wenn sie alleine unterwegs sind – dies bezieht sich sowohl auf kurze wie auch auf längere Wege.

Die Begleitwege an sich werden von den Interviewpartnerinnen und Interviewpartnern aus unterschiedlichen Perspektiven wahrgenommen. Zum einen sind Begleitwege Teil der Betreuungsaufgaben, also eine Pflicht, die erfüllt werden muss. Die Interviewpersonen, die Wege gemeinsam mit anderen zurücklegen, sind nicht nur für sich selbst verantwortlich, sondern übernehmen auch die Verantwortung für die Person, die begleitet wird. Ein Weg wird nicht mehr einfach zurückgelegt, sondern wird für die Begleitperson zu einer vielschichtigen Aufgabe und bisweilen zur Herausforderung. Zum anderen werden von den Befragten die Begleitwege als gemeinsam verbrachte Zeit mit den zu betreuenden Personen gesehen und somit als Raum für Gemeinsamkeit, Wertevermittlung und Bewusstseinsbildung. Der gewünschten Vorbildwirkung entsprechend, werden insbesondere bei den Begleitwegen mit Kinder im städtischen Umfeld bewusst umweltfreundliche Verkehrsmittel gewählt und auf den Pkw verzichtet.

4 ZUSAMMENFASSUNG UND AUSBLICK

Die Zwischenergebnisse der beiden oben vorgestellten Forschungsprojekte zeigen auf, welche vertiefenden Daten und Informationen – und somit Wissensbestände – zur Alltagsmobilität von Menschen (mit Betreuungsaufgaben) generiert werden können. Wie die Arbeiten zeigen, ist es dazu auch erforderlich die in der Verkehrsplanung heute meist vorherrschenden schriftlichen, standardisierten Befragungsmethoden mit persönlichen leitfadengestützten Interviews und mit entsprechenden Planvisualisierungen zu ergänzen. Im Vordergrund der beiden Forschungsprojekte steht das Verstehen von Mobilität als Prozess, der in Wechselwirkung mit den unterschiedlichen Lebenszusammenhängen sowie den alltäglichen, unbezahlten Versorgungs- und Betreuungsaufgaben der einzelnen Menschen steht. Dem qualitativen Paradigma entsprechend werden weder Repräsentativität noch eine möglichst hohe Anzahl an Fällen als Auswahl- und Bewertungskriterien herangezogen. „Da die qualitative Sozialforschung eben nicht im Sinne der quantitativen Methodologie generalisieren möchte, ist die Frage der Stichprobengewinnung und -ziehung, somit auch die der Repräsentativität, keine entscheidende. Qualitativer Methodologie geht es eben eher um Typisierungen bzw. Typologien, weshalb die Repräsentativität nicht so bedeutsam erscheint.“ (Lamnek, 2005: 384)

Für die Verkehrsplanung im Allgemeinen und die Entwicklung von smarten Mobilitätsdienstleistungen und -angeboten im Besonderen ergeben sich aus diesen Projekten folgende Implikationen:

- Bei Erhebungen von Daten und Informationen bewussten Fokus auf die vielfältigen Alltage von Menschen legen

- und dabei die Gender- und Diversity-Dimensionen integrativ berücksichtigen;
- Bei der Interpretation und Darstellung von Wissen zu und über Mobilität von Menschen auf die Grenzen der Aussagekraft von Daten hinweisen;
- Partizipative und kreative Methoden in der Verkehrsplanung und Mobilitätsforschung anwenden;
- Gendability (Erharter, 2012) von smarten Mobilitätsdienstleistungen und –angeboten umfassend prüfen.

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Digging into the Smartness: A Short Technopolitical (Pre)History of Vienna's Urban Lakeside

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1 ABSTRACT

The smart city project "Vienna's Urban Lakeside" (VUL) – "Seestadt Aspern" for German speakers – is currently being built upon a landscape where relevant historical events took place. The most well known of these events are the Battle of Aspern-Essling (1809), in which the Napoleonic army failed to cross the Danube, and the inauguration of the Aspern Airfield (1912), which was of great importance until World War II. However, widening the historical span from the Neolithic period to the current construction of this "smart" urban district of Vienna (begun in 2007), there are to be found further elements that illustrate the relevance of the Aspern region in historical and technopolitical terms. For this reason, the paper considers the possibility of "digging" into the technopolitical history of the region in order to reveal the specific intertwining of power and technology in different periods. Rather than a pure historical analysis, the paper is conceived of as a preface to an anthropological approach to the technopolitical substratum of the VUL, which can be regarded as an experimental and therefore key part of a larger smart city project involving the whole city of Vienna. Taking the example of Aspern's region, the general suggestion of the analysis is that the historical contrast allows us to note that, while in the past technology and politics have appeared explicitly linked, in the present the discursive settings of the "smart urbanity" tend to conceal the relations of power (i.e. the political economy) behind a seemingly pure technological improvement of the ways we will dwell in the cities of the future.

2 INTRODUCTION: HORSES AND THE EXPLICITNESS OF POWER

The novel Ein Spion in der Schlacht bei Aspern[1] starts with the description of what, in the time of the Empress Maria Theresa, it meant to be a "big wagoner" (Grossfuhrmann):

We must go back to the year 1756 in order to start this novel. In this year, in the time of Maria Theresa, there was a house in the Fuhrmanngasse, in the Leopoldstadt quarter, which had the number 109. The house belonged to one of the so-called "big wagoners", who were those that brought "big amounts" of trading goods into the province of Austria, for which they needed to have at least 40 or 50 horses.

The big wagoner Jakob Hübler was an especially distinguished man. He owned 80 horses and one could see his wagons in every commercial street of Moravia, Bohemia, Styria, Hungary and even in Italy. Jakob Hübler was a rich man. But he wanted to become richer: I won't stop, he once said, until I have 200 wagons, for which I will need at least 1200 horses (Bräuerle 1891).

The beginning of the novel recreates the social, historical and physical landscape in which the battle of Aspern-Essling later took place. In the 18th century, the power of a merchant could be quantified as being the number of horses he possessed. But this was not a local particularity of the "province of Austria", nor is it a measure of power confined to the late 18th and early 19th century. Horses, or more accurately the "horsepower" of an engine, continue to indicate the social status of the person to which they belong, even in the present day. Today, however, there are additional facts that destabilize the correlation between the number of "horses" of an engine and the real power of its owner. On the one hand, a working class man might have a powerful car if he invests a big part of his wage into buying it. Hence the number of "horses of power" one has does not reflect one's actual position within the structure of power of a given society. On the other hand (and this is what is at stake for the following analysis) the "horses of power" of a vehicle is a technical, metaphorical term, that disguises the complexity of the material and social conditions of control and use that constitute the real power this person gains by possessing a specific technology. To be sure, in 18th Austria one could not possess 80 horses and be defined as "poor"; in the 21st century, however, there might be found more than one humble citizen on the periphery of Vienna driving quite more than 80 horses of power.

The articulation of power with a specific technological object or a measure of technological strength seems to lose its equivalence in the context of postindustrial society. In 21st century neoliberal democracies, the

[1] "A Spy in the Battle of Aspern". Note that all translations from German to English are mine.

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distribution of power is not as explicitly linked to technology as it was in the Age of Enlightenment. The reasons for the dilution of the intelligible conditions of dominance are evidently too complex to be encompassed here.[2] Notwithstanding, in the following analysis it will be stressed how different periods of the history of Aspern can be associated with concrete technological objects and materialities that enabled specific configurations of power. As mentioned previously, this short historical reading aims at stressing the contrast with what happens in the most recent period of the history of Aspern. Interestingly, within the current smart city project Seestadt Aspern (VUL), the power that will be exerted over its future population does not reveal itself in any explicit form. Nothing indicates that the future smart city involves specific forms of domination. On the contrary, its ecologically concerned, technologically engaged and politically participatory, democratic spirit is permanently highlighted. But in contrast with the "clean" depiction suggested by the involved companies and government institutions, recent analyses stress the necessity of unpacking the political economy embedded in many smart city ventures (e.g. Hollands 2008; Newman et al. 2009; Deakin & Al Waer 2011; Vanolo 2013). Likewise, the VUL project entails a political economical program that must be revealed. This is not to say that the VUL is a "wrong" or a "bad" urban project in any moral or political sense. It is rather a call for attention to the technological rationale that, in the form of sheer technical discourses on the quality of urban life, downplays the fact that every technological implementation (and to a greater extent when reflecting on "urban" scale) must be understood along with its political economical logic; that is: its capacity to embody, enable and reproduce specific structures of power.

3 PREHISTORY OF A SMART CITY

In 1981, at the exposition Aspern: von der Steinzeit zum Motorenwerk[3], the director of Vienna's former History Museum mentioned three important events that determined the history of the Aspern region: first, the battle of Aspern-Essling (1809), in which the Napoleonic army failed to cross the Danube; second, the inauguration of the Aspern Airfield (1912), which was of great importance until World War II; and third, the installation of a General Motors engine plant in 1980. In addition, the exposition aimed at showing the archeological objects found in the area, which dated from the Neolithic period onwards and which would "deploy thousands of years of history before the eyes of the beholder" (Waissenberger 1981).

Three decades later we can add a new event: the emergence of the Vienna Urban Lakeside, whose official history began in 2007 when the Swedish company Tovatt Architects & Planners won the bidding process with its comprehensive plan of the future "smart quarter". That history, as aforementioned, originates from a much deeper temporal, factual and environmental anthropocene. I refer to it as the "prehistory of VUL", not because it must be sought solely within the historiographical time of what we formally know as "prehistory", but to stress that in the past there was obviously no notion of a "smart city" in the region of Aspern. There is not a continuous chronological line along which we can see the development of the idea of a "smart city" from the Neolithic period to the 21st century. There is no "single history"; rather, there are diverse histories that sometimes overlapped but that did not necessarily originate with one another. The term "technopolitical (pre)history" is therefore not employed in any teleological sense, but rather to outline an analytical frame that focuses on the intertwining of technologies and the structures of power in different periods on the same landscape. The following points will suggest that a technopolitical analysis is thus central not only to the account of the events that occurred in the region of Aspern before the history of the VUL officially started, but also in order to disclose the articulations of power and technology as they underhandedly irrupted in the 21st century with the name of "smart urban planning".

4 THE TECHNOPOLITICAL STRATA OF HISTORY

Before the VUL, the two biggest infrastructural projects undertaken in Aspern were the Airfield (1912) and the General Motors Factory (1980). The ground was excavated for both projects and as a consequence of these excavations different archeological remains were found. It is precisely in the wake of big technological ventures that the presence of previous human technologies is discovered underneath the landscape's surface. This is how the "natural" terrain becomes a suddenly humanized place; in this case an archeological site. The

[2] The analysis of the advent of "biopolitics" by Michael Foucault (2008) constitutes, in this regard, an excellent reading of the historical and anthropological conditions that faded the explicitness of the forms of political with the onset of Liberalism.

[3] "Aspern: from the Stone Age to the Engine Plant".

access to lower geological strata of the region of Aspern has been enabled by these significant technological undertakings and continues to be done as a consequence of the VUL construction. Despite certain controversies having arisen because of the “suboptimal” conditions in which the current digging is being carried out, the promotion of smart urbanity seems to be the priority of the government rather than the interests of archeological knowledge.[4]

At any rate, according to the findings of the early 20th century archaeological excavations, the region was populated from at least the late Neolithic period, as shown by the many tools shaped in stone or in horns of red deer. Also found were remains of ceramic pots deriving from the Bronze Age, more specifically within the central European Urnfield culture (Franz 1927). The more recent excavations, on the occasion of the General Motors Factory and the VUL, have confirmed the hypotheses of two prehistoric settlement phases: one in the late Neolithic period (Cooper Age) revealed by the typical ceramic shapes of the Baden culture (3300 – 3100 BC), and another in the late Bronze Age up to the middle Urnfield culture (1300 – 1000 BC), from which the remains of construction posts were gathered. Hence the diverse objects of the prehistoric material culture collected in Aspern allow us to gain a rough depiction of the technological nodes of these periods: Ceramic pots, horn artifacts, loom weights, spin whorls, firedogs, stone axes, shaped silicon, remains of clay huts, etc. (see Penz 2010).

In the period between the start of Christian era and the Middle Ages human settlements proliferated in the adjacent areas. The economy of the region was characterized by agriculture, timber trade and the production of flour by means of ship-mill technology. Despite the increasing number of human settlements in the area, the population density remained low for hundreds of years. Thus, the historical data concentrates on a striking event that occurred in the early 19th century, namely the Battle of Aspern-Essling, to which the many historical documents and archeological remains bear vivid witness. In the mass graves, for instance, are to be found the skeletons of French soldiers and slain horses, as well as military clothing, ammunition and weaponry. In the time of the Napoleonic Wars, weaponry was quite explicitly at the core of technological power. The editors of Museum Aspern 1809 describe in detail the advances in military technology of the epoch and its correlation with the violent power struggle that was spreading through Europe:

Among the many reforms undertaken by the Archduke Charles must be counted the renewal of the army’s equipment, especially weapons and firearms, which contributed to the technical advances of the epoch. This new equipment had been planned for a long time, since the year 1798 (…) but the permanent warfare, the subsequent economic struggles and the negative results of the military campaigns had forced them to evacuate the world wide known Viennese rifle fabric, after which the Steyrer fabric (1800) and the Ferlacher (1805) fell into hands of the enemy, providing them [the French] with more than 50.000 firearms and, at the same time, delaying the 1798 planned renewal of the Austrian equipment until 1808 (Dassler 1981).

If warfare, the fight for hegemonic power in Europe, and weaponry were the motor of technological progress during the Napoleonic Wars, by the end of the 19th century, this landscape was testimony to some of the first motorized flight attempts. Beside the several zeppelin landings that took place in Aspern, the most important event was without doubt the inauguration of the Airfield in 1912. An aviation school and an aviation museum complemented an infrastructure that served as a military airbase in both World Wars. The Aspern Airfield rapidly became a symbolic place and, accordingly, was never detached from politics. Thus, for instance, while in 1913 the emperor Franz Joseph was pictured following one of the popular flight shows through binoculars[5], in 1930 Adolf Hitler chose precisely Aspern to organize a “massive meeting”, which he announced with bright orange posters on which one could observe the black swastikas along with the promises of Hitler’s success in his fight for “bread and freedom” (see Müller & N.S.D.A.P. 1930).

The Airfield served the Wehrmacht during World War II and until 1955 was used and controlled by the Red Army. Aeronautic technology and the control of its infrastructures was therefore openly linked to the structures of power of the first half of the 20th century. After the Russian occupation, the Airfield installations were mainly employed for civil aviation purposes, and in the second half of the century, the technological performances undertaken in the area acquired a more ludicrous tone: when Schwechat took over the function of Vienna’s principal airport, Aspern turned into a car race spot. The Austrian Automobile Club hosted all kind of races: Touring, Formula Ford, Motorbike, Formula Five and even Formula One.

[4] http://derstandard.at/1334530900570/Wiener-Stadtteil-Archaeologische-Schaetze-in-Aspern.

[5] http://www.asperniq.at/magazin/luftschiffe_und_tollkuehne_flieger/

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Famous drivers such as Stirling Moss and Niki Lauda saw victory on the Aspern circuit, and international figures such as the Saudi king Saud ibn Abd al-Aziz came along to enjoy the race and to solemnly deliver the prestigious prizes.[6]

Automobile technology has continued to be characteristic of Aspern from the 1980s to the present day as a consequence of the General Motors Factory. At the time the factory was built an uneven trade balance was endangering the Austrian economy. At the end of the 1970s the former Federal Chancellor, Bruno Kreisky, suggested fabricating an "Austro-Porsche" in order to increment the exportation rates. Conflict of interest with more powerful German companies, however, ruined these plans. In 1978 the Austrian government organized a congress to gauge the possibilities of improving the country's performance in the exportation of automobiles. Austria was deemed too small to produce its own cars on the large-scale, but Aspern was seen as an optimal place to build an engine factory, the General Motors corporation (nowadays the Opel), that would revive this sector of industry.

The main activity in Aspern, before the construction of the Vienna Urban Lakeside began, was the car industry; an industry that (as everybody knows) has always been tightly interwoven with politics. Perhaps for this reason, the engine and gear mechanism production at Aspern attracted the prominent Austro-Canadian entrepreneur Frank Stronach, a man who attempted to purchase the Opel factory in 2009. It is worth mentioning that Stronach was not only interested in car technology; he tried to enter politics when he ran as candidate for the Austrian presidency in the elections of 2013, creating the Team Stronach party. Curiously, alongside his political career, his areas of business also encompass weapons production (he is well known for the Eurofighter) and even horse racing.[7] One could suggest that the control over weapons and horses somehow transports us once again to the Napoleonic wars and to the 18th century "big wagoners". The times change and its contexts are often incomparable, but if one looks at the example of the man who tried to invest in Aspern's engine factory, the struggle for power and technology seems to freely move up and down in the time, sometimes mixing ideas, practices and materials, thus letting the strata of history reveal their own potential for recursion.

5 CONCLUSIONS

I have sketched some of the historic and prehistoric events that have marked the landscape of Aspern in a technopolitical sense. Despite having drawn a brief illustration of it, the central idea is that the view from the present backwards allows us to reconstruct the intertwining of power and technology in the past. It is my suggestion that, in contrast, the analysis of this articulation in the present time entails more difficulties. Thus, the depiction of the current project of the Vienna Urban Lakeside as a merely technological undertaking seems to provide us with an incomplete picture. Smart urban projects need to be analyzed not only in technical, but also in political and economical terms. The VUL likewise needs to be approached inasmuch as it entails the reconfiguration of specific relations of power. The history of Aspern is only one example that evidences the unavoidability of considering technological advances along with the structuration of the relations of power that prevail in a given society. A smart city project is not an exception. It has been suggested that social anthropology and other social sciences may unpack the ways in which power is currently reshaping itself in order to pervade within the cities of the future. The VUL marketing campaign, for instance, boasts the smartness of its future citizens by highlighting their efficient and technologically screened control of energy use.[8] This is highly desirable, but many questions remain. One of them could be whether it is even possible for "smart citizens" to be solely technologically proficient: that is, unconcerned with the historical, ideological and economical principles that underpin the perfect lives that others have designed for them.

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EmoCycling – Analysen von Radwegen mittels Humansensorik und Wearable Computing

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1 ABSTRACT

Radfahren erfreut sich einer zunehmenden Wertschätzung. Einerseits als neuer Lifestyle, andererseits als wichtiges Thema der städtischen Mobilitätsplanung: Bike-Sharing-Angebote, Radwegekonzepte und Förderung eines umweltfreundlichen Mobilitätsmix sind hierbei wichtige Stichworte. Daher fördern zunehmend mehr Städte den Ausbau der Radwege-Infrastruktur, um das Radfahren attraktiver zu gestalten. Wie stark Radfahren aber tatsächlich angenommen und praktiziert wird, hängt von ganz verschiedenen Faktoren ab: Verkehrslage, Quantität und Qualität der Infrastruktur, Topografie sowie das subjektive Sicherheitsempfinden z. B. an unübersichtlichen Kreuzungen beeinflussen die Verkehrsmittelwahl.

Insbesondere die Erfassung und Analyse des subjektiven Sicherheitsempfindens stellt hierbei eine große Herausforderung dar – wird aber durch neue Methoden der Humansensorik (Exner et al. 2012) möglich. Entwicklungen in den Bereichen des Wearable Computing sowie der Geoinformatik ermöglichen es, das subjektive Sicherheitsempfinden während der Fahrt genauer zu analysieren. Anknüpfend an Projekte zur emotionalen Stadtkartierung (Höffken et al. 2008, Zeile et al. 2010) erfolgt ein Live-Monitoring der Probanden während der Fahrt. Mittels eines Sensorarmbands (Smartband) zur Erfassung psychophysiologischer Reaktionen des Körpers in Kombination mit Video-Kamera-Daten und GPS-Koordinaten wird der emotionale Zustand der Probanden sekundengenau gemessen. Dadurch lassen sich Emotionen, insbesondere Stress, interpretieren und auf einer Karte verorten sowie die Auslöser (Trigger) identifizieren. Zudem kann auf diese Weise der Verkehr kontinuierlich erfasst und in die Analyse mit aufgenommen werden, um Gefahrenstellen zu lokalisieren.

Nach einer Einführung in das Thema Radfahren in der Untersuchungsgemeinde Kaiserslautern, gibt das Paper einen Überblick über den aktuellen Stand der Methodik, die Konzeptionierung der Teststrecken sowie die Methodik im konkreten Projekt EmoCycling. Darauf basierend werden die Ergebnisse des Projektes vorgestellt und daraus resultierende weiterführende Fragenstellungen aufgezeigt.

2 RENAISSANCE DES RADFAHRENS

o Vom Lifstyle “Urban Cycling”…

Fahrrad fahren ist „in“. Gerade in Städten wie Amsterdam, Kopenhagen, Münster oder Freiburg sind trendige Zweiräder immer öfter zu sehen, wie bspw. die sogenannten Single-Speeds, aber auch Fixies oder einfache Klappräder. Die motorunterstützten, beziehungsweise motorbetriebenen Pedelecs und E-Bikes gewinnen ebenfalls mehr und mehr an Beliebtheit. Es ist zu erkennen, dass Design und Individualität in der Ausstattung des Zweirads eine immer größere Rolle für den modernen Radfahrer spielen (Die Welt 2013). Dies spiegelt sich auch in der sogenannten Blogosphäre wieder: Der Internetauftritt „We are traffic“ (www.wearetraffic.de) in Hamburg ist eine fortlaufende Fotoserie, in der zahlreiche Radfahrer Hamburgs porträtiert werden. Griin (www.griin.de) ist ein Blog zur nachhaltigen Mobilität, bei dem auch das Fahrrad eine wichtige Rolle spielt und der in Kopenhagen entstandene „Cycle Chic“-Blog (www.copenhagencyclechic.com/) ist mittlerweile auf der ganzen Welt verbreitet.

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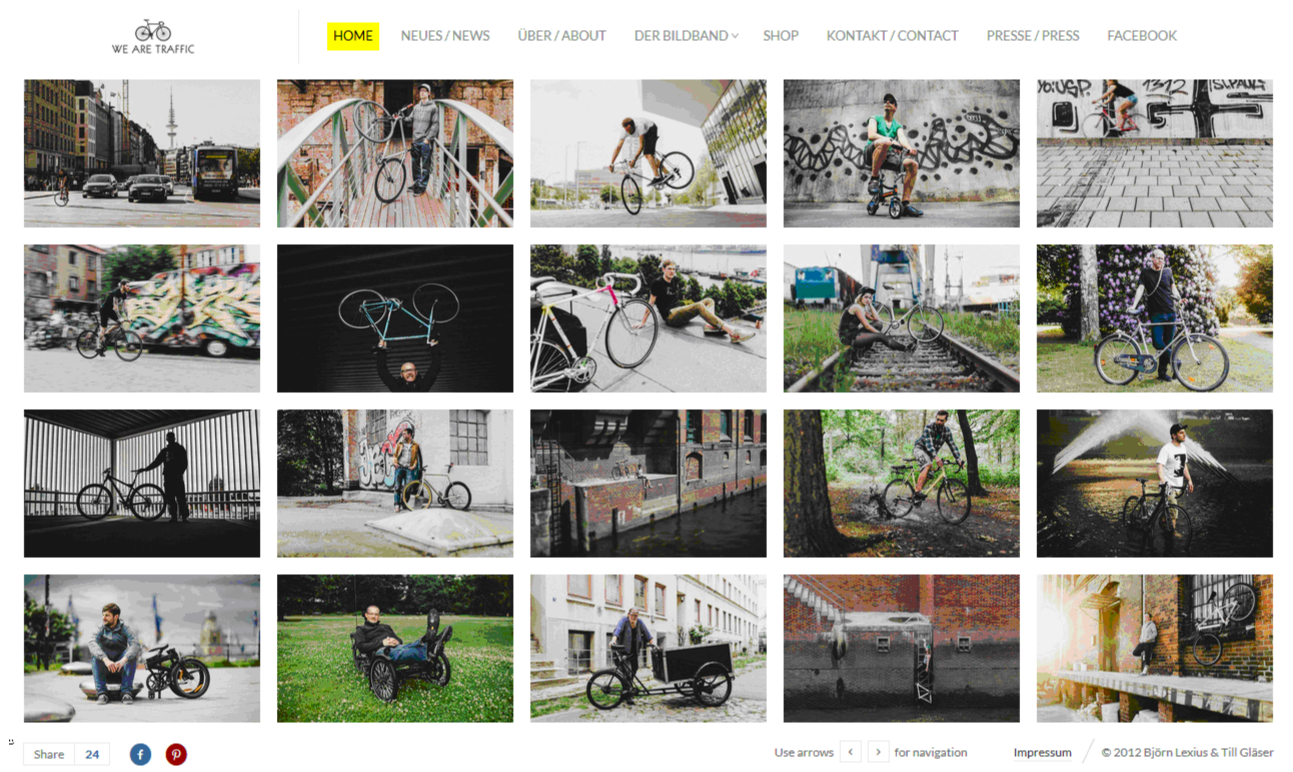

Abb. 1: Screenshot von „We are Traffic“ (Quelle: www.wearetraffic.de)

2.1 ... zur planerischen Aufgabe

Vor dem Hintergrund nachhaltiger und ökologischer Stadtentwicklung muss die Disziplin der Stadtplanung Verantwortung für die städtische Zukunft annehmen und ressourcensparende Mobilitäts-Konzepte entwickeln. Dabei gewinnt auch das Radfahren für die Stadt- und Verkehrsplanung an Bedeutung. Diese Fortbewegungsart reduziert den CO^2-, Staub-, und Lärmausstoß sowie die Belastung durch andere Schadstoffe und verbessert die Atmosphäre der Stadt. Dementsprechend arbeiten viele Städte daran, ihre Radverkehrsinfrastruktur an die Nachfrage anzupassen und neue Verkehrskonzepte zu entwickeln. „Die verkehrspolitischen Leitbilder sind im Wandel begriffen; das Radfahren ist in der Mitte der Gesellschaft angekommen. In den meisten Gemeinden gibt es mittlerweile einen politischen Konsens zur Radverkehrsförderung. Das Fahrrad wird zum zentralen Bestandteil einer Mobilitätskultur, welche die Autonutzung auf die wirklich notwendigen Fahrten beschränkt und die Funktion von Straßen und Plätzen als Lebensraum in den Mittelpunkt rückt.“ (Bracher 2013).

3 RADVERKEHR IN KAISERSLAUTERN

3.1 Historischer Abriss

Noch in den 1980er Jahren verfolgte man in Kaiserslautern das Leitbild autogerechter Planungen. Ziel war es, den Radverkehr vom Hauptstraßennetz zu trennen und weitgehend auf Nebenstraßen zu führen. Diese Maßnahmen machten den Radverkehr wenig attraktiv, da es in der Konsequenz keine direkten und schnellen Verbindungen gab. Zudem erhöhte sich das Gefährdungspotenzial auf den Hauptstraßen, da sich dort keine Radverkehrsanlagen für die Nutzer befanden (Ruhland 2013). Im Jahre 2003 beabsichtigte die Stadt Kaiserslautern die Radverkehrssituation zu verbessern. Ziel war es, flächendeckend attraktive Rahmenbedingungen für den Radverkehr zu schaffen, um Kaiserslautern als fahrradfreundliche Stadt zu etablieren. Basierend auf einer Bestandsanalyse der Radverkehrsanlagen wurde ein netzorientiertes Mobilitätskonzept im Sinne einer Angebotsplanung erarbeitet. Dabei orientierte sich das Radverkehrsnetz am Hauptstraßennetz und es wurde ein Fahrradabstellanlagenkonzept sowie exemplarischen Wegweisungen entwickelt (SV-Kaulen 2013). Zudem wurden Einbahnstraßen im Hinblick auf eine mögliche Öffnung für den Radverkehr in Gegenrichtung überprüft und teilweise auf Basis eines erarbeiteten Prüfverfahren und Wertungskatalogs für den Radverkehr geöffnet (Fraunhofer 2013).

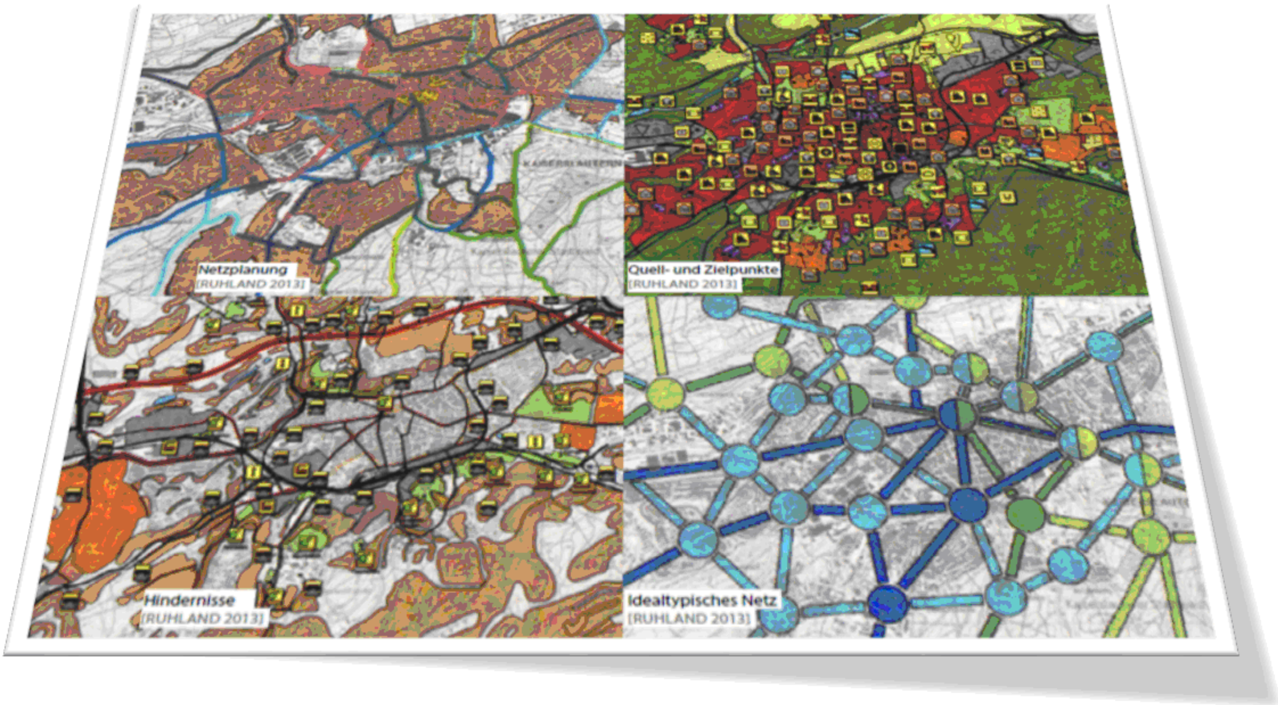

Abb: 2: Verkehrskonzepte in Kaiserslautern (Eigene Darstellung, basierend auf Ruhland 2013).

3.2 Aktuelle Situation

Insgesamt ist die Situation für den Radverkehr in Kaiserslautern immer noch als ungenügend zu beschreiben, da Kaiserslautern zu lange dem Leitbild der autogerechten Stadt folgte. Das ist am Modal Split abzulesen: Liegt der bundesweite Durchschnitt des Radverkehrsanteils bei 10 %, so sind es in Kaiserslautern nur 2,5 %. Vor allem entlang der Hauptverkehrsstraßen ist die innerstädtische Radverkehrsinfrastruktur nur mangelhaft ausgestattet. Potential bietet allerdings die kompakte Stadtstruktur, da alle wichtigen Zielpunkte im Umkreis von 3 km liegen. Jedoch stehen der Kompaktheit die Faktoren der gering vorhandenen Fahrradkultur, die Topographie und mangelnde Verkehrsinfrastruktur entgegen.

Allerdings hat die Stadtverwaltung die Bedeutung des Radverkehrs erkannt und ein Strategie- und Handlungskonzept erarbeitet, um die Radverkehrsinfrastruktur zu verbessern sowie konkrete Maßnahmen (z. B. Schaffung von Abstellmöglichkeiten in der Innenstadt) zu realisieren. Allgemein verlaufen viele Radrouten, wie zum Beispiel die direkte Verbindung zwischen Hauptbahnhof und Universität auf Nebenstraßen (meistens Tempo-30-Zonen). Solche verkehrsberuhigten Straßen sind grundsätzlich für den Radverkehr geeignet. Demnach beinhalten straßenverkehrsrechtliche Maßnahmen auf diesen Strecken die Öffnung von Einbahnstraßen und Markierungslösungen. Neben Fahrbahnmarkierungen in der Eisenbahnstraße ist die Optimierung des Opelkreises, eines großen innerstädtischen Hauptverkehrsknotenpunktes, für den Fußgänger- und Radverkehr geplant. Aber auch „weiche Maßnahmen" zur verbesserten Kommunikation und für einen Bewusstseinswandel werden durchgeführt, wie die Teilnahme an der Aktion Stadtradeln. Zudem hat der Landkreis Kaiserslautern einen Mängelbogen für den Radverkehr eingerichtet mittels dem Radfahrer auf Basis von Google Maps Mängel, Gefahrenstellen und Probleme melden können (Kreisverwaltung Kaiserslautern 2013).

4 EMOMAPPING IM KONTEXT DES RADFAHRENS – METHODIK

Wichtigste Voraussetzung für eine gute Entwicklung der Verkehrsinfrastruktur ist eine gründliche Analyse der Ausgangssituation. Hierbei spielt Live-Monitoring eine wichtige Rolle. Mit dessen Hilfe kann der Verkehr kontinuierlich untersucht und so zeitnah und situativ Gefahrenstellen lokalisiert sowie Probleme festgestellt werden. Eine neue Methode zur Analyse des menschlichen Wohlbefindens im urbanen Kontext sind

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Ansätze der emotionalen Stadtkartierung bzw. dem EmoMapping. Hierbei handelt es sich um eine Methode der Verknüpfung von Emotionen und geographischen Informationen. Der Mensch dient dabei als Messinstrument, also als eine besondere Form von Sensor. Daher wird diese Art von Methodik der Humansensorik zugeordnet (Exner et al. 2012).

Diese dem Gebiet der Emotional Geography (Nold 2009) zugeordneten Ansätze versuchen durch die Erfassung von Vitaldaten (Hautleitfähigkeit, -temperatur und Pulsschlag) und am Körper getragenen Sensoren (wearable computing) Rückschlüsse über das Empfinden der Probanden im urbanen Kontext zu ermöglichen. Der Mensch bzw. seine physiopsychologischen Reaktionen dienen als Sensoren, um den situativ-räumlichen Kontext erfassen und analysieren zu können. Die Methodik erlaubt es, Rückschlüsse auf die emotionale Lage eines Menschen zu ziehen und diese im Stadtraum zu verorten. Die physiologischen Messungen im EmoMapping erfolgen objektiv, um Erkenntnisse über subjektive Empfindungen zu gewinnen. Das Hauptaugenmerk dieser Technologie liegt momentan darin, Stress interpretieren zu können, um damit Hinweise auf Gefahren oder negative Einflüsse zu gewinnen. Damit bietet sich diese Methode hervorragend an, um im Kontext des Fahrradfahrens angewandt zu werden. Der Begriff EmoCycling ist geboren.

4.1 Vorarbeiten

Projekte, die sich mit dieser Art der Emotionsmessung beschäftigen, sind zum Beispiel die „Greenwich Emotion Map“ (www.emotionmap.net) sowie jüngeren Datums die „Emo-City-Map“ (www.emocitymap.com). Projekte am Fachbereich Computergestützte Planungs- und Entwurfsmethoden (CPE) der Technischen Universität Kaiserslautern, welche von dieser Thematik handeln sind „Mapping People“ (Zeile et al. 2009); „Emotionale Stadtkartierung“ (Höffken 2010); „Humansensorik in der räumlichen Planung“ (Exner et al. 2012), „Smart Sensoring as a Planning support Tool for Barrier free Planning“ (Zeile et al. 2011) und „Sensing the City“ (Bergner et al. 2012) sowie „Human Sensory Assessment“ (Bergner et al. 2013). In diesem Zusammenhang ist auch die Diplomarbeit „Emotionales Barriere-GIS als neues Instrument zur Identifikation und Optimierung stadträumlicher Barrieren“ (Bergner 2010) zu erwähnen.

4.2 Methodischer Ansatz

Um psychophysiologisches Monitoring zu verstehen, muss zunächst der Begriff Psychophysiologie erklärt werden. „Die Psychophysiologie untersucht Zusammenhänge zwischen bestimmten physiologischen Abläufen im Körper und emotionalen bzw. kognitiven Prozessen“ (Kirsten-Stammen 2008). Dabei können emotionale Reaktionen, also psychische Prozesse, aufgrund von bewusster oder unbewusster Wahrnehmung, durch physiologische Veränderungen wahrgenommen werden. Die Reaktion des Körpers auf ein wahrgenommenes Ereignis nennt man „autonome Physiologie des Organismus“ (Bergner 2010: 69). Diese reaktiven Körperfunktionen sind z. B. die Zu- oder Abnahme der elektrischen Leitfähigkeit der Haut (elektrodermale Aktivität, kurz EDA), sowie von Herzschlag, Muskelaktivität, Gehirnaktivität, Augenbewegung oder die Veränderung der Hauttemperatur. Der Körper reagiert auf „negativen Stress“, indem die Frequenz des Herzschlags steigt. Dies fördert zudem die Durchblutung der Extremitäten (Bergner 2010: 69). Damit einher gehen ein Absinken der Hauttemperatur sowie der Anstieg der Hautleitfähighkeit – der Proband hat den Eindruck des „kalten Angstschweißes“.

In der Medizin werden physiologische Parameter gemessen, um Rückschlüsse auf die Gesundheit eines Patienten zu erlangen. In der Vergangenheit kamen vorwiegend stationäre Messsysteme zum Einsatz, allerdings etabliert sich unter dem Begriff des „Ambulatorischen Assessments“ eine Methodik diese Parameter ambulant im Alltag zu messen und zu dokumentieren. Die Entwicklung dieser Technologie geht dazu über, immer unauffälligere und nicht-störendere Geräte zu produzieren und diese mit anderen Technologien wie z. B. GPS zu kombinieren. Diese Technik kann auch außerhalb des „Medizinambulatorischen Assessments“ Anwendung finden, z. B. in der empirischen Sozialforschung (Papastefanou 2009: 443). Psychophysiologisches Monitoring beschreibt dabei den Vorgang der Aufnahme und Auswertung sich verändernder physiologischer Daten um diese in Form von emotionalen Reaktionen zu interpretieren. „Der fortwährende, technische Fortschritt hat zur Entwicklung von Mehrkanalgeräten geführt, welche gleich mehrere physiologische Signale in unterschiedlichen Kombinationen aufzeichnen können“ (Bergner 2010: 74). Besonders gute Rückschlüsse auf emotionale Reaktionen lassen sich durch physiologische Daten ziehen, die als Stress interpretierbar sind. In diesem Zusammenhang versteht man

Stress als ein Konstrukt, dass sich aus den Basisemotionen Ärger und Angst zusammensetzt und als Indikator für negativ empfundene Einflüsse dient (Exner et al. 2012: 692). Die Information eines besonders negativen Eindrucks einer Person an einem bestimmten Ort und zu einer bestimmten Zeit ermöglicht es, stresserzeugende Quellen im Raum oder besonders stressige Alltagssituationen zu finden.

4.3 Technisches Set-up

Die Probanden wurden mit unterschiedlichen Geräten ausgestattet, deren Daten im Zuge der Auswertung und Analyse synchronisiert wurden. Dies sind:

GPS-Logger

Die räumlichen Daten werden mithilfe eines GPS-Trackers gemessen. Bei diesem Gerät handelt es sich um einen „i Blue 747“ von der Firma „Transsystems“. Dieser besitzt einen Knopf, mit welchem Timestamps bzw. Zeitstempel gesetzt werden können. Dies ist vor allem beim Start und beim Ende des Laufes sehr wichtig, da sich nur mit Hilfe dieser Timestamps in den CSV-Dateien, die das Gerät ausgibt, der Start und Endpunkt eines Durchlaufs identifizieren lassen. Das Gerät ist so eingestellt, dass es jede Sekunde einen Wegpunkt aufnimmt. Die GPS-Daten können aufgrund von Signalstörungen oft fehlerhafte und vom eigentlich zurückgelegten Weg abweichende Punkte verzeichnen. Diese Abweichungen können zwischen 5-15 Meter liegen.

Video-Kamera

Die Hero 2 Kamera von GoPro (10 x 10 x 24,5 cm, 780g) liefert eine Auflösung von 1920x1080 Pixel. Videoaufnahmen werden als mp4-Datei abgespeichert. Die GoPro Kamera verfügt über diverse Tragevorrichtungen. Sie kann zum Beispiel auf dem Kopf oder um die Brust geschnallt werden. In diesem Projekt wurde die GoPro mit einem Gurt an der Brust eines Probanden befestigt. Eine Befestigung am Lenker des Fahrrads ist auch möglich.

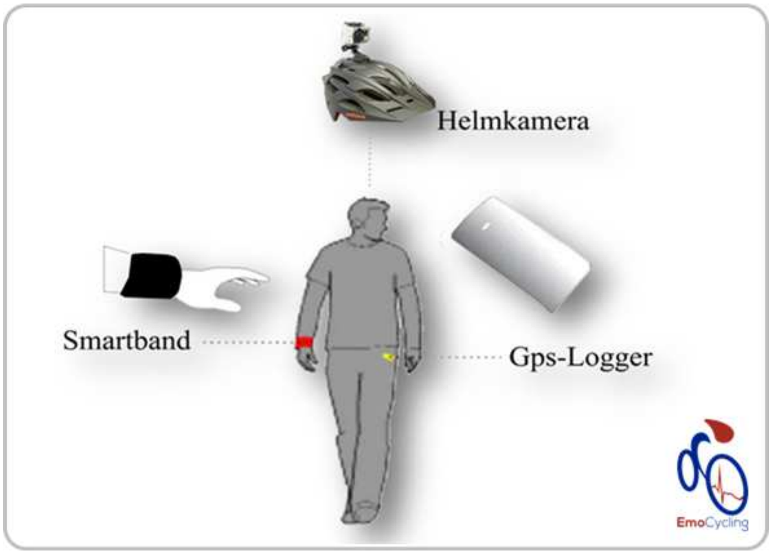


Abb.3: Technisches Set-Up – Ausstattung der Probanden (Eigene Darstellung).

Smartband

Die physiologischen Daten werden mithilfe eines Sensorarmbands, dem sog. Smartband von Bodymonitor (www.bodymonitor.de), gemessen. Seinen Ursprung hat dieses Smartband im medizinambulatorischen Assessement. Es wird normalerweise in Laborsituationen zur Messung verschiedener Vitalparametern genutzt, vor allem auch für die elektrische Leitfähigkeit des Körpers (Zeile 2010: 216). Das Smartband erlaubt mithilfe mehrerer Sensoren die Aufzeichnung der Änderungen verschiedener Körperfunktionen hinsichtlich folgender Parameter (Bergner 2010: 104):

- Hautleitfähigkeit (Elektrodermale Aktivität),
- Hauttemperatur,
- Pulsvolumen und
- Triaxiale Beschleunigung.

Das Gerät besitzt eine 1-Gigabyte große SD-Karte zur Datenaufzeichnung und einen USB-Port zum Datenaustausch mit dem PC. Das Ausgabeformat der Daten ist das ASCII-Format, welches sehr verbreitet ist und das Auswerten und Verarbeiten in vielen Softwareprogrammen ermöglicht. Außerdem kann der Frequenzbereich zur Erfassung zwischen einem und 1500 Hertz frei eingestellt werden.

4.4 Methodisches Vorgehen

Im konkreten Fall wurden die physiologischen Daten zur Hautleitfähigkeit und Hauttemperatur ermittelt, und mit Timestamp sowie Ortskoordinate kombiniert. Das Vorgehen gestaltete sich folgendermaßen:

- Synchronisation der Geräte: Das Synchronisieren erfolgt manuell (Zählen eines Countdowns), indem die Markerfunktion beim GPS-Gerät gesetzt (zweimal) und gleichzeitig das Smartband aktiviert wird. Von diesen Fixpunkten ausgehend erfolgt die Synchronisation.
- Dokumentation: Zudem erfolgt eine schriftliche Dokumentation von Probanden-Nummer, Uhrzeit des Starts und den Wetterbedingungen.
- Aufbereitung der Daten: Nach der Erfassung der Daten müssen diese aufbereitet werden. Dies beinhaltet das Zurechtschneiden der Daten, da durch die separate Aufzeichnung der 3 Messinstrumente (GPS-Tracker, Smartband, Videokamera) Abweichungen bezüglich der Messdauer entstehen. Hierbei wird die "Erste Ableitung" der Verlaufskurve gebildet (vgl. hierzu Zeile et al. 2013: 132).
- Synchronisation der Daten: Die durch die Synchronisation der Geräte erzeugten Fixpunkte haben die Daten von Smartband und GPS-Tracker einen synchronen Beginn, sodass auf dieser Basis die Daten zusammengeführt werden. Einzelne Ausreißer werden separat untersucht, indem Emotionsdaten und Geodaten mit Video- und Toninformation abgeglichen werden.
- Auswertung der Daten: Hierbei wird zwischen quantitativer und qualitativer Auswertung der Daten unterschieden. Die aggregierte Auswertung der physiologischen Daten (quantitative Analyse) erlaubt Rückschlüsse hinsichtlich der Identifizierung von „Hot-Spots“, welche durch die situationsbezogene Auswertung im Einzelfall – unter Einbezug der Videoaufnahmen – konkretisiert werden kann (qualitative Analyse).
- Visualisierung der Daten: Die erhobenen Daten können auf Basis von GIS und anderen Analysetools in unterschiedlicher Weise visualisiert werden. Wichtige Darstellungsformen sind dabei Heatmaps, aber auch Punktanalysen.

4.5 Projektaufbau

Im Projekt „EmoCycling“ wurden zwei Teststrecken von je sechs Studenten befahren. Für jeden Abschnitt wurde eine Teststrecke mit unterschiedlichem Anforderungsprofil ausgewählt.

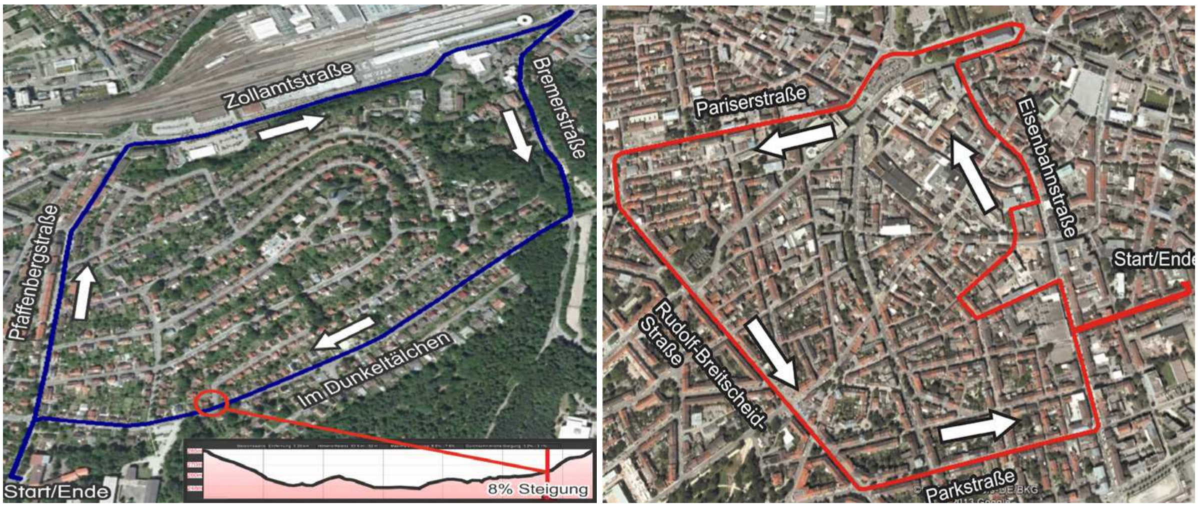


Abb. 4: Die beiden Testrecken A (links) und B (rechts) – mit dem Höhenprofil der Teststrecke A (Eigene Darstellung).

Teststrecke A testete das Verhalten bezüglich der Topographie. Hierbei fuhr jeder Proband die drei Kilometer lange Strecke einmal mit einem herkömmlichen Fahrrad und anschließend mit einem Pedelec. Ziel dieser Messungen ist es, das Stressempfinden bei hoher und niedrigerer körperlicher Belastung zu vergleichen. Die topographischen Verhältnisse sind wichtig, um den Unterschied zwischen einem normalen Fahrrad und einem Pedelec zu zeigen. Teststrecke B hingegen untersuchte das Verhalten auf Hauptstraßen, Einbahnstraßen, bei mehreren Spurwechseln sowie auf Abschnitten mit und ohne Radverkehrsinfrastruktur. Des Weiteren wurde auch ein möglicher Lerneffekt durch wiederholtes Fahren der gleichen Strecke getestet. Die sechs Probanden fuhren unter vergleichbaren Rahmenbedingungen drei Mal zu verschiedenen Tageszeiten. Die Streckenlängen von ca. 3,3 km entsprachen dabei einer realistischen Wegstreckenlänge im Innenstadtbereich. Anhand dieser Route soll die Stressbelastung für Radfahrer in alltäglichen Verkehrssituationen in Kaiserslautern untersucht und deren Ursachen gefunden werden.

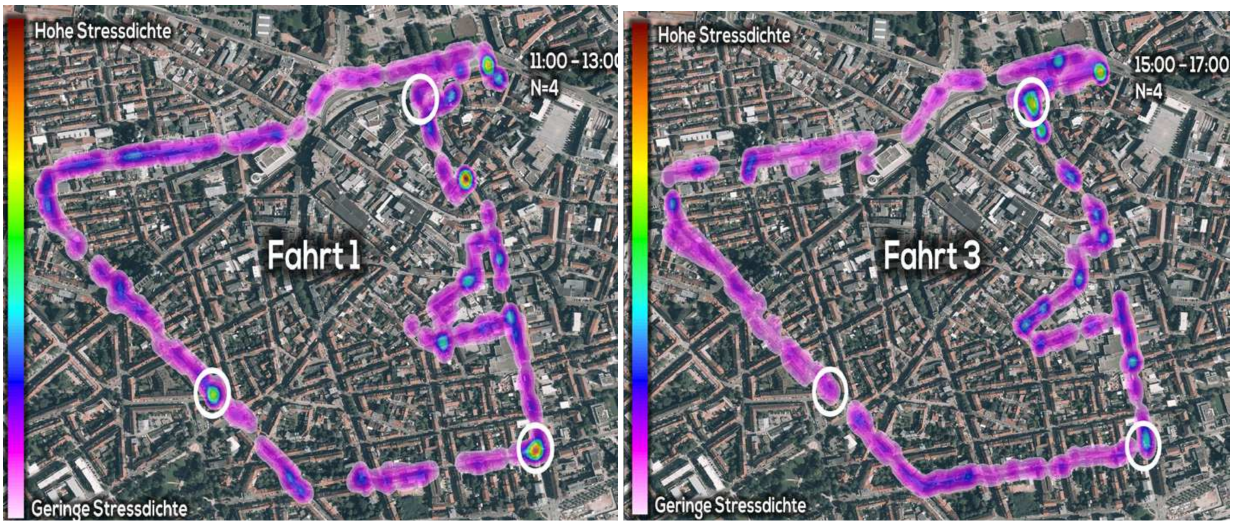
5 ERKENNTNISSE

5.1 Stressbereiche identifizieren

Die quantitative Analyse erlaubt die Identifikation von Hot-Spots, also Orten, an denen erhöhte Veränderungen in den Vitaldaten zu verzeichnen sind. Durch diese Akkumulation von Auffälligkeiten können dann die einzelnen Datensätze der Fahrten (je Fahrer) betrachtet werden. Damit wird es möglich,

- Häufigkeit und
- Ort

von Stressreaktionen zu erkennen. Die erzeugten Daten können dann in Form von Heatmaps visualisiert werden, wodurch potenzielle Gefahrenstellen aufgezeigt werden.



5.2 Mehrwert Videoaufzeichnung – Analyse externer Einflussfaktoren

Mithilfe der qualitativen Auswertung ist es möglich, die jeweiligen stressauslösenden Elemente genau zu beschreiben und Ursachen sowie Zusammenhänge einer Stressreaktion zu identifizieren und nachzuvollziehen. Dies ist in besonderer Weise durch die die ergänzende Auswertung der Videoaufzeichnung möglich, mittels der die externen Einflussfaktoren genauer ergründet werden. „Durch die Zusammenführung der Messdaten in einem Video erfolgt [sic] wird die qualitative Auswertung der zurückgelegten Wegstrecke erleichtert. Die Wechselwirkungen zwischen Stressreaktion und Situation können so schneller analysiert und nachvollzogen werden.“ (Zeile et al. 2013, 135). Die qualitative Auswertung ermöglicht damit die Analyse von

- exaktem Zeitpunkt und
- auslösenden Faktoren

des Eintritts von Stressreaktionen, womit die identifizierten Hot-Spots (siehe 5.1) verifiziert (oder widerlegt) werden können. Ohne eine Videoaufzeichnung bliebe nur die Möglichkeit die Probanden im Anschluss zu befragen. Diese Methodik ist sehr subjektiv und kann zu Ungenauigkeiten führen.

Beispiel für den Mehrwert des Videoeinsatzes ist die Untersuchung eines einsehbaren Verkehrsknotenpunktes. Der auf Basis der quantitativen Analyse identifizierte Stresspunkt (erhöhte Stressdichte) wird retrospektiv anhand des Videomaterials auf mögliche Auslöser untersucht. In einem konkreten Beispiel auf "Teststre-

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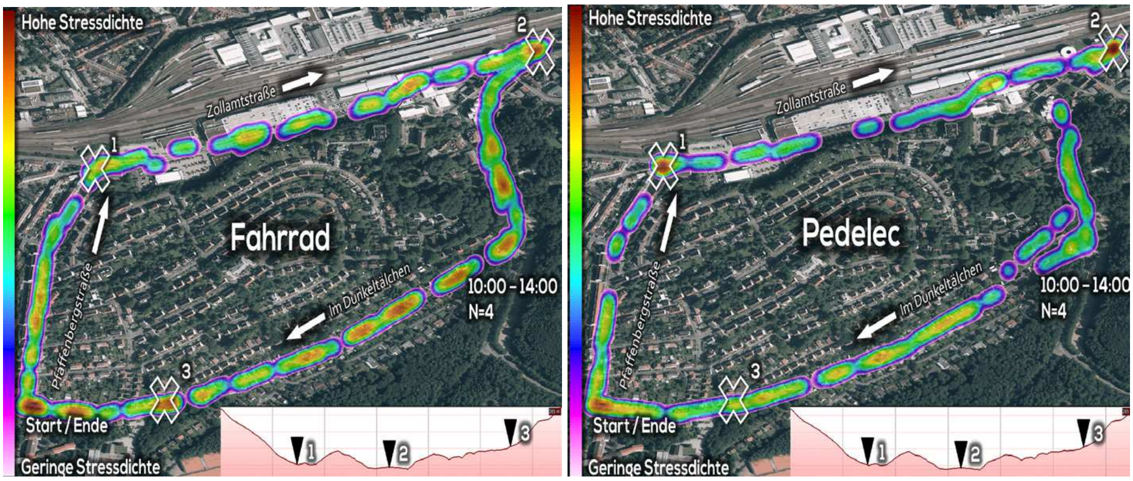
cke A" ergab sich folgendes Szenario: Der Proband nähert sich der Kreuzung und erkennt das von der Seite nahende Fahrzeug aufgrund einer unterbrochenen Sichtbeziehung erst spät. Ursache für die behinderte Sichtbeziehung ist ein zu stark gewachsenes Straßenbegleitgrün. Hier konnten die Vitaldaten durch die Einschätzung des Fahrverhaltens (Abbremsen, Ausweichen) belegt werden. Durch die Bearbeitung der Vegetation kann diese Gefahrensituation für zukünftige Verkehrsteilnehmer behoben werden.



5.3 Trigger-Erkennung

Wichtigste Erkenntnis, neben der Weiterentwicklung der quantitativen und qualitativen Auswertung, war die Einführung einer weiteren Analyseart – die Trigger-Erkennung. So weist die quantitative Analyse Schwächen hinsichtlich der zeit-räumlichen Visualisierung auf, da eine verlangsamte Geschwindigkeit zu einer höheren Stressdichte in der Darstellung führen kann. Auf diese Weise werden Ergebnisse „verfälscht", da Standzeiten oder Langsamfahrten – durch die höhere Raumdichte der einzelnen Messpunkte – zu einer grafisch höheren Dichte (und damit intensiveren Hot-Spots) führen. Es zeigte sich, dass „Hot-Spots" bspw. an Ampelanlagen und damit verbundener Standzeit – etwa bei einer Rotphase – auftreten. Dies wird dadurch verursacht, dass die Messgeräte im Sekundentakt aufzeichnen und sich Stresspunkte dadurch bei geringer Geschwindigkeit oder an Standpunkten „anhäufen".

Um dieses Problem zu umgehen, wurden in dieser Auswertung nur die ersten Stresspunkte erfasst. Hierdurch verringert sich die Anzahl der in die Dichteberechnung einfließenden Daten, wodurch eine genauere Hot-Spot-Erkennung möglich wird und vorher „nichterkannte" Punkte relevant werden.

5.4 Grenzen

Die Auswertung und Synchronisierung der Datensätze ist mit einem hohen Zeitaufwand verbunden. Als große Herausforderung wird daher gesehen, wie eine stärker automatisierte Erfassung, Synchronisation und Auswertung der Daten (mittels Kamera, Smartband, GPS-Tracker) erfolgen kann. Die Entwicklung eines Toolsets, welches die Daten automatisch synchronisiert, würde eine enorme Erleichterung darstellen. Zudem würde eine automatisierte Auswertung eine Echtzeitanalyse ermöglichen (die ohne diese wenig Aussagekraft hätte). So war auch die Wetteranfälligkeit der Messgeräte ein Hindernis. Das Smartband ist nicht wasserdicht und neigt bei Nässe dazu, fehlerhaft aufzuzeichnen oder gar auszufallen. Die potentielle Ungenauigkeit des GPS-Signales, welche bis zu 20 m betragen kann, reduziert teilweise die Genauigkeit des räumlichen Kontextes. Nachteile dieser Form der Datenerfassung sind zudem die bislang hohen Anschaffungskosten für Smartbänder und Brustkameras. Um die Methode in der städtischen Planung zu etablieren, müssten die Kosten sinken.

6 FAZIT UND AUSBLICK

Die Methodik des „EmoMapping" wurde in diesem Projekt zum ersten Mal zur Untersuchung von Radverkehrsinfrastrukturen herangezogen. Zwar bedarf es einer technischen und methodischen Weiterentwicklung, jedoch bietet EmoCycling bereits jetzt eine Möglichkeit zu einer objektiven Bewertung und Analyse des Radverkehrs, um diesen sicherer zu gestalten. Die Datensätze ermöglichten – so zeigten die Ergebnisse – eine vielseitige Bewertung und Analyse des Fahrverhaltens. Gängige Methoden der Datenerhebung werden somit um eine objektive Dimension erweitert. Die Methode des EmoMappings eignet sich für eine neuartige Analyse des Radverkehrs, da hierdurch interessante und situations-bezogene Erkenntnisse gewonnen werden können, was gerade im Bereich der Mobilität als eine dynamische, sich stetig verändernde Umgebung für den Verkehrsteilnehmer, wichtig ist. Auch konnte im Laufe des Projektes die Auswertungs-Methodik weiterentwickelt werden, insbesondere hinsichtlich der Trigger-Erkennung.

Die Möglichkeiten und Potentiale dieser Technik lassen sich aktuell nur in geringem Maße für die Alltagspraxis ausschöpfen. Daher ist eine wichtige Frage, inwieweit diese Methode für die alltägliche Praxis nutzbar gemacht werden kann. Dies muss in weiteren Studien – in Zusammenarbeit mit Kommunen und Mobilitätsforschung – untersucht werden. Beispielsweise, ob solche Erhebungen die Aufstellungen von präzisen Handlungsempfehlungen für Verkehrsplanung vereinfachen und verbessern.

Das Fortschreiten und die konkrete Anwendung in der Praxis hängen aber direkt mit der Entwicklung anderer Technologien zusammen. So wird die GPS-basierte Lokalisation immer genauer, Messgeräte und Smartphones immer kostengünstiger, kleiner und unempfindlicher (bspw. hinsichtlich Erschütterungen und Wetter). Gerade das Smartband befindet sich ncoh in experimentellem Modus, aber in absehbarer Zeit werden solche Geräte in Serie gefertigt. Damit rückt die Chance näher, dass entsprechende Geräte im Alltag genutzt werden und so eine viel umfassendere Datenauswertung möglich wäre. Dies ebnet den Weg, um EmoMapping zu einer automatisierbaren, einfachen und günstigen Methode zu machen. Wichtig ist hierbei, dass die Messgeräte kompakter und alltagstauglicher werden, sie z. B. mit Bluetooth ausgestattet und mittels Smartphone-App bedient werden.

Die Benutzer müssten hierbei selbst entscheiden, welche Vitaldaten sie weitergeben, denn Datenschutz ist einer der virulenten Aspekte dieser Methodik – gerade wenn sie als dauerhafter Assistent regelmäßig eingesetzt genutzt wird. Ähnliche Anwendungen ermöglichen es bereits jetzt Nutzern durch die Bereitstellung solcher Daten sportliche Erfolge oder den gesundheitlichen Zustand zu überprüfen, wie bspw. das System NikePlus (secure-nikeplus.nike.com/plus/).

Langfristig könnte hieraus eine Art Echtzeitmonitoring für Stresssignale oder andere emotionale Signale im Stadtverkehr entstehen, welches dann als Informationsquelle für die Verkehrsplanung, Navigationssysteme und die Gestaltung von öffentlichen Räumen dienen kann.

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European Standards for Vocational Training in Urban Regeneration

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1 ABSTRACT

SATURN is the Leonardo da Vinci funded project developed by a partnership of Edinburgh World Heritage, Warsaw School of Economics, CEIT Alanova and IURS (Institut pro udržitený rozvoj sídel o.s.). The project aims to establish a framework for vocational studies in urban regeneration. One of the key questions this project raises is: what range of skills and knowledge professionals should have to enable them to define issues accurately and find the most suitable solutions for urban regeneration? The SATURN project provides a set of manuals and recommendations for students, learners, and professionals in the field of urban regeneration. The real value of SATURN comes from its practical dimension and input from practitioners actively involved in city planning and the processes of urban regeneration.

2 BACKGROUND ON URBAN REGENERATION AND VOCATIONAL LEARNING

Currently, there is a strong deficit of specialists with broad interdisciplinary skills needed in urban management (including heritage management in Central and Eastern European countries). Most professionals responsible for this domain are geographers, planners, architects, art historians and conservators. Required are broad skills such as an interdisciplinary approach, management skills, an economic background and knowledge of how to obtain funding from diverse sources. Moreover, investors operating in urban heritage areas need to have knowledge of the historic social values of these sites. The local decision makers, administrators and regulators need to have knowledge of economic and management skills and can also benefit when they can have access to broader international experiences and examples. Anyway, in practice sometimes professional knowledge, management skills, or language skills to work internationally are lacking.

Urban regeneration as a subject for vocational learning and as an academic research discipline is likely to be one of the visionary and developing fields on the horizon over the next 20 years. Projects dedicated to the redevelopment of city centres and brown field sites are becoming a necessity. The issue becomes even more complicated in the old historic cities with a relatively high public involvement. The links between conservation, urban design, coordinative and financial skills are crucial elements of any regeneration project or strategy and are still largely absent in urban heritage management standards. It is important that these problems are addressed to achieve the fastest and most effective outcome.

One of the best ways of learning and teaching is through analysing good practice. Urban regeneration is no exception. However, effective learning is efficient if the process of discovery encourages creative thinking about a problem. European unification and technological development in communication allow the efficient exchange of information between people interested in the subject. SATURN provides a platform for the exchange of views on good practice and standards in vocational teaching. One important aim of the project is to produce a set of manuals focused on examples of good practices in urban regeneration as well as a set of recommendations. The overall object is to provide centres of education with an efficient tool, which will bridge the gap between theory and practice. The SATURN project has been funded the the European Life Long Learning Programme Leonardo between 2012-2014.

3 PARTNERSHIP APPROACH

The real value of SATURN comes from its practical dimension and input from practitioners actively involved in processes of urban regeneration. It also involves vocational trainees who are not only one of the key beneficiaries of the project but also participants, which should allow the project to bring the real educational value. Moreover, SATURN involves communities living in partner cities, to ensure an even more practical dimension to the project and to test some of the ideas through a community engagement process. The SATURN blog (http://eurosaturn.blogspot.co.uk/) informs about ongoing activities and results. One outcome of the project are three manuals, focusing on management aspects in urban regneration, social and economic aspects as well as technological aspect. In addition, the main product of the SATURN projects is the formulation of recommendations and standards for professionals and teachers/trainers in the field of urban regeneration.

4 SPOTLIGHT ON DIFFERENT ASPECTS OF URBAN REGENERATION

4.1 Heritage-led urban regeneration (Krzysztof Chuchra)

Urban regeneration is multidiciplinary, requiring a broad range of expertise. However, currently there is a deficit of specialists with broad interdisciplinary skills. Moreover, the local decision makers, administrators and regulators can lack economic and management skills and also access to broader international experiences and examples (mostly due to language barriers). These are the main principles, which the SATURN project looks to address, by building a new platform, which will provide standards for vocational training in urban regernation for students and practitioners.

Heritage can play a significant role in urban regeneration, especially in large historic cities such as Edinburgh. Projects dedicated to the redevelopment of city centres and brown field sites are becoming a necessity. The issue becomes even more complicated in historic cities with a relatively high public involvement. The links between conservation, urban design, coordinative and financial skills are crucial elements of any regeneration project or strategy, and yet are still largely absent in urban heritage management standards. These are often embodied in local planing policy frameworks, where heritage led regeneration can be helps to bond together relevant development policies through a range of small interventions and large infrastructure projects.

4.2 Conservation-led urban regeneration – the case of Edinburgh World Heritage

Edinburgh is a challenging historic city to conserve due to its high number of monuments and building of historic importance. Many of those buildings are privately owned, which makes the process more challenging, requiring well integrated approach and effort of all relevant partners operating in the historic city centre. The main reasons are:

(a) Poor aesthetic and structural condition of historic environment (physical);

(b) lack of funding for an appropriate maintenance (economic);

(c) lack of knowledge and understanding to importance of repair and maintenance (social);

(d) lack of a strategic approach to the management of historic city centres through planning policies well coordinated with strategies orientated on economic development, sustainable tourism and community engagement (structural);

(e) low priority for the sustainable management of historic city centre (political).

	2005/06	2006/07	2007/08	Change	Edinburgh 2008
A listed buildings*	656	656	656	0	877
B listed buildings**	863	864	863	-1	2699
C listed buildings*	157	156	157	+1	1178
Total for the World Heritage Site	1676	1676	1676	0	4754

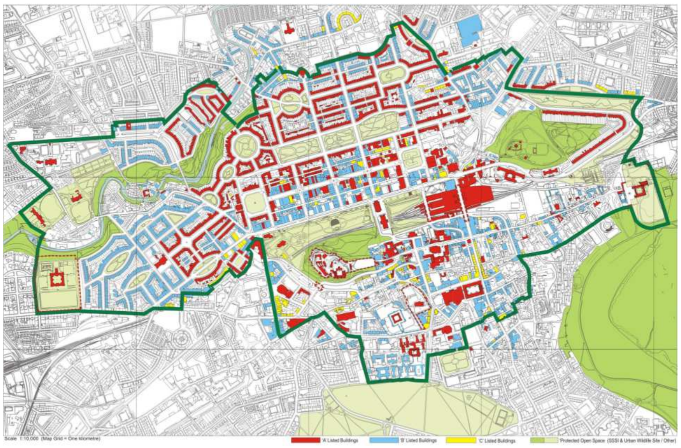
Source: Historic Scotland, as at 31 March 2008

**Source: Scottish Civic Trust, as at June 2008

The Old Town benefited from a survey in 1984 showing an urgent need to develop an agenda for conservation-led regeneration in the Old Town. One of the key indicators was a significant drop of population of the Old Town from 23,000 in 1901 to 3,000 in 1981. Soon after that, the Old Town Renewal Trust (OTRT) was set up by the City of Edinburgh Council (CEC) to deliver the agenda, which had a strong regeneration orientation.

Rationalisation of heritage management and urban regeneration in Edinburgh

Since late 1970s the Edinburgh's historic centre benefits from a significant investment in regeneration with excellent results. Both organisations were well prepared to do the work and soon became community based achieved through leadership and care to details. These became components, which reinstated civil pride and confidence in the city, triggered the successful decision to inscribe the New and Old Towns of Edinburgh to the World Heritage List in December 1995.



Map of Listed Buildings in the World Heritage Site

Soon after the inscription, in 1999, ENTCC and OTRT were merged to form one organisation focused on the entire World Heritage Site – Edinburgh World Heritage (EWH). The establishment of EWH reflected a rationalisation of heritage management in the city centre. The new organisation absorbed all functions of its predecessors with an addition of the implementation of the World Heritage Convention guidelines. The differences in the state of conservation between the both towns were reduced and a unified management would ensure a well coordinated approach. Most likely it would also mean reduced cost of management of the historic city centre for the public pocket.

The meaning of World Heritage in Edinburgh

Initially the concept was used to rationalise the way heritage was managed in the city. To an extent it had political connotations achieving positive results through set up of Edinburgh World Heritage by a merger of the key organisations operating in Edinburgh's city centre. Later on, the World Heritage Site became a 'planning issue' because often it was used by various interests groups to campaign against major developments in the city centre. From the perspective of the architectural integrity and authenticity, conservation practice and aesthetic values of the historic city centre there was a clear justification for treating the World Heritage status as a tool for monument protection.

The Old and New Towns of Edinburgh World Heritage Site Management Plan

The management plans often are perceived as conservation plans. However the practice differentiated both documents focusing the management plans on complex multi disciplinary issues against conservation plans, which often deal with relatively smaller sites or monuments. In case of Edinburgh, the management plan has a real political value as a platform where various direct and indirect interests meet. There is a range of reasons for it:

- High awareness of historic value of the built environment and World Heritage status amongst the citizens,
- Capital status of the city,
- Large, centrally located site,
- high number of various interests directly and indirectly related to the city management,
- Development pressure in the city centre,
- High concentration of historic buildings,
- Competition for public funding amongst public bodies.

In Edinburgh the Management Plan falls under planning guidance deriving from the Local Plan. It means that conservation is a part of city management and often is used as a tool in urban regeneration. Moreover, the way historic assets are managed and treated is well defined through the guidance, which in turn has to be addressed in design of new developments located in the historic environment. The principles are focused not only on preserving the historic structures but historic character of the city without compromising standards of living.

Conservation Funding Programme (CFP)

A conservation work requires a significant investment and often property owners cannot afford maintenance and appropriate repair. Repairs of historic properties require appropriate building materials, for instance a particular type of sandstone often sourced from a particular part of the country, skills and specialists, as well as tools such as scaffolding. In case of Edinburgh the scale of required work is vast due to a high concentration of listed residential buildings.

The most neglected buildings causing hazard to citizens' health and safety fall under jurisdiction of the City of Edinburgh Council, which can issue a statutory notice to an owner. It allows the local authority to take initiative if required and become a project manager on behalf of proprietors who failed to maintain their property and organise necessary works. Still costs of the project have to be covered by proprietors, including 15% administration fee issued by the Council. The proprietors have an option to apply to EWH for a repayable grant of up to 25% of eligible works, when it comes to enforced repairs. Although it is a good system essentially, it can be easily abused by a local authority because the proprietors do not have any contractual relationship with the Council's contractors and often the final costs of repairs are higher than expected before a project starts. From the EWH perspective the statutory notice powers can be an opportunity to repair a property, which will benefit from the Council-led project, for instance by saving on costs of hiring scaffolding.

Creative interpretation of the World Heritage Convention - Edinburgh World Heritage model of management

Modern urban conservation practice becomes more complex on the both levels: practical and managerial. The practical side of urban conservation is a craft requiring a great deal of knowledge and experience to follow the best practice and conservation fundamentals. Nowadays, the technology steps in with new efficient and fabric friendly solutions such as graffiti removal by laser, doff steam cleaning system for removing paint from stonework, non invasive methods of treating dry rot, endoscopy used to define problems in parts of a building difficult to reach without structural intervention, or even work safety standards have improved considerably. Nevertheless, one of the key components in urban conservation is traditional building methods. By learning those skills one builds knowledge on why historic buildings were constructed in particular way reflected in building materials available at the time, climate or even geopolitics.

On the managerial level urban conservation evolved to a multi disciplinary specialisation. It covers disciplines such as architecture, planning, urban regeneration, construction, traditional building methods, project management, interpretation and at least few others. A structure of an organisation dealing with complex and numerous conservation and related projects should reflect this complexity.

Spatial planning

The city management practice proves that planning and monument protection can function against each other in the political terms. The planning system in the United Kingdom is well developed and relatively flexibly. It means that the system is exposed to lobbying as it is development driven. Often it causes conflicts and misunderstanding between conservation lobbies and developers. The first ones often form community groups based on the local residents or even organisations. These groups campaign against development proposals of low quality of design proposals, which are against the planning policy, erosive to the architectural character of a conservation area and/or World Heritage Site.

Developers investing in a city are obliged to ensure that design proposals are presented to the public well in advance. The outlines of a planning application for building permission have to be consulted before it is formed at the pre-application stage. There are guidelines defining the minimal period of time for public consultations; however nothing prevents developers from extending it, especially if the planned development is complex and potentially controversial. Local authorities facilitate the process ensuring the process is inclusive and transparent and that developers are advised on the planning policy framework. In case of Edinburgh the process can be challenging due to:

- high concentration of historic buildings;
- high levels of architectural authenticity and integrity;

- complex system of monument protection – the city centre is covered by the conservation areas powers as well as world heritage designation;
- relatively highly educated residents who understand the process;
- civic pride;
- high awareness of world heritage designation.

4.3 Social and economic aspects of urban regeneration (Marek Bryx)

All over Europe there are magnificent examples of urban regeneration projects, yet vast majority of them present social and economics aspects of sustainability, while ecology and green solutions are sometimes left behind. Our recent results of SATURN project and global shift toward green and eco-developments and redevelopments proved that deprived areas cannot by only renovated in order to restore social life and increase economic value of the area but should be changed in a way which will provide green and environmentally responsible solutions. Thus the issues which need to address in the urban regeneration projects include not only rules of city regeneration and interdependencies existing between them; but also green technologies. Therefore, the aim of session delivered by Warsaw School of Economics team is to summarise not only the main results of SATURN project regarding urban regeneration process, but also point out new challenges and open broad discussion on eco-redevelopment and green solution in the existing building stock in the decades to come.

All over Europe there are magnificent examples of urban regeneration projects. When we look at the chart 1 we can see different reasons for making regeneration projects and programs.

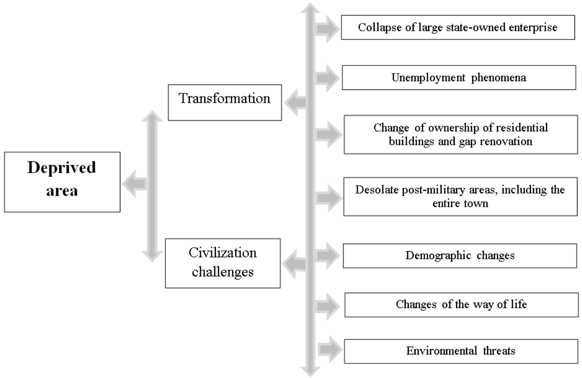
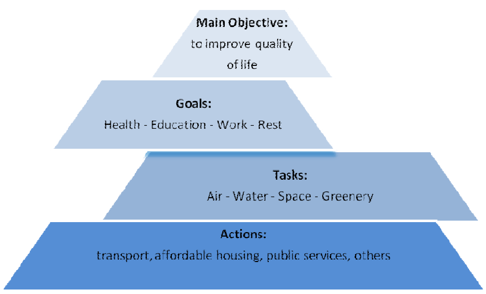


Chart1. Cause of depraved areas. Source: Bryx M: Green Urban Regeneration Projects. Manual for SGH students

When time goes by, increasingly important are the causes, not on the historical past, although they are still have their influence, but those which concern the future and challenges associated with this. The future has its name – Green or Eco city.



Pyramid of revitalization purposes. Bryx M: Green Urban Regeneration Projects. Manual for SGH students

Eco-city can be simply described as a human settlement which, as a multi structure, aspires to be a part of natural ecosystem. Aspires means to take a different action to revive, rebuild, protect or implement ecosystems inside a city. It concerns differed ecosystems but especially water, air, green spaces, spoil. When we think about areas that should be regenerated it means that one or more of these ecosystems must be

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improved in regeneration process. All these systems should provide healthy abundance to its habitants and visitors.

In my opinion the objective of a city is an improvement of quality of life in the city area. Thus the green city is responsible for at least health, education, jobs and rest of its citizens. All this is only fair and refers specifically to the degraded areas. This relationship is visible in the short, but especially in a long term. To achieve these goals other tasks should be fulfilled by taking specific action by local authorities.

Proposed above a hierarchy of urban regeneration project had not referred to the general criteria of designation of crisis area which were included in the regional separate operational programs, according to Polish law represented by the document called "Guidelines for the development of local revitalization programs". Due to the above, urban areas, had to meet not less than 4 of the criteria chosen by the Regional Managing Institution, on the regional level, among 10, contained in Art. 47 section 1 of the Regulation 1828/2006, namely:

(1) High levels of poverty and exclusion;

(2) High long-term unemployment;

(3) Unfavorable demographic trends;

(4) Low levels of education, significant skills deficiencies and high dropout schooling;

(5) High levels of crimes and violations;

(6) High level of environmental degradation;

(7) Low level of economic activity;

(8) High number of immigrants, ethnic and minority groups, or refugees;

(9) Comparatively low level of housing value;

(10) Low levels of energy efficiency of buildings.

And areas of blocks of flats had to meet at least three criteria from four number 1, 5,7, and 9 of the above. By irony, the only criterion strictly connected with the idea of green city is criterion number 10. But it was not especially important for Polish cities because problem of energy consumption, energy efficiency of majority of old blocks of flat had been solved by special long term action and dedicated public money, earlier.

Generally, all documents defined effects that should be achieved in deprived area are concentrated on 3 aspects as it is shown at chart3:

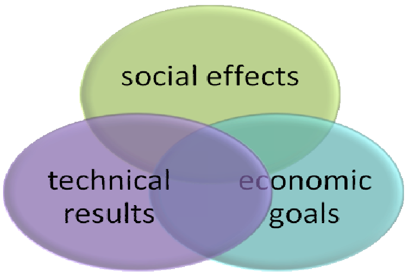

Chart 3. Results of revitalization projects expected in deprived areas

Led by my department at SGH researches and postgraduate studies of urban regeneration, to whose I included the so-called technical visits. These visits consisted of studying best practices of regeneration projects, in the places where project had been implemented. Discussing with authors of these projects our postmaster students confirmed the fact that municipalities were aware of the needs of implementation the green ideas into these projects. And partly it was done. But there was a constant problem of financing these aspects of revitalization projects. SATURN, in which many professionals were involved in, confirmed that local authorities are really endeavoring towards green changes inside the city. Thus they are as flexible as it possible to use sources in the most effective way. And also researches made by my department confirmed it too. We can say: not aware of problems helps to find financial sources but awareness induces to bend criteria to the real city needs.

It leads us to the question: Will future criteria of regional development programs include the aspects of green cities?

We should remember that Polish cities have no their own money in their budgets to regenerate deprived areas or implement new, green ideas. There are not special programs prepared specifically for these tasks. However, there will be regionals programs based on EU funds, and the question is if in the new programming perspective 2020 will there be criteria empowered the idea of green cities? The discussion at the governmental level is being continued now. And I hope that it will bring expected solutions and opportunities.

4.4 GIS technologies in urban regeneration (Julia Neuschmid)

4.4.1 GIS as a decision support tool

Geographic Information Systems (GIS) is one of the most common ICT tools employed in urban management and is prevalent among both the public and private organisations which have a role in making our cities more sustainable. The main role of GIS is as a decision support tool for both technical experts and decision-makers alike. GIS allows users to conduct complex geospatial analyses combining data from various sources such as socio-economic statistics, satellite imagery and monitoring data. In this sense, GIS decision support tools function as social-technical instruments (a cross between computer and management sciences) which help users understand complex systems. GIS-based decision support applications are available for fields ranging from transportation, resource management, crime analysis, energy infrastructure, land use planning and disaster management to real estate, business development and marketing. GIS also plays an important role in informing and involving citizens in the planning process and promoting more sustainable lifestyles (Schrenk et al. 2010).

4.4.2 How GIS can be used in urban regeneration

Urban regeneration has to be considered as a dynamic process, structured through different and progressive phases rather than a single event (Gullino 2009; Kingston et al. 2005). These are analysis of the current situation, development of plans and strategies, stakeholder involvement, implementation, and monitoring. The following table shows when and how GIS might contribute to the goals of the regeneration process. The major GIS-based tools and trends in urban regeneration are described below.

Phases of Urban Regeneration	ICT / GIS Tool
Issue identification, baseline studies, identify area to be regenerated	Enquiry/reporting tool, public involvement in form of consultation, Web 2.0, crowdsourcing, mobile applications, location-based services, spatial analysis tools, visualisation tools, tracking and monitoring tools
Inventory conditions, analyse current situation	Spatial analysis tools, public involvement in form of information and transaction, visualisation tools
Analyse trends	Predictive modelling, public involvement in form of information and transaction, visualisation tools
Engage stakeholders	Community process tool, all types of public consultation, asset mapping, collaboration tool, reporting and tracking services, Web 2.0, crowdsourcing, mobile applications, location-based services, visualisation tools
Develop phase, design and (re-)develop strategies and plans	Predictive modelling, asset mapping, scenarios, simulation, visualisation tools, collaboration tools, stakeholder involvement
Explore design and development options and prioritise	Visualisation tools, consultation, deliberative involvement
Evaluate, select options, decision-making	Visualisation tools
Implement plans	Documentation of implementation, collaboration tools, community process tools, collect new data, GPS, geotagging
Analyse and evaluate, assess impacts, monitoring, control and report	Performance based planning, information and transaction, monitoring and tracking tool, spatial analysis tools, visualisation tools

Table 1: The role of ICT and GIS tools in different phases of urban regeneration (extended table based on Kingston et al. 2005)

Web Portals - Data for urban management: As the amount of spatial data available and usage of GIS has grown, many efforts have been done to share data both internally and with others. The philosophy behind this approach is that “behind a good city management there is a good information system” (Gullino 2009, 2017). Available since the mid 1990s, web portals are one of the most common applications on the Internet. Web portals present information from various sources in a unified way. City administrations rely on web portals to exchange information among organisations and also with the general public. For example with the CentropeMAP portal (www.centropemap.org) the user receives maps showing regional data from different

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sources together in the same view. Such infrastructures are actively supported in Europe through the INSPIRE Directive (Schrenk et al. 2010 and 2012, Gullino 2009).

The earlier part of this decade saw the rise of Web 2.0 services which rely on user-generated content from so-called “prosumers” – users and producers of information. The services range from video sharing sites to blogs and social networks such as Twitter, Facebook, Google+, etc. The age of Web 2.0 also has led to increasing use of collaboration tools in combination with web portals. Planners too have adopted collaboration tools and use them to interact with peers and citizens and assist in guiding planning processes.

GIS in spatial analysis: GIS is commonly used to conduct baseline studies, to identify issues such as an area to be regenerated, inventory conditions, and an analysis of the current situation. For example analysing the existing, including official and unofficial developments such as informal settlements; analysing social diversity and inclusion, e.g. the income and the national/ethnic background of residents or analysing the (real-time) movement such as commuting patterns of residents.

Gis and visualisation: Visualising large amounts of information interactively is one of the most attractive and useful capabilities of GIS. GIS is a powerful tool to present spatial information in impressive ways, e.g. users can take advantage of computationally intensive functions such as "draping" a perspective view over a surface (like a digital elevation model) or creating the impression of three dimensions. All processes in urban regeneration can profit from impressive visualisation. For example the area to be regenerated and its current conditions can be visualised on thematic maps. These maps can be presented to decision makers and/or to the public. In the phase when strategies and plans are developed different scenarios can be visualised to present to decision makers and also the public in the phase of stakeholder engagement. Visualisations are helpful to select between different strategies and options. Also visualized information can give a clearer picture of the current situation as it can be interpreted more easily than e.g. data and information in a tabular form. An example is 3D visualisation. Seeing and interacting with geospatial data in 3D drives insights that just aren't possible in 2D. With GIS you can visualise raster, and vector data for 3D feature, terrain, subsurface, and volumetric views. You can make virtual tours and walk around districts.

GIS and simulation: GIS can be used in the develop phase of a regeneration project for the design and (re-)development of strategies and plans. On the one hand this is useful for planners and decision makers on the other hand also for other stakeholders such as the public to be informed and involved in the regeneration project. With GIS different design and/or development options can be explored, options prioritised and decisions made more easily. As a part of development projects, people can experience the future form of the city with the help of an augmented reality application to simulate future developments. For example the Aspern Urban Lakeside project in Vienna that is one of the largest urban development projects in Europe. The application simulates the Aspern urban lakeside project and creates augmented reality solutions that can be implemented in planning and participation processes.

Figure 1: Augmented reality App simulating the construction of new houses (Source: URL 1, Aspern Seestadt; Reinwald et al. 2013)

Handheld applications (mmart phone navigation, route planning, mobile GIS) – Just as the web is rapidly evolving, so too is the manner in which we access it. Smart phones are fast evolving into a platform for more sophisticated mobile GIS applications and decision support systems for planning practitioners. The recent explosion will not go unnoticed by planners and city managers. A great number of new mobile applications for cities are under development that focus on context and location-based information. An example is the LIMES App (www.limes-mobile.eu) which allows visitors to discover the ancient Roman Frontier with their mobile devices. It is a context-aware system and shows points of interests (POI) nearby on a map with information about the specific Roman site. Additionally there is Augmented Reality component making visible the cultural heritage sites by showing destroyed buildings or situations of the Roman lifestyle (e.g. soldiers marching in the scenery). Augmented Reality technology allow to view real-world environment together with elements on the mobile application that are supplemented by computer-generated information such as sound, video, graphics or GPS data.

GIS and participation: GIS can be used in all types of public consultation, i.e. information, (real) consultation, active participation, etc. (Kingston et al. 2005). E.g. online maps used for public consultation, citizens point out problems on maps, citizens develop suggestions for improvement of areas, and crowdsourcing. Citizens provide data and information about the current situation and their requirements. This is the most common way of participation where GIS-based tools are used. The technology behind is geotagging - GPS-enabled smart phones have led to a surge in location-based services, i.e. services that present information in its spatial context. Planners are also adopting tools such as Geotagging, using the GPS capabilities of smart phones to link geographic information to photos, to assist them in their work. An example is to map emotions. GIS applications are used to capture the emotional perception of space and then to visualise the feelings at its place of origin to use this information for urban planning.

Figure 2: EMOMAP App Austria (Source: URL 2, Emotion Map)

GIS and monitoring: In the implementation phase of urban regeneration projects GIS can be used to monitor the implementation and the regeneration process of an area. With the help of defined monitoring indicators GIS supports analysis and evaluation, impact assessment, monitoring, control and reporting. A monitoring system helps planning-authorities to compare certain conditions over time, to detect changes, to evaluate, and to plan. It represents a snapshot of the country (e. g. in the form of an atlas) and functions as an early warning system. In other words it supports policy makers to make decisions and put effective measures. Orthophotos and/or GIS data can be used to monitor the development of a regeneration area over time.

5 CONCLUSION AND FUTURE POTENTIAL

One of the key challenges for a living historic city is accommodation of sustainable development to ensure appropriate standards of living without compromising its architectural distinctiveness. The issue becomes particularly complex when historic assets are based within the urban core, which requires an extensive regeneration. Conservation of heritage assets can play a leading role in those processes by strengthening the architectural character and redefining the functions of the urban space. Conservation-led regeneration can build on people’s memories of a place and enable the delivery of their visions and lay the foundations for the following generations. Contemporary practice in urban regeneration benefits from the modern technologies such as GIS, which became a standard in spatial planning. Those technologies allow city managers achieving sustainable goals as they aim for efficiency, which in longer term should lead to the green, sustainable city status. Moreover, the technologies assisting the urabn regenration processes are not static as they are subject to constant development.

As the number of various ICT tools available increased over the past decades, so too did the nature of their application to urban regeneration. There are phases in the urban regeneration process where ICT and GIS are used commonly, e.g. identification of areas to be regenerated, analysis of the current situation and visualisation of the results, monitoring and change tracking, analysis of trends and scenarios, and visualisation of design options. Today, specific ICT tools that form the foundation for modern Urban Information Systems range from sophisticated 2D and 3D GIS modeling and simulation solutions, Web Portals, Collaboration Suites, and Decision Support Systems to Web 2.0 era social networking applications, location-based services and applications for smart phones and other handheld devices. The next generation of tools will likely be based on mobile and cloud computing technologies and closely connected to the arising "Internet of Things" and Semantic Web.

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Exploring Population Distribution and Motion Dynamics through Mobile Phone Device Data in Selected Cities – Lessons Learned from the UrbanAPI Project

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1 ABSTRACT

The paper discusses experiences of development and implementation of public motion explorer (PME) tool as part of the EU FP7 project urbanAPI. This tool has been applied to three EU cities with the objective to investigate population distribution dynamics and anonymous population movement patterns within urban environments as an instrument to map shapes of urban attractiveness and accessibility and as a support for transportation and infrastructure planning. The paper describes technical details of the Motion Explorer application by demonstrating the different applications for the City of Vienna, Bologna and Vitoria-Gasteiz and it discusses the results of the first round of the user evaluation using the Criteria Indicators and Metrics methodology. The initial results indicate that the application is intuitive and highly useful for city planning and provides the evidence-based information, which is either expensive or difficult to collect using other approaches.

2 INTRODUCTION

Population distribution is since long detected through census activities. These data are important but provide today insufficient time specific information as population distribution is changing steadily during the day because of the various activities making it necessary to access various places. Those population movements – e.g. for education- , working-, recreation-, visiting- and shopping activities - lead to steadily changing population distribution patterns during the day. To observe these motion patterns, mobile phone location data turn out as a new and appreciated data source which promises a wide range of possibilities exploring these data. (Loibl & Peters-Anders, 2012)

Not only communication device location is a valuable information source but also the examined relations, interrelations and impacts. All information is helpful for urban planning, urban design and infrastructure layout. Visualizing those dynamics provides information which allows supporting urban planning, transportation infrastructure improvement etc.. This article provides an overview of approaches for data analysis to explore motion patterns. The pattern detection refers to geographic coordinates and time stamps extracted from mobile communication device location data.

3 PRINCIPLES OF MOBILE DEVICE DATA FOR POPULATION DISTIRBUTOIN AND MOTION ANALYSYS

3.1 Data representativeness

As Michalopoulou et al. (2010) have proven the spatial relationship between mobile device activities and population distribution, the mobile device volume can be taken as proxy data, in order to spatially describe population distribution-, activity - or motion - patterns. The mobile phone market penetration (the share of mobile devices related to adult and teenage population) can be observed in the EC member states between 80 and 130%. (www.mobilethinking.com gives an overview of the subscriber numbers: 2012 6,8 billion subscriptions have been contracted which is a market penetration of 96%. In Austria (which data are used here) 8 million citizens hold around 12 million mobile device subscriptions, resulting in a subscriber/population ratio of 150%. A1, Austria's largest mobile communication service provider, supplied in 2012 around 5,3 million subscribers, resulting in a market share of around 45%. (http://en.wikipedia.org/wiki/List_of_mobile_network_operators_of_Europe#Austria, observed -3/2014)

These numbers proof a satisfactory representativeness of the data as proxy to describe the entire population distribution, letting assume that the mobile device distribution pattern of large companies matches quite well with the population distribution pattern. Nevertheless a certain social bias within the data might still be

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possible: In the early days of the mobile communication market, people/population groups were attracted by certain companies depending on their tariffs, their image, and special services they provided. Austria's largest telecom company was e.g. known as "business customer provider". But during the last years these biases have been declining because of the various changes of tariffs, services and image of all providers. Today usually all companies provide various tariffs, matching all user needs and budgets. Thus the users observe all competitors and change their subscriptions more or less frequently (which is even easier, since phone numbers can be kept when changing the provider), or use phones from several providers (thus the national mobile subscription volume today often exceeds the national population numbers).

Nevertheless there might be still a (small) social bias within the data of certain providers, which has to be explored and calculated (Loibl & Peters-Anders, 2012).

3.2 Data location information

Mobile communication networks are organized in cells where each cell is equipped with an antenna, mounted on a cell tower, and with a transmitter station, supplying the mobile phone subscribers in the particular cell. (The terms mobile, mobile phone, cell phone and mobile device denominate telecommunication equipment with diverse functionality – mobile device will be used as general term.) The transmitter stations link the mobile devices to the mobile communication provider's network. As the telecom infrastructure must be prepared to handle incoming activities of each customer (talking, texting, e-mailing, web-browsing), the infrastructure has to observe continuously the connection between each mobile device and a respective network cell.

Each provider uses similar solutions for locating a mobile device: location information comes (today mostly) from the cell tower to which the mobile devices are connected to. The positions of the cell towers are taken as location proxies for the subscribers carrying mobile devices, a location accuracy which is -to some extent- sufficient. (Some telecom companies provide a position triangulation considering the neighbouring cell towers, which seems to be more accurate.) Movement of customers causes motion of their mobile devices. The mobile devices frequently send/receive signals to stay connected to the cell towers. If the signal quality declines (due to movement of a device), the mobile phone will be redirected to a neighbouring cell which provides the best signal quality.

The volume of mobile devices connected to a cell tower is restricted to a certain number, because of data volume limitations. Thus, in areas where a larger user number of devices is expected, cell towers are built more densely resulting in smaller cell extents. The cell sizes can vary from a diameter of a few 100 meters in city centres to several kilometers in rural areas, as shown in various cell tower maps (e.g. www.senderkataster.at, www.funksender.ch, www.cellreception.com,) As in urban areas the cells are smaller, the location accuracy is sufficient for detailed spatial activity pattern analysis using these mobile phone location data.

4 MOTION EXPLORATION TOOL DESIGN

4.1 Objectives

The motion exploration tool makes use of these data and it has been finally applied to the following three cities serving as case study areas and mobile device data have been acquired:

- for the Vienna Region where the log file data of all A1 mobile communication service subscribers have been collected during two weeks, containing geographic coordinates and time stamps .
- for Bologna where data for hourly time ranges aggregated for 100x100 m raster cells have been provided by TIM, a major Italian mobile communication service company, for a week and
- for Vitoria-Gasteiz where the geographic coordinates and the time stamps of mobile phone call initiation, have been provided by Telephonica, a major Spanish telecom company, for some days.

Thus for two cities – Vienna and Vitoria-Gasteiz - raw data have been explored, extracted and aggregated to raster cells to match the public motion exploration data interface to be used for tool application, for Bologna only pre-processed data were available.

4.2 Mobile Device Data pre-processing and analysis

Although every day a large amount of mobile device data is produced in nearly all countries and could be used for mobility and population distribution investigations, relatively few studies are carried out making use of these data. The most important reasons for this might be: (i) there is still a mistrust applying these data violating privacy - from the public side, the scientists and the science funding agencies, (ii) only a few mobile communication companies are willing to deliver these data, (iii) extraction of the appropriate content from the log files requires quite some efforts in terms of programming expertise and data storage capacity.

As described above, the Austrian provider A1 delivers raw data which allows a flexible exploration of population distribution pattern changes over time, aggregation of subscriber distribution to individual spatial entities and interaction and motion pattern analysis by aggregating single trips during the day. The applications presented below refer to current work which has been conducted for the Vienna region making use of sample data for a reference week.

The public (population, stakeholders, planners) may benefit from the applications in several ways (Loibl & Peters-Anders, 2012), e.g.:

- improving traffic infrastructure by discovering spatio-temporal commuting patterns,
- upgrading accessibility or attractiveness after detecting and investigating locations occupied by fewer people than other comparable areas
- better adaptation of public transportation time tables on demand by exploring the temporal variation of intensive infrastructure/open space utilization

To deal with such issues logged mobile device data (with its time stamps and geographic coordinates) turn out as a valuable source to explore public motion- and infrastructure adoption patterns. Distinct time and location information of the mobile device activities as well as the customer movements allow for a mapping of the spatio-temporal distribution of the cell phone subscribers and applying them as proxy for time-specific population distribution.

4.3 Mapping mobile phone user distribution and distribution dynamics

The easiest way to map mobile phone user distribution is to aggregate all customers observed at one location within a certain time range. These locations are either the cell towers or triangulated positions based on cell tower locations and signal quality. Therefore the data must be sorted by time stamp, coordinate pairs and so-called IMSI-codes (International Mobile Subscriber Identity) and all double counts of IMSI-codes for the observed time range must be erased. Finally the complex IMSI-codes have to be replaced by a serial number. Figure 1 depicts such mobile phone user totals aggregated to the monitored locations in the Vienna City centre during an early morning hour. Larger circles indicate more phone users linked to the particular cell tower. Small circles inside large ones indicate local sub-cells (e.g. within buildings).

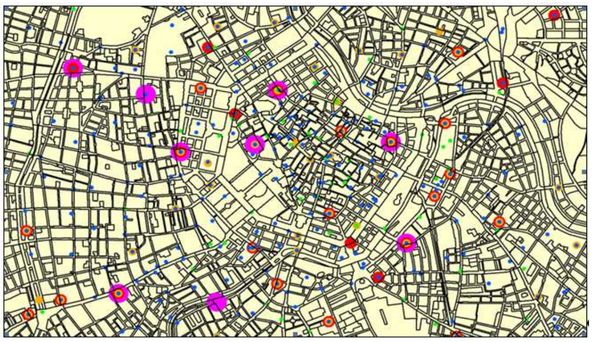

Figure 1: Mobile phone user totals, linked to the nearest A1 network antenna in the Vienna centre – single morning pattern 2009
Source: Data A1, processing: AIOT - Austrian Institute of Technology GmbH.

The numbers of mobile device users by cell do not deliver a density pattern. Generating density patterns requires aggregating user numbers within certain areas (e.g. districts, network cells, grid cells). The smaller the network cells and the smaller the analysis entities (census districts, traffic cells) the higher is the spatial resolution for visualizing the distribution pattern.

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Such a spatial aggregation of mobile phone location data by time-slices has been conducted applying Vienna data for different time steps to depict the diurnal population distribution dynamics. Figure 2 presents so called “heat maps” showing the population distribution of mobile device subscribers (here the distribution at 10:45h and 13:00h, November 19th, 2011).

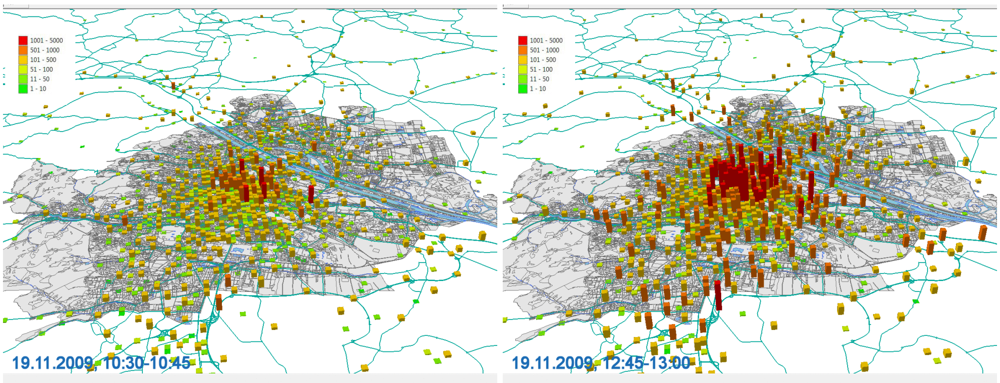

Fig. 2: mobile device subscriber distribution in Vienna related to 500m raster cells. Source: Data A1, processing and development: AIT - Austrian Institute of Technology GmbH (Loibl & Peters-Anders, 2012)

The data allow examining not only distribution of population within space but also the comparison of the variation of space occupation over time (Figure 3).

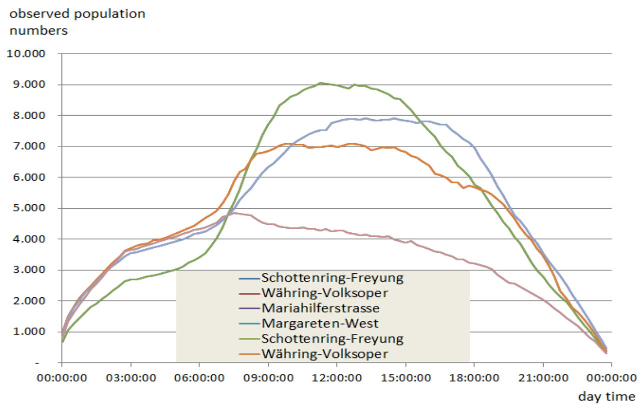

Figure 3: Visitor occupation characteristics during the day in selected places (1x1 km2 cells) within Vienna based on mobile phone log data. Source: Data A1, processing and development: AIT - Austrian Institute of Technology GmbH

	Destinations										
Origins	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8	D-9	D-10	totals O-D
O-1	x	10	4		14		10		12		50
O-2	4	x	33		44		4	15	39		139
O-3			x								
O-4				x							
O-5					x						
O-6						x					
O-7							x				
O-8								x			
O-9									x		
O-10										x	
Totals											x

Figure 4: Structure of a static O-D matrix

4.4 Motion exploration

Heat maps as shown above (Figure 2) present only cell occupation density pattern for time steps. Exploring motion requires data on interaction – on movement from one cell to another. The matrix below (Figure 4) shows the organisation of such interaction data – as an origin-destination (O-D) matrix – each matrix-cell contains the number of travelers moving from one origin to a destination cell.

But this matrix still provides static information: the general motion pattern of persons within a defined time range. To extract data on motion dynamics trip chains of person groups for origin cells during a day are collected by aggregating origin-destination interaction totals for regular time steps – e.g. 15 minute intervals, hours or a set of hours, depending on the required temporal resolution.

The required structure for examining motion dynamics is: for each origin cell rows per time step are provided, where the destination cells contain the traveler totals, targeting destinations. The tabular structure has to be repeated for each origin cell. Thus movements of the inhabitants of each origin cell can be visualized through animated maps. As a map can only show the movements starting from a single cell this origin cell has to be selected first. The map pairs below depict – as an example - the destination cells of moving inhabitant groups from two origin cells to show the local differences in movement behaviour (Figure 5).

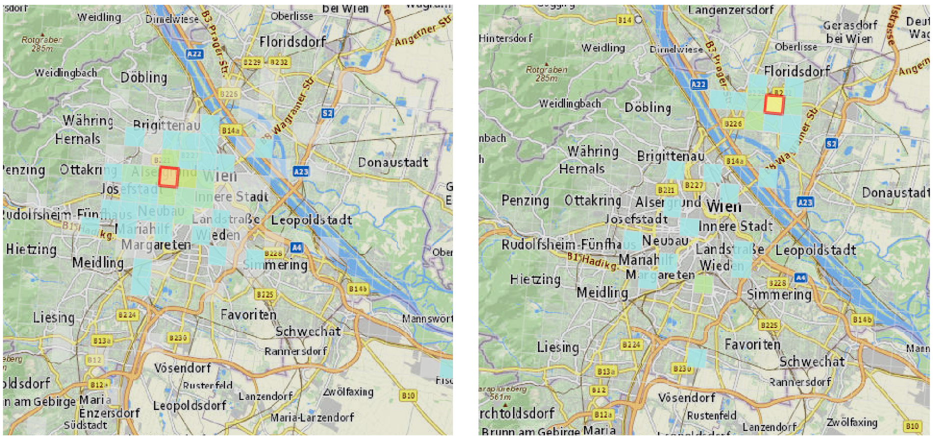

Figure 5: Comparison of target traffic from 2 different source cells (left versus right) – entries over time. Source: Data A1, processing and development: AIT - Austrian Institute of Technology GmbH

4.5 Tool development

A Web based tool has been developed providing 3 applications:

- Application 1 Mapping of diurnal population distribution patterns,
- Application 2 Mapping of motion dynamics for interactively selected cells (targets or origins), and
- Application 3 Depiction of the diurnal visitor occupation of an interactively selected cell.

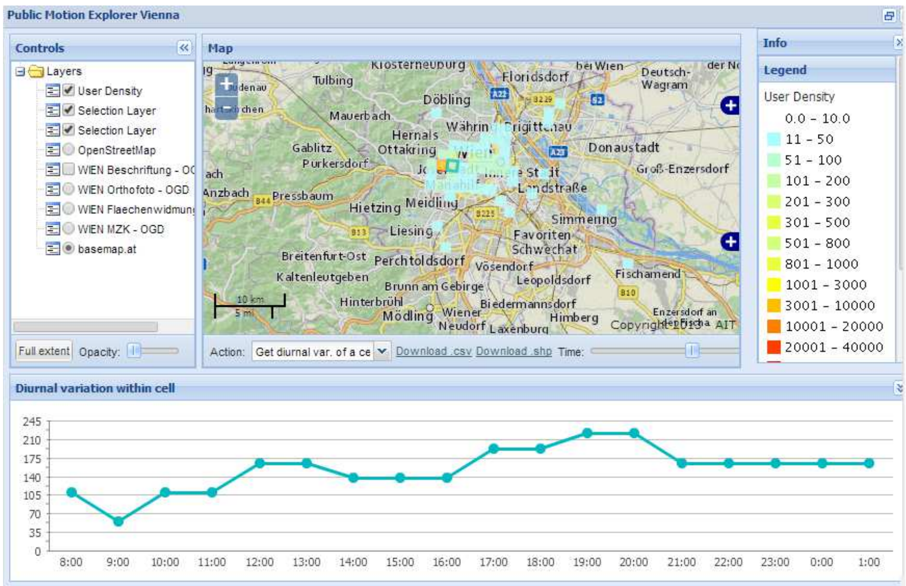

Figure 6: Mapping of motion dynamics for interactively selected cells (targets or origins), and presentation of the diurnal visitor occupation of an interactively selected cell. (Application 2 and 3). Source: Data A1, processing and development: AIT - Austrian Institute of Technology GmbH

5 PRELIMINARY EVALUATION RESULTS

Using CIM methodology (Khan Z, et al 2013a; Khan Z, et al 2013b) an evaluation design process was carried out that resulted in detailed evaluation criteria, sub-criteria (derived from ISO 25010 characteristics) and their respective assessment indicators and weighted questions. The objective of the interim evaluation was to assess the usability, functionality, benefits and relevance of urbanAPI applications against user

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requirements and pre-defined criteria. The overall evaluation participation rate was very promising as 16 expert users from three case study cities and stakeholder board, with different roles and expertise i.e. urban planners, policy makers, GIS experts, IT experts and others, participated for the interim evaluation of PME applications. Due to space limitations we briefly present usability and benefits results.

The PME application is accessible via a web-based graphical user interface that shows visual maps and provides various interactive features. Most of the evaluation results indicate that the PME application is an effective source of information to identify population distribution and mobility patterns across the city that can potentially be used for urban and transport planning and policy making. PME application allows end users to interact with the city map and to explore population distribution and mobility patterns. It also allows showing dynamically changing space occupation for various zones of the selected city.

One of the major limitations identified is the lack of appropriate quality and granularity of GSM data (with necessary details) acquired from different mobile service providers. This data does not provide sufficient details to fulfil all necessary requirements of end users e.g. examining social biases, transportation mode, position accuracy, live/active and dead mobile device connections etc. Nevertheless, the cross-comparison of features supported by available data from different mobile communication providers indicate strengths of the application as well as identify additional data elements needed to support similar features for other cities. This indicates that application itself has the potential to contribute significantly in gaining insights of space usage and mobility analysis. However, the overall population distribution and mobility patterns represent an approximation but still are useful to gain this kind of information which otherwise is not available or too expensive to acquire at city scale. Further, it provides sufficient information to initiate new planning projects, decision making and policy making. Most of the evaluators found application intuitive and easy to understand and use but also indicated that resolution of maps can be enhanced and intuitiveness can be further improved e.g. by providing context sensitive help. In addition, it is recommended that suitable means should be adopted to build capacity of end users via sufficient training/guidance depending on the skill sets and IT background of end users.

6 CONCLUSION AND OUTLOOK

The presented examples give some insights into the exploration possibilities to be carried out by using mobile phone data sets. The evaluation results indicate benefits and potential of the application but also identify need for quality and granularity of data elements needed to support a variety of planning needs and user requirements. For the future faster visualisation and better elaborated tools can be expected which allow the delivery of web-based dynamic maps on demand, to explore single time slices and in a more far future real time data on the fly - given that there will be a closer collaboration with the mobile network providers to do this. Concerning 3D visualisation one of the biggest challenges will be to find appropriate representations of the data in the 3D scenario as well as appropriate interaction mechanisms. Furthermore, suitable pre-processing steps of the data towards these representations must be explored and implemented. Beyond that it would be interesting to link the (anonymised) motion data with additional data like age, sex or occupation to gain deeper insights into the behaviour and habits of the moving population of a city.

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Garden in Motion – an Experience of Citizens Involvement in Public Space Regeneration

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1 ABSTRACT

The paper illustrates a Placemaking process developed in Potenza Municipality (Southern Italy), based on an interpretation of the theories by the French landscape architect Gilles Clément. A laboratory has been organized in a residual area of the city, famous for an architectural monument, the bridge designed by Sergio Musmeci. The Internet allows a continuous online storytelling of work, creating citizens engagement on projects or choices and producing creativity and knowledge circulation. In this perspective "Garden in Motion" initiative produced new important processes for the community life, just like in Gilles Clément's "Garden in motion", where the processes of nature are favoured and spontaneous plants put in condition to grow and move freely.

2 INTRODUCTION

In recent years protests frequently occurred in cities all over the world. Generally, symbols of such protests are parks, but behind parks, people claim an improvement of urban quality, more services, a greater involvement in decisions and more generally a better quality of life and a wider welfare.

Last year the international public opinion supported the protests in Turkey to save Gezi Park, one of the last small green spaces in Beyoğlu (Istanbul), which was threatened by a shopping centre project. During the latter days, new protests occurred in Turkey, which led to social networking ban. This suggests that even 2013 protests were directed to a request of democracy increase and Gezi Park was just a symbol, a way to gather more attention.

Jacobs (1961) observed that quality of life was closely linked to the ability of a community to self determine its conditions of everyday life. The greater is self organization ability, the wider are the possibilities of producing social capital.

In order to support this kind of activities, Davidoff (1965) argues that the role of a planner should not only be limited to analyse social problems and try to propose possible solutions, but he should be a sort of "advocate" of categories that do not have enough power and financial resources, able to mediate between the plurality of community interests, in order to pursue the general interest.

The situation highlighted by Davidoff fifty years ago is still current today; the representativeness of several groups of citizens continues to be a problem accentuated by increasing gap between citizens and institutions. This is manly due to the typical decision maker's behaviour, principally concentrated in relationships with self-referring groups with the only purpose to protect their interests rather than to listen to the community.

Great part of urban renewal programmes can reach, in the best cases, the medium level of Arnstein Ladder (1969); consequently citizens do not believe in public participation involvement or prefer other more bottom-up forms, such as Placemaking (Schneekloth and Shibley, 1995).

This approach has been applied in Potenza, a small municipality located in southern Italy, following some initiatives pursued by several local associations. An abandoned area, important for its architectural symbols, has been chosen in order to build a participatory design process and to give back to the city a shared space with no public expense.

This activity led to a working group composed by architects, sociologists, engineers, journalists and philosophers, called "Garden in motion". "Garden in motion" is also a bottom-up urban renewal project of an abandoned space in Potenza municipality, famous for an architectural monument, the bridge designed by

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Sergio Musmeci. This area, for a lot of time used as an uncontrolled parking, has been transformed into a garden, with children playground and spaces for walking, reading and cultural events.

On July 2013, the above mentioned group organized a free workshop involving young architects, engineers and agronomists. The area below Musmeci Bridge has been cleaned and analysed; existing plants have been catalogued. Participants studied possibilities of space use, also interviewing local residents and listening to old tales: Who lived there? Was there a community? Who does frequent the area now?

At the end of the research, workshop participants proposed some designs in order to decorate the area. Proposals have been published (online/offline) and shared with citizens. The final project has been developed with the voluntary participation of many citizens.

3 THE STORY OF "GARDEN IN MOTION" EXPERIENCE: TOWN INVOLVEMENT AND STORYTELLING

Sirky (2010), describing communities development patterns or interest groups, states that groups managing problems of collective resources assume the shared respect of cooperation rule.

In most cases a strong interest towards a problem\good\space makes the spontaneous action of involved people more effective, than previous policies adopted in good management by responsible Agencies\Local Authorities.

Today we are immersed in technology with continuous connections which improve ideas and experiences exchange.

The stronger is knowledge circulation, the greater is community growth. For this reason, citizens participation in urban space design and management has consequences, also in terms of innovation.

Digital approaches and technologies also allow to build a strong storytelling of community actions, able to go much farther than city limits. It is possible to build an internal engagement, to activate citizens on projects or choices and produce circulation creativity and knowledge. It is no longer to promote actions or projects, such as a marketing bottom-up participation.

Fig. 1: Citizens working to realize the "Garden in motion".

3.1 The context and the engagement

The internet and the great possibilities offered by digital technologies allow us to tell the experience, making sure that the story becomes part of the experience itself.

The context is typical of a provincial town, which grew haphazardly, with an increasing poverty, little investment in services by local authorities and lack of experience in citizens participatory processes.

The choice of the area to be regenerated is not random: it is an abandoned area, forgotten by the institutions, behind a monument of great architectural value, but almost unknown in the city, Musmeci bridge.

Fig. 2: The underside of Musmeci Bridge.

During a workshop, some practitioners - agronomists, sociologists, architects, engineers - put the area under observation and designed a number of proposals with zero impact.

The first phase, analysis of the space below the bridge, collaborative design of some furniture and design of communication campaign, had a very strong impact on citizens.

The continuous online storytelling of work (blogs, social networks, wiki approaches) added news about hyperlocal context to mainstream. But it was mainly the online space to explain the story of what was happening in the city. Also, this space has been built in a participatory and spontaneous way using pictures, text and comments. The population was made curious with small actions based on urban games.

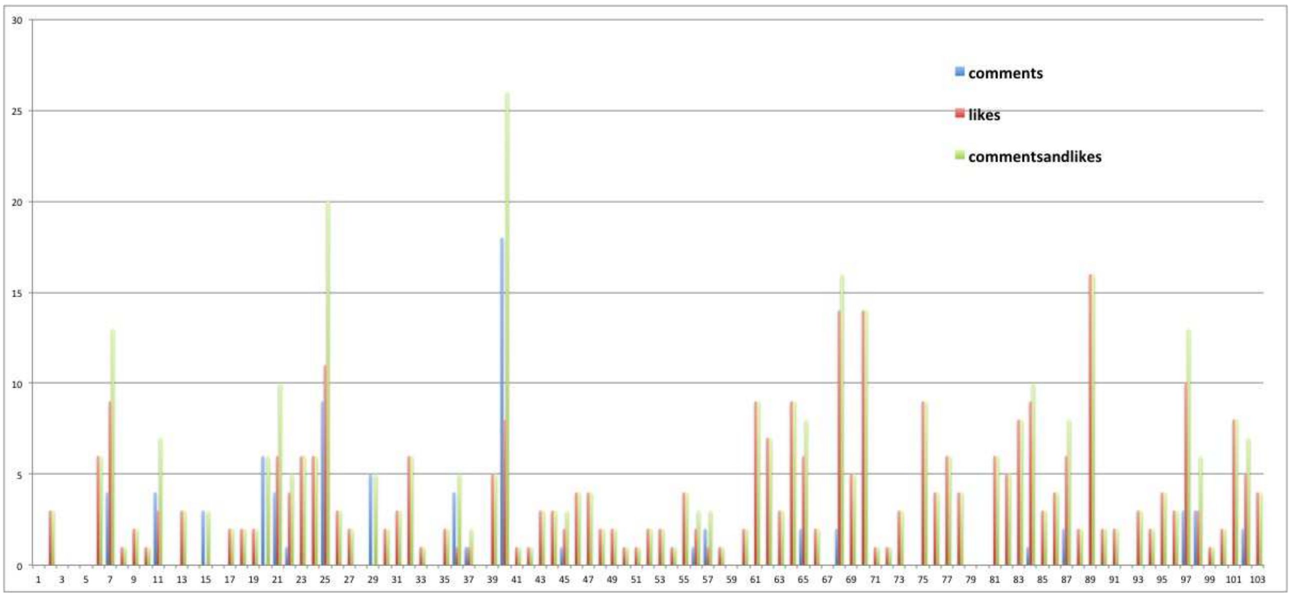

Fig. 3: Number of Likes and Comments on “Garden in motion” Facebook group.

The participation to storytelling experiment design has become a way to participate to the entire project development and to the regeneration of the identified space.

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Fig. 4: The urban game created to promote the initiative in the city and to engage citizens.

Some plants, for example, have been disseminated in the city, photographed, geolocated, posted on the internet. Without receiving instructions, citizens began to track the traces of the game, joining to the story.

Meanwhile, the exposition of project proposals prepared by practitioners represented a further inclusion invitation for other citizens. Which project would you choose? Citizens have commented, selected, suggested, becoming both part of the “Garden in Motion community” and active nodes.

At the same time traders, private enterprises, administrators encouraged by the enthusiasm created around the initiative, helped providing materials, equipments, and even food.

Hundreds have joined to the second phase, mainly based on the construction of the furniture of the area under Musmeci bridge. This number of participants was almost unexpected for the reality of the city. That community was then able to supervise the area.

The storytelling of the positive experience of “Garden in Motion” has activated new interest in associations, artists, single citizens that have filled the area of cultural events, according to a logic of cooperation, proposing new ideas.

Weinberg (2012) highlights that network is always smarter than individuals, even when the latter are very skilled. It is in the network that ideas are mixed, taken together, combined, revised. It is also a matter of community connections.

4 WHY THAT PLACE, WHY THE MONUMENT

“Garden in Motion” is an initiative testing an innovative approach to design and suggests a different way to enjoy a monument, to live an urban fragment, to take care of a collective space.

Based on an interpretation of the theories by the French landscape architect Gilles Clément, especially related to the concepts of third landscape and Garden in Motion, it was decided to conduct a laboratory located in a residual area of the city of Potenza, in proximity to the bridge crossing Basento river, designed by the Italian architect Sergio Musmeci.

Fig. 5: An external view of Musmeci Bridge.

This bridge was built at the end of the sixties of the last century and it is one of the few elements of architectural interest in Potenza city.

The bridge was built entirely with reinforced concrete and its forms are the result of a complex engineering research conducted by Musmeci, who pursued the maximum correspondence between shape and structure.

The result is a work characterized by a complex and unexpected spatiality, perceived through the pedestrian path under his deck, which offers picturesque views and interactions with the river landscape and the city.

Because of these values the bridge was recognized in 2003, among the first Italian works of contemporary architecture under the protection by the Ministry of Heritage and Cultural Activities, becoming a monument like Coliseum and Santa Maria del Fiore.

The importance of the relationship between the monument and the environmental context in which it is placed had already been affirmed by Venice Charter in 1964 and placed in the centre of the action of protection. Later on, the declaration ICOMOS of Xi'An (2005) reiterated the importance of the contribution that the context provides to the value of the monument.

The relationship with natural environment, past and present social practices, uses and activities and other forms of intangible heritage that create form and space have been included in that concept.

The same declaration also paid attention to the importance of documentation understanding environment interpretation in inclusive and multidisciplinary ways.

4.1 A social laboratory as a means of protection

Focusing the attention on the bridge as a monument, Garden in Motion represented an important moment of awareness of its monumental value and an opportunity to build new communitarian values.

The context has been studied and analyzed in all its aspects: results of these analyses were the basis of the design workshop and interventions implementation.

Great emphasis was placed on community education and public awareness to achieve conservation objectives and to improve means of protection and management.

A new awareness of the importance of the relationship between the monument and the context has been the basis of subsequent activities of collective use of the area.

Fig. 6: Garden in Motion Building.

In this perspective, the "Garden in Motion" initiative has given (and continues to give) its contribution in the activation of some processes of great importance for the life of a community, just like in Gilles Clément's Garden in motion, where the processes of nature are favoured and spontaneous plants put in condition to grow and move freely. The interest in the monument and the participation to social dynamics are like seeds of wild plants sown in a field.

In this sense, and according to the etymological interpretation of the term "monument", the "Garden in Motion" experience activated human and social energies fundamental in a community life that not only transformed the physical environment of the bridge, but they also created a number of perception practices and a place usage.

5 THE CITY DESIGNED WITH A BOTTOM-UP APPROACH: THE DICHOTOMY BETWEEN FORMAL AND INFORMAL SPACES

Participation can be defined as a dichotomy between formal and informal spaces such as the collective contribution to urban design, through activism phenomena of that trigger informal spaces, starting from critics to functionalism patterns, which ultimately would lead to estrangement and liabilities between citizens.

In order to better specify what kind of functionalism is referenced in the project for the city it is useful to start from critics by Lefebvre (1993) opposed to this sociological theory.

Lefebvre considers functionalism as a coincidence between rationality and functionality that would bring function to create reality. He states that "the new cities showed merits and deficiencies, more evident than merits, of functionalism, when it wants to create the framework and the conditions of daily life."

A space between the formal place of the city, designed and planned without any participation form of the future users will be a place with almost exclusively unique ways of interaction. People living that space are unable to have unusual behaviours, compared to the prescribed forms, without being accused of madness.

Considering a kind of anachronistic functionalism, still contemplated today, the city designed and governed without participatory paths appears to be a space of silence.

The silence, defined as lack of response to the aims proposed in the city project, is the nourishment for the continuous replication of formal places.

Apathy that characterizes citizens could be generated by situations described in the International Situationist (1958): “It is important to redevelop the area around them, to build for them, without distracting them from worries transmitted through the eyes and ears”.

The city expands leaving on one side empty places without function and on the other side multiplying functions and places consumption, transforming its inhabitants in space consumers.

On one hand there are formal places that require feasible behaviours and actions only if recognized in dominating economic and social system, on the other hand at the edge of the city are located the informal places that allow intents sharing.

Away from the project, the "manufacturer" inhabitant in empty spaces of the city claims his right of movement and action, which up to nowadays has been denied.

In several cases. the “design machine” does not give meaning and function to informal spaces if they are not attractors of economic interests.

All this brings us to an issue dealt with by Lefebvre: the Right to the City.

Fig. 7: Garden in Motion Building.

The re-appropriation of informal spaces by single or informal groups of citizens through reuse or urban regeneration actions are an expression of the rights to the city as an active proposition in countering individuals separation and specialization of places imposed by formal city.

Controlling behaviours and actions that people practicing in the interstices of free cities, like simple deviance from the common sense, is reductive because they are not the result of individual strategies of re-appropriation, implemented according to place characteristics, but acts more or less aware of collective design of places and their potentiality.

Harvey (2008) argues that the “right to the city" is more than an individual freedom to access to resources offered by town, but it is the right to change ourselves by changing the city.

While individuals and individuality are not recognizable in informal spaces, it is possible to outline political and organization aspects that collectivity uses to govern the informal space.

5.1 Application of this approach to “Garden in Motion experience”

The basic idea was to induce to a garden design taking into account informal uses of Potenza, which citizens already put into practice in that place.

In addition, there was the will to second, using the term adopted by Clement, informality of place, through a proposal of self-built furniture, connections with formal city and construction of a privileged point of view of Musmeci bridge.

"The aesthetics of natural disorder", as defined by Clement have been reproduced in the first phase of the workshop through analysis of needs. Workshop participants were invited to explore needs expressed by citizens mapping through senses, signs of presence and action of man. Each participant revised the information collected in a project which expresses a function for the garden, a formal strategy of connection to the city.

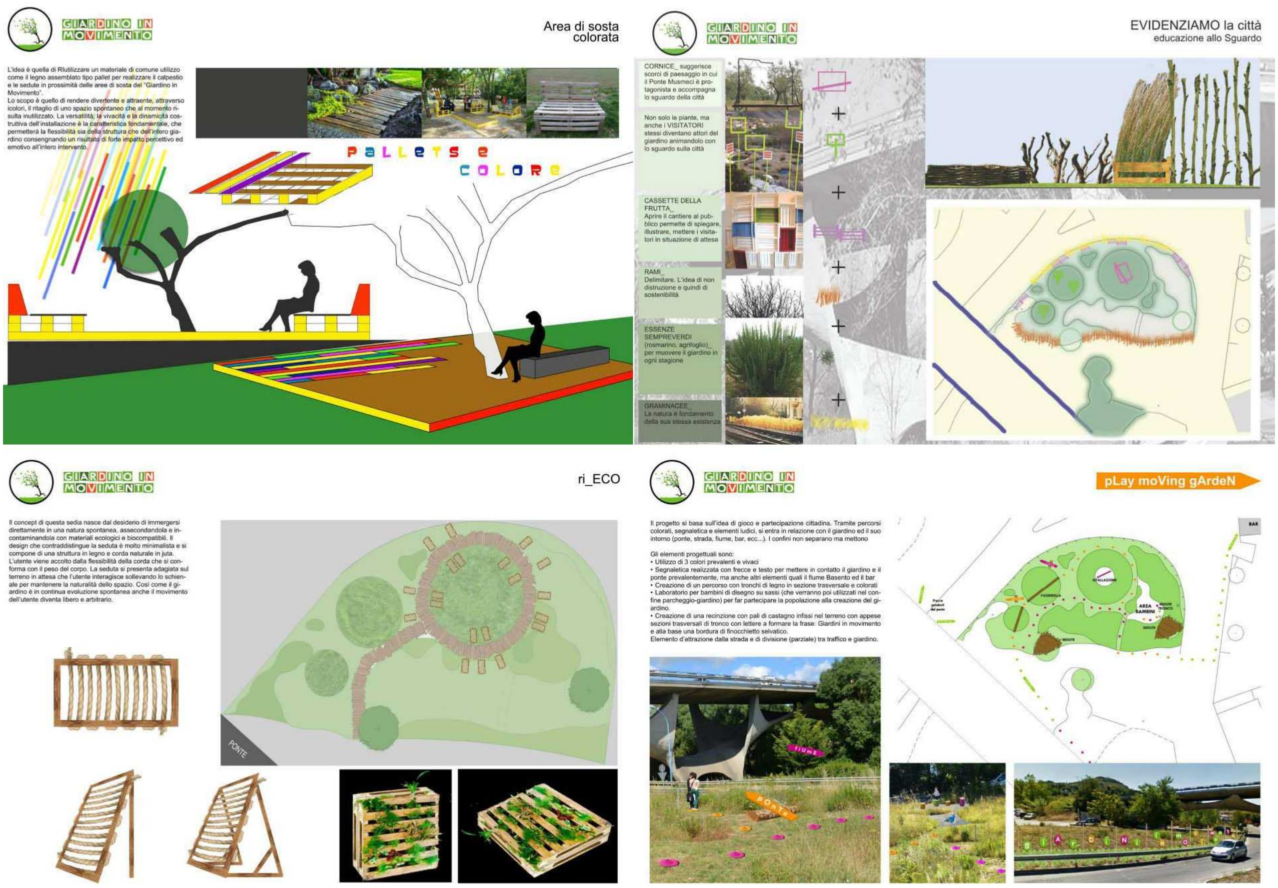

Fig. 8: Several examples of workshop designs.

Fig. 9: Spontaneous growth of plants in the garden.

Considering again Clement's theory, participants no more played the role of architect sculptors but that of garden makers with the only purpose to accompany with their own projects transformations already present in that place.

6 FROM THE BRIDGE TO THE GARDEN: A CULTURAL CONTRIBUTION BETWEEN THE CITY AND THE MONUMENT

The "Garden in motion" design and implementation come from several experiences developed in past years in this area. The attention was focused on Musmeci Bridge, an extremely important engineering and architectural artifact, crossing the Basento river, full of symbolic values and historical memory of the city, completely abandoned today. Under the bridge there is an dismissed industrial area with green spaces, which requires a reconversion. The location of the industrial area on Basento river dates back to post World War II, when some mechanical and steel industries have been located in this zone taking into consideration the proximity of the area with the railroad which connected the city of Potenza with Tyrrhenian and Ionian coasts. The importance of this area is crucial because, due to the worldwide economic crisis, a lot of activities have been abandoned. Consequently the area could be converted to leisure, sports and cultural activities. The motivation is due to the position. This area has a good level of accessibility, it is one of the few flat zones of the city, it is close to Rossellino park, it is close to a Roman bridge (Saint Vito bridge), it is very close to a zone where an important participatory process of reconversion to park of an old pig breeding (Murgante 2012) is on-going and the municipality has also a project of a fluvial park around the Basento river. For this reason, the most important cultural associations of the city, since several years, organize many cultural events in the area to attract media attention to the zone and to remind its importance to the whole city population.

Fig. 10: Shows for children organized in the Garden.

Consequently, important events, such as “Musmeci Art” and the “Festival Città Cento Scale”, have been organized by Basilicata 1799 Association with important companies of aerial dance which have produced choreography for the bridge.

In 2011, for the first time, the attention was moved form the bridge to the context where the bridge is located. Basilicata 1799 Association organized a workshop with the architect Franco Zagari identifying the area under the bridge as a place to "define" a garden according to Gilles Clément's theories.

The attention moved more and more on the idea of participation and how to make the "garden" a recognized place of citizenship: a public space that emphasized the common good.

In this experience attention has been paid to create living environments, coupling nature needs with common requirements of people life. Activities implemented (and that will be realized with network growth) are essentially based on participation, volunteering, low environmental impact and low cost.

7 CONCLUSION

"The garden in motion" develops methods and models of participation that spread an antagonistic culture to the speculative conception of space, waste of energy, environment and landscape depauperation, consumption of human resources promoting common goods. When citizens are involved in decisions about space and time organization of a city, cooperation processes will be generated leading to a collective benefit. The higher is the level of involvement, the greater will be the perceived responsibility towards those spaces, even in future times.

One of the advantages of the project is the possibility to repeat the experience in other places of the city. The local authority can provide only logistical support, without investment of economic resources. The city participates to the design phase selecting proposals, building decorations, cleaning the area where, at the end of the project, neighbourhood events, cultural events, meetings with a social purpose are organized. Citizens feel responsible for a public place that they have renovated and given back to the city. They also try to live that area by filling it with local culture.

Potenza Municipality does not have large green spaces, nor great cultural and architectural Heritage. In this city poverty rate and social disadvantage have doubled in recent years. Municipality and other local authorities do not have resources to invest, but citizens are willing to participate in building their city. Experiences such “Garden in Motion” replicated in other neighbourhoods can generate processes of public good re-appropriation, very useful for the community: citizens observe, compare and choose, becoming important actors.

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Infographics for Smart People in Smart Cities

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1 ABSTRACT

Since 2012 the PBL Netherlands Environmental Assessment Agency has been working on a series of infographics on mobility, energy, food, water, waste and cargo flows in the Netherlands. The aim of these graphic visualisations is to create smarter and more sustainable urban environments by informing experts, policy makers and the general public about relevant urban flows and possible perspectives for action. The infographics show the scale, proportion and systemic relationship of flows on various scales, from global to local, and are based on recent scientific research by the PBL Netherlands Environmental Assessment Agency. Inspired by the work of the Austrian sociologist Otto Neurath and the German graphic designer Gerd Arntz, a first booklet on infographics on food, energy and mobility in the Netherlands has been published by PBL in 2012. Currently, the PBL Netherlands Environmental Assessment Agency is working on graphic visualisations of ten urban flows, such as mobility, energy, waste, cargo and water, that will be published and exhibited at the International Architecture Biennale Rotterdam 2014. This paper shows and describes a selection of infographics that are relevant for smart people in smart cities.

2 INTRODUCTION

In the context of rapid urbanisation and growing environmental challenges (UNEP 2013), the discourse of the smart city promises an era of innovative urban planning driven by smart urban technologies that will make cities safer, cleaner and, above all, more efficient. The promise of smart sustainable cities is predicated on the dynamics of social media alloyed to the Big Data generated by an urban infrastructure strewn with sensors. Feedback loops are supposed to engage citizens an enable behaviour change, just as real-time control systems tune infrastructure to become more energy efficient. Social media dynamics enable both self-organisation and efficient ecosystems, and reduce the need for traditional governance, and its associated costs. Behind it all is the application of ICT technologies.

However, a growing group of planners en researchers criticizes that generic technology-driven concepts that are imposed on cities will not work (see, among others, Hill 2012 and Hajer and Dassen 2014). Experimental green new towns like Songdo in South Korea, Masdar in the United Arab Emirates or Dongtan in China stand witness to what happens if we opt for sustainability but continue following the planning concepts of the 20th Century. These are, in the end, smart cities on a modernist footing, the 21st Century equivalents of Brasilia and Chandigarh. And, even though they were created in a politically 'easy' 'tabula rasa' situation, they have not lived up to their promises (Ferrão and Fernández 2013).

2.1 Smart people make sustainable and livable cities

Considering the failure of generic 'cities from a box' concepts, we need to think about the technologies in context. Next to smart technologies, we need smart citizens, smart planners and smart governments to make the smart, sustainable and livable city become a reality. Smart urbanism is about constant learning, inspiration, measurements, analysis and readjustments. This requires a rethinking of how public administrations operate. They will need to change. Interestingly, we see how the new civil society full of well-educated citizens raise so many astute questions and produce so many new demands that a classical bureaucracy becomes a defence industry. The classical 'decide, announce, defend' model is vulnerable is a world of constant learning. It could work much better in an era in which the government held the monopoly on good knowledge. But that is over. ICT technology brings information and knowledge within reach of many. Governments now face an 'energetic society' (Hajer 2011) of citizens that you either relate to make them part of the solution or find opposite you. 21st Century cities have increasingly have an opinionated and often well informed citizenry that will resist, quarrel, raise questions, call for amendments, oppose. And often for good reason. The art of planning is to combine the intelligence of policy makers, planners and companies with the intelligence of citizens.

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2.2 Visualizing the urban metabolism

A fundamental starting point to make citizens, planners and policy makers smarter is to create a better understanding and awareness of the way our cities work at the moment. The problem is, however, that our urban metabolism is complex and often hidden. There is little general awareness where our energy, water and food comes from and where our waste goes to? Furthermore, what effects does our way of living have on the urban surrounding and countries in other parts of the world? And finally, how can each citizen contribute to create a smarter and more sustainable city.

To create a broader awareness and to inform citizens, planners and policy makers, the PBL Netherlands Environmental Assessment Agency has recently been working on several projects using infographics that visualize the urban metabolism and related environmental issues. In this context infographics are a powerful tool to communicate information. They can present complex information in a compact, comprehensible and attractive form. Thereby infographics make data, information and knowledge easily accessible to various target groups, such as general public, planners, stakeholders and policy makers. The PBL work with infographics has been inspired by the work of the Austrian sociologist and philosopher Otto Neurath. Already in the 1920s Neurath worked on graphic design and visual education to make the information about society and economy understandable for everybody. With the illustrator Gerd Arntz and with Marie Reidemeister, Neurath created Isotype, a symbolic way of representing quantitative information via easily interpretable icons (Vossoughian 2008). At international conventions of city planners, Neurath presented and promoted his communication tools.

In this paper two recent PBL publications with infographics are presented. The first publication, ‘Nederland Verbeeld’ (PBL 2012), contains infographics on food, energy and mobility issues in the Netherlands. The second publication presented in this paper is called ‘Smart about Cities: Visualizing the Challenges for 21st Century Urbanism’ (Hajer and Dassen 2014). ‘Smart about Cities’ contains visualizations of the urban metabolism in the Netherlands in relation to international environmental issues.

3 THE NETHERLANDS IN INFOGRAPHICS

The publication ‘Nederland Verbeeld’ contains 29 infographics combining short texts and graphic visualizations that illustrate various issues concerning the topics of food, energy and mobility in the Netherlands. Next to visualizing current trends and developments, the publication also shows perspectives for action per topic.

3.1 Food

Figures 1 to 6 show a selection of infographics concerning food and mobility issues. Figure 1 shows that the quality of our food has improved but that an average diet contains too much meat and fat, and overweight is an increasing problem. Moreover, food worth 325 Euro gets wasted per household per year. We live in an age of overconsumption and could be much more efficient about our food. Figure 2 illustrates the footprint of the Dutch consumption, including food, cotton and wood. Per person 0.6 hectare is needed which is almost a soccer field. For the whole population three times the size of the Netherlands is needed. A big part of the footprint can be found in South-America which can be attributed to land-use by cattle. Finally, figure 3 shows the effects of different personal diets. On average the footprint of an vegeterian is 30 percent smaller in land-use. The related production of greenhouse gas is about 20 percent less compared to an average diet.

3.2 Mobility

Figures 4-6 illustrate mobility issues. Figure 4 shows that about a quarter of the Dutch CO_2 emissions is caused by transport and the European Union has the ambition to reduce the amount of greenhouse gasses by 60 percent until 2050. Figure 5 illustrates our travel motives related to different modes of transport. Most of the kilometres travelled are related to commuting to work, and most of those kilometres are made by car. Figure 6 shows the CO_2 emissions caused by vacation trips. It shows that one return trip by plane to New York is as much as a quarter of the average CO_2 emissions of a Dutch person per year. It can be compared to the yearly amount of CO_2 emissions caused by travelling 35 kilometres per day.

Fig. 1: Infographic on food 1: overview of recent developments and issues

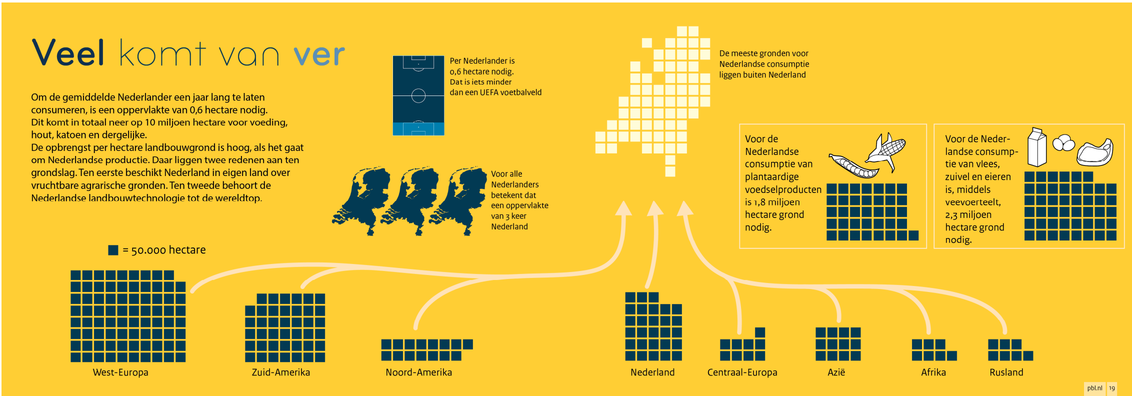

Fig. 2: Infographic on food 2: the footprint of Dutch consumption

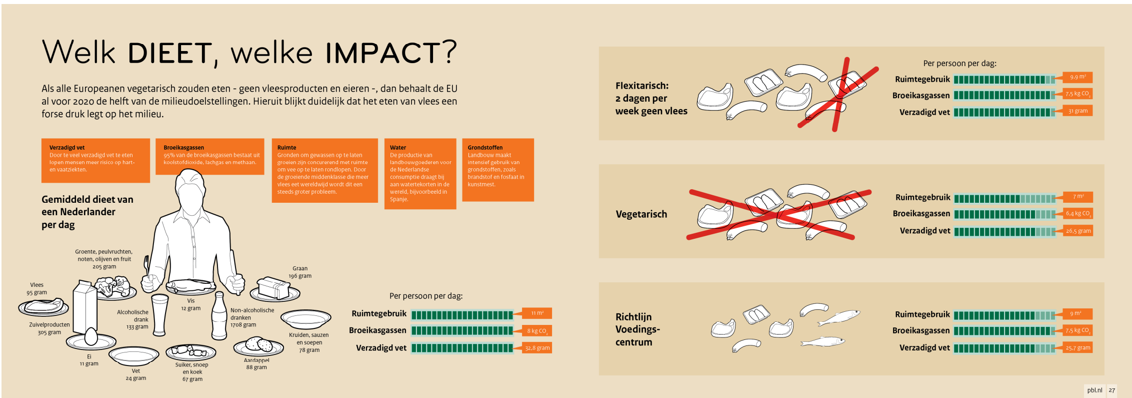

Fig. 3: Infographic on food 3: impacts of various food diets

Fig. 4: Infographic on mobility 1: overview of recent developments and issues

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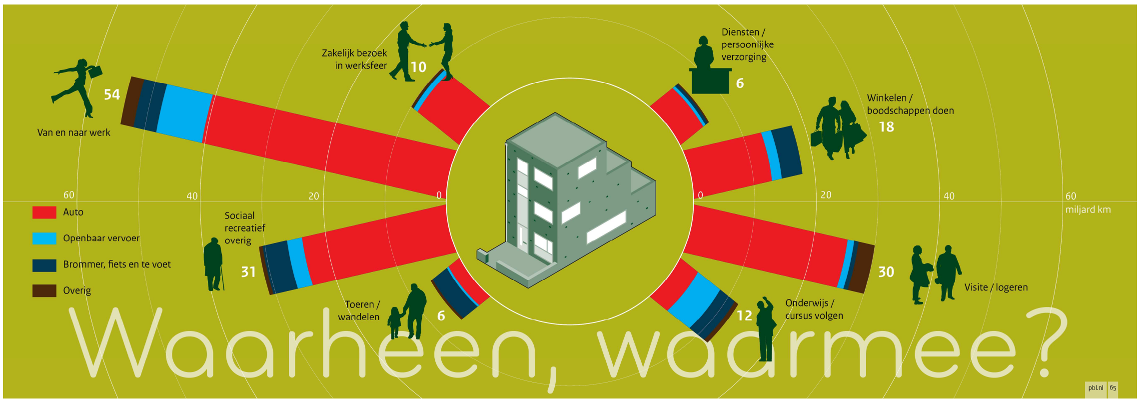

Fig. 5: Infographic on mobility 2: travel motives related to different modes of transport

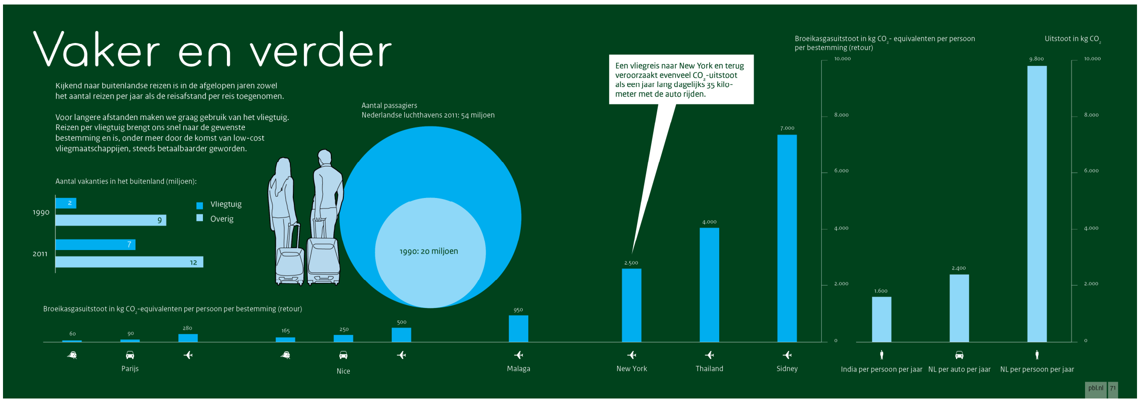

Fig. 6: Infographic on mobility 3: CO2 emissions of various vacation trips in relation to average CO2 emissions per person per year

4 SMART ABOUT CITIES

Since summer 2013 the PBL Netherlands Environmental Assessment Agency has been working on preparing the exhibition and publication 'Smart about Cities: Visualizing the Challenges for 21st Century Urbanism'. This exhibition and publication is part of the International Architecture Biennale Rotterdam 2014 (IABR). The upcoming edition of the IABR argues that the city is an integral part of one huge urban landscape, a complex system that has become our natural environment. This point of departure has many implications for the way we plan and design this urban environment. Perceiving it as an organism opens up possibilities to develop spatial interventions that make use of its metabolism.

The contribution of the PBL contains fifty infographics on urban flows in the Netherlands, Europe and the world. The infographics have been produced by a group of PBL researchers in close collaboration with graphic designers and cover ten substantial urban flows:

- People (demographic flows)
- Mobility (traffic flows)
- Cargo
- Food
- Fresh water
- Air
- Energy
- Construction material
- Biodiversity and nature
- Waste

Per theme five infographics have been elaborated. The first infographic always shows the scale of the flow related to a person (e.g. How much energy does a person use per year? How much food does an average person eat? How much waste does a person produce?). The second infographic presents a flow chart. For example, how much waste is produced by what kind of source and how does the waste get treated? The third infographic shows the physical infrastructure on a map of the Netherlands related to the specific flow. The fourth and fifth infographics vary per theme and present issues on a global scale and possible perspectives of action.

As an example of one the tens urban flows, the following five pages show the infographics on waste (see Figures 7-11). In the ideal world of recycling, waste does not exist. What we would call waste or rubbish simply serves as raw material for the next cycle. The question is whether this perfect world of 100% recycling has ever existed, or can ever exist. Animals, plants, and particularly human civilisations leave traces that are not erased in subsequent cycles but that remain long after they were left ¬– from dinosaur bones, to ashes and potsherds. Humans have always produced waste. However, the volume and nature of waste flows have changed over time; there is more waste today than ever before, and the amount keeps growing.

For Europe, recycling is becoming increasingly more attractive, also from an economic and geopolitical point of view. Europe depends on other countries for many raw materials, and these materials are likely to become scarcer and more expensive in the future, due to global economic and population growth. Therefore, Europe should carefully manage its current resources, including the materials present in products and waste.

A growing number of companies and regions aim for a circular economy, in which production cycles are closed as much as possible. This means that products are increasingly being designed in such a way that materials can easily be recovered at the end of the product life cycle. Waste prevention and reuse are the guiding principles of this approach. A circular economy would also allow a shift from owning to leasing goods, where producers retain ownership of the materials.

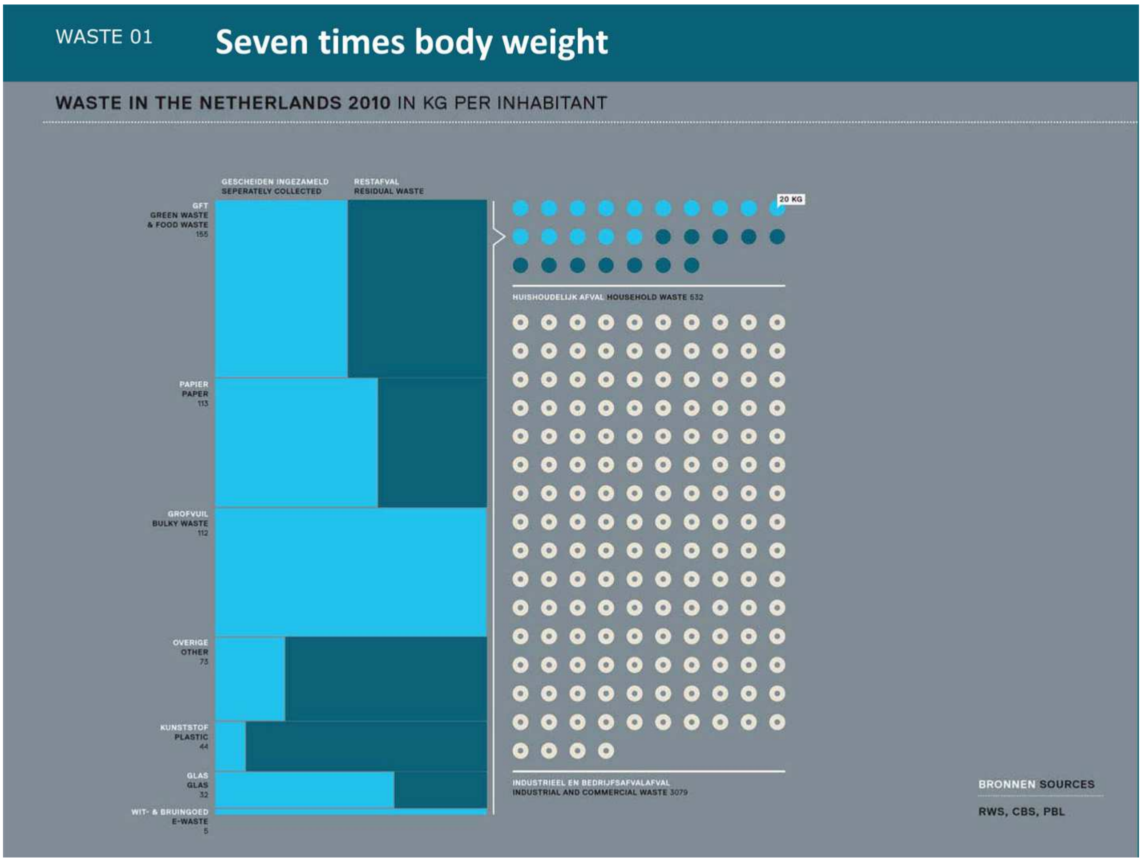

Fig. 7: Waste per person in the Netherlands

4.1 Seven times body weight

Each year, every Dutch citizen discards 530 kilograms of waste. This is seven times the average adult body weight, and four times as much as in 1950.The main components of household waste are organic items (vegetable, fruit and garden waste), paper and cardboard. Sixty per cent of all discarded paper and glass is collected separately; for plastic this is only 13%.

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Contemporary households own more things than ever before, and throw more things away. In other words, the turnover rate is higher. Goods such as clothing and furniture are much less often mended, repaired or reused than in the past. Many products now come as disposables, such as diapers and plastic packaging material. However, some waste flows have decreased or completely disappeared; the production of coal ash, for example, ceased when the Netherlands switched from burning coal over to natural gas in the 1960s.

Waste production appears to be correlated with economic prosperity. Waste growth tends to stagnate during economic downturns. This was particularly the case during the oil crisis of the 1970s and the economic recession of the 1980s, and has also been observed in recent years as a result of the present economic crisis.

Household waste is only the tip of the iceberg. The majority of waste (85%) is produced by factories, offices and businesses. This share amounts to an additional 3000 kilograms of waste per Dutch citizen per year.

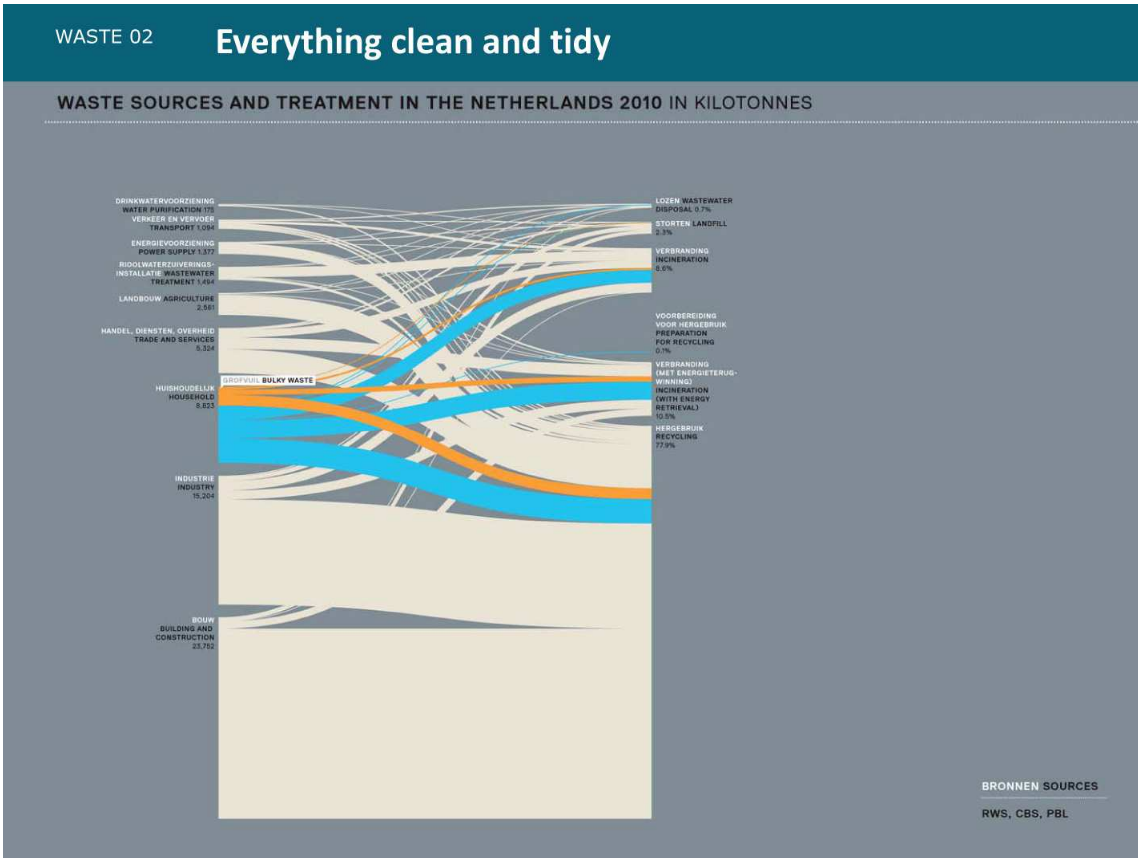

Fig. 8: Flow chart of waste sources and treatment in the Netherlands

4.2 Everything clean and tidy

Waste management in the Netherlands appears to be a problem solved; partly thanks to sophisticated logistics. Back in 1980 most household waste ended up in landfills, but now it is efficiently recycled or incinerated. Large-scale industrial waste scandals are also a thing of the past. For only a few dimes per person per day, we dispose of our waste in a clean and proper manner.

Better still, our waste is put to good use, as more than 75% is recycled, and a part of the 20% that is incinerated thus contributes to heat and electricity generation. No more than 3% ends up as landfill or is disposed of as waste water.

Waste management in the Netherlands has become so efficient that Dutch incineration plants currently have overcapacity. As a result, they are importing waste from other countries. Waste from London and southern Italy, for example, is being incinerated at the Port of Rotterdam. Thus, waste incineration generates energy as well as profit.

Fig. 9: Map of waste infrastructure in the Netherlands

4.3 Cities are wasting waste

Waste separation and recycling are effective ways to reduce the amount of residual waste. Many Dutch municipalities collect sorted waste door-to-door and have household waste recycling centres. Reuse has also gained popularity, mainly thanks to the rise of online platforms such as eBay for buying and selling used goods. These platforms also facilitate sharing and leasing.

Generally, more waste is recycled and reused in rural areas and small towns than in cities, where a larger share of plastic and organic waste ends up in incinerators. Thus, in terms of recycling there is still plenty of room for improvement in cities.

4.4 From landfills and incineration to recycling

European countries differ considerably in their waste production and waste management. Rich countries such as the Netherlands produce more municipal waste per head of population than less prosperous countries. However, waste management also significantly improves with increasing prosperity; progressing from waste dumping to well-managed landfills, from simply burning waste to waste-to-energy incineration, and finally from incineration to recycling. The richer European countries aim to further reduce the amount of waste going into landfills and incinerators; the Netherlands aims for a 50% reduction in incinerated waste, over the following decade.

For Europe, recycling is becoming increasingly more attractive, also from an economic and geopolitical point of view. Europe depends on other countries for many raw materials, and these materials are likely to become scarcer and more expensive in the future, due to global economic and population growth. Therefore, Europe should carefully manage its current resources, including the materials present in products and waste.

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A circular economy goes beyond waste-to-energy incineration and recycling. In this system, waste is no longer viewed as waste, but as a resource for new products.

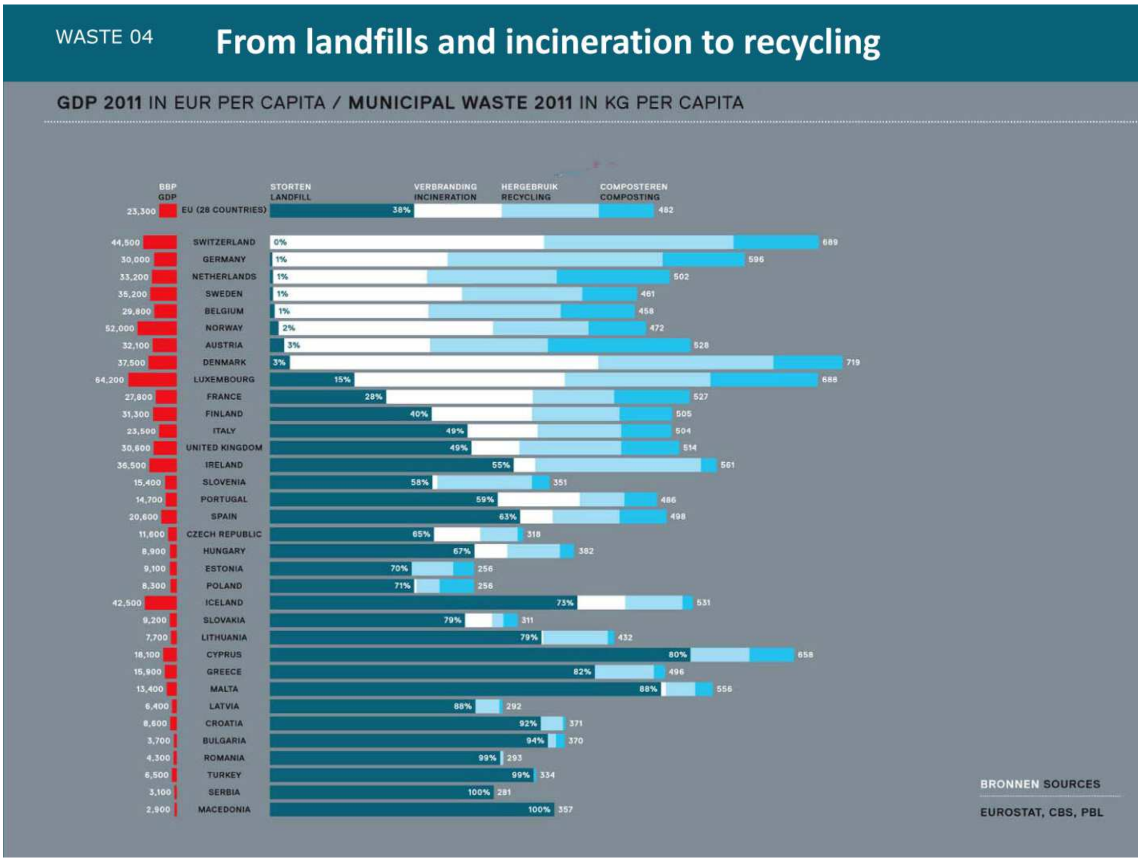

Fig. 10: European comparison of waste production and waste treatment

Fig. 11: Global issues related to waste Waste

4.5 Waste travels the world

Across the globe, population growth and increasing prosperity lead to growing waste flows. This is primarily an urban issue – not only because urban populations are growing so rapidly, but also because urbanites on average produce two to four times more waste per person than do rural inhabitants. The latter generally are poorer, consume less, and reuse and recycle more. In 1900, the global urban population produced 300,000 tonnes of waste per day. A hundred years later they produced ten times this amount: 3 million tonnes per day. By 2025, this figure is expected to have doubled to 6 million tonnes per day.

These quantities are an enormous burden on urban environments; particularly in less developed countries where waste management is not well-organised. In countries with many people living below the poverty line, the enormous waste flows are leading to deplorable conditions. In some cities, the slums are overflowing with rubbish. Numerous people live and work on the vast rubbish dumps of big cities. Furthermore, large quantities of plastics end up in nature areas and oceans, where they increasingly endanger the environment for both humans and animals.

Waste, however, also offers opportunities. If better recycled and reused, waste becomes a valuable resource for new products. As was common practice in the Netherlands, decades ago, many poor countries have a lively tradition of recycling and reuse. Over the years, people developed their own informal collection systems, which support a broad sub-economy based on recycling. These days, they process not only local waste, but also discarded electronic parts and equipment, known as e-waste, from Western countries. Processing e-waste is profitable because electronic devices often contain valuable metals such as copper, nickel, iron and even gold. However, great care must be taken to avoid unsafe exposure, because e-waste may contain hazardous substances. According to the United Nations Environment Programme (UNEP 2012), the available data on e-waste is limited, and in poorer countries, particularly in Africa and Asia, waste dumps are known where e-waste is not being processed safely.

5 CONCLUSIONS

Cities stand in the front line of sustainable development. They contribute most to CO2 emissions and other resource use; but they are also most capable of innovation and change. Smart technologies can help to make cities more resource efficient, but generic technology-driven concepts will not be enough. To create more sustainable and livable cities in the future it will also be necessary to combine the intelligence of policy makers, planners and companies with the intelligence of citizens. A fundamental starting point to make citizens, planners and policy makers smarter is to create a better understanding and awareness of the way our cities work at the moment. The problem is, however, that our urban metabolism is complex and often hidden. In this context infographics on urban metabolism and environmental issues are a powerful tool to communicate information, and to create a general base of awareness. Infographics can present complex information in a compact, comprehensible and attractive form. Thereby they make data, information and knowledge easily accessible to various target groups, such as general public, planners, stakeholders and policy makers.

6 ACKNOWLEDGEMENTS

The infographics in ‘Nederland Verbeeld’ (PBL 2012) and ‘Smart about Cities: Visualizing the Challenges for 21st Century Urbanism’ (Hajer and Dassen 2014) have been produced by a team of researchers and designers of the PBL Netherlands Environmental Assessment Agency in collaboration with graphic designers. The infographics in ‘Nederland Verbeeld’ have been elaborated in collaboration with Frederik Ruys (Vizualism). The infographics in ‘Smart about Cities: Visualizing the Challenges for 21st Century Urbanism’ have been produced in collaboration with Catalogue Tree, a design company specialized in the visualization of data.

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L(i)ebenswerte Quartiere – Wohnportraits als Beitrag zur smarten Planung?!

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1 ABSTRACT

Bei aller Kritik an punktuellen Bürgerbeteiligungsverfahren mangelt es in der derzeitigen Debatte an langfristigen kreativen Lösungen für die Planung. Das folgende Praxisbeispiel widmet sich positiven Erfahrungen mit Selbstportraits zum Thema „Wohnen" bei der Leitbildgestaltung der Metropole Ruhr. Eingebunden in die allgemeinere fachtheoretische Diskussion verfolgen die Verfasserinnen die stärkere Einbindung von Laien in den Planungsdiskurs, um sie intensiver an quartiersbezogenen Entscheidungen zu beteiligen. Der Fokus des Artikels liegt auf einem geeigneten Partizipationsverfahrenk, die das Empowerment von Bürgerinnen und Bürgern als Herausforderung der kommunalen Planung begreift.

2 EINORDNUNG IN DEN FACHTHEORETISCHEN DISKURS

Wem dient die Stadtplanung? Wer ist der Rezipient von Planung? Diesen beiden Fragen nährte sich Lucius Burckhardt (1981) in seinem Tagungsbeitrag „Was ist Wohnlichkeit? Meßbare [!] und unsichtbare Bedürfnisse" mit Kritik am Verständnis vom Bürger: „Unser Referat befasst sich […] mit der Kritik eines quantitativen Bedürfnisbegriffs. Dazu müssen wir in einem ersten Schritt die Indeterminiertheit der menschlichen Bedürfnisse […] beschreiben. Daraus folgt ihre technische Unerfüllbarkeit, die Unmöglichkeit für die Bedürfniserfüllung quantitative Standards festzulegen" (ebd. 201). Seit dem Tagungsbeitrag vor über 30 Jahren hat sich die Pluralität der Lebensstile weiterhin ausdifferenziert. Es ist daher immer schwieriger geworden, die Rezipientinnen und Rezipienten der Planung in ihrer kulturellen, religiösen, geschlechtlichen, altersbedingten etc. Vielfalt zu operationalisieren, ohne sie auf ein indifferentes ‚Mittelmaß' zu reduzieren. Zeitgenössische Planung erfordert einen neuen Bürgerdialog mit der Bevölkerung, um neue Standards für milieuspezifische, multikulturelle und multiethnische Ansprachen zu setzen (Huning 2014). Als typisches Beispiel für das althergebrachte ‚Diktat der Planung' sei hier das Leitbild der Autogerechten Stadt erwähnt. Im vorliegenden Beispiel wurde der individualmotorisierte Pendler (zumeist weiß und männlich) als Rezipient der Planung angesehen. Heutige Herangehensweisen unterscheiden sich davon durch milieuspezifische Perspektiven. Bürgerbeteiligungsverfahren dienen der teilhabeorientierten Implementierung von Planung in bestehende Stadtquartiere. Gegensätze zwischen etabliertem und erkenntnisoffenerem Planungsverständnis sind idealtypisch in Tabelle 1 dargestellt.

Quantitative Stadtplanung	**Qualitative Stadtplanung**
Neoliberale Stadtentwicklung	Soziale/partizipative Stadtentwicklung
‚Quantifizierung' des Bürgerwillens durch standartisierte Befragungsmodelle	qualitative (kritische), ergebnisoffene Methoden
konsensorientiert	diskussionbetont
homo oeconomicus	smart citizen (grassroutes)
Großbauprojekte	quartiersbezogene Instandsetzung
punktuelle Bürgerbeteiligungsverfahren (passiver Ansatz)	experimentelle Partizipationsprozesse (inkludierend, kritisch, aktivierend)
Verantwortung liegt bei den Planern	Verantwortung wird unter allen Akteurinnen und Akteuren geteilt
Kosteneffizienz als oberstes Ziel	---

Tabelle 1: Einordnung der Methode in Quantitative-Qualitative-Planungsphilosophie (eigene Übersicht)

Wir denken, dass ein Schlüssel in der künftigen Partizipationskultur in der Rückbesinnung auf den einzelnen Bürger liegt. Eine neuerer Ansatzpunkt begreift den Bürger als zentral(s)tes Element von Urbanität, in der der Bürger, einem Stadtatom gleich, im wechselseitigen Austausch zu seiner urbanen Umgebung steht. Bezugnehmend auf dieses Verständnis sollte sich die Bürgeransprache stärker am „Smart Citizens"-Konzept

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orientieren. Der Begriff leitet sich von „Smart City“ ab, was die weiche bürgerbezogene Effizienzsteigerung von Städten in Einklang mit der Optimierung der ‚harten‘ Infrastruktur unter Ausdehnung des quartären Sektors beschreibt (Caragliu, Del Bo, Nijkamp 2009). Schon heute gelten smarte Städte als erfolgreicher, wenn es um die Verlagerung von Arbeitsplätzen und Innovationspotential (Bevölkerungs- und Wirtschaftswachstum) geht (Glaeser & Berry 2006). So entstand die Idee, unterschiedliche Bewohnerinnen aus dem Ruhrgebiet ihre Wohnbiographie ‚erzählen‘ zu lassen. Aufbauend auf ihren Beiträgen berichtet der nachfolgende Artikel vonpositiven Erfahrungen mit Wohnportraits und –fotografien im Ruhrgebiet.

3 „IDEENWETTBEWERB METROPOLE RUHR“

Das Projekt „L(i)ebenswerte Quartiere für Alle“ (Gleichstellungsstelle des RVR, 2013) entstand im Rahmen eines regionalen Diskurses zur künftigen Leitbildgestaltung der Metropole Ruhr, deren städtebauliche, wirtschaftliche und sozioökonomische Konflikte dem altindustriellen Erbe zu verschulden sind. Initiator des mehrstufigen Dialogs war der Regionalverband Ruhr (RVR), das überregionale Planungsorgan, zuständig für die Abstimmung bei der Infrastrukturplanung von 11 kreisfreien Städten und vier Kreisen mit rund 5,2 Millionen Einwohnern. Um eine möglichst große Akzeptanz der Planung zu gewährleisten, wurden nicht nur Expertinnen und Experten, sondern im großen Umfang auch Bewohnerinnen und Bewohner sowie in der Wissenschaft Tätige in beispielhafter Form an der Ideenfindung beteiligt. Ein neues Planungsverständnis prägte die Beteiligungsstruktur, bei der Planerinnen und Planer in wechselseitigen Präsentationen und Diskussionen mit ‚Planungslaien‘ ihre Paradigmen im Rahmen dreier Veranstaltungstage, verteilt über die gesamte Region hinterfragten.

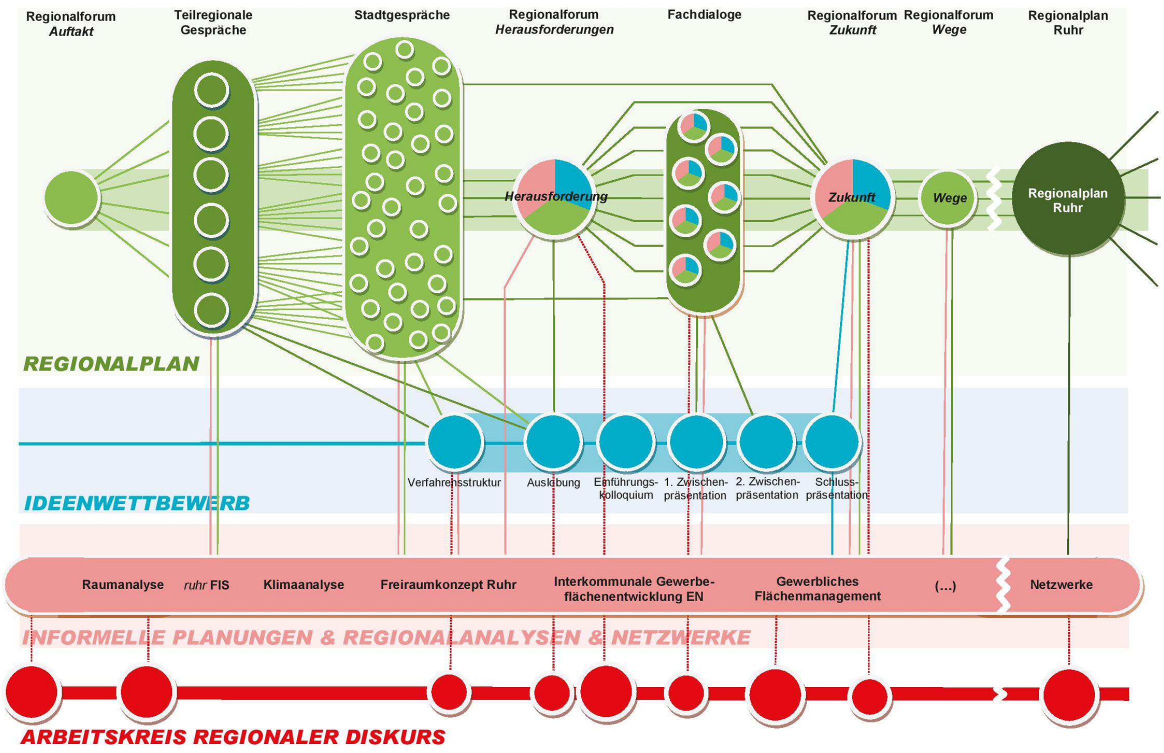

Abb. 1: Integration des Ideenwettbewerbs in den regionalen Diskurs (Quelle: RVR 2013:6)

Die Akteursbeteiligung erfolgte in mehreren Teilschritten, die in Abb. 1 dargestellt sind (RVR 2013). Anhand der Grafik ist erkennbar, dass der Ideenwettbewerb an den Präsentationstagen (siehe „Zukunftsforen“ in der Konzeption) eine zentrale Rolle bei der Entwicklung des Regionalplans einnimmt. Am Anfang dieses Prozesses vom 10.-11. Juli 2013 stand die Präsentation von „1.000 Ruhrideen“, bei denen die Bürgerinnen und Bürger in Kooperation mit den lokalen Medien aufgerufen wurden, ihre Belange für den Umbau der Region zu veröffentlichen (400 Einsendungen). An diesen breiten Bürgerdialog knüpfte der Wettbewerbsbeitrag des Frauennetzwerks Ruhrgebiet im Rahmen des zweiten Dialogtreffens an, das am 11. September 2013 stattfand. Das vorrangige Ziel dieser Veranstaltung war der Austausch der sogenannten

Fachöffentlichkeit unter dem Titel „Ruhrwissen" (RVR 2013). Das Frauennetzwerk war eines von zehn Expertenteams, dessen Idee Eingang in den Dialog fand.

3.1 Die Wohnportraits – ein Beitrag des Frauennetzwerks

3.1.1 Beschreibung der Methode

Die Initiative des Frauennetzwerks Ruhrgebiet basiert auf einem informellen Zusammenschluss von etwa 140 Stadtplanerinnen, (Landschafts-)Architektinnen, Gleichstellungsbeauftragten und fachlich einschlägigen Professorinnen. Die Akteurinnen setzen sich mit der Verankerung des Leitprinzips „gender mainstreaming" in regionalen Planungs- und Gestaltungsprozessen auseinander, beteiligen sich bei der Umsetzung von Projekten und bieten eine Plattform für Kooperationen, Planungsbeteiligung und Kommunikation. Allem voran setzt sich das Netzwerk kritisch mit den Planungen im Ruhrgebiet auseinander und verfasst Stellungnahmen zu aktuellen Themen (Gleichstellungsstelle des RVR, o. J.). Der Wettbewerbsbeitrag ist charakteristisch für die undogmatische Herangehensweise des Frauennetzwerks.

Die Wohnportraits tragen eine explorative Handschrift. Dementsprechend ist die Stichprobe nicht-repräsentativ für die Grundgesamtheit – eine Ausweitung ist jedoch in Planung.[1] Dem Aufruf der Wohnportraits folgten in der ersten Runde des Projekts zunächst lediglich Frauen im Alter zwischen Ende 30 und Mitte 60 Jahren. Dabei wurden Texte und Fotos zu den drei Leitfragen

- Wie wohne und lebe ich heute?
- Was ist mir wichtig? sowie
- Wie möchte ich in Zukunft wohnen? (Perspektiven für 2030)

gesammelt. Verzerrungen, die durch die Interpretation oder Redaktion der Beiträge entstehen könnten, wurden minimiert. Entscheidende äußere Faktoren wie Einkommen, Partnerschaft oder Familie, Jobsituation etc. fanden nur insofern Erwähnung, als dass sie von den Teilnehmerinnen selbst als ausschlaggebend für ihr Wohnverhalten angesehen wurden. Die Aufgabe des Netzwerks bestand insbesondere in der Aktivierung der Teilnehmerinnen am Anfang des Projekts.

Umgangssprachlich verfasste Wohnberichte haben einen besonderen Stellenwert, da sie die Individualität der ‚Stimme' betonen. Wer darf sprechen? Wessen Stimme hat Bedeutung? Diese unterrepräsentierte Stimme charakterisierte die Natur des Projekts. Sie zeigte nicht nur, wie der Bürger sein kann, für den die Stadtplanung ist, sie ‚emanzipierte' den Bürger auch von der grauen Masse der Bevölkerung, diente als individuelles Sprachrohr, Zeitdokument, verlieh Legitimität und geteilte Verantwortung in der Diskussion um die Zukunft der Region.

Im Vergleich zu anderen qualitativen Methoden wie dem Interview, kann der Befragte in den Wohnportraits eigenmächtig Schwerpunkte setzten – Abstand zum Geschriebenen nehmen – revidieren. Etwaige Revisionen können erläutert oder verschwiegen werden. Weiterhin ist die Autorin oder der Autor vom Adressaten unmittelbar im Text verortbar. Die somit transporteierten Eindrücke unterliegen prinzipiell der Deutung des Lesers, der Leserin. Insofern wurden Texte lediglich im Hinblick auf Orthographie redigiert und autorisiert.

3.1.2 Wohnen im Revier – Ergebnisse aus den Wohnportraits

Bedingt durch ihr Engagement im Frauennetzwerk stammte die Mehrheit der Teilnehmerinnen des Pilotprojekts aus der mittleren Einkommensschicht mit einem unterdurchschnittlichen Ausländeranteil (n=10). Dennoch zeichnen die Wohnportraits eine breite Fülle an Wohnorten innerhalb des Landes Nordrhein-Westfalens aus. Allen Berichten war das Ruhrgebiet als Wohn- oder Arbeitsstandort gemein.

Im folgenden werden beispielhaft Aussagen aus dem Modelldokument (Gleichstellungsstelle des RVR 2013) aufgegriffen, die aufgrund der geringen Fallzahl nicht repräsentativ sind. Vielmehr dienen die Aussagen der

[1] Das Wohnportraitprojekt wird derzeit ausgeweitet, wobei die guten Erfahrungen mit den Teilnehmerinnen in einen breiteren Aufruf münden, sowohl was die Altersstruktur als auch das Geschlecht betrifft. Auch männliche Befragte verfassen derzeit ein Wohnportrait. Geplant ist es, weitere Gruppen wie beispielsweise Menschen mit Migrationshintergrund, die einen wesentlichen Anteil an der Bevölkerung ausmachen, miteinander zu vergleichen und in den Diskurs einzubinden. Die Fortführung des Projekts mit 20 weiteren Teilnehmerinnen und Teilnehmern wird im April 2014 abgeschlossen und kann von den Autorinnen bezogen werden.

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Beschreibung des Arbeitsprozesses und als Möglichkeitskosmos. Zur ersten Frage „Wie wohne und lebe ich heute?“ antwortete ein Teil der Teilnehmerinnen mit Eigentumswohnformen. Die übrigen Teilnehmerinnen wohnten in Mehrfamilienhäusern bzw. zur Miete. Daneben spielten auch parzellierte Wohnprojekte mit Eigentums- und Mietmöglichkeiten eine Rolle. Auch in der Bausubstanz fanden sich wesentliche Unterschiede. Vom traditionellen Zechenhaus über gründerzeitliche Bebauung bis hin zum Hochhaus reichte das Spektrum der Teilnehmerinnen. Über Anpassungen an Angehörige mit Handicaps wurde berichtet. Neben finanziellen Aspekten spielten Gemeinsinn, „der Charme des Hauses“, die familiäre Bindung an den Ort, Mobilitätsaspekte sowie die bauliche Infrastruktur eine ausschlaggebende Rolle für die Wohnortwahl.

Trotz minimaler formeller Vorgaben zur Beantwortung der Leitfragen herrschte ein allgemeines Bewusstsein vor, dass das Wohnumfeld immense Bedeutung habe. Die selbstkritische Analyse der Teilnehmerinnen war zum einen durch ihre Berufsbilder geprägt, zum anderen durch ihre individuelle Geschichte und Haltung, die das Projekt herausstellen wollte. So wurde auch das Vorhandensein von Sozialwohnungen (im Eigentum) oder die Rolle von multiethnischen Bezirken angesprochen: „Es ist spürbar, dass es wenig Kontakt zwischen den Kindern, Jugendlichen und Familien aus dem Mietwohnungsbau (sozialer Wohnungsbau) und den Eigentumswohneinheiten gibt, obwohl die Kinder gemeinsam in den Kindergarten und in die Grundschule gehen.“ (Gleichstellungsstelle des RVR 2013: 8) Auffällig war auch, dass allen Frauen die Familiengerechtigkeit der Wohnstätte (auch in den nachfolgenden Generationen) wichtig erschien. Außerdem wurden Problemfelder der altengerechten Planung thematisiert. Viele bekannten sich auch bei der letzten Frage „Welche Vision habe ich für 2030?“ zu altengerechten „bunten“ Bezirken, die stärker in das Leitbild der Region eingehen sollten. Die Texte, die allesamt aus der persönlichen Perspektive verfasst waren, konnten nachträglich zu sieben Themenbereichen der Planung zusammengefasst werden:

- Alltagstauglichkeit von Wohnung und Umfeld
- bezahlbarer Wohnraum und Wohnungsvielfalt
- kurze Wege zur Nahversorgung und Angebote der sozialen Infrastruktur
- gute Rad- und Fußwegeinfrastruktur
- gute Anbindung an Öffentliche Verkehrsmittel
- wohnungsnahe, nutzbare und unbelastete Grün- und Erholungsbereiche
- Räume und Netzwerke für gemeinsame Aktivitäten und bürgerschaftliches Engagement im Quartier

Daneben existierte der große Wunsch nach Zugehörigkeit zu einer Gemeinschaft (Abb. 2). Einige lösten diese Herausforderung im Alltag durch Entscheidungen für Wohnprojekte oder WGs. Eine Teilnehmerin äußerte diesbezüglich: „Der Stadtteil ist durch eine hohe soziale und kulturelle Vielfalt und ein dichtes Infrastrukturangebot gekennzeichnet. […] Ein engeres nachbarschaftliches Zusammenwohnen wäre ein […] weniger anstrengendes, kräftezehrendes Umfeld“.

Die wohl wichtigste Erkenntnis aus den Wohnportraits mit Signalwirkung für die Region blieb, dass der Bevölkerungs- und Imagewandel vieler Stadtquartiere, in denen Umbau- und Rückbaumaßnahmen vollzogen werden, individuell unterschiedlich erlebt wird (positiv – ablehnend – gleichgültig).

Es ließ darüber hinaus aktivistische Ansätze zur lebens-gestalterischen Auseinandersetzung mit Planungsthemen in den Vordergrund rücken: „Uns ist es wichtig, zukünftig die Qualitäten des Wohnens und des Lebensumfeldes in den Fokus zu rücken. Uns interessiert vor allem die Alltagstauglichkeit, verbunden mit der Fragestellung: Wie können wir negative Entwicklungen stoppen und positive Ansätze stärken?“ (Gleichstellungsstelle des RVR 2013: 3).

3.1.3 Die fotographische Stimme

Gute Erfahrungen wurden neben den Wohnportraits in Textform mit Fotografien als ergänzende Methode gemacht. Bis zu zehn Fotografien illustrierten die jeweiligen Beiträge. Die Methodik ist unter dem Titel „Photovoice“ aus dem kritischen Empiriekontext bekannt (Mitchell 2011). Die Idee, ‚Betroffenen‘ durch eigene Fotos die Möglichkeit einzuräumen beispielsweise ihren Sozialraum zu präsentieren geht auf Versuche zurück, ethisch-sensible Feldforschung im Globalen Süden zu betreiben. Unter ethisch vertretbarer Forschung wird ein Weg verstanden, bei dem Betroffene (Bewohnerinnen und Bewohner) erlittene

Missstände selbst fotografisch dokumentieren können und in den Publikationsprozess eingreifen dürfen, ohne für eine jeweilige wissenschaftliche Studie voyeuristisch ‚ausgebeutet' zu werden.

Abb. 2: Fotographie aus dem Wohnportrait „Innerstädtisches Wohnen zur Miete"

Die Motive der Fotographien konnten rückblickend gruppiert werden. Das Wohnen spiegelte sich in Aufnahmen der Eingangssituation, des Gartens, diverser Freizeitaktivitäten, von Geselligkeit, Kindern, Gastronomieeinrichtungen und Verkehr in der Wohnumgebung wider. Die Fotografien nahmen einen besonderen Stellenwert bei den Wohnportraits ein, da sie die Grenze zwischen subjektiver und objektiver Wahrnehmung durchbrachen. Insbesondere, da die Wohnportraits anonym verfasst wurden und keine Aufschlüsse über den Wohnort enthielten, bildeten diese eine gelungene Brücke zur objektiven Wohnwelt der Befragten.

4 FAZIT

Das Versprechen, sich dem Bürgerdialog zu öffnen, Kritik und persönliche Empfindungen zuzulassen, erhöht die Diversität in der Planung. Die Dialogform der Wohnportraits verdeutlicht, dass aufbauend auf dem Thema „Wohnen" alle Bürgerinnen und Bürger durch (implizites) Expertenwissen einen Beitrag zur regionalen Entwicklung leisten können. Der Universalitätsanspruch des ‚Planungsdiktats' führt hingegen nach Meinung der Autorinnen zur Entfremdung von der Disziplin. Ein Fokus des Netzwerk-Beitrags (Gleichstellungsstelle des RVR 2013) lag deshalb auf der Integration qualitativer Methoden in den Planungsprozess. Wohnportraits wurden hierbei als wichtige Brücke zwischen institutioneller Planung und individuellen Wohnwünschen identifiziert.

Als Ziele bei der Implementierung von innovativen Methoden in der Planung beschreibt der vorliegende Beitrag:

- die Einbettung von außerkanonisch-kreativen Methoden in einen breit angelegten interdisziplinären Planungsprozess, der auf größtmögliche Inklusion aller Akteurinnen und Akteure abzielt;
- eine Auseinandersetzung mit kritischen Bürgerwünschen frühzeitig zuzulassen sowie eine Bühne für engagierte Bürgerinnen und Bürger zu schaffen sowie
- die Bereitschaft zur Dokumentation und weiterem Dialog.

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Unter Anleitung der Gleichstellungsstelle des Regionalverbandes Ruhr dienen die Wohnportraits in der Leitbildgestaltung der Metropolregion Ruhr „2030“ als tragfähige Option zur frühzeitigen Einbeziehung smarter Bürger. Durch den zweistufigen Aufbau aus (1) Selbstverortung sowie (2) der Identifikation von Schwerpunktthemen in der individuellen Wohnsituation kann ein Rückschluss auf unterrepräsentierte Themen bei der Leitbildgestaltung der Region vollzogen werden. Die Rückbesinnung auf Einzelstimmen im Planungsdiskurs ermöglicht zugleich einen Dialog ‚auf Augenhöhe‘, eine bessere Verständigung der Bürger untereinander (allgemeinverständliche Sprache) und Distanz zu bestehenden Paradigmen, um diese zu bestätigen oder zu revidieren.

Zusätzlich zu den genannten Chancen der Methodik verweisen die Autorinnen auf die Relevanz zukünftiger Anwendungsversuche der Methodik. Als offene Fragen hierfür können folgende Anhaltspunkte dienen:

(1) Welche unterschiedlichen Aspekte oder Gemeinsamkeiten können im Laufe der Arbeit mit verschiedenen Gruppen identifiziert werden?

(2) Welche Aktionsschritte folgen bei den Teilnehmerinnen und Teilnehmern kurz- und langfristig auf die Selbstporträts und welches Echo hat dies auf die Planung?

(3) Welche Schritte der Bewusstseinsbildung können vor/durch die Teilnahme an den Wohnportraits bei Personen, die sich nicht im professionalen Rahmen mit Planung auseinandersetzen, erzielt werden?

(4) Welche Zeitdauer erweist sich als sinnvoll, um Einstellungen und Ansichten langfristig abzufragen (Standpunkte im Wandel)?

(5) Repräsentativitätsaspekte: Wie kann entschieden werden, wer als Teilnehmer in Frage kommt?

Abschließend erhoffen sich die Verfasserinnen weitere Erkenntnisse aus dem bestehenden Arbeitsprozess an Folge-Wohnportraits mit anderen Bevölkerungsgruppen.

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Mobilstationen – Bausteine für eine zukunftsfähige Mobilität in der Stadt

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1 ABSTRACT

For making our cities and regions more attractive, clean, competitive and liveable, solutions for an intelligent urban mobility are necessary. Urban transportation and traffic developments all over the world show the huge demand for solutions in this field. Future urban mobility is based on an intermodal traffic system, which allows people flexible and multimodal travelling within the city. Therefore the capacity of public transportation as the backbone of urban traffic systems has to be extended for individual traffic modes. The integration of the motorised individual traffic and cycling – both also provided as sharing offers – will be one important factor. Not only technological innovations extend the opportunities of travel mode choice. A key factor is the focus on the user and its lifestyle-related mobility preferences, since functionality, sensible integration in urban fabric accompanied by a user-centred design and the easy access to mobility offerings are two important aspects in terms of usability. Developing mobility stations at strategically relevant traffic nodes – including at least two forms of public transport – is beside others one of the measures recommended by the International Association of Public Transport (UITP 2012: 22). Due to its function and visibility within the urban space mobility stations could serve as the physical expression of future mobility.

The central idea of a mobility station is the structural and spatial connection of functionality and design. As an important interface of public transportation and individual traffic modes the station needs to be organised as good as possible. Thus the size respectively the quality and quantity of features and offerings of each station depend on its location within the city. A basic requirement of mobility stations is the connection between different modes of transport including the availability of environmental-friendly forms of mobility. A sensible integration in the urban context along with a recognizable design of mobility station areas is the basis for developing an attractive urban space of high quality, which also serves as meeting point for people living in the neighbourhood and as a place of arriving, departure or change. Therefore mobility stations can in a second dimension serve as Bausteine to improve urban quality by reshaping the former traffic space.

2 EINLEITUNG

Der Verkehr in urbanen Regionen sieht sich aktuell mit erheblich veränderten Rahmenbedingungen und Anforderungen konfrontiert. Dazu zählen vor allem Themen wie die Erneuerung und effiziente Bewirtschaftung von Verkehrsinfrastrukturen, Klimaschutz und Klimaanpassung sowie auch Aufgaben, die aus der Energiewende resultieren. Hinzu kommen unter anderem auch der demografische Wandel und die allgemeinen Problemlagen der öffentlichen Haushalte. Dem Gegenüber stehen Entwicklungstrends, die seit einiger Zeit insbesondere die Mobilitätskultur vieler Stadtbewohner revolutionieren: Das Prinzip „Teilen statt Besitzen" einer neuen Sharing-Economy-Generation zählt ebenso wie sich ändernde Ansichten zu Konsumverhalten und einem – in der westlichen Welt – ressourcenverschwendenden Lebensstil dazu. Immer mehr Stadtbewohner fordern ihr Recht auf Stadt ein. Die Straße als einer der wichtigsten öffentlichen Räume der Stadt wird in der Wahrnehmung ihrer Bürger immer öfter zur Verkehrsabwicklungsfläche ohne urbane Qualitäten. Vielerorts kann die Straße ihre ursprünglichen wichtigen Funktionen nicht mehr erfüllen. Diese Entwicklungen bieten die Chance, mithilfe von Umgestaltungen innerhalb des urbanen Mobilitätssystems Anstöße für eine zukunftsfähige Mobilität zu geben.

3 INTERDISZIPLINÄRES FORSCHUNGSPROJEKT: NEUE MOBILITÄT FÜR DIE STADT DER ZUKUNFT

Die Komplexität der Wechselwirkungen der eingangs genannten Aspekte erfordert eine integrierte Betrachtung unterschiedlicher Disziplinen. Insbesondere die verkehrlichen Aspekte dürfen nicht mehr isoliert betrachtet werden. Die klassische Verkehrsplanung mit ihren weitestgehend quantitativen Methoden und Werkzeugen ist der Diversität zukunftsorientierter Mobilitätskultur allein nicht mehr gewachsen. Auch in aktuellen Regelwerken wie in denen der Forschungsgesellschaft für Straßen- und Verkehrswesen (FGSV)

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sind zwar innovative Ansätze für fußgänger- und radverkehrsfreundliche Straßenräume enthalten, doch eine konsequente planungspraktische Umsetzung bleibt bisher aus bzw. findet nur selten statt.

Fig. 1: Forschungsansatz des Forschungsprojektes „Neue Mobilität für die Stadt der Zukunft“

Das vom Institut für Stadtplanung und Städtebau der Universität Duisburg-Essen durchgeführte Forschungsprojekt „Neue Mobilität für die Stadt der Zukunft“[1] versucht diesem Erfordernis durch eine integrierte Betrachtungsweise von Stadt- und Verkehrsplanung sowie der wichtigen sozialwissenschaftlichen Komponente gerecht zu werden und zeigt Handlungsansätze für die urbane Mobilität der Zukunft auf (Fig. 1). Durch diesen innovativen Betrachtungsansatz war es möglich, die unterschiedlichen Stadträume der Untersuchungsstadt Essen differenziert zu betrachten und im Laufe der Forschungen unterschiedliche Maßnahmenpakete für die Stadtbereiche herauszuarbeiten. Dabei spielte neben stadtstrukturellen Aspekten, verkehrlichen Potenzialen ebenso auch die Verteilung der verschiedenen Lebensstilgruppen und deren spezifischen Mobilitätspräferenzen eine wichtige Rolle.

Stadträume einer jeden Stadt sind unterschiedlich und erfordern eine differenzierte Sichtweise, will man ihre jeweiligen „Begabungen“ für die Mobilität nutzen und fördern. Eine typisierende Beschreibung des Stadtraumes hilft dabei, die vielfältigen baulichen, raumstrukturellen Merkmale nutzbar zu machen. Der Stadtraumtypenansatz basiert im Grundsatz auf der Annahme, dass bestimmte Gebiete des Siedlungsraumes meist durch eine weitgehend homogene Baustruktur gekennzeichnet sind. Im Fokus der Forschungsarbeit wurde auf gesamtstädtischer Ebene eine Stadtraumtypologie entwickelt, die Merkmale wie stadtstrukturelle Lage, Gebäudetypologien und charakteristische Straßenkategorien sowie die Qualität des ÖPNV unterscheidet. So kann die Stadt in unterschiedliche Bereiche unterteilt werden, die jeweils bestimmte strukturelle Charakteristika aufweisen. Die Stadtraumtypologie ist hierbei von doppeltem Nutzen: Zum einen lässt sich auf Grundlage der Analyseergebnisse beispielhaft an verschiedenen Interventionsbereichen untersuchen, wie die Zukunft der Mobilität auf Quartiersebene entworfen werden kann. Zum anderen kann mit einer belastbaren Typologie gewährleistet werden, dass grundsätzliche Strategien auf vergleichbare Stadträume in Essen und mit Einschränkungen auch auf andere Städte übertragbar sind. Das entspricht dem Anspruch des Projektes, Strategien nicht nur für die Stadt Essen zu entwickeln, sondern grundsätzlich übertragbare Ansätze zu entwickeln.

Am Beispiel eines Gründerzeitquartiers wird urbane Mobilität im Jahr 2030 dargestellt. Hier treffen unterschiedliche Mobilitätsformen auf engem Raum aufeinander, Bus, Straßenbahn- und U-Bahnlinien sowie eine wichtige radiale Verkehrsachse im Stadtverkehr stellen ein attraktives Angebot für die Stadtbewohner dar. Die öffentlichen Räume sind im Vergleich zu anderen Stadtquartieren attraktiv gestaltet. Die Verkehrssimulationen weisen bis auf den ÖPNV und Elektroautos im Privatbesitz weitere Substitutionspotenziale von MIV- Wegen auf. Besonders gilt dies für Fußgänger und den Radverkehr. Auch

[1] Die folgenden auf das Forschungsprojekt bezogenen Aussagen lassen sich vertiefend im Abschlussbericht des Projektes wiederfinden. Der Volltext ist verfügbar unter: www.uni-due.de/staedtebau.

durch Sharing-Angebote kann in diesem Bereich noch ein beträchtlicher Anteil an Wegen, die sonst mit dem MIV durchgeführt werden, ersetzt werden. Hinsichtlich der Lebensstile der Bewohner des Stadtquartiers zeigt sich ein Übergewicht von modernen Lebensstiltypen und Personen mittleren Alters, die in besonderem Maße Sharing-Angebote befürworten. Auch der Radverkehr wird von dieser Gruppe positiv bewertet. Diese Potenzialanalysen stellten die Grundlage für die Formulierung verschiedener Maßnahmen dar, die in der Summe beispielhaft zeigen, wie die Mobilitätsvisionen im Jahr 2030 in einem integrierten Ansatz von Stadtplanung, Verkehrsplanung und Sozialwissenschaften entwickelt werden und letztlich zu einem Gewinn an Lebensqualität für die Stadtbewohner beitragen können. Die Einrichtung von multimodalen Mobilstationen an strategisch wichtigen Verknüpfungspunkten ist dabei eine der Maßnahmen, die innerhalb des Forschungsprojektes zur Umsetzung vorgeschlagen werden. Mobilstationen können aufgrund ihrer Funktion und Präsenz im Stadtraum als gebauter Ausdruck einer neuen Mobilität fungieren und wesentliches Element eines zukunfstfähigen Mobilitätssystems darstellen.

4 MOBILSTATIONEN ALS MULTIOMODALE VERKNÜPFUNGSPUNKTE

Grundlegende Komponente von Mobilstationen bilden die unterschiedlichen Verkehrsträger des ÖPNV. Die gleichzeitige Berücksichtigung einer hohen Aufenthaltsqualität und ergänzende Nutzungen im Umfeld lassen eine hohe Zentralität erwarten und machen Mobilstationen zu attraktiven Orten des alltäglichen Lebens innerhalb von Stadtquartieren. Wesentlich dabei ist die gute Sichtbarkeit im Stadtraum sowie die Platzierung an städtebaulichen markanten Situationen – bestenfalls an Plätzen. Außerdem ist eine Anbindung an Fahrrad- und Fußwegenetze unbedingt zu beachten. Abhängig von der Lage im Stadtraum, der Frequentierung und des Bedarfs ist es erforderlich die Quantität der einzelnen Angebote für jeden einzelnen Standort zu prüfen und deren Umfang anzupassen. Elementares Merkmal ist der Übergang bzw. die Verknüpfung unterschiedlicher Verkehrssysteme, die zum einen den ÖPNV und zum anderen die Verfügbarkeit von umweltfreundlichen Mobilitätsformen für den individuellen Gebrauch mit einschließt. Die reine Abwicklung des Verkehrs steht bei einer Mobilstation nicht im Vordergrund. Verkehrsplanerische Vorgaben geben zwar einen Rahmen, doch stehen vor allem Anforderung und Grundsätze des Städtebaus und der Stadtgestaltung im Vordergrund. Eine logische Einbindung in den städtebaulichen Kontext ist die Grundlage für die Schaffung eines attraktiven und belebten Ortes, der als Ankunfts-, Abfahrts- und Umsteigeort sowie als Treffpunkt für das umliegende Quartier dient. Die Größe und Ausstattung von Mobilstationen ist dabei abhängig von ihrer Lage im Stadtraum.

4.1 Weiterentwicklung zu Mobilstationen der “zweiten Generation”

Mobilstationen sind grundsätzlich keine neue Erfindung, jedoch variieren bestehende Beispiele neben ihrer konkreten Begriffsbezeichnung[2] vor allem im Hinblick auf ihre städtebauliche Integration und Ausstattung. Ein gutes Beispiel für eine funktionale Erweiterung von Haltestellen des ÖPNV sind die sogenannten *mobil.punkte* der Stadt Bremen. Die Förderung von Car-Sharing steht hierbei im Vordergrund, will die Stadt doch bis zum Jahr 2020 20.000 Car-Sharing Nutzer erreichen. Evaluationen zeigen bereits, dass die Autos seltener und rationaler genutzt werden. Beim Wechsel vom eigenen Auto auf das Carsharing-Angebot verringert sich im Durchschnitt die jährliche Fahrleistung um die Hälfte (SRL und VCD 2010: 1). Zwar kann am Beispiel Bremen gezeigt werden, inwiefern eine funktionale Erweiterung von bestehenden Verknüpfungspunkten sinnvoll gelingen kann, doch beschränkt sich diese Erweiterung überwiegend auf den konsequenten Ausbau von Car-Sharing-Stationen.

Doch gerade aktuellere Beispiele machen deutlich, dass eine Weiterentwicklung bestimmter Merkmale erfolgt ist und eine zweite Generation von Mobilstationen erkennbar wird. Deutlich wird dies vor allem durch eine Konzentration auf den gestalterischen Anspruch und einer städtebaulichen Integration der baulichen Erweiterungen. Dies verdeutlicht beispielsweise der gegenwärtig in der Umsetzung befindliche Aufbau eines Netzes von Mobilstationen in Offenburg. In der ersten Aufbaustufe sind sechs Mobilstationen im Stadtgebiet vorgesehen, in einer weiteren Ausbaustufe sollen alle Stadt- und Ortsteile Mobilstationen erhalten. Die Mobilstationen sind zum einen so zu gestalten, dass sie im gesamten Stadtgebiet als ein System erkannt werden und sich dadurch vom Straßenraum deutlich abheben. Die eingesetzen Module (wie etwa

[2] Der Begriff “Mobilstation” ist in der gegenwärtig verfügbaren Litertaur nicht abschließend definiert. Es ist daher davon auszugehen, dass mit Bezeichnungen wie etwas Mobilitäts-Hub, Mobilitätsstation, Mobilpunkt oder etwa Verknüpfungsanlage letztlich ähnliches thematisiert wird.

überdachte Car-Sharing Stellplätze mit PV-Anlagen, Fahrradboxen, oder ein Kiosk) sollen sich laut Umsetzungskonzept durch ihre an die räumliche Situation angepasste Anordnung in das schon existierende städtebauliche Ambiente einfügen (Kassel 2013: 62). Die konzeptionellen Ideen lassen erste Ansätze erkennen, Mobilstationen als städtebauliche Elemente bzw. *Bausteine* zu begreifen, die damit einen Grundstein für eine zukunftsfähige urbane Mobilität darstellen könnten.

4.2 Netzhierarchie und Kategorisierung

Der Ansatz der Entwicklung einer Netzhierarchie lässt sich methodisch anhand einer Kategorisierung von Verknüpfungsanlagen[3] ableiten (FGSV 2009: 7). Eine funktionale Gliederung von Verknüpfungsanlagen ermöglicht eine Unterteilung in verschiedene Funktionsstufen sowie die Ausdifferenzierung der Gestaltungs- und Ausstattungsmerkmale. Auf Grundlage dieses Ansatzes lässt sich für die Ebene von Städten und/oder Stadtregionen eine Netzhierarchie von Mobilstationen definieren. Eine zielführende Kategorisierung in die drei Größen S,M und L (Fig. 2 u. 3) ergibt sich maßgeblich aus der Qualität der vorhandenen Verknüpfungspunkte in Verbindung mit deren Lage im Stadtraum.

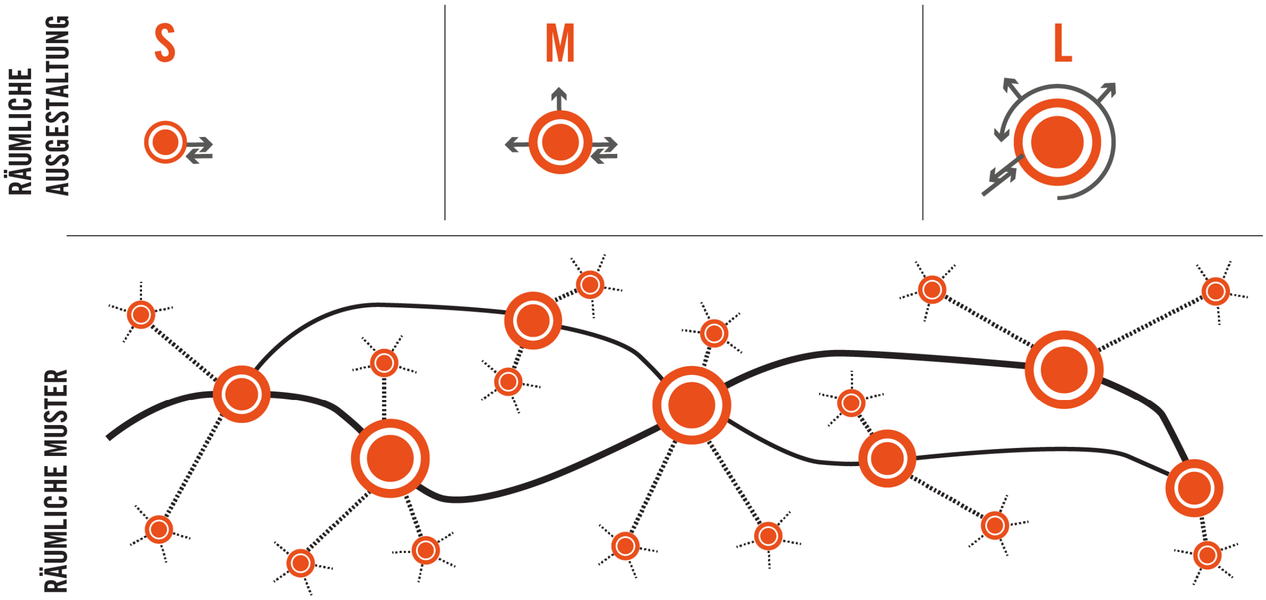

Fig. 2: Netzhierarchisierung von Mobilstationen in die Größen S,M und L

Neben verkehrsmittelabhängigen Anforderungen, die es an die unterschiedlichen Hierarchiestufen der Mobilstationen gibt, bestehen vor allem grundsätzliche Anforderungen im Hinblick auf die Gestaltung (FGSV 2009: 15). Zusammen mit einer flächendeckenden Barrierefreiheit, einer guten Erreichbarkeit, einer räumlichen Kompaktheit, Informations und Orientierungshilfen sowie weiteren wichtigen Aspekten steht die Aufenthaltsqualität im Fokus von Mobilstationen der zweiten Generation. Die Gestaltung der Mobilstationen beschränkt sich dabei nicht nur auf den engeren Bahnhofs- bzw. Haltestellenbereich. Eine zielführende Entwicklung muss sowohl die Zu- und Abgänge als auch angrenzende Quartiere miteinbeziehen, da sie die Funktion von Mobilstationen maßgeblich mit beeinflussen (Zemp 2012: 7).

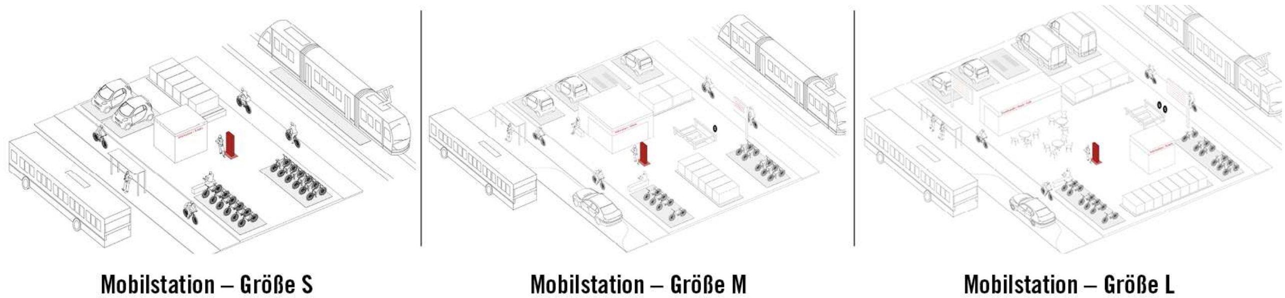

Fig. 3: Aufbau von Mobilstationen in den Größen S,M und L

[3] Eine Verknüpfungsanlage ist eine Betriebsanlage des öffentlichen Personennahverkehrs, in der die Fahrgäste zwischen Verkehrsmitteln und Linien umsteigen können (FGSV 2009: 6)

5 FAZIT UND AUSBLICK

Das mit der Errichtung von Mobilstationen verbundene Ziel ist es, diese Orte der Verknüpfung im kollektiven Bewusstsein mit einer „Mobilitätsgarantie“ zu assoziieren und somit mittelfristig das routinierte Verkehrsverhalten zu beeinflussen. Sie stellen aus städtebaulicher Sicht ein neues Element dar, das nicht nur auf einer technischen Ebene Verkehrsträger sinnvoll und effektiv miteinander verknüpft, sondern auch öffentlichen Raum neu strukturieren und damit aufwerten kann.

Die Errichtung von Mobilstationen kann darüber hinaus als ein gesamtstädtischer Ansatz zur Förderung von Elektromobilität begriffen werden (Aichinger 2014: 55). Fahrzeuge, die batterieelektrisch betrieben werden, tragen zwar – sofern sie mit erneuerbaren Energien aufgeladen werden – zu einer Reduktion von Lärm- und Schadstoffemissionen bei (Baum et al. 2012: 70; Firnkorn und Müller 2012: 265). Die Flächeninanspruchnahme bleibt aber unabhängig von der Antriebsart bestehen (Dross et al. 2012: 56). Einen interessanten und vielversprechenden Ansatz stellt der Einsatz von Elektroautos im Car-Sharing dar und ist gleich aus mehreren Gründen vorteilhaft. So können zum Beispiel die hohen Batteriepreise und damit verbundenen Fixkosten aufgrund der effizienteren Nutzung des Autos auf mehrere Nutzer umgelegt werden (Firnkorn und Müller 2012: 265). Gleichzeitig wird mit einer verstärkten Bereitstellung solcher Angebote den eingangs angedeuteten gesellschaftlichen Entwicklungen Rechnung getragen. So können Mobilstationen einen bedarfsgerechten Aufbau öffentlicher und halböffentlicher Ladeinfrastruktur begünstigen und so einen Beitrag für die erfolgreiche Einführung von Elektromobilität leisten. Gleichzeitig können auf der Grundlage dezidierter Standortkonzepte die oftmals punktuellen Ladepunkte des elektromobilen MIVs zu intermodalen Schnittstellen gedacht werden.

Durch die Errichtung eines attraktiven Netzes von Mobilstationen soll den oben genanten Herausforderungen begegnet werden. Basierend auf einem intelligenten Standortkonzept kann in einem ersten Schritt die Hierarchisierung des Netzes erfolgen, bevor dann die schrittweise Umsetzung der Stationen vorangetrieben wird. Der Umbau von vorhandenen Verknüpfungspunkten des ÖPNV könnte zum einen durch die vernetzte Angebotserweiterung weiterer Mobilitätsformen – einschließlich Infrastruktur für elektromobile Verkehrsmittel wie etwa die Bereitstellung einer eigenen Stromversorgung über PV-Anlagen und (induktive) Lademöglichkeiten für E-Fahrzeuge – verbunden mit einer städtebaulichen Aufwertung durch beispielsweise der Schaffung von attraktiven Platzstrukturen als wichtiger Treiber der Elektromobilität wirken. Mobilstationen in ihren unterschiedlichen Hierarchiestufen können so als *Bausteine* betrachtet werden, mit denen gegenwärtige, dem Auto begünstigende Verkehrsräume menschengerecht umgestaltet werden und somit zu städtebaulichen Aufwertungen führen können. Nicht zuletzt kann dadurch eine neue, umweltfreundliche Mobilitätskultur aktiv gefördert werden und folglich zu mehr Lebensqualität in den Städten beitragen.

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Modellierung raum-zeitlicher Bevölkerungsverteilungsmuster im Katastrophenmanagementkontext

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1 EINLEITUNG

Effektives Katastrophenmanagement erfordert möglichst genaue raum-zeitliche Informationen sowohl über Strukturen als auch über betroffene Personen. Während physische Strukturen sich in der Regel nur langsam verändern und daher auf kurze Sicht weniger zeitkritisch in der Erfassung sind, ist die räumliche Verteilung der Bevölkerung hochgradig variabel über die Zeit (Freire und Aubrecht 2012). Die direkte Erfassung potentiell betroffener Personen bei Katastrophen ist nicht oder nur sehr eingeschränkt möglich, daher wird bei der Planung vorbeugender Maßnahmen und der Abschätzung des Gefahrenpotentials die Bevölkerungsverteilung modelliert.

Zensusdaten stellen dabei eine standardisierte Datengrundlage dar, die aber in zweierlei Hinsicht limitiert ist. Zum einen ist die räumliche Ausdehnung der Zählsprengel meist zu groß und unregelmäßig um auf lokaler Ebene ausreichend genaue Aussagen über die betroffenen Personen machen zu können, zum anderen repräsentiert der Zensus die Verteilung der Wohnbevölkerung, also den Ort, wo sich die Personen in der Regel in der Nacht aufhalten. Naturgefahren (und deren Auswirkungen) können räumlich sehr fein differenziert, sowie teils ohne Vorwarnung zu einem beliebigen Zeitpunkt auftreten. Es besteht daher die Notwendigkeit, Information zur Bevölkerungsverteilung sowohl in einem räumlichen Kontext zu verfeinern als auch die zeitliche Komponente mitzuberücksichtigen (Aubrecht et al. 2012).

2 MODELLIERUNG

Um die räumliche Repräsentation zu standardisieren wird zumeist ein regelmäßiges Raster als Referenz herangezogen. Die Umverteilung der Bevölkerung von administrativen Einheiten auf dieses Raster erfolgt dabei mittels Methoden der räumlichen Disaggregation (Eicher und Brewer 2001). Für die Zuordnung der Bevölkerung auf die Rasterzellen wird in der Regel Landnutzungsinformation verwendet (Aubrecht und Steinnocher 2007). Ergebnis dieser Disaggregation ist eine räumlich differenzierte Verteilung der Bevölkerung, die sich allerdings auf die zeitliche Dimension der Eingangsdaten beschränkt.

Die Modellierung der Bevölkerung über einen Zeitraum – etwa einen Tag – erfordert eine zusätzliche Differenzierung der Eingangsdaten. Zensusdaten alleine geben dabei keine Auskunft über die raum-zeitliche Variation der Bevölkerung. Benötigt wird vielmehr eine Aufschlüsselung der Bevölkerung nach Erwerbstätigen und nicht-Erwerbstätigen, Pendlern, Schülern, etc. sowie Aktivitätsmuster dieser Gruppen über den Tagesverlauf (Bhaduri 2008). Dazu gehört etwa, dass Pendler vor allem zu den Tagesrandzeiten auftreten, Erwerbstätige untertags im Büro sind, etc. Diese Aktivitätsmuster können in Form von Funktionen definiert werden und dann in das Modell einfließen. Die Granularität des zeitlichen Modells ist theoretisch beliebig (Aubrecht 2013), in der vorliegenden Studie wird im Stundentakt modelliert. Die Disaggregation erfolgt dabei pro Zeiteinheit, wobei die Bevölkerungsgruppen gemäß ihrer Aktivitätsmuster auf unterschiedliche Landnutzungseinheiten verteilt werden.

Das entwickelte Modell basiert im ersten Schritt auf drei Bevölkerungsgruppen:

- *Work (W):* repräsentiert die werktätige Bevölkerung
- *Commuters (C):* repräsentiert die Pendler zum Zeitpunkt des Ein- und Auspendelns
- *Home (H):* repräsentiert die restliche Bevölkerung

Obwohl diese Einteilung eine starke Vereinfachung darstellt, ist sie deutlich differenzierter als die Verortung der Bevölkerung nur über Wohnorte. In diesem Zusammenhang benötigt die Gruppe der Pendler spezielle Beachtung, weil sie keine eigenständige Menge der Gesamtbevölkerung, sondern eine Untergruppe aller Werktätigen ist; d.h. Pendler sind Werktätige auf dem Weg zur oder von der Arbeit.

Um die Bevölkerungsgruppen räumlich verteilen zu können, bedarf es korrespondierender Landnutzungseinheiten. Diese umfassen Büro-, Gewerbe- und Industriegebiete für die werktätige

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Bevölkerung, Straßen- und Bahnnetzwerke für die Pendler und Wohngebiete für die restliche Bevölkerung. Die räumliche Zuordung erfolgt über regelmäßige Raster, die die angesprochenen Nutzungseinheiten prozentuell repräsentieren. Eine Zelle kann daher auch mehrere Nutzungsarten umfassen, wobei die Gesamtnutzung 100% nicht überschreiten sollte.

3 IMPLEMENTIERUNG

Im Rahmen des EU-FP7 Projektes CRISMA (www.crismaproject.eu) wird ein solches raum-zeitliches Bevölkerungsmodell entwickelt, wobei auch Schnittstellen mit anderen zusammenhängenden Modellen (z. B. Evakuierungsmodellen) berücksichtigt werden (Aubrecht et al. 2014). Die Implementierung erfolgt auf Basis von *emikat.at*, einem von AIT entwickelten Datenmanagementsystem.

emikat.at ist ein internetfähiges Client-Server System und erlaubt es verteilt agierenden Expertenteams, die für die Modellierung benötigten Daten dokumentiert und historisch nachvollziehbar in Versionen zu sammeln und zu verwalten. Aufbauend auf diesen Modelldaten unterstützt *emikat.at* die Erstellung von umfangreichen Modellen zur Berechnung von Schlüsselfaktoren auf räumlicher und zeitlicher Basis. Ergebnisse der Modellberechnung können wiederum über verschiedene Auswertungsmodelle nach unterschiedlichen Fragestellungen als Tabellen und Grafiken präsentiert und über offene Schnittstellen (OGC-WFS, OGC-WMS, OGC-WCS) für andere Anwendungen verfügbar gemacht werden.

Ein wesentliches Element von *emikat.at* ist auch der integrierte Szenario-Manager, der es erlaubt, verschiedene Zeitpunkte und Versionen gegenüberzustellen, um damit den Entscheidungsträgern “Was-wäre-wenn-Analysen“ zu ermöglichen. *emikat.at* wurde ursprünglich für die Emissionskataster-Berechnung von österreichischen Bundesländern entwickelt. Derzeit erfolgt eine Erweiterung auf andere Anwendungs-bereiche, wie beispielsweise hier für den Bereich Krisenmanagement.

4 ANWENDUNG

Die ersten Anwendungen basieren auf Testdaten des Bezirks Baden in NÖ und modellieren Erwerbstätige, nicht-Erwerbstätige und Pendler im Tagesablauf. Als Grundlage für die Bevölkerungsgruppen wurde auf Daten aus Bezirks- und Gemeindestatistiken zurückgegriffen. Die Wohnbevölkerung und die Beschäftigten stehen auf Gemeindeebene zur Verfügung, Informationen über Pendler liegen nur auf Bezirksebene vor. Da die Informationen jedoch alle auf Gemeindeebene benötigt werden, wurden die Ein- und Auspendler für die einzelnen Gemeinden geschätzt.

Die Gesamtbevölkerung wird zunächst in Erwerbstätige und Nicht-Erwerbstätige geteilt, wobei die Erwerbstätigen zum Teil in der Gemeinde, zum Teil außerhab der Gemeinde arbeiten. Diese Anteile werden über die Ein- und Auspendlerzahlen sowie über die Anzahl der Beschäftigten pro Gemeinde geschätzt. Daraus ergeben sich die drei Parameter werktätige Bevölkerung (*W*), Bevökerung zu Hause (*H*) und Pendler (*C*). Die Verteilung dieser Gruppen über den Tag wird über Aktivitätsfunktionen festgelegt. In der Nacht befindet sich die gesamte Bevölkerung zu Hause, im Laufe des Morgens sinkt der Anteil dieser Gruppe auf den Wert (H), im gleichen Masse steigt der Anteil der Gruppe der arbeitenden Bevölkerung auf den Wert (W). Am Abend kehrt sich dieser Prozess um. Problematischer ist der Umgang mit den Pendlern, da diese nur temporär am Morgen und am Abend auftreten.

Abb. 1 zeigt eine solche Aktivitätsfunktion einer Gemeinde für einen Wochentag im Stundentakt. Das Absinken der Absolutzahl der Gesamtbevölkerung im Laufe des Tages deutet an, dass es sich um eine Auspendlergemeinde handelt. Die Anzahl der Beschäftigten in der Gemeinde (W) ist gering. Die Pendlerzahlen ergeben sich aus der Differenz von Nacht- und Tagbevölkerung und werden auf einen Zeitraum von 6:00 bis 9:00 Uhr sowie 17:00 bis 20:00 Uhr verteilt.

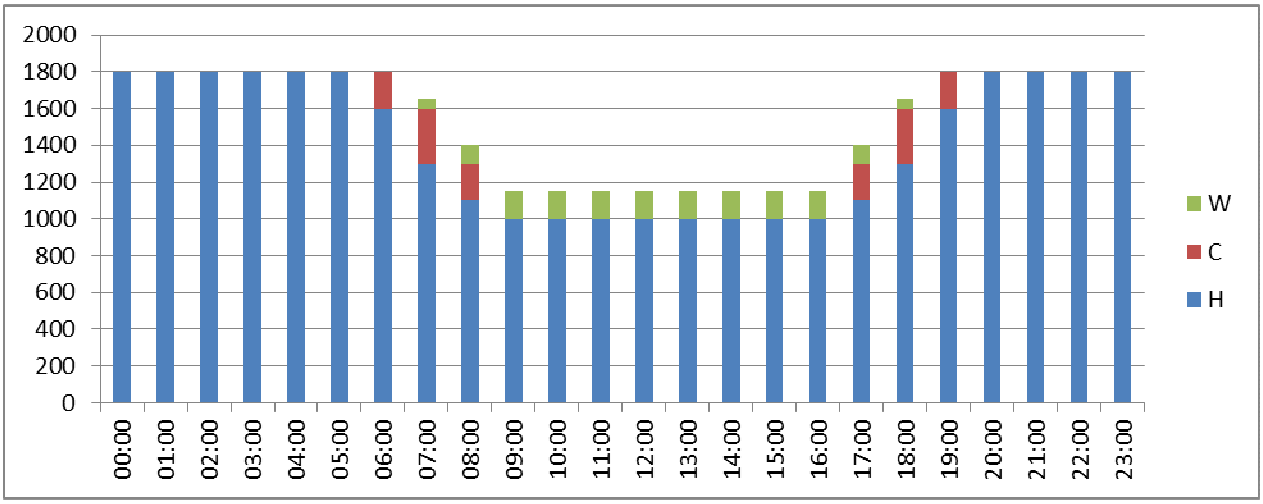

Abb. 1: Aktivitätsfunktion der Bevölkerung einer Gemeinde

Die solcherart für die Gemeinde errechneten Bevölkerungsmuster werden auf die korrespondierenden Landnutzungseinheiten disaggregiert. Als Grundlage wurde ein Rasterlayer herangezogen, der den Grad der Versiegelung repräsentiert (Steinnocher et al. 2011). Büro-, Gewerbe- und Industriegebiete wurden einerseits über CORINE land cover (CLC 2006) ausmaskiert und zusätzlich über Firmenstandorte definiert. Dadurch konnten auch kleinere Gebiete als teilweise betrieblich genutzt ausgewiesen werden. Letztlich wurden Verkehrsnetzwerke höherer Ordnung mit den Daten verschnitten. Das Ergebnis ist in Abb. 2. dargestellt.

Die Disaggregation der Bevölkerungsgruppen erfolgt pro Stunde, es werden daher 24 Rasterlayer mit unterschiedlicher Bevölkerungsverteilung pro Tag erzeugt. Abb. 3 und 4 zeigen zwei dieser Bevölkerungslayer, einen für drei Uhr nachts und einen für drei Uhr nachmittags. Deutlich zu sehen sind die Unterschiede in den Ortszentren, die als Büro- und Gewerbegebiete untertags mehr Bevölkerung aufweisen als in der Nacht. Auch das unterschiedliche Verkehrsaufkommen dokumentiert sich in der stärkeren Auslastung der Straßen untertags.

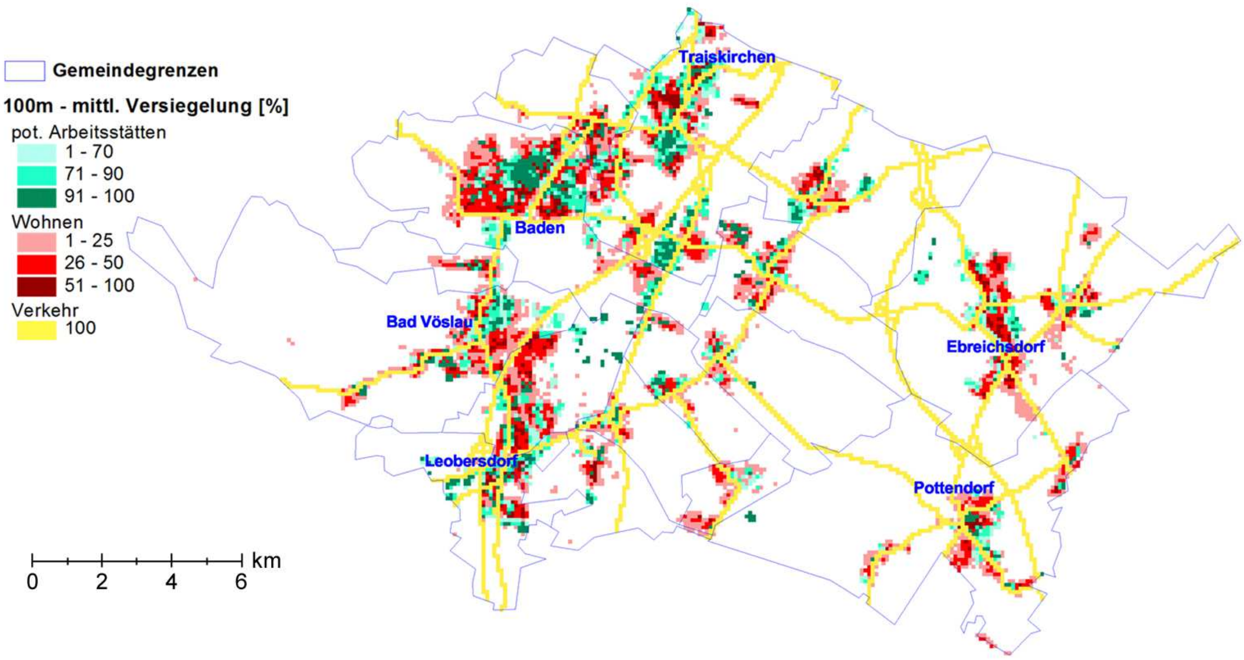

Abb. 2: Rasterlayer mit den drei Landnutzungseinheiten: Wohnen (rot), Arbeiten (grün), Verkehr (gelb)

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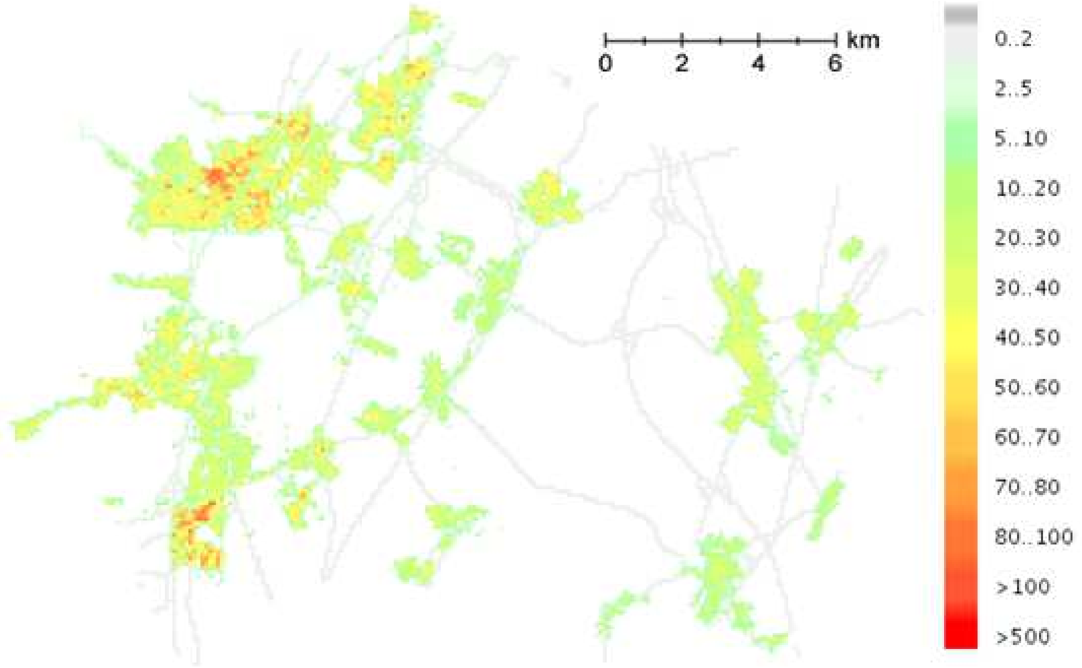

Abb. 3: Bevölkerungsverteilung um 3:00 Uhr

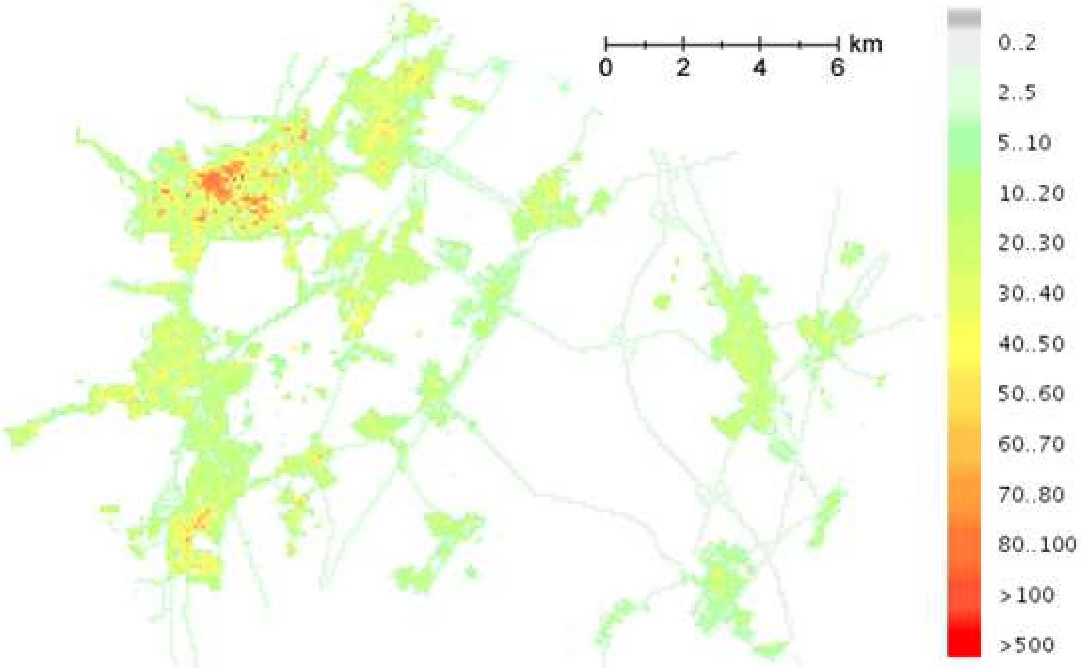

Abb. 4: Bevölkerungsverteilung um 15:00 Uhr

5 DISKUSSION UND AUSBLICK

Die vorliegende Studie zeigt die ersten Resultate einer raum-zeitlichen Bevölkerungsmodellierung. In Ergänzung zur räumlichen Verteilung der Bevölkerung, wie sie bei räumlichen Disaggregationsansätzen erreicht wird, berücksichtigt die vorgestellte Methode auch die zeitliche Variation der Bevölkerung innerhalb eines Tagesablaufes. Die Herausforderung liegt in erster Linie – wie meist bei Disaggregationsansätzen –in der Verfügbarkeit der Eingangsdaten.

Um „sauber" modellieren zu können, benötigt man Beschäftigungs- und Pendlerdaten auf Gemeindeebene. Vorallem zweitere stehen in der Regel nicht zur Verfügung und müssen daher geschätzt werden, was natürlich zu Unschärfen in den resultierenden Datensätzen führt. Auch in Bezug auf die räumliche Modellierung könnte die Datenlage besser sein. Während die Bebauungsdichte in Wohngebieten einen guten Schätzwert für die Bevölkerungsverteilung liefert, benötigt man für die Modellierung der Tagesbevölkerung genaue Angaben über die räumliche Verteilung von Arbeitsplätzen. Das könnte über Firmendatenbanken modelliert werden, sofern diese auch Beschäftigtenzahlen pro Unternehmen ausweisen und geokodiert vorliegen.

Der Modellierungsprozess selbst ist konsistent und einfach umzusetzen. Die derzeit ausgewählten Bevölkerungsgruppen sind jedoch noch nicht ausreichend, um eine plausible Verteilung der Bevölkerung modellieren zu können. Neben den Werktätigen sollten jedenfalls auch Schüler berücksichtigt werden. Als zusätzliche Aktivität müsste auch das Freizeitverhalten modelliert werden, welches aufgrund seines komplexen raum-zeitlichen Musters eine besondere Herausforderung darstellt. Im Rahmen des CRISMA Projekts wird versucht, diesbezüglich innovative Ansätze zu entwickeln.

Abschließend sei noch erwähnt, dass die Validierung raum-zeitlicher Bevölkerungsmuster eine eigene Forschungsfrage darstellt. Die Wohnbevölkerung oder auch Arbeitsplätze könnten über diverse Register zumindest näherungsweise bewertet werden, Verkehrsströme mittels punktueller Zählungen. Werden spezielle Zeiträume wie etwa Mittagspausen oder Abendfreizeit in der Modellierung berücksichtigt, wird die Validierung der räumlichen Muster zu einer wahren Herausforderung. Die einzige Referenz, die zurzeit für repräsentative Samples der Bevölkerung zur Verfügung steht, sind anonymisierte, raumbezogene Daten von Mobilfunknutzern. Diese liefern repräsentative Informationen über die Bewegung der Bevölkerung im Raum, allerdings beschränken sich die Samples in der Regel auf einen Provider, sodass nur relative Verteilungsmuster abgeleitet werden können. Des Weiteren wird in letzter Zeit verstärkt versucht raum-zeitliche Aktivitätsmuster aus freiwillig zur Verfügung gestellten Daten (VGI) aus sozialen Netzwerken abzuleiten (Aubrecht et al. 2011). Während der zeitliche und thematische Auflösungsgrad dieser Daten hervorragend sein kann, stellt vor allem die limitierte Repräsentativität durch ungleich verteilte Datengenerierung ein konzeptionelles Problem dar.

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Multilayer Information Management System for Personalized Urban Pedestrian Routing

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1 ABSTRACT

The present paper aims to describe the work carried out inside the ARGUS project to design and develop a software tool that manages heterogeneous cartographical datasets in order to offer personalized routing services. The project is focused on guiding blind and visually impaired in urban and rural environments with the help of binaural sounds. The navigation algorithm in the ARGUS smartphone application relies on GPX tracks containing the path to follow and informative points of interest along the path. These GPX files, previously recorded or created on demand, are downloaded from the remote service platform where the Multilayer Information Management System is hosted.

This module handles, on one hand, crowdsourced data from OpenStreetMap and ARGUS users and, on the other hand, cartography from individual city providers. Moreover the system defines a set of spatial attributes to categorize the most relevant and signifcant types of urban elements for the target user group, which are represented as geographical point or lines, enabling users to decide which type of objects have a positive effect such as tactile pavements, negative or neutral effect during the trace of a path. This user specified aproach affect the route finding by changing the routing weights. Different levels of visual impairment and skills from one user to another, as well as personal preferences, make this module a decisive configurable abstraction layer for the route calculation module.

2 INTRODUCTION

2.1 The visually impaired and ARGUS project

Navigation systems for cars and road traffic are widely used by millions of people everyday to reach unknown destinations or simply help during driving. In a similar way, navigation solutions for pedestrian also exist, and with a proper interface, they can get even more useful in the case of people with disabilities to help them live more autonomously.

The ARGUS project was born with the aim of developing a solution that provides new means of pedestrian navigation for users with visual impairments. It relies on a satellite based navigation (GNSS/EDAS – EGNOS Data Access System) terminal for people with impaired visual capabilities, guiding them along pre-defined tracks using binaural sounds. It introduces an innovative guidance support system based on the provision of a non-intrusive virtual-lead-line perception. This offers a more natural "track navigation" instead of the classical "waypoint or route navigation" which is used for car navigation or people with all visual capabilities. Appart from the innovative binaural instructions, the project has covered the development of an underlying personalized route generation module, which works upon an heterogeneous spatial data set managed by the Multilayer Information Management System module. This Multilayer Information Management System (MIMS) is what this paper aims to present, which basically consists of a PostgreSQL database with PostGIS pgRouting extension and a set of C++ classes.

2.1.1 System architecture

The general architecture of the whole ARGUS solution is as shown in Figure 1. The Service Platform offers the web services used by the user interfaces to interact with the itinerary creation and management modules. The MIMS module handles all the data that comes from different sources, such as cartography providers or information uploaded by users, and interfaces with the web services and the itinerary creation.

The User Terminal shown in the figure, consists of a smartphone application and a positioning unit for the GNSS reception and processing.

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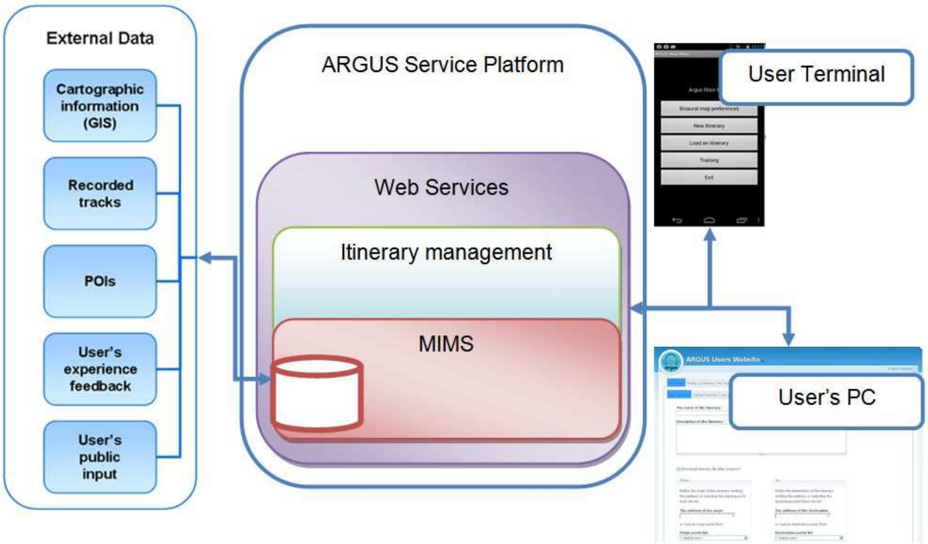

Fig. 1: General architecture of the ARGUS Solution

3 SPATIAL DATASETS

3.1 OSM

The Base Cartography is the geographical data needed to create the base spatial layer upon which the routing network topology is built. Digital mapping providers (both commercial and crowdsourced) digitally recreate the different real-world kinds of roads, ways, areas or buildings geographically referenced. Crowdsourced maps use inputs from community users. This base layer in ARGUS is taken from OpenStreetMap, one of the most known crowdsourced open source map service worldwide, with good coverage in Europe. The prototype consists of cartography in the following cities: Soest (Germany), Vienna (Austria), Madrid (Spain), San Sebastian (Spain) and Portsmouth (UK).

3.2 City Data

OSM provides the possibility to map pedestrian sidewalks as a separate geometry, but in general, the exact geometry of the pedestrian walking axis is not recorded. In that case, the sidewalk is usually added as an attribute on the street geometry, which only indicates the existence of a sidewalk (e.g. sidewalk=left).
Therefore, the ARGUS project partners tried to get more detailed geometry data within the different pilot areas to improve the cartography of the ARGUS network and inherently, the route calculation. Detailed pedestrian data was acquired from the test region of the city of Soest and the test region of the city of Vienna. The city of Vienna provided routable pedestrian data from the GIP (Graphenintegrationsplattform) dataset of a small test area near the Vienna town hall with additional relevant Points of Interests for blind pedestrians. Furthermore,the city of Soest provided detailed routable pedestrian data for the whole region of Soest from the ALKIS dataset of Germany.

3.2.1 Comparison

For the sake of a comparison, an example of a small extent in Vienna is shown in Figure2, where OSM network and specific Vienna city network are overlapped. The main contribution of the City Data is that sidewalks and zebra crossings geometries are perfectly defined and aligned along the axis of the streets where pedestrians can walk safely.

3.3 Points of Interest

The Points of interest in ARGUS are both Generic POIs obtained from the cartography providers, and personal points that users can upload to the system. They can be classified according to different categories. Also, user points are classified into three possible natures: GREEN (private personal points), BLACK (shareable negative points) and WHITE (shareable positive points). The negative or positive nature of a point influences the calculated route. Some categories of Generic Points of Interest can also have a default nature of WHITE or BLACK, if they should be treated as points to avoid or as helpful points (like acoustic zebra crossings).

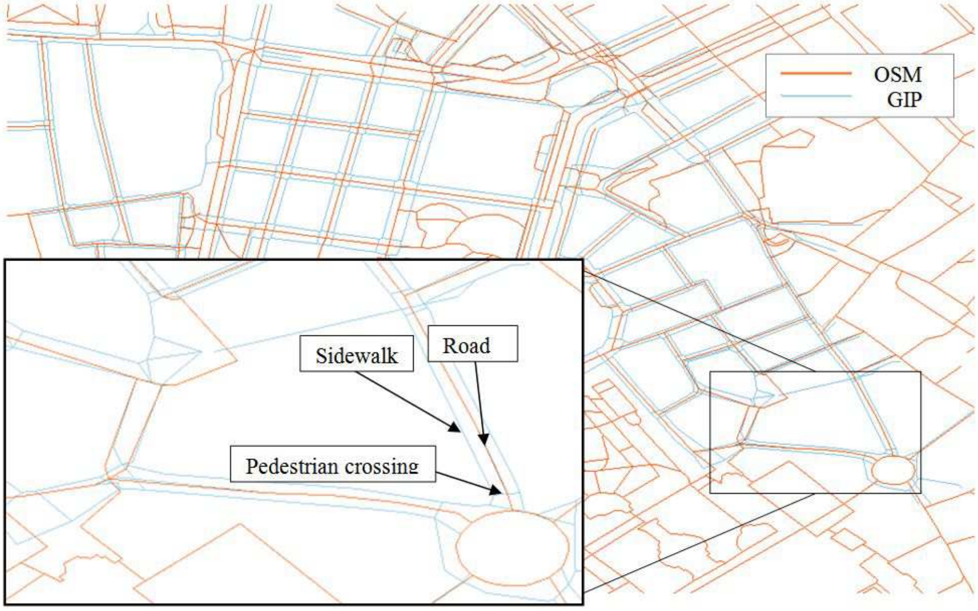

Fig. 2: Comparison of the two OSM and City networks in Vienna

3.4 Tracks/Routes

Tracks and routes are ordered sets of geographic points that describe a path, stored in a GPX file, and also represented as a linestring in the ARGUS database. On one hand, the route calculation module generates a GPX file for an origin - destination pair on each request (called route) based on the cartography and the Points of Interest; on the other hand, the User Terminal can record a real path (called track) performed by the user and upload it to the system for later use (instead of creating a new route) or sharing it with the community.

4 DATA PRE-PROCESSING

4.1 Preparation of the OSM data

The data structure is based on nodes, ways, relations and tags. For a routable network it is important that every way element has to be fragmented at every crossing of the streets. In ARGUS, the converter and routing engine tool osm2po is used to create a routing network. This tool creates a routing topology table with the connection information from one edge to the next. Additionally, it calculates default costs which are based on the length of the edges and the average configured speed of the different road categories. These default costs of the tool cannot be used for the pedestrian routing in ARGUS, because the speed is not relevant for the route calculation due to the different user behaviours of people with visual impairments. Therefore the ARGUS system implements their own dynamic weight model based on the different users.

Edge weights must be calculated in order to find suitable routes for people with visual impairments, as the whole route cost will be tried to minimize by the route calculation. Additionally, the ARGUS user has the possibility to classify special categories as helpful objects or objects that should be avoided during the route. These different user preferences influence the weight of the routing graph. The Dijkstra algorithm implemented in the PostGIS shortest_path function is used to get the optimal path based on the lowest weights.

For the computation of the weights of each edge, additional data have to be added. The goal of a routing topology engine is to process only the OSM data relevant for the routing calculations. Therefore, it does not provide information about the complete attributes of the OSM data. The user defined attribute information of the OSM dataset will also rely on OSM attribute information (like for example letterboxes, etc.) and therefore attribute information of the OSM dataset of the edges and nodes has to be imported into the database. In the project ARGUS, the import tool osm2pgsql is used. Osm2pgsql is a tool, which converts and imports the OSM data format to a PostgreSQL database. This tool adds features that use certain tags, which are defined by a configuration file and transforms the nodes and ways to linestrings and polygons. It is only used to import the data into the database, but has no routing functionality in it, so the dataset can't tell which linestring is connected to each other.

The imported OSM attribute data is connected with the routing table by the use of the unique OSM ID. This enables the routing table to get more information about the used attributes of edges or nodes.

4.2 Preparation of the City data

The cartography used in Vienna and Soest is very heterogeneous. First, they do not have a common structure (ALKIS dataset of Germany, GIP dataset attributes of Austria). And, second, they use different attributes. The database inheritance concept within PostgreSQL has been taken as a basis to abstract the underlying original data source from the above common layer used by ARGUS web services. Therefore, tables are classified as "Parent" – "Child" tables. The concept of inheritance allows joining common attributes in one table like geometry, name, etc. of various datasets and provide a unique ID for all datasets. For that reason, a common set of attributes was defined which every dataset has to fulfil. These attributes are the minimal necessary attributes for the creation of a routing network graph: source, target, geometry, length of the edge, name and the classification of the street based on OSM classification value which is used for the buffer and the assignment of POIs to the network edges. The parent table holds the common information of all child tables and is connected to each child table. The child tables provide further information about the inhomogeneous attributes of the datasets. The same concept is also used for the city POIs; therefore, two parent tables were created (city_network and city_POI).

Among the advantages of this approach, on one hand, a common structure is obtained, with additional diverse attributes in the child tables. On the other hand, simple extendibility and the use of same attributes of all available city data is achieved. The use of inheritance in the database layout offers a flexible and extensible way for the import of the city GIS data and gives the possibility to easily integrate them in the future.

5 PERSONALIZED ROUTE CALCULATION

5.1 Category and Preference configurations

A set of categories was defined based on requirements collected from user surveys and completing it with OSM categorizations. Street segments can be categorized according to OSM attributes (both coming on line or point elements) or the existence of generic or user defined points of interest nearby. Table "category" collects all the possible categories and their default behaviour on route calculation (as seen on Table1). Two tables ("category_preference" and "category_preference_extension") handle specific user preferences to modify this behaviour.

Id	categoryname	defaultnature	typeuser	class	value	osm	typeroute
50	Pavement Furniture	3	TRUE	Others	0		TRUE
51	Stairs and steps	3	TRUE	Others	-1	"highway=steps"	TRUE
53	River	3	FALSE	Others	-1	"waterway=river"	FALSE
56	Specially adapted walkway	1	TRUE	Users	1		TRUE
57	Dropped Kerb	0	TRUE	Users	2		TRUE

Table 1: Sample values in table "category" where categories are classified and tagged

The calculation of weights in the routing algorithm is done for each edge within the graph. Basically, the different points and line information are categorized in general information and relevant information for routing. Some categories are able to influence the cost value of the edges (typeroute=TRUE) and furthermore also the route from a start to an end point, as the cost increases where difficulties for visually impaired appear (black nature), and reducing it wherever helpful points are found (white nature). Other categories are registered with the aim of providing information about things or services found near the route but they cannot influence the route.

5.2 Route Calculation results

Every time a user wants to create a new route, the request comes from the CreateItinerary web service. This request contains an origin and destination pair of coordinates (green points can also be used). The best cartography available is chosen automatically if both exist (OSM and City). In the Figure3 below, the two cartographies were tested manually to see the different results obtained in Soest.

Fig. 3: Comparison of the routes obtained for different cartographies (OSM and City network in Soest).

6 CONCLUSION

This paper has presented the Multilayer Information Management System of ARGUS, which offers the management module to handle heterogeneous datasets to offer personalized pedestrian routing services. It is oriented to assist blind and visually impaired users on more autonomous everyday situations.

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Land registry office of the county administration of Soest, http://www.guide4blind.de

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Narrative Urban Mapping

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1 ABSTRACT

UrbaneGeschichten[1] is a project and mobile web platform for a bottom-up citizens' chronicle. It aims at collecting and mapping everyday life stories directly from citizens. Thus, it taps information from hitherto inaccessible sources with potential value within urban planning processes. The project draws from four theories: 1) Digital Natives by Prensky (Prensky 2001), characterizes prospective participants with a strong affinity for as well as a high intensity of use of technology. 2) Cognitive Surplus by Shirky (Shirky 2010), states that means, motive and opportunity are crucial for participation. 3) The Wisdom of Crowds by Surowiecki (Surowiecki 2005), argues that large groups can – under the right circumstances – achieve better solutions or answers than the most skilled individuals. 4) Crowdsourcing by Howe (Howe 2008), defines a new form of operating process relying on the skills and knowledge of a large group of unknown individuals.

As one way to combine these opportunities, we analyze if the web service Crowdmap Classic,[2] provided by the non-profit tech company Ushahidi,[3] is suitable for the purpose of collaborative narrative urban mapping. Therefore, the Crowdmap deployment UrbaneGeschichten has been set up and input from within the city of Kaiserslautern (Germany) was solicited. The project received significant input from citizens, thus documenting everyday life in Kaiserslautern from May to December 2013, and remains open. Submissions tended to focus on private aspects of life. From the findings it is concluded that Crowdmap Classic is a suitable tool to access information about locations and everyday life stories.

Similar technologies have also been used by other projects from urban planning contexts. One example is EmoMap (Klettner et al. 2013), which solicits geo-referenced data in order to map citizens' subjective perception regarding affective qualities of environments. Another, somewhat similar approach was taken by the project mappines.[4] Such examples and the present project show that valuable information can be crowdsourced and displayed on maps, while furthermore supporting Brabham's argument that Crowdsourcing can be useful in participation processes in spatial planning (Brabham 2009).

2 INTRODUCTION

The attempt to record history and historical changes of a city – in written or visual form – has already been adopted. Implementations such as Google Goggles[5] or the Talking Places (Hensch 2012) project based on RADAR (Memmel 2012) technology have been set up. Projects as these are usually designed for mobile devices and present background information and pointers to further reading, but they focus mainly on presenting history in a visual way through pictures and 3D-renderings. The information attached or linked to the objects is often official. Thus, they provide access to information in an easily comprehensible way. Also, they invite people to take part in the projects by contributing their own pictures or texts. An extension to the information presented in form of text or pictures was recently presented with the prototype Urban Storytelling (Dörrzapf 2013). It proposes information in audio format which can be retrieved e.g. by downloading or streaming, while strolling about the city.

In the field of urban planning, the value of these projects lies in their potential to retrieve information about a city and its inhabitants. To retrieve information requires people to contribute to such a project. The motivation for participation follows from theories such as Cognitive Surplus, Wisdom of the Crowd and Crowdsourcing, which will be presented in Section 3. Citizens who contribute to such projects face questions as these: Which picture to choose? Which story to tell? Should I participate at all? In other words, the

[1] UrbaneGeschichten.de, Dec 20,2013.
[2] https://crowdmap.com/, Dec 20, 2013.
[3] http://www.ushahidi.com/, Dec 20, 2013.
[4] http://www.mappiness.org.uk/, Feb 27, 2014.
[5] http://www.google.de/mobile/goggles/#text, Sep 14, 2013.

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precondition "to find something special to publish" represents a barrier which limits the scope of such a collection. If these entry barriers could be lowered, previously inaccessible knowledge would become available. Thus, a platform is needed that invites citizens to contribute their experiences and memories - independent of historical value. Brabham has argued that internet-based, public participation – especially non-expert knowledge – can give valuable input to urban planning processes. (Brabham 2009)

3 PARTICIPANTS AND PARTICIPATION

3.1 Participation

New generations grow up surrounded by technology. As a consequence, certain theories exist which aim at explaining how these generations distinguish themselves from previous ones. Prensky names parallel processing, multi-tasking and networking as some of the core characteristics of his concept of the Digital Natives. (Prensky 2001) Tapscott and Williams' concept of the Net Generation also identifies networking as crucial, calling it the new generation's modus operandi. (Tapscott and Williams 2009: 48) Furthermore, they state that individuals make use of it not only to consume passively, but to collaborate permanently. (ibid.: 47) There are also studies which concentrate on active smartphone users, e.g. Go Smart 2012. (Google Inc. et al. 2010) It defines Smart Natives based on their affinity for technology and the web as well as a high intensity of use of mobile internet devices. Thus, the technology and the opportunities it offers are embedded in their everyday life while at home or on the way. All three concepts assume a certain natural expertise in the use of technology in every aspect of everyday life. This is a feature of increasing importance in the context of the development of future planning processes. According to Höffken and Streich, the role of the Smart Native as a citizen is relevant, as the Mobile Citizen (Höffken and Streich 2011) takes an interest in his environment and is willing to engage – opening new forms of mobile participation (Höffken 2014). His engagement will offer opportunities for urban planners to tap the knowledge of local experts as a source of information. (Höffken and Streich 2011) Especially in the context of urban planning, Streich introduces the term of the homo ludens, who – due to his playful nature – approaches technology experimentally and becomes a competent media actor. (Streich 2011: 217, 663)

3.2 Participation theories

In order to tap the potential of these smart natives, the question why anybody should invest his time and skill in any project arises. Shirky answers this question with the so-called Cognitive Surplus (Shirky 2010). He observed that there exist huge amounts of spare time among the "world's educated population" (ibid.: 27), accompanied by an increasing accessibility of media, which enables people to engage in projects they are interested in. For most citizens, it has become normal to be "part of a globally interconnected group" (ibid.: 24). And by becoming a part of life, social media is "not only something we consume, it's something we use" (ibid.: 52) to gather or share information or to coordinate our joint actions. For Shirky, it is clear that although "media is the connective tissue of society" (ibid.: 54), it only enables a change of behavior from consumption towards participation – it does not cause it. Shirky states that "the fusing of means, motive, and opportunity creates [...] cognitive surplus out of raw material of accumulated free time" (ibid.: 184). This cognitive surplus can be used to create large, communal projects as small bits of contributions together can create something of lasting value. But as contributions have to be joined in order to be transformative, the people behind the project need to develop a culture of communicating, sharing and collaboration.

The value of information from these contributions has been examined by Surowiecki. He claims in his book "The Wisdom of Crowds" (Surowiecki 2005) that most people mistakenly assume that valuable knowledge is in the hands of a few. He explains why large groups can – under the right circumstances – achieve better solutions or answers than the most skilled individuals. The members of the group do not need to be exceptionally intelligent. They just need some information, such that the errors will average out when all answers are aggregated. Therefore, the larger the group is, the better the solutions will be. To work as a wise crowd, a group has to fulfill four conditions: diversity of opinion, independence, decentralization and aggregation.

Crowdsourcing is a concept which relies on the participation of crowds – ideally of large crowds. It can enable Wisdom of the Crowds, but it also focuses on the dynamics of people working together via the web. The neologism Crowdsourcing consists of two words, "crowd" and "outsourcing". (Wenzlaff 2012: 13) It defines a form of operating process, where a task is presented to a large group of unknown individuals to contribute to a project, each using their individual skills. Howe himself defines Crowdsourcing as: "[...] the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. [...]" (Howe 2006) This can take the form of peer-production (when the job is performed collaboratively), but is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential laborers. Howe concludes from this process which "had its genesis in the open source movement" (Howe 2008: 8) that "a large and diverse labor pool will consistently come up with better solutions than the most talented, specialized workforce" (ibid.: 54).

3.3 Crowdsourcing in the Urban Planning Context

Public participation during the planning process can be either enforced by law or done voluntarily. Streich argues that the traditional methods of public participation will be extended by employing technology and especially the internet. According to him, the arguments against computer-aided public participation are no longer valid, as many people now have access to the internet and possess the means to use it. Furthermore, such computer-based participation systems now provide low entry barriers. Streich suggests that a new form of monitoring results from this combination which he calls inductive monitoring – individuals do not only submit data but they also provide impulses for new topics. (Streich 2011)

Brabham (Brabham 2009) argues that even "deeper levels of engagement" (ibid.: 257) in this context can be reached. Using the internet as a platform provides opportunities which are beyond the ones offered by traditional participation methods. The latter ones are limited because citizens are heard but rarely empowered to contribute. Therefore, Brabham proposes the introduction of the Crowdsourcing model in planning processes to enable public participation. The benefits of crowdsourced public participation lay in:

- collecting more ideas by opening the creative process to participation,
- empowering the participants, especially those who are usually excluded,
- the range of involvement can be chosen by the participant according to his interest,
- the discovering and access of non-expert knowledge as well as
- the access to creative solutions, which could have been overseen by experts.

4 EVERYDAY LIFE, MEMORY AND ARCHIVES

The project aims at collecting everyday life stories. Bausinger gives one definition of everyday life. (Bausinger 1996) He states: "Everyday life is the space in which we move, without reflection, whose paths we walk in sleep, without effort, whose meanings and constellations are immediately accessible, wherever we do, whatever we do, where acting has a natural character, where we share a perception of the meaning of our actions with each other." (ibid.: 33) Bausinger points out that this understanding of everyday life has nothing sophisticated about it. It is rather about routine, about the space where we feel automatically confident, without the need to reflect on each move we make.

Halbwachs argued that no memory exists outside of a spatial frame. The environment is reality which endures. Thus, memory is always connected to substantial spatial conditions – such as buildings, monuments and landscapes. Furthermore he suggested that memories are constructed within social structures and institutions. (Halbwachs 1991) Halbwachs as well as Assmann and Assmann draw a picture of individuals and groups which obtain memories through own experiences, experiences of others and those passed on by institutions in form of rites, feasts etc. The latter defined two subgroups of collective memory: communicative memory, which they also call everyday memory, and cultural memory (Assmann and Czaplicka 1995). The communicative memory includes the varieties of the collective memory which are based on everyday communication and interaction. It represents the "still living past" (Dornik 2004: 21), experienced by the contemporary generations and has a limited temporal horizon, as it is bound to the living holder of the experience. (Assmann and Czaplicka 1995: 127; Erll 2011: 127; Zierold 2006: 71) In contrast, the cultural memory has a fixed temporal horizon, which "does not change with the passing of time" (Assmann and Czaplicka 1995: 129). The memory is stored through texts and traditions and relies on institutional communication – e.g. practice of rites, but is not factual history. Communicative memory can become part of the cultural memory when it is considered important enough and can be "transferred" via

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media. (Erll 2011: 5) Assmann states that the "cultural memory extends or complements everyday life" (Assmann 1999: 57).

Another way to preserve memories are archives, which are “the places of the cultural memory”. (Erll 2011: 127) The function of an archive originates in the task to administer official records and documents. Even though city archives assemble wholesome documentations, there is a gap, as many everyday life stories will never enter those official records. In Germany, for instance, it is dictated by law which documents must and which may be archived. (Deutscher Bundestag 1988) Dornik (Dornik 2004) sees the internet as a representation of the communicative and cultural memory. The first can be transferred (communicated) and stored on the internet, while the second finds entrance into the net through institutional communication of traditions and events for example. Although the internet raises reachability and extends the original lifetime of memories, its durability is still a matter of discussion. (ibid.: 21)

5 NARRATIVE URBAN MAPPING - USE-CASE: URBANEGESCHICHTEN

5.1 Technological Basis – Ushahidi

The software used to implement the project that will be described in this section, is called Ushahidi. The word Ushahidi is Swahili and means "testimony" or "witness" (Shirky 2010: 15). This free and open source software works by generating online visualizations of collected geo-referenced data. Information can be submitted via a form on the webpage, email or Twitter as well as text messages. (Ushahidi 2012) Further, the Ushahidi mobile app - which is available for different mobile operating systems, like iOS and Android – allows to submitt reports and to receive updates, and it contains most of the features also available in the web frontend. (Ushahidi Website - Downloads 2012)

Reports can be submitted via:

- the mobile apps for iPhone and Android,
- an e-mail using the UrbaneGeschichten address,
- by sending a tweet with the hashtag #UrbaneGeschichten and
- by filling out a form on the website, linked to through the box or the button in top of the website.

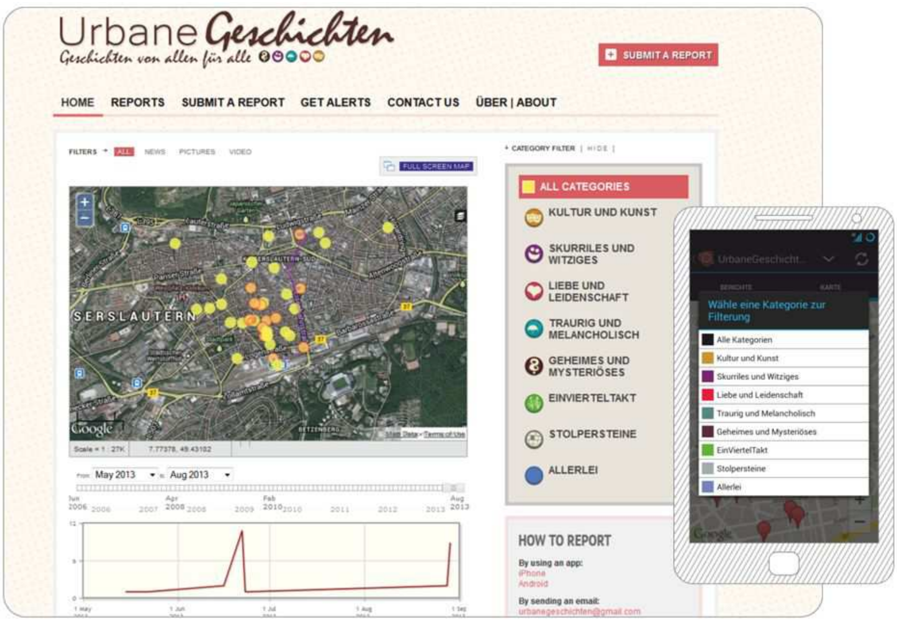

Figure 1 Frontend of UrbaneGeschichten – Mobile Version of UrbaneGeschichten (sources: https://urbanegeschichten.crowdmap.com, Ushahidi app, own source).

5.2 Presentation of Concept of UrbaneGeschichten

UrbaneGeschichten is a project that aims at collecting geo-referenced data in form of stories, reports and narrations on a public internet platform. The project is rooted in the city of Kaiserslautern, but it is not limited to this region. Given significant data in form of a large number of stories, the platform could give an insight into experiences and opinions regarding certain locations. This would enable the emergence of an alternative, digital city chronicle. Technically, the project is based on Crowdmap Classic and the Ushahidi app provided by Ushahidi. As a working principle, Ushahidi employs Crowdsourcing and – in line with Surowiecki's Wisdom of the Crowds – any of its deployments will therefore require a large group of active participants. If the Crowd got interested, such a collection of stories from the crowds would have the potential to summon much knowledge in one place. Of course, it is not sufficient simply to get people's interest. They must also participate. Therefore, to open the project to the public, it was advertised through flyers and posters at public places especially in the beginning. The poster contained the web address of UrbaneGeschichten in normal text-mode, as well as in form of a QR Code and additionally as an abbreviated web address. Also QR-Codes representing links to the Ushahidi app on Apple Store and Google Play were integrated to facilitate the access.

5.3 Use Cases and Requirements

As already mentioned, a collaborative city chronicle depends on the participation of many. Therefore potential users and their individual needs have to be identified. The crowd that was identified as potential participants can be divided into three main groups: the contributors, the communicators and the evaluators. The first group comprises the ones who have a main interest to participate by sharing their experiences in and around the city. The second, the communicators, are people who will use the platform as a place to advertise and file their projects, while at the same time sharing coming events with their friends and followers. The last group, which mainly has a professional background, will probably have an interest in the evaluation of the published experiences and opinions.

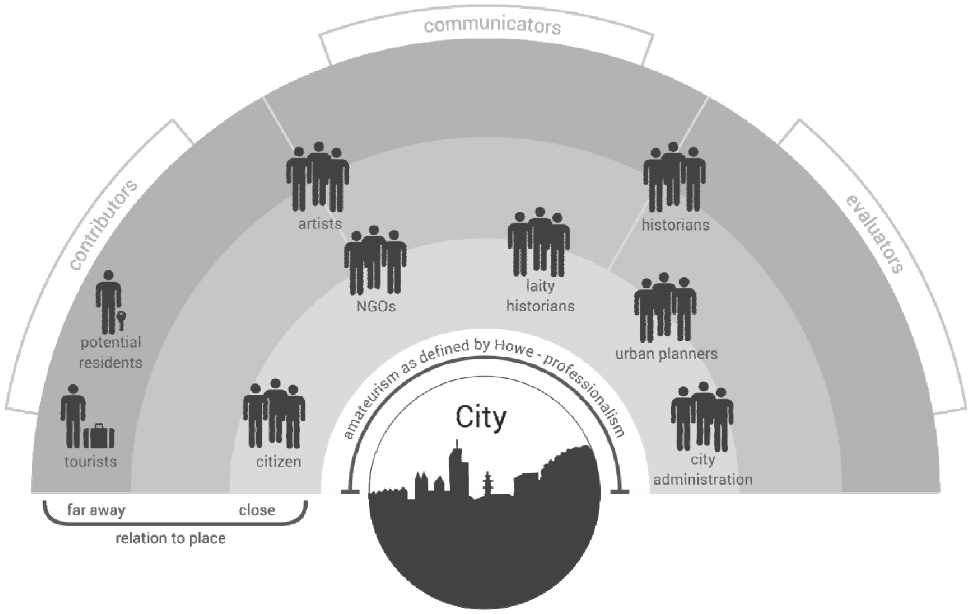

Figure 2 Main potential user groups – Characterization in terms of the two most important identified features (own source).

Additionally, two characteristics were found to be of some importance to the project. One is the relation towards the place or city people may want to read or write about, the other is their level of professionalism. The first characteristic indicates from which point of view potential users will approach the opportunities available through the web frontend, while the latter implies a methodological approach in using it. The user groups are heterogeneous, i.e., they vary internally in their characteristics, and users cannot uniquely be assigned to one of the groups described in the following. Nevertheless, stereotypical user groups support us in defining expected use cases for an actual implementation of such a platform. They are summarized in Figure 2. However, note that, the enumeration of user groups given there is not exhaustive, as it represents assumptions about prospective users. Due to the difficulties associated with analyzing user behavior, and due to the fact that user groups will overlap, see above, these hypothetical groups cannot be verified.

Prior to creating the website UrbaneGeschichten, it was necessary to conceive possible categories to organize the incoming stories and to make them searchable and easily accessible. By the time UrbaneGeschichten was set up, six categories were defined to provide a basic structure for stories: Kultur und Kunst (culture and arts), Skurriles und Witziges (bizarre and witty), Liebe und Leidenschaft (love and passion), Traurig und

Melancholisch (sad and gloomy), Geheimes und Mysteriöses (secretly and mysterious) and Allerlei (Various). Those categories were chosen to organize the stories according to their content. The list was extended in light of certain events that took place while working on this project, cf. Figure 1.

5.4 "Analog" Presentations

To raise the awareness for UrbaneGeschichten and to collect further contributions, four analog presentations were conducted in Kaiserslautern during the time period covered in this conbtribution. Theses presentations consisted of a printed map showing the venue of the respective event and the area around it. Furthermore, a poster informed the participants about what UrbaneGeschichten is and how to proceed to contribute to the project. Cards were supplied on which visitors could write down their stories, opinions or feedback, with an option to refuse to publish the stories online. The cards could be placed on the map through a twine and a pin, and were later entered into the online platform by the authors of this paper. The four occasions and locations at which these analog presentations were held was the block party EinViertelTakt in June 2013, at the urban planning discussion forum Stadt.Umbau.Salon in October 2013, and in two local cafés during November and Decemer 2013. This way, a total of 42 contributions had been collected in written form and transferred into the online collection by the end of 2013.

5.5 Evaluation

The purpose of this section is to evaluate the gathered data. The source of that data is Crowdmap, which automatically accumulates certain statistics, and complementary data that has been recorded while working on this project.

Categories	Amount
Kultur und Kunst | culture and arts	11
Skurriles und Witziges | bizarre and witty	12
Liebe und Leidenschaft | love and passion	8
Traurig und Melancholisch | sad and gloomy	0
Geheimes und Mysteriöses | secretly and mysterious	3
EinViertelTakt | block party	24
Stolpersteine | stumbling blocks	12
Allerlei | various	19
Categories assignments of all stories (68)	89

Figure 3 Numerical distribution across categories - The number of times each category has been assigned to any story on UrbaneGeschichten (own source).

5.6 Reports

In total, 68 reports were submitted until December 31, 2013. To avoid overly emphasizing one event in the statistic, eight reports are counted as a single report, since they contain identical information, but at different locations. The distribution of the stories across the categories is not uniform. Note that the number of assigned categories exceeds the number of entries because multiple categories can be assigned to a report. To see the distribution in numbers, see Figure 3.

The fraction of each category among all submitted stories can be seen in Figure 4. The largest share is taken by the category EinViertelTakt with 29%, followed by Allerlei (various) with 23%. The smallest share of submissions was received in the category Geheimes und Mysteriöses (secretly & mysterious) with 4%, while the eighth category (sad & gloomy) does not appear in the statistics as there were no entries.

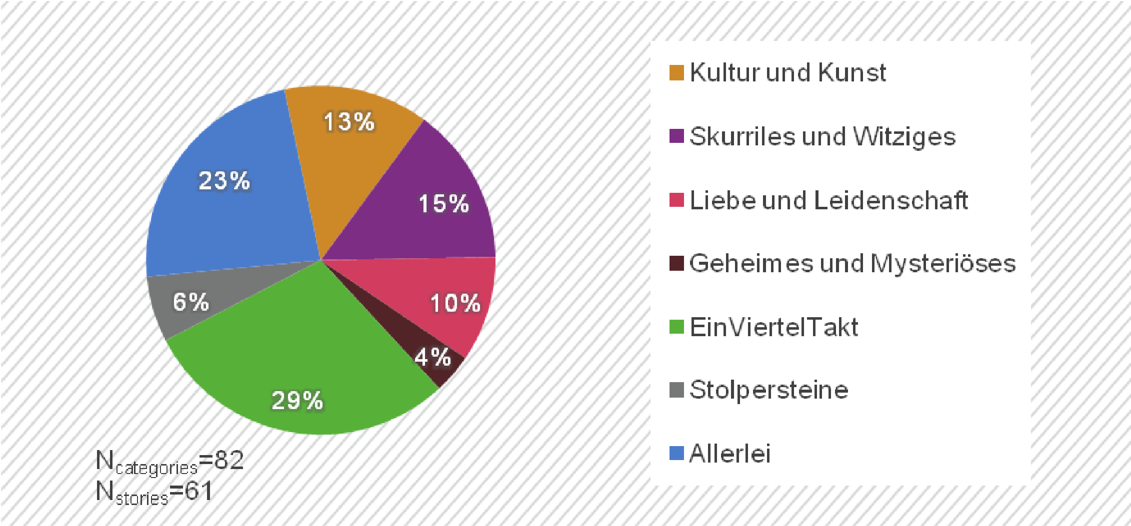

Figure 4 Pie chart of the distribution of reports – Reports can be assigned to multiple categories. Thus, N can exceed the number of reports, in this case (own source).

To reveal whether users tend to submit recent events, or whether they prefer to tell the world stories from the more distant past, the gap between assigned date and the actual submission date was measured. For some, no date was assigned, and it could not be determined from the context of the stories. Those ones will be referred to as "unknown", in what follows. Figure 5 shows the distribution of the resulting time gaps grouped into coarse time intervals from stories older than one year to stories submitted on their day of occurrence. Next to the extra group of the unknown, there is also the group of events that lay in the future when they were entered.

One can see that the bars of reports with stories reported less than one month and over a year after they took place are the highest. Most unknown dates derive from the offline presentation at the block party, when the form was not always filled out completely. The smallest bars correspond to reports dated in the future and to stories for which between one month and one year passed until submission.

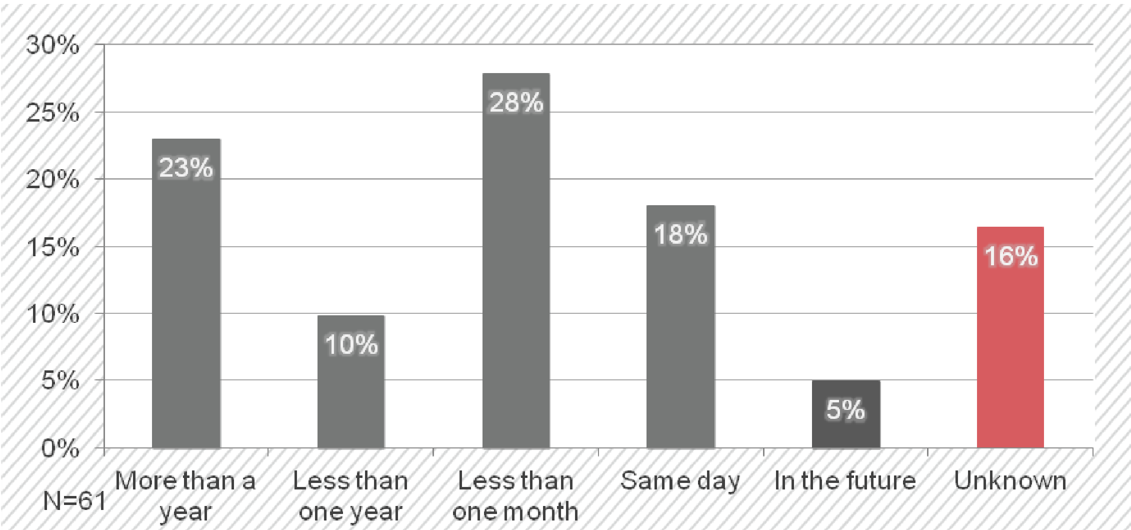

Figure 5 Time between assigned report date and submission date – This chart shows the distribution of submissions across various time gap intervals. Note that even though Ushahidi records the submission dates, uncertainties are to be expected, because some cards from the presentation at the block party did not contain an assigned date (own source).

5.7 Content

Besides the rather quantitative analysis above, it was also of interest whether the topics covered in the submitted stories could be analyzed. To this end, attributes were selected to reveal whether the submitted reports focused rather on private or public topics. The six content attributes and the questions behind them are:

- personal (Does the story have a private character?),

- places (Does the story refer to specific locations?),
- inhabitants (Does the story refer to locals in the reported area?),
- city (Is the story about the city itself?),
- events (Is the story about some event?) and
- informative (Does the story have an informative character?).

Each question was answered for every story (N = 61) by either yes or no. Figure 6 shows the percentage of yes and no answers for every attribute. The attributes were divided into two groups. Group one comprises stories which are of private character (personal, places and inhabitants), while the second group of stories covers public topics (city, events and informative). The attributes from the private and public groups appear to be anti-correlated, which can be seen especially well from the trend lines in Figure 6. This means that it is more likely to find two attributes from the same group than to find one public and one private attribute in the same story. That allows for the conclusion that in most cases a story comprised attributes either from the first group or from the second. Note however that there are some reports which contain characteristics of both groups. One fourth of the reports refer to the city in which the story took place (16 stories) and 75% mention some specific place (46 stories).

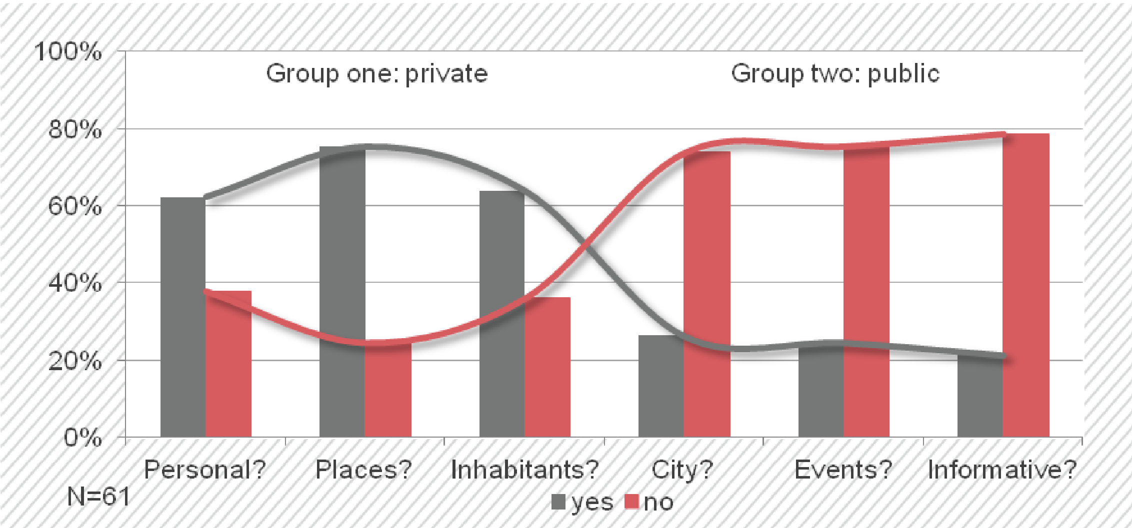

Figure 6 Distribution of reports across selected content types – The percentage of yes and no answers to each of the questions specified in the text. The trend lines connect yes and no answers, and suggest that most stories belong either to the left group (private) or the right group (public) rather than uniting characteristics from both groups (own source).

Furthermore, one may be led to the false conclusion that reports are balanced between the public and private groups. But, there are in fact more reports in the private group (44) than in the public group (13). Together with the neutral reports, which could not be assigned to any one group because they possessed an equal count of attributes in either group (4), the total of N=61 evaluated reports is reached. Note that since reports of the same content at multiple locations have been removed from this statistic, here N is smaller than the total number of collected reports (68).

Figure 7 Tag cloud of the most frequently mentioned words – These give an idea and brief overview of the topics covered in the 68 reports (source: http://www.wordle.net).

After evaluating the reports according to their attributes of content, the texts were also evaluated visually using a cloudtag, cf. Figure 7 below. Among the most frequently occuring words, the terms ich (I), wir (we), KL, Rad (cycle), Abend (evening), Kaiserslautern, Stadt (city), Jahren (years) and Freund (friend) stand out.

6 DISCUSSION

Statistical data collected over a time span of only 8 months was analyzed for this contribution, which allows only for a limited amount of deductions. Yet, the data did indeed reveal some remarkable findings. From the data obtained from the Crowdmap servers, it is known that 254 individuals visited the site during this period, during which 68 stories were collected in total. When comparing these two figures, one has to consider that many reports have not been submitted online, but rather in written form at EinViertelTakt and during three exhibitions of analog versions of UrbaneGeschichten. A further result of the statistical analysis was that stories with both public and private character were reported. Surprisingly, the number of private stories in the evaluated collection exceeded the number of public or neutral stories by a factor if 2.5. Having the opportunity to express opinions about the city, there were only very few stories with negative connotation. Also, many stories referred to specific places, and still a significant amount related directly to the city. Thus, it is concluded that Ushahidi is a highly suitable tool for narrative urban mapping.

Using these results, there are potential applications for such a narrative database in the context of urban planning. Firstly, for the field of urban studies, UrbaneGeschichten could prove to be useful as it offers monitoring and real-time acquisition of information. This information is collected in form of narrations, opinions and material, e.g. in form of pictures, and is usually not accessible to this extend via traditional sources or participation processes. Further, as the platform possesses social media functionalities, it could become a meeting point of people interested in planning issues, thus becoming integrable in the participation process. Secondly, UrbaneGeschichten offers a platform for the urban planner to tap local knowledge as well as to get in contact with people interested in urban planning issues. Yet, there are remaining barriers as not everyone has the required means to access the internet. Nevertheless, the platform has the potential to become a meeting point where people can share and discuss information and opinions.

Overall, UrbaneGeschichte has shown to be a suitable tool and to hold the potential to collect, archive and allow access to narrations of all kinds.

An additional aim of the project was to find out if it has the potential to become a complementary – but incomplete – city chronicle of snaps from biographies, anecdotes or opinions and experiences within the spatial environment of a city. This question was answered by outlining theories related to memory and their preservation in relation to the internet. The finding was that the internet as a medium to publish everyday life stories does work with regard to its ability to lower the barriers of the selection process. But, it also works with regard to archiving and making stories retrievable. Since more private than public matters have been collected in UrbaneGeschichten, it seems that it could become an alternative archive of urban narratives that complements official archives – which focus on published media and historical facts. Thus, the project enables a bottom-up process to information gathering and collaborative urban mapping of narrations.

Furthermore, this process of sharing memories publicly enables - additionally - that places can become "imprinted" with multiple different experiences and therefore multiple memories. The potential of these is to become part of a cultural memory and therefore part of the prevailing identity or group identity, unfolding through contemplation of these memories.

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Neue Einblicke – Social Media Monitoring in der Stadtplanung

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1 ABSTRACT

Das Social Web ist ein Kommunikationskanal, der mittlerweile weit verbreitet ist und den man allgemein schon als Standard bezeichnen kann. Vielfach wurde beschrieben, wie Social Media auch in der Raumplanung zur Kommunikation und Partizipation genutzt werden kann (vgl. Habbel, Huber 2008; VHW 2011; Haller, Höffken 2011). Der Stadtplanung von heute bietet sich aufgrund der stetigen Entwicklung von Hard- und Software sowie eines immer komplexer werdenden Internets eine Vielzahl an Instrumenten, um eine erfolgreiche Planung durchzuführen. So ist es heutzutage möglich, die verschiedenen Aufgabenfelder mit digitalen Werkzeugen zu unterstützen und zu bearbeiten.

Ein Beispiel ist der Einsatz von Social Media im Kontext der Bürgerbeteiligung. Um hierbei genauere Analysen des Nutzerverhaltens vornehmen zu können, bietet sich ein Einsatz von Monitoring-Tools wie bspw. Google Analytics an. Dabei steht die Möglichkeit, noch präziser auf die Interessen und Anregungen der Nutzer einzugehen, um eine gezieltere Kommunikation zu erreichen, im Fokus des Interesses (von Dobeneck, 2012). Ziel dieses Papers ist es, in Erfahrung zu bringen, wie der Einsatz einer begleitenden Social Media Strategie aussehen kann und welcher Mehrwert sich für die Stadtplanung erzielen lässt.

Nach einem einführenden Teil, werden die Grundlagen von Social Media und der Mehrwert digitaler Instrumente in der Stadtplanung aufgezeigt. Zentrales Element des Papers sind die Ergebnisse aus der Untersuchung eines Praxisbeispiels – eines Weblogs für ein Stadtentwicklungsprojekt. Basierend auf den dort gewonnen Daten werden Erkenntnisse bezüglich möglicher Analysen und Auswertungen, aber auch Grenzen und Hindernissen aufgezeigt. Aufgrund dieser praxisnahen Analyse werden die allgemeinen Erkenntnisse und der Nutzen für einen Einsatz in der Stadtplanung skizziert, wodurch sich konkrete Handlungsempfehlungen ableiten lassen.

Ebenfalls werden mögliche Gefahren dargestellt, welche eine Erhebung von nutzergenerierter Daten im Bezug zum Datenschutz, bzw. Recht auf Privatsphäre mit sich bringen. Diese kritische Reflektion soll helfen, einer Übereuphorisierung der Datenanalyse entgegenzuwirken, um eine realistische Einschätzung des Anwendungspotentials für die Stadtplanung geben zu können.

2 EINLEITUNG

2.1 Social Media in der Stadtplanung

Eine moderne Stadtplanung beinhaltet heutzutage die Nutzung neuer Medien wie beispielsweise verschiedene Social Media Kanäle oder Weblogs. Da Planungsprozesse zunehmend komplexer werden und trotzdem eine transparente Bürgerbeteiligung erfolgen soll, nutzen immer mehr Städte und Gemeinden solche digitalen Plattformen, um Bürger an Planungen teilhaben zu lassen. Dabei besteht der Vorteil darin, dass sich jeder mit den unterschiedlichsten Meinungen, Anliegen und Wünschen äußern kann, um mit einem Vorhabenträger in Dialog zu treten.

Damit verlagert sich Bürgerbeteiligung zunehmend auch in den digitalen Bereich. Wurden in der klassischen Bürgerbeteiligung noch verschiedene Varianten eines städtebaulichen Vorschlags verbal diskutiert und sich mit Stimmzetteln für eine bestimmte entschieden, so zeichnet sich für die Zukunft ab, dass sich solche Arten von Debatten zunehmend auf die digitale Ebene verschieben. Und mit dieser Verlagerung und dem Einsatz sog. Monitoring-Tools bietet sich heutzutage die Möglichkeit, ein gezieltes Monitoring des Nutzerverhaltens durchzuführen.

2.2 Fragestellung und Vorgehen

Das Paper untersucht anhand eines Beispiels die Möglichkeiten des Monitoring-Tools Google Analytics und in wie weit es sich für stadtplanerische Aufgabenfelder nutzen lässt. Es wird aufgezeigt, welche Informationen gewonnen werden können und wie diese die Kommunikation unterstützen. Nach Einführung in die Thematik werden die Bereiche Social Media und Social Media Monitoring definiert und deren potentieller Mehrwert dargestellt. Hierbei finden Aspekte wie Big Data, Data Mining, aber auch Social Media als Teil von E-Partizipationsprojekten Berücksichtigung. Die theoretischen Grundlagen werden anhand eines Fallbeispiels – dem „Vaihinger Band" – genauer beleuchtet und kritisch reflektiert. Ziel ist es, grundsätzliche Erkenntnisse für die Stadtplanung abzuleiten, um somit den Nutzen, aber auch Hindernisse und Grenzen des Social Media Monitorings herauszuarbeiten. Abschließend folgt ein Gesamtfazit über den grundsätzlichen Einsatz von Monitoring-Tools im Kontext der Stadtplanung.

3 SOCIAL MEDIA IN DER STADTPLANUNG

3.1 Social Media

Der Begriff „Social Media" entspringt, wie die Wort-Verbundenheit vermuten lässt, dem Social Web und ist:

„...ein Sammelbegriff für internet-basierte mediale Angebote, die auf sozialer Interaktion und den technischen Möglichkeiten des sog. Web 2.0 basieren." (Sjurtis, 2011). Dabei stehen many-to-many Kommunikation und der Austausch nutzergenerierter Inhalte (User Generated Content = UGC) im Vordergrund. Solche UGC erzeugende soziale Netzwerke sind beispielsweise Facebook, Twitter, Google+, aber auch Weblogs, YouTube Kanäle und Foto-Dienste wie Flickr, Instagram oder Pinterest. Social Media beschreibt damit die auf soziale Interaktionen abzielenden Anwendungen im Social Web, bzw. dem – aufgrund unscharfer Definitionen vielfach synonym verwendeten – Web 2.0.

Das Social Web besteht „…aus webbasierenden Anwendungen, den Daten, die dabei entstehen und den Beziehungen zwischen Menschen, die diese Anwendungen nutzen" (Ebersbach et al. 2011, S. 35). Die Anwendungen sind personalisiert und jede Interaktion eines Individuums ist somit nachvollziehbar. Somit werden Interaktionen und Inhalte sichtbar zu machen, was ihnen einen hohen Grad an Transparenz verleiht. Die Idee dahinter ist eine „Selbstorganisation" der Nutzer, die mit Hilfe der Community (Gemeinschaft) die Inhalte an deren Bedürfnisse anpasst. Dadurch ist es möglich, das Wissen jedes einzelnen zu vernetzen und infolgedessen „eine Art kollektives Wissen" aufzubauen (Ebersbach et al. 2011, S. 36).

Bisweilen findet sich ein Einsatz von Social Media im Marketingbereich, um beispielsweise die Bekanntheit einer Marke oder eines Produktes zu steigern, um neue Zielgruppen zu erschließen oder um gezielt Nutzer zu animieren, Unternehmensinhalte auf diesen Netzwerken zu teilen. Doch auch in der Stadtplanung bietet sich heute die Chance, durch einen Einsatz von Social Media neue Kommunikationswege zu beschreiten, um seitens der Planung noch enger mit allen Beteiligten zusammen zu arbeiten. Die Gründe hierfür sind knapper werdende öffentliche Ressourcen der Kommunen, die zu einem Umdenken gezwungen werden, um sich mehr an den Bedürfnissen der Bürger zu orientieren (vgl. Jourdan 2007, S. 23).

3.2 Social Media als Teil der E-Partizipation

Unter E-Partizipation (elektronische Partizipation) versteht man den Einsatz von IuK (Informations- und Kommunikationstechnologien) mit dem Ziel, dass Bürger „...auf verschiedensten Ebenen des politischen Systems mitwirken oder dies zumindest beeinflussen"(Kuhn 2006, S. 30).

Social Media als eine Art "neues Instrument" kann helfen, E-Partizipation zu realisieren. Der Weg der Stadtplanung wird in Zukunft vermehrt dahin gehen, dass Bürger immer stärker mit einbezogen werden und ihnen somit mehr Einfluss an Entscheidungen eingeräumt wird. Ziel ist demzufolge eine partizipativere und offenere Planung, die lokales Wissen nutzt, Konfliktpotentiale frühzeitig erkennt, die Planung in Legitimation und Akzeptanz stärkt und die Kommunikation zwischen Politik, Verwaltung und Bürgern verbessert (vgl. SenStadt 2012, S. 59). Im Bereich Social Media ist beispielsweise die Schweizer Stadt St.Gallen ein Vorreiter dafür, wie Social Media Kanäle zur Kommunikation transparent eingesetzt werden, um Bürger in Entscheidungsprozessen mit einzubeziehen (Stadt St.Gallen, 2014).

4 SOCIAL MEDIA MONITORING IN DER STADTPLANUNG

In Zeiten des sich immer weiter entwickelnden und somit komplexer werdenden Internets, ist es möglich, an immer mehr Informationen zu gelangen. Dadurch, so die berechtigte Hoffnung, rücken die Menschen mit ihren unterschiedlichen Meinungen, Ansprüchen und Sichtweisen stärker in den Mittelpunkt einer Planung, so dass all die unterschiedlichen Nutzungsansprüche Gehör und Berücksichtigung finden.

4.1 Definition Social Media Monitoring

In der heutigen Zeit des Social Web, in denen 74 % (Stand 12/2011, Tendenz steigend) der Nutzer mittlerweile in mindestens einem sozialen Netzwerk angemeldet sind, gewinnt Social Media Monitoring an Bedeutung (Bitkom, 2011). Social Media Monitoring beschreibt die langfristige Beobachtung von Nutzerverhalten auf Social Media Plattformen. Dazu zählen unter anderem die Gesamtanzahl der Besuche der Webseite (Besuche), die Gesamtanzahl der aufgerufenen Seiten (Seitenaufrufe), die Dauer eines Besuchs im Durchschnitt (Durchschnittliche Besuchsdauer), der prozentuale Anteil neuer Besucher (% neue Besucher), die Anzahl der Seiten pro Besuch (Seiten/Besuch) und eine örtliche Übersicht der Zugriffe (Räumlich meiste Zugriffe). Laut einer Marktstudie vom Fraunhofer Institut zum Thema Social Media Monitoring Tools, sind mögliche Anwendungsfelder u. a. (Kasper et al. 2010, S. 8):

- Reputationsmanagement
- Wettbewerbsbeobachtung
- Trend- und Marktanalyse
- Kampagnen-Monitoring
- Meinungsführeridentifikation (Influencer Detection)

4.2 Anwendungsfelder in der Stadtplanung

Social Media Monitoring eignet sich aufgrund der vielfältigen Möglichkeiten im Social Web für Kommunen und Planungsträger, da diese die Daten in sozialen Netzwerken, den User Generated Content, analysieren können. So lassen sich durch Monitoring-Tools beispielsweise der Erfolg des Reputationsmanagement einer Stadt oder Gemeinde nachverfolgen, die Social Media im Bereich des Stadtmarketings einsetzen. Ebenso ist es möglich, zu überprüfen, wie erfolgreich der Einsatz von Social Media bei einer bestimmten Kampagne war (Kampagnen-Monitoring). Auch können Meinungsführer identifiziert werden, um somit die relevanten Ansprechpartner zu finden und frühzeitig unterschiedliche Meinungen einzuholen.

Des Weiteren eignen sie sich für den Planer, um frühzeitig Trends und Meinungsbilder zu erkennen und ermöglichen es, auf diese zu reagieren. Das Social Media Monitoring dient der Generierung und Auswertung von Quellen des Social Web mittels Tools und ist als Instrument der Informationsbeschaffung für die Stadtplanung nützlich.

4.3 Das Beispiel Google Analytics

Monitoring-Tools bieten unterschiedliche technisch-methodische Ansätze, die jedoch keiner allgemeingültigen Definition unterliegen und im Rahmen dieses Papers in drei Gruppen unterteilt werden: a) „eingebetteten Tools" wie bspw. Google Analytics, welche mittels Quellcode auf Webseiten impliziert werden, b) accountspezifische, die Zugriff auf die API (Application-Programming-Interface) eines individuellen Accounts wie bspw. Facebook erlauben und c) „externe Tools“ wie bspw. Google Trends, die sog Metaanalysen von im Netz veröffentlichten Daten vornehmen (so ermöglicht es beispielsweise das externe Tool „Google Flu Trends“, anhand der Suchanfragen im Web, Grippewellen vorherzusagen). Insgesamt sind eine Vielzahl an Monitoring-Tools – mit unterschiedlichem Funktionskatalog – verfügbar (über 230 alleine auf http://wiki.kenburbary.com/), von denen einige kostenlos, die meisten jedoch kostenpflichtig sind.

Ein Beispiel ist das Tool „Google Analytics“, mit Hilfe dessen exemplarisch das Monitoring im konkreten Fallbeispiel erfolgte. Es ist ein Analyse-Tool, welches zu Google Inc. gehört und sich 2005, durch das Aufkaufen des Web-Analytik Unternehmens „Urchin“, zu einem Global Player im Bereich Web-Analyse entwickelt hat (Schotzger, 2005). Auf der Homepage (https://www.google.de/intl/de/analytics/) ist es möglich, Auswertungen von Webseiten vorzunehmen und sich diese durch standart- oder benutzerdefinierte Berichte, auf einem personalisierten Dashboard anzeigen zu lassen. Google Analytics wird, Stand Mai 2013, auf 57,5 % aller Webseiten verwendet, was in etwa einem Marktanteil von 81,8 % entspricht (w3techs, 2013). Damit ist es das wichtigste Tool im Bereich der Web-Analyse.

Es ist als kostenlose Version verfügbar und muss zuerst als Quellcode in die zu analysierende Webseite eingebettet werden. Durch Verwendung sogenannter „Cookies“, welche als Textdatei auf dem zugreifenden PC gespeichert werden ist es möglich, eine Analyse des Nutzerverhaltens anzufertigen. Wichtiges Detail hierbei ist, dass Google Analytics es anhand von Cookies ermöglicht festzustellen, mit welcher IP-Adresse (anonymisiert) auf die Seite zugegriffen wird. Das Ziel dieses Analyse-Tools ist es, eine fundierte Informationsbasis für die Betreiber bereitzustellen, um damit die Seiteninhalte an die Bedürfnisse der Nutzer besser anzupassen und sie dadurch gezielt zu optimieren. Der Betreiber der Webseite erhält Kenntnis über das Nutzerverhalten, wie beispielsweise beliebte Themen, Verweildauer und Zugriffszahlen. Auf dieser Basis besteht für die Betreiber die Möglichkeit, die Webseite nach ihren Vorstellungen hin zu beobachten (Google Inc., 2013).

5 FALLBEISPIEL VAIHINGER BAND

5.1 Das Projekt

Die Aurelis Real Estate GmbH & Co. KG, im Folgenden Aurelis genannt, ist ein Immobilienunternehmen mit Hauptsitz in Frankfurt am Main/Eschborn und hauptsächlich als Projektentwickler tätig. Ein aktuelles Projekt ist das „Vaihinger Band“ in Stuttgart, welches vorsieht, eine innenstadtnahe Brachfläche von ca. 2,5ha Größe zu entwickeln und neu zu bebauen. Es grenzt an den S-Bahnhof Vaihingen und liegt zwischen dem Gewerbegebiet „Synergiepark-Stuttgart“ und der Stadtmitte von Vaihingen, neun Kilometer südwestlich des Stadtzentrums vom Stuttgart (Aurelis Team 2013, S. 1).

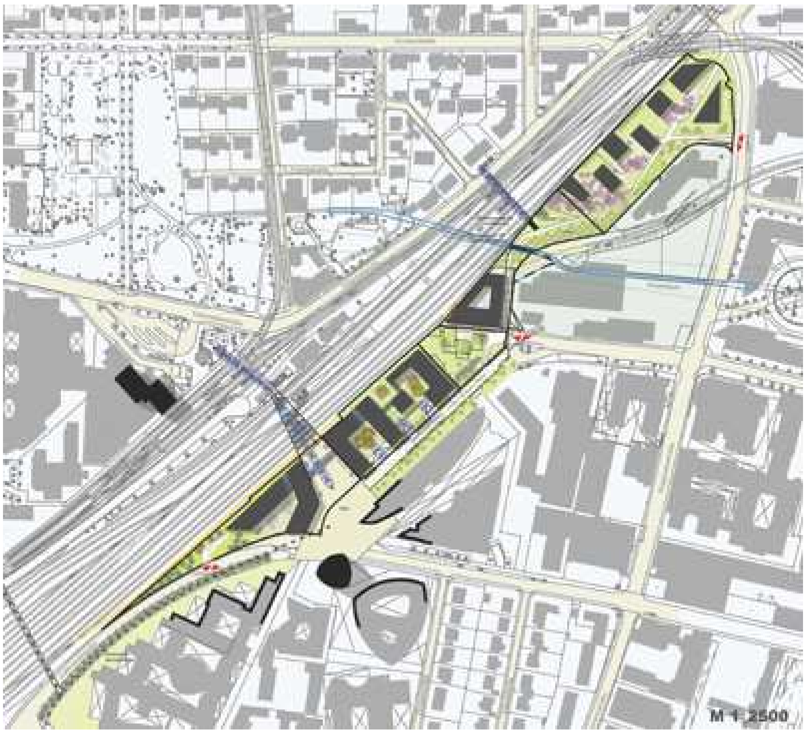

Abb.1: Screenshot des Weblogs zum Vaihinger Band (Quelle: http://www.vaihinger-band.de)

Ursprünglich sollte auf der Fläche ein Fernomnibusbahnhof (FOB) errichtet werden. Dies stieß jedoch auf erheblichen Widerstand seitens der Bevölkerung, was sich in einer Bürgerinitiative widerspiegelte (Die IgFOB-Initiative gegen einen zentralen Fernomnibusbahnhof in Vaihingen). Der Gemeinderatsbeschluss für den FOB wurde daraufhin wieder aufgehoben. Im März 2010 brachte sich Aurelis mit dem Vorschlag ein, zusammen mit den städtischen Vertretern einen moderierten Beteiligungsprozess durchzuführen, welcher mit Hilfe von sog. Planungswerkstätten vonstattengehen sollte. Ziel war es, gemeinsam mit kommunalen Politikern, Verwaltungen, Verbänden und Bürgern ein neues Nutzungskonzept zu erstellen (vaihingen-ös.de, 2010).

Ende Juni 2010 wurde damit begonnen, die Rahmenbedingungen festzulegen sowie die zu erreichenden Ziele zu formulieren, welche dann einen Monat später vor dem Umwelt- und Technikausschuss der Landeshauptstadt Stuttgart (UTA) präsentiert wurden. Damit eine Stärkung der Legitimation und Akzeptanz der Planung erreicht werden konnte, wurden auf Planungswerkstätten verschiedene Workshops und Vor-Ort-Termine abgehalten, die den Bürgern die Möglichkeit einräumte, ihre Ideen zur zukünftigen Nutzung der Fläche vorzuschlagen und mitzudiskutieren.

Im Februar 2011 wurden drei unterschiedlichen Szenarien öffentlich präsentiert und im April dem Umwelt- und Technikausschuss (UTA) der Stadt Stuttgart vorgestellt. Nach mehreren Terminen resultierte daraus die Idee, das Konzept „Stadtbausteine" weiter zu entwickeln, welches eine Neubebauung mit vielen Freiflächen vorsieht. „Im Ergebnis hat sich der UTA kongruent zu den Teilnehmern der Planungswerkstatt, mehrheitlich für die Ausgestaltung des Szenarios 2 Stadtbausteine ausgesprochen." Nach Erarbeitung der Rahmenplanung wurde im April 2012 mit der Einleitung des Bebauungsplanverfahrens begonnen (Aurelis Team 2013, S. 2).

5.2 Einsatz von Social Media – der Weblog

Um die Entwicklung des Vaihinger Bandes zu begleiten und transparent zu gestalten, wurde von Aurelis eine Online Plattform – ein sogenannter Weblog erstellt, der nach der Erarbeitung des Rahmenplans Online ging. Ziel war es, die Bürger über den aktuellen Projektstatus zu informieren und mit ihnen im Dialog zu bleiben. Zudem sollte er ein Instrument zur Kommunikation nach außen, aber auch ein Feedback-Kanal für die Bevölkerung sein. Neben der Informationsbereitstellung durch Aurelis, konnten auf dem Weblog Kommentare abgegeben werden. Diese sollten durch das Moderatoren-Team auch beantwortet werden.

Der Blog wurde auf Basis der Open Source Software Wordpress, ein CMS = Content Management System, von einem externen Dienstleister realisiert und ist unter der URL www.vaihingerband.de seit September 2012 abrufbar. Die Inhalte werden von Aurelis-Mitarbeitern verfasst und online gestellt. Der Weblog zum „Vaihinger Band" ist damit der erste Versuch des Immobilienunternehmens das Social Web als Kommunikationsstrategie für diese Art von städtebaulichen Großprojekten zu nutzen.

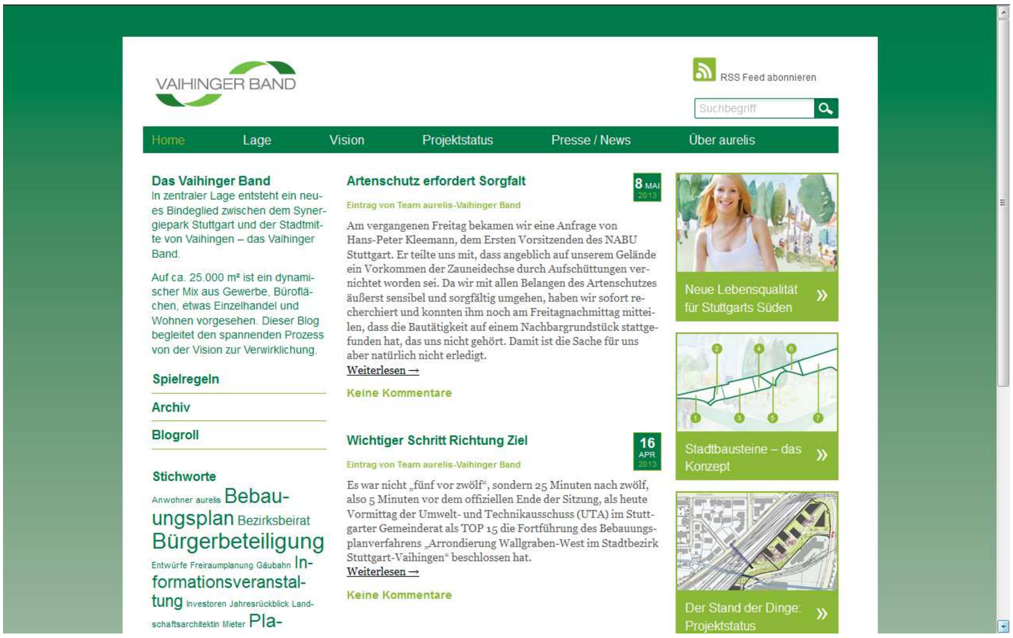

Abb. 2: Screenshot des Weblogs zum Vaihinger Band (Quelle: http://www.vaihinger-band.de)

5.3 Methodisches Vorgehen

Im Rahmen der Umsetzung des Weblogs beauftragte Aurelis das Fachgebiet Computergestützte Planungs- und Entwurfsmethoden in Raumplanung und Architektur (CPE) der TU Kaiserslautern mit der Begleitforschung. Ziel war die Evaluierung des Weblogs und des darauf erfolgten Nutzerverhaltens, um eine Einschätzung über die Möglichkeiten, Hindernisse und Verbesserungsmöglichkeiten dieser neuen Kommunikationsstrategie zu gewinnen. Ebenfalls sollte eine allgemeine Einschätzung abgegeben werden, ob sich ein solcher Weblog ebenfalls für zukünftige Projekte eignet.

Im Rahmen der darauf aufbauenden Diplomarbeit wurde das Monitoring über den Zeitraum von 9 Monaten mittels des Tools Google Analytics durchgeführt, um Aufschluss über die Besuche, die Seitenaufrufe, die durchschnittliche Besuchsdauer, den prozentualen Anteil neuer Besucher, die Anzahl der Seiten pro Besuch und eine Übersicht der Zugriffsorte zu erhalten.

Die Analyse und Auswertung des Blog wurde auf Basis der Daten durchgeführt, die von dem Programm Google Analytics erfasst wurden. Der benötigte Quellcode wurde von einem externen Dienstleister auf der Home- sowie allen Subdomains installiert, woraus sich ein vollständiges Bild der Nutzerströme ziehen ließ.

5.4 Ergebnisse

Der Erhebungszeitraum war vom 01.09.2012 bis 23.05.2013 und umfasste somit rund neun Monate. Hierbei wurden folgende Kennzahlen aufgezeichnet:

www.vaihingerband.de	Kennzahlen
Besuche	819
Seitenaufrufe	4.478
Ø Besuchsdauer	00:03:30
% neue Besuche	69,23 %
Eindeutige Besuche	567
Seiten/Besuch	5,47
Absprungrate	32,72 %
Räumlich meiste Zugriffe	Stuttgart (244)

Tabelle 1: Kennzahlen des Weblogs

Im Schnitt ergaben sich dabei 91 Besuche pro Monat, was zuerst einmal auf ein geringes Echo der Webseite hinweist. Es wurde ersichtlich, dass 69,4 % (568) einmalige Besuche waren, wohingegen 30,6 % (251) wiederholt auf die Seite zugriffen. Dies bedeutet, dass nur rund 1/3 aller Besuche wiederholt auf die Webseite zugriffen.

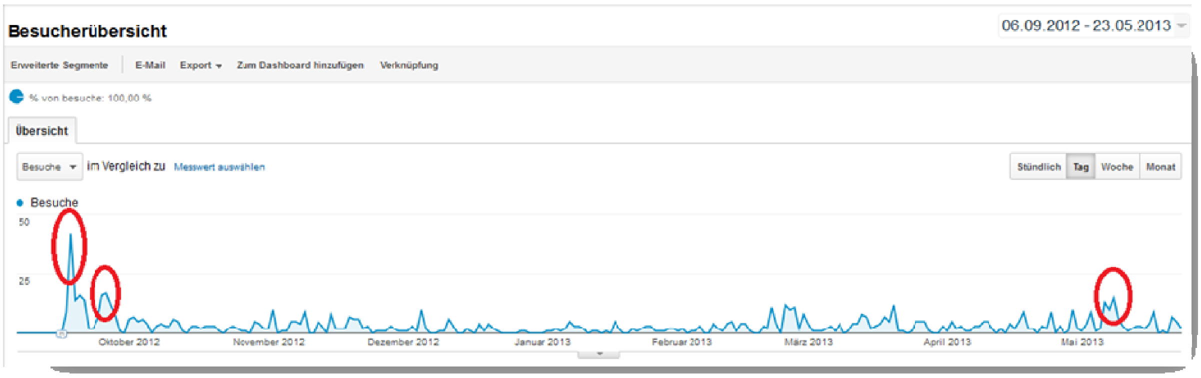

Abb. 3: Verteilung der Zugriffe im Zeitlichen Verlauf (Quelle: https://www.google.de/analytics)

Bei der tagesgenauen Auswertung der Besucherspitzen, also Tagen mit vergleichsweise hohen Zugriffszahlen, wurden drei Maxima mit je 42, 26 und 15 verzeichnet.

Ein Abgleich mit dem Veröffentlichungsprotokoll zeigte, dass es sich bei den ersten beiden Spitzen um die Tage nach der Veröffentlichung des Weblogs handelte und somit nicht unbedingt auf eingestellte Artikel zurückzuführen war. Die dritte Spitze ergibt sich aus dem Online-Stellen eines Artikels zum Thema Artenschutz („Artenschutz erfordert Sorgfalt“), in dem von Seiten Aurelis stellung zu falschen Anschuldigungen bezogen wurde. Hinsichtlich der räumlichen Verteilung zeigte sich, dass – kaum überraschend – die meisten von Stuttgart (244) und Frankfurt/Eschborn (91) aus erfolgten. Dies ist insofern von Bedeutung, da sich in Stuttgart das befindliche Bauvorhaben der Aurelis verorten lässt. Daraus erschließt sich für die Betreiber der Webseite, dass es genau aus der Region viele Zugriffe gab, in der das Projekt angesiedelt ist. Die nachfolgende Grafik zeigt eine Verortung anhand der Bundesländer, die jedoch auch bis auf lokale Ebene heruntergebrochen werden kann.

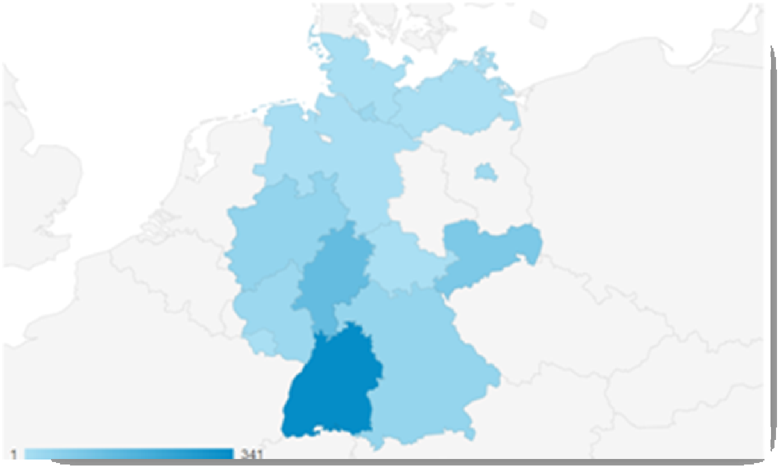

Abb. 4: Räumliche Verteilung der Zugriffe auf die Webseite (Quelle: https://www.google.de/analytics)

Im nächsten Schritt wurden die Seitenaufrufe analysiert. So zeigte sich, dass die 819 Besucher insgesamt 4.478 Seitenaufrufe verursachten, welche im Schnitt 3.30 min dauerten. Bei Auswertung des Leseverhaltens wurde ersichtlich, dass sich die Gesamtanzahl der Besucher im Schnitt 5,47 Seiten/Besuch angeschaut haben. Dazu zählen die Home- sowie alle Subdomains des Weblog. Ein weiterer wichtiger Punkt der von Google Analytics erfasst werden kann ist die Absprungrate. Sie stellt den prozentualen Anteil von Besuchern dar, die nur eine Seite betrachten und ohne Interaktionen nach weniger als zehn Sekunden die Seite wieder verlassen. Sie lag in diesem Fall bei 32,72 %, was als üblicher Wert angesehen ist (netzlabor GmbH, 2011).

Abschließend wurde das Zustandekommen der Zugriffe auf die Webseite ausgewertet. Daran lässt sich erkennen, ob die Seite durch die Suchmaschine Google gefunden, sie direkt in die Browserzeile eingegeben oder sie etwa auf sozialen Netzwerken geteilt wurde und von dort aus der Zugriff erfolgte. Wie sich in der folgenden Grafik erkennen lässt, kamen 34,2 % der Zugriffe durch Verweise von sozialen Netzwerken zustande, was bei 18 von 819 Zugriffen insgesamt jedoch sehr gering ist. Die meisten erfolgten entweder durch Eingabe in eine Suchmaschine (41,6 %) oder durch direkte Eingabe in die Browserzeile (24,2 %).

„Buzz“ bedeutet so viel wie summen oder schwirren und kann mit „Gerede“ ins Deutsche übersetzt werden…“ (gruenderszene.de, 2013). Der Social Media Buzz bedeutet in diesem Zusammenhang, ob und wie viel „Gerede“ bezüglich des Projekts im Social Web zu verzeichnen ist. Für das Vaihinger Band zeigte sich, dass es über den gesamten Zeitraum gerade mal 18 Verweise von den bekannten Plattformen Facebook und Twitter gab.

Insgesamt wurde anhand des Beispiels deutlich, dass es nur wenig Interesse an der Plattform gab und sich keine Diskussionen entwickelten. Dies erklärt sich durch einen vorher schon erfolgreich verlaufenen Planungsprozess und eine kaum vorhandene, grundsätzliche und umfassende Kritik an dem Projekt. Ebenfalls wurde veranschaulicht, worauf das Augenmerk bei zukünftigen Projekten gelegt werden sollte, die durch eine Kommunikationsplattform unterstützt werden. Eine klare Struktur der Seite ist dabei ebenso wichtig wie eine Einbindung in soziale Netzwerke. Für die Firma Aurelis bedeutete die Auswertung ein positives Ergebnis, da praktisch keine Kritik zum Vorhaben auf der Webseite abgegeben wurde und genau augezeigt werden konnte, wo das Hauptinteresse der Besucher lag.

6 KRITISCHE REFLEXION

Ein solches Thema zur Analyse von Nutzerdaten kann nicht ohne den kritischen Apsekt des Datenschutz behandelt werden. „Nach § 4 Bundesdatenschutzgesetz (BDSG) ist die Erhebung, Verarbeitung und Nutzung personenbezogener Daten nur zulässig, wenn der Betroffene eingewilligt hat oder eine andere Rechtsvorschrift die jeweilige Datenverwendung auch ohne entsprechende Einwilligung legitimiert“ (Ulbricht, 2011). Allgemein lässt sich jedoch sagen, dass: „...Social Media Monitoring ... durchaus im Einklang mit deutschem Datenschutzrecht betrieben werden (kann). “ (Ulbricht, 2011).

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Beim Besuch von mit Google Analytics versehenen Seiten wird in der Datenschutzerklärung zudem darauf hingewiesen, dass Cookies auf dem Rechner platziert werden, wogegen jedoch durch Einstellungen im Browser Einspruch erhoben werden kann. Die Problematik hierbei ist einerseits, dass die Einstellung zur Deaktivierung von Cookies meist im Browser versteckt ist, andererseits wissen viele Nutzer nicht, wie Google Analytics Daten erfasst und somit bspw. die personalisierte Werbung ermöglicht. Es besteht die Gefahr, dass unliebsame Meinungsgruppen von Diskussionen ausgeschlossen werden können und dadurch eine einseitige Informationsbasis entsteht, die ein Vorhaben positiv in der Öffentlichkeit platziert, obwohl durchaus Kontroversen bestehen. Ein anderer Aspekt ist die geringe Qualität der Diskussionen, die in sozialen Netzwerken geführt werden. Sie sind nicht immer aussagekräftig und werden teils von Anonymen Nutzern in eine unerwünschte Richtung gelenkt.

Ein ebenfalls wichtiger Punkt ist der, dass viele Anbieter von Monitoring-Tools ihren Sitz außerhalb Deutschlands haben und sie somit nicht dem deutschen BDSG unterliegen. Gerade vor dem Hintergrund der Enthüllungen von Edward Snowden bleibt somit der fade Beigeschmack, ob die gewonnen Daten von ausländischen Behörden nicht doch personenbezogen zugeordnet werden können und deshalb ein politisches Ausspähen denkbar ist. Dies ist vor allem dann relevant, wenn es in Zukunft gesetzlich verankerte E-Partizipation auf Bundesebene geben sollte, in denen beispielsweise deutschlandweite Bürgerentscheide oder das Freihandelsabkommen mit den USA zur Debatte stehen.

7 FAZIT UND AUSBLICK

Es konnte aufgezeigt werden, dass sich Monitoring-Tools von der Stadtplanung dazu nutzen lassen können, um Social Media Plattformen zu untersuchen und auszuwerten. Anhand des Beispiels wird deutlich, wie ein Monitoring-Tool als Instrument eingesetzt werden kann, um mit einem neuen Ansatz den Wirkungsgrad einer Social Media Plattform zu quantifizieren. Es wird deutlich, dass durch eine ständige Entwicklung im Social Web, auch für die Stadtplanung neue Instrumente zur Verfügung stehen, was durch den Einsatz von Monitoring-Tools um einen weiteren Aspekt ergänzt werden kann. Social Media wird demnach für die Stadtplanung immer bedeutender, eben weil sich nutzergenerierte Inhalte mittels Monitoring Tools auf deren Inhalte hin auswerten lassen. So kann die Frage nach dem Mehrwert von Social Media in der Stadtplanung dahingehend beantwortet werden, dass eine Vielzahl an Daten auf unterschiedliche Art und Weise ausgewertet werden können und es hierdurch möglich ist zu überprüfen, ob und wie erfolgreich der Einsatz von Social Media zur Unterstützung eines Vorhabens im Bezug zur Stadtplanung ist.

Derzeit gibt es jedoch eine Fülle an Tools, die sich dazu eignen, Daten aus sozialen Netzwerken auszuwerten. Jedes Tool hat dabei andere Funktionen und besitzt somit unterschiedliche Vor- und Nachteile. Je nach Sinn und Zweck muss individuell entschieden werden, welches Tool bspw. zur Erfassung von Daten einer Kommunikationsplattform oder eines Sozialen Netzwerkes dient. Für das Monitoring von Webseiten hat sich zur Gewinnung von Daten, Google Analytics als besonders wertvoll herausgestellt. Dieses Tool ermöglicht es neben Zugriffszahlen, insbesondere das Verhalten der Nutzer einer Webseite nachzuvollziehen. Aufgrund der Analyse konnte festgestellt werden, dass die Reichweite des Weblogs als sehr gering einzustufen ist und dass durch eine fehlende Einbindung in andere Soziale Netzwerke nur sehr wenig Traffic generiert werden konnte.

Aufgrund dieser Tatsache wurde deutlich gemacht, dass eine Webseite, die nicht zusätzlich durch soziale Netzwerke unterstützt wird, ihre Wirkung als Kommunikationsplattform als solche verfehlt. Mit Hilfe einer solchen Einbindung in soziale Netzwerke wäre es also möglich gewesen, auf der Webseite zum Vaihinger Band mehr Traffic zu generieren, um sie als Kommunikationsplattform besser zu unterstützen. Es zeigt sich, dass durch eine Monitorings auf die Bedürfnisse der Nutzer eingegangen werden kann, um im Bereich Social Media eine Transparenz und Offenheit darzulegen, welche die Akzeptanz gegenüber einem Vorhaben in der Bevölkerung steigern kann.

Anhand der Analyse und des Monitoring konnten Aurelis somit klare Handlungsempfehlungen für dieses, aber auch für zukünftige Projekte mit auf den Weg gegeben werden. Die wichtigste Erkenntnis dabei war, dass die Seite das eigentliche Ziel als Kommunikationsplattform verfehlte und in ihrer Reichweite sehr begrenzt war. Zudem wurde ersichtlich, dass jegliche Einbindung sozialer Netzwerke fehlte, was jedoch den Bekanntheitsgrad der Seite erheblich steigern könnte. Ebenfalls erkennbar war, dass aufgrund des enormen Aufwands beim Betreiben der Seite und dem durchgeführten Monitoring zusätzliche Kräfte akquiriert werden sollten, um der Fülle an gewonnenen Daten gerecht werden zu können.

Es bleibt festzustellen, dass Monitoring-Tools dabei hilfreich sind, das Potential von UGC auszuschöpfen. Jedoch bleibt anzumerken, dass bei allen Vorteilen die Monitoring-Tools bieten, sie trotzdem nur unterstützend sind und somit nur als Teil eines gesamten Planungsprozesses gesehen werden können. Auch sollte beachtet werden, dass sich nicht alle Probleme auf digitale Weise lösen lassen, sondern sie nur eine zusätzliche Unterstützung erfahren können.

Durch das sich ständig weiterentwickelnde Social Web und immer neueren Monitoring-Tools wird es zukünftig noch mehr Möglichkeiten geben, um diese für die Zwecke einer nachhaltigen Stadtplanung gezielt einzusetzen, was sich bereits heute in ersten Ansätzen abzeichnet.

8 DANKSAGUNG

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Regional Identity and Culture in Intercompany Networks – a Case of Transdanubian Winery Networks

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1 ABSTRACT

Nowadays a wide range of cooperations can be observed from strategic alliances through networks of suppliers till clusters, due to the fact that market players through collaboration can gain competitive advantages, can facilitate their market penetration and corporate growth. Wineries are neither exception of these cooperations while they go through a dynamic transformation. But how can regional identity, culture, trust and the connectedness of economic players encourage wine-makers to cooperate, to participate in a network or to be an active member of a cluster?

The objective of the research is to measure how social capital can influence network or cluster formation through its soft factors such as culture, connectedness, mutual trust and regional identity. Hypothesis states that participation in a winery cluster is highly dependent on regional identity. Statistical examination - using factorial analysis and bivariate correlations - of seven different wine regions in Transdanubia, covering up 179 wineries who are active members of a network or a cluster proves that there is a positive significant correlation between regional identity and likeliness of joining or even forming a network. Intercompany cooperations tend to develop faster in regions where economic players share common values, norms and show deep regional identity between their members. In this work, a special focus is devoted to the wine region of Pannonhalma.

2 INTRODUCTION

Emphasizing regional identity, culture and trust in network formation we must remember the thoughts of Fukuyama (2000) about economy: "economy is not what it seems to be; it is well rooted in social life, and it cannot be analyzed without taking the establishment of modern societies into account". This means that economy is inseparable from culture: actors are highly influenced by all those elements, structures and functions that surround them in time-space relations, such as nature, history, tradition, morality, norms or even individual connectedness (Paasi 2009; Brányi 2012). Moreover, individual connectedness - in other words social relations - in line with regional identity promotes social trust and confidence, which gives great support to regional development through local networks (Vadasi 2009).

3 THEORETICAL BACKGROUND

The regions are striving for establishing the relatively high level of income and employment. Their competitiveness is not for their own sake, it is aimed at the improvement of the welfare, living standards and quality of life of the people who live their, which is based on the ability of innovation. A region can be successful if employees concentrate in the economic services and in the processing industry, but their competitive advantage derives from business services and knowledge centres. With the development of technology, the accelerated time people's learning and knowledge have required/demand a continuous change. (Tamándl 2013) To be able to utilize the possibilities, together with regions the institutions have to create a flexible structure which takes into account the regional facilities, the possibilities and needs of the regions; furthermore, the structure of the institution is suitable for adopting technological, economic and social innovations, and is capable of close cooperation and communication with the regional economy. (Rechnitzer 2009) Innovation has priority, because they contribute to development. That is the reason why it is necessary to create harmony between the needs of companies. (Filep 2009)

Researchers found that regions with commonly shared cultural background, with high social capital and trust seems to be able to initiate and execute regional economic development strategies and projects more easily and more effectively than regions with low social capital and low trust (Vadasi 2009). According to Vadasi "regional competitiveness can be evaluated by the level of development of clusters and networks located in the region. The formation and development of these networks always rely on the supportive social and cultural background, which is built on existing trust and confidence." After having social networks and trust established, more mature corporate networks can evolve (Granovetter 2005). These networks also serve as a reward and punishment system among economic actors; furthermore, it improves the regional consciousness and solidarity (Putnam, 2000; Coleman, 1990).

4 RESEARCH METHOD

This paper is empirically based, therefore quantitative descriptive research method was chosen, where samples were taken once (Malhotra, 2005). The entire population of the wine firms from the eight Transdanubian wine regions was sourced. In all, 179 firms were included in the sample with the restriction, that they must belong to an active operating wine cluster or network. All of these firms were surveyed, out of 179 firms, 128 replied resulting in a response rate of 71%, which is outstanding and statistically it can be considered as representative (Sajtos – Mitev, 2007). To collect data during the qualitative research phase surveys were created and delivered to respondents personally, by mail or online after an initial phone call about the research.

Respondents were asked a series of questions related to social capital, which measured the willingness of cooperation, the motivation of entering a network or cluster and the level of trust and confidence toward local economic actors in the wine industry. Respondents were asked to assess these factors on a five-point Likert scale from strongly disagree to strongly agree. The final survey contained 57 questions, where the measuring level of the response combinations show 11 nominal, 18 ordinal and 62 scale variables.

5 RESULTS

Hungarian national wine production averaged 3,5 million hl in the last 5 years (2007-2012) according to National Council of Wine Communities (Hegyközségek Nemzeti Tanácsa – HNT, 2012), which made up a 2% of total EU wine production. Hungary occupies the 18th position in the ranking of wine producers in the world, and the 8th rank in the EU (HNT, 2012). The surface dedicated to grape growing was 71.791 ha of vineyard in 2012 (HNT, 2012), which shows a significant 15% reduction since the EU accession.

The majority of vineyards can be found in 22 wine regions (appellations), where Hungary produces mainly PDO wine (protected designation of origin), PGI wine (protected geographical indication) and table wines on 53.842 ha (HTN, 2012). In this paper I focus on the Trandanubian region of Hungary which covers up 15 wine regions with 25.558 ha. Out of these 15 wine regions the above mentioned 8 wine regions were measured, giving 59% of the Trandanubian wine production (HTN, 2012).

Within these 8 wine regions some private and even government agencies stimulate the formation of wine networks or clusters between wine growers and cellars; however, it was eased up by the culture and the history of wine growing, as well as the willingness of mutual assistance and cooperation. In some cases, other agents such as higher education institutions or government agencies extend these cooperations.

5.1 Soft factors effecting intercompany cooperations

Before the data were submitted to factor analysis using Principal Component Analysis, all those soft factors were ranked, that influence the motivation of entering a wine network or cluster. According to the results, it can be seen, that Vadasi's (2008) findings were partially accepted as the positive image of the region (4,82), identification with the region (4,65), former acquaintance with cluster members (4,20) were valued as the most important factors of entering a network or a cluster. Paasi (2002) claims that "spatial connection and proximity results in interpersonal interactions among community members", is a statement valid for the measured wine regions as well. As a result, intercompany cooperations are well supported by commonly shared cultural values and norms.

The first three soft elements were followed by factors such as possibilities of lobbying (3,67), trust and confidence to local actors (3,45), former strong connections with members (3,41), coping with former negative "memories" (3,23) and the possibility of dividing tasks between members (2,79). The results highlight the importance of confidence and connectedness in intercompany network formulation. Regarding Putnam (1993) and Coleman (1998) network density, confidence and durability of relationships, in other words former connections with members, are key elements to high level of trust and cooperation. Indeed, these soft factors of social capital are valued highly important by respondents. Standard deviation approves it statically, as it is always below 0,7, which means that wine growers and cellars uniformly share these values.

5.2 Correlation between soft factors

After having the soft factors ranked, correlations of variables were controlled for statistical significance with Pearson's correlation coefficient in order to reveal the linear relationship between trust and confidence, regional identity, lobbying power, risk sharing and between former business relations or acquaintance. Boxplot helped identifying potential outliers, and then correlation analysis was performed. Correlations were accepted above 0,01 significance level (Sajtos-Mitev, 2007, 211. p.).

It can be concluded, that trust and confidence correlates statistically to risk sharing among members (r=0,657), possibility of lobbying (r=0,608), coping with former negative "memories" (r=0,505), dividing tasks between members of cluster or network (r=0,465) or even it strengthens the lobbying power towards governmental institutions (r=0,460).

These findings on trust and confidence are in line with Putnam's (1993) statement on trust or distrust, namely "trust, confidence, norms and elementary networks, so to say "civil virtues" exert and facilitate their effect in social relations". Regarding Coleman's (1998) three types of social capital utilization theory, the role of norms and sanctions are present in the Trandanubian wine clusters or networks. It helps overcoming former negative experiences, extends connectedness to local actors, thus creating mutual trust.

Furthermore, it can be stated, that former acquaintances correlates with active business connections between members (r=0,469), helps dividing tasks between local actors (r=0,437) and a perfect tool of sharing risks and overcoming market threats (r=0,435). At this point referring to Granovetter (2005) and Coleman (1998), social connectedness can greatly influence the development of social networks, which in turn affects the willingness to cooperate. Built on former connections companies do not set up defensive behavior, they realize common interest instead. After having social networks established, more mature corporate networks can evolve, which can also be found between the Transdanubian wine cluster members, as well as in Pannonhalma wine region.

Regional identity or one's identification with the region as a soft factor effecting intercompany cooperation was measured in the research too. Results show a strong correlation between the identification with region, namely how one identifies himself with a certain region with its culture, sociality, morality or traditions, and between projecting positive image of the region (r=0,599). As Paasi (2009) states regional identity indicates social integration in a region. Giving the fact that wine regions have very clear boarders they are easy to differentiate from one another, as a consequence, wine growers and cellars can unambiguously identify themselves with the region and they actually doing so.

5.3 Soft factors effecting intercompany cooperations

The soft factors were analyzed using Principal Component Analysis with varimax rotation and considered all valid observations of each variable for the missing data. The index of Kaiser-Meyer-Olkin (KMO) adequacy of the sample was 0,645 and the Bartlett's Test of Sphericity (significant to 0,000) indicated the factorability of data. The KMO indicates that the factor analysis is an appropriate technique (Sajtos-Mitev, 2007, p. 258).

The result of factor analysis suggested that the motivation of entering a wine network or cluster is explained by five factors, with 66,9% of total variance explained. The Cronbach's alpha is above 0,5, which represents a good range for an exploratory study, furthermore, the items' coefficients absolute value are above 0,5 as well (Sajtos-Mitev, 2007). It is possible to conclude that the items in each dimension of the construct are suitable for measuring all those soft factors that influence the motivation of entering a network or a cluster.

As one contribution of this study, Table 1 shows the variables and accordingly the emerged factors. It is possible to observe that they represent the dimensions of social capital, namely trust and confidence, regional identity, connectedness and distrust. The meaning of each factor can be inferred from the content.

In the case of Pannonhalma wine region's wine growers the social capital is represented mainly by *trust and confidence*, which explains 29,24% of the total variance. The *regional identity* factor represents 11,89%, the *connectedness* factor 10,26% , the *power of cluster* factor 8,27% and finally the *distrust* factor explains 6,98% of the total variance.

The results call attention to the fact that the averages of the variables in each factor, in other words the soft factors motivating wine firms to enter a network, are very similar for *trust and confidence*, *regional identity* and *connectedness* and *power of cluster* factors, ranging from 2,85 to 4,3, while *distrust* factor has a mean of

2,75. Therefore, we conclude that there is an important role of social capital in the decision of entering or formulating a wine network or even a cluster in the Pannonhalma and Transdanubian wine region. However, distrust is present, but it is underweighted compared to the other four factors. In this perspective, we argued that the soft factors of social capital were effectively motivators in the intercompany cooperations, as discussed previously.

Factor	Item	Loading	Mean
Trust and confidence 0,812* 3,05**	Possibilities of lobbying	,830	3,67
	Possibilities of dividing tasks	,810	2,77
	Increasing trust and confidence to local actors due to cluster	,660	3,45
	Lobbying power towards government institutions	,640	2,74
	Business connections between members	,580	2,65
Regional identity 0,727* 4,73**	Positive image of the region	0,91	4,82
	Identification with the region	0,80	4,65
Connectedness 0,629* 3,72**	Former acquaintenance with members	0,83	4,20
	Strong connections to local members	0,79	3,24
Power of cluster 0,564* 2,85**	Developing active trade connections with member companies due to cluster	0,73	2,65
	Increasing power of cluster members toward suppliers	0,70	2,53
	Risks are commonly shared among members	0,50	3,37
Distrust 0,528* 2,75**	Due to distrust low level of knowledge-transfer	0,74	2,55
	Higher costs but low rate of return through cooperation with others	0,70	2,68
	Cooperation with rival companies	0,54	3,03

*Note: Cronbach's alpha, **Note: Mean of factor

Table 1: Soft factors motivating Transdanubian wine firms to enter a network or cluster. Source: own research (2013)

6 FINAL CONSIDERATIONS FINAL CONSIDERATIONS AND FUTURE RESEARCH POSSIBILITIES

As wineries from all over the world go through a dynamic transformation since globalization, many wine producing enterprises in the traditional European wine regions are forced to deal with low-cost, standardized quantities of New World wine backed with heavy marketing campaigns. Hungarian wine producers are neither exception; just like other traditional European wine producers they seek competitiveness by intercompany cooperations. Generally Hungarian wine networks are present but formed rarely, which can be explained by bad memories of forced cooperation during communist era, lack of capital in the wine sector, distrust between actors and some opportunistic behavior with short term thinking (Cafaggi, 2010). To overcome these difficulties a supportive social and cultural background is essential, which is built on existing trust and confidence, in other words, on social capital.

The aim of this research was to examine social capital and to measure those soft factors that motivate or influence enterprises to enter intercompany cooperations. The research applied to the role of social capital in wine industry shows that intercompany network formation is highly influenced by trust and confidence, regional identity and connectedness of local actors. However distrust is still present, it cannot hinder network formation itself, but able to slow down knowledge-transfer between members. The results confirm the importance of assessing social capital in intercompany wine networks, which can be summarized: 1. high level of trust and confidence ease up intercompany formations; 2. intercompany networks divide the risks among members; 3. intercompany networks allow that its members solve their collective problems easily.

The case of the eight wine regions in Transdanubia demonstrates that spatial connection and former interpersonal interactions among members were necessary to initiate first informal network formation. After having social networks and trust established, more mature corporate networks could evolve. The publication results also support the findings of Granovetter (2005) and Vadasi (2009), namely society has to reach a certain level of social capital to establish networks, which can later improve competitiveness, enhance broader social cooperations and boost knowledge-transfers.

Future research should investigate social capital evolution and their effect in wine clusters and networks on a longer time scale, exploring the role of trust and connectedness in emerging wine regions as well.

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RegioProjektCheck – New Instruments to Evaluate the Impacts of Housing, Industry and Retail Projects. Case Study: New Supermarkets and their Effects on Existing City Centres

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1 ABSTRACT/THE REGIOPROJEKTCHECK APPROACH – MAJOR REGIONAL PROJECTS REQUIRE EARLY INTER-MUNICIPAL COORDINATION

The regional tier for planning and approval occupies a central position in Germany's settlement and land development. It becomes involved when regional plans are drawn up at county level. However, it is at municipal level that the actual location of any new housing, industrial and retail schemes is determined. The impact of these new projects is often felt not only locally but regionally – both in a positive and negative sense, i.e. the effects in financial, transport, ecological and sometimes social terms are not limited to administrative boundaries of municipalities or even cities. In many cases they extend far beyond the municipalities' administrative boundaries and cause changes in the regional structure and in the development of closely intertwined cities and municipalities.

Great importance is given to the processes of consideration and negotiation, which have to a large extent been formalised in Germany, involving local stakeholders in politics, planning, the economy as well as citizens. However, as a rule, these processes are spatially limited to subspaces or technically restricted to specialist subjects. An overall view which considers different impacts on one another is often lacking or limited, at least at the time when decisions are made, i.e. before the actual development plan is adopted. This is where the RegioProjektCheck (RPC) applied research project comes in. RegioProjektCheck helps with the appraisal and assessment of both positive and negative effects of new residential areas, industrial zones and major retail projects from early on in the process. In-depth questioning of specific topics then leads to a higher-level assessment which equally examines economic, ecological and social aspects and so is able to influence planning decisions at an early stage. While the project's focus lies on the computation and illustration of regional effects, RegioProjektCheck can also provide the basis for considerations at municipal level, depending on the size of the municipality. The appraisal of impacts is achieved with relatively readily available data, is GIS-based and should, as a rule, work for Germany as a whole.

2 EMBEDMENT INTO SUSTAINABLE LAND MANAGEMENT, PROJECT TEAM AND PROJECT DURATION

The research project is supported by the Bundesministerium für Bildung und Forschung (Federal Ministry of Research and Education) as part of the "Nachhaltiges Landmanagement" (sustainable land management) research programme in the period 2011 to 2014. It is a joint project in module B "Innovative Systemlösungen für ein nachhaltiges Landmanagement" (Innovative system solutions for sustainable land management) (cf: www.nachhaltiges-landmanagement.de). Furthermore, RegioProjektCheck is a joint research project with HafenCity Universität Hamburg (HCU) and the Institut für Landes- und Stadtentwicklungsforschung (ILS), Dortmund, in cooperation with the planning consultants Gertz Gutsche Rümenapp (GGR), Hamburg, and Raum & Energie, Wedel.

RegioProjektCheck seeks to provide a set of standardised tools that can be employed throughout Germany. It was developed in cooperation with two model regions to ensure that the toolbox is practicable and meets the requirements of relevant local stakeholders and, if need be, its content can be modified in order to achieve these goals. The "Landkreis Harburg" (federal state of Lower Saxony) borders on Hamburg in the south; the "Rheinisch-Bergischer Kreis" (North Rhine Westphalia) lies east of Cologne. Selection criteria for these model regions were their declared interest in the project and the fact that the regions were expanding and growing and thus were confronted with the development of new residential and industrial areas as well as large retail developments. Inclusion of local stakeholders took place with expert interviews and workshops in which the approach and intermediate results were then discussed with them. Additionally, an external expert panel was set up which was composed of representatives of municipal and regional planning authorities as well as promoters of the economy and representatives of the private sector.

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3 REGIOPROJEKTCHECK – TOPICS AND FIELDS OF ACTIVITY

RegioProjektCheck was developed for housing, industrial and retail projects and seeks to support the process of opinion-forming during the early stages of a project when planning decisions are made (before the start of the actual development plan procedure). The target group for its application includes representatives from the municipal and regional administrations as well as representatives in the field of politics and the economy. RegioProjektCheck models and assesses municipal and regional impacts caused by new residential, industrial and retail developments and examines the following fields of activity: "municipal infrastructure cost", "municipal income", "impact on transport", "energy consumption", "area and ecology", "accessibility" and "competitive locations of supermarkets" (see figure).

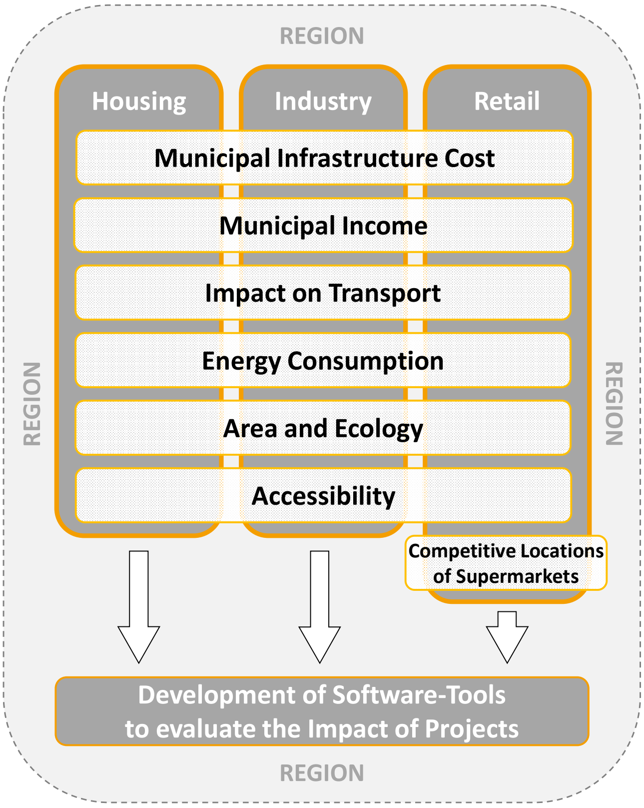

Fig. 1: RegioProjektCheck – Topics and fields of activity

RegioProjektCheck was designed as a GIS-based toolbox which can be used modularly (i.e. separately for each field) according to the local and regional possibilities and problems. Furthermore, users can test variants of the proposed projects – e.g. different sizes and locations – by modifying certain project parameters. This will promote discussion and consideration at municipal and regional levels during the early planning stages. The following section provides a detailed description of the content and methodology in the "competitive location of supermarkets" field.

4 FIELD OF ACTIVITY: COMPETITIVE LOCATION OF SUPERMARKETS

The locations of supermarkets and their effects on existing local suppliers are a continuous source of controversial discussion in Germany. Therefore, the focus of the RegioProjektCheck study is placed on the anticipated changes in absorption of purchasing power and the anticipated changes in turnover of existing businesses caused by a new supermarket. It is based on changes in shopping behaviour (purchasing power flows) which result from a new supermarket. The centres mainly affected are looked at, i.e. city centres, neighbourhood and local supply centres as well as important single supply locations within the municipality or nearby municipalities.

The model is based on a Germany-wide telephone survey of more than 4,000 households (approximately 10,500 people) making approximately 6,100 shopping transactions (first and second main shopping locations) in the contexts of different settlement cultures. In consideration of the competition among municipalities and regions, it was possible to deduce the probability of a household or person using a specific supermarket by taking into account the retail format and distance from home to supermarket (retention of buying power, shown as exponential function). If the existing local purchasing power (consumer expenditure on food retailing is on average 2,560 euros per person and year, of which 84.6 percent are spent in supermarkets (cf: Statistisches Bundesamt (Ed) (2009)), own computations and updates) is included in the calculation, the assumed annual turnover for food products can be calculated for each location. The specific competition in the region is calculated on the basis of geo-referenced data input on the region's existing retail situation and, derived from it, the distance matrix between home (based on settlement cells of 250 x 250 metres edge lengths) and location of supermarkets.

The sample calculation for the establishment of a supermarket in the model region "Landkreis Harburg" comes up with the following catchment area for the new project, differentiated according to proportional absorption of purchasing power (see figure). It is based on the above assumptions about the absorption of purchasing power as a factor of population density, level of purchasing power and competition in a particular location.

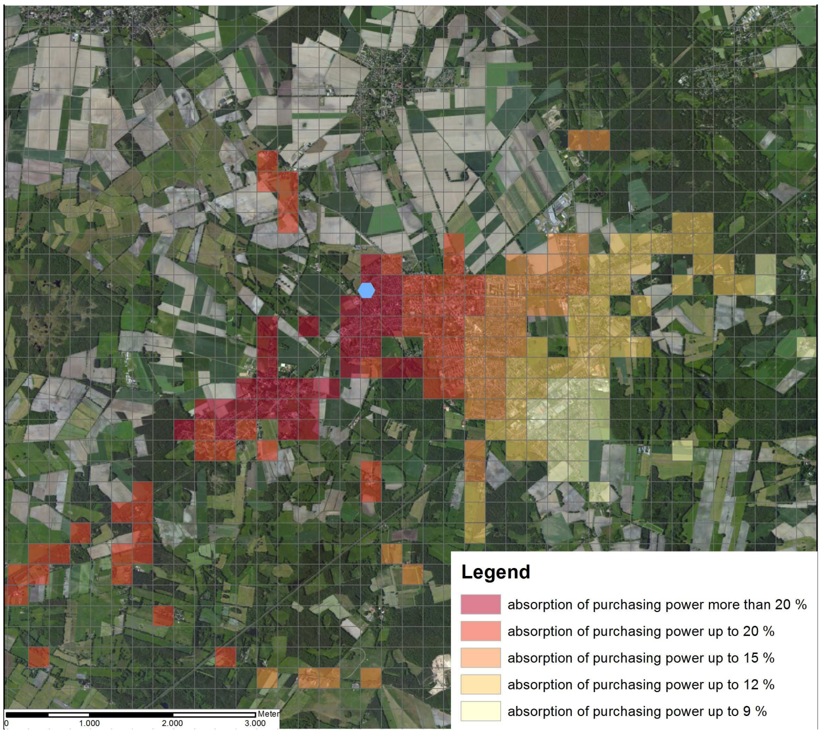

Fig. 2: New supermarket – Catchment area for the new project

The anticipated overall annual turnover is approximately 8.5 million euros (gross) in the grocery sector (this does not include the anticipated sales figures in the toiletries sector and the non-food II sector – i.e. sales items such as clothing etc.). The figure also allows for an attractiveness factor of new shops.

The RegioProjektCheck applies this method for calculating the absorption of purchasing power to all supermarket locations in the region. Comparison of the computed turnover of the (proposed) supermarket before and after implementation results in a delta, i.e. a differential of calculated turnovers in the grocery sector. This differential is equivalent to the average calculated loss of sales that the existing supermarkets may expect due to the opening of a new supermarket.

In the sample calculation this shows the following figures (see table):

	City centre	Neighbourhood centre
Overall manual turnover – before	19.6 million euros	27.4 million euros
Overall manual turnover – after	17.7 million euros	22.8 million euros
anticipated changes in turnover	***- 1.9 million euros***	***- 4.6 million euros***
anticipated changes in turnover (%)	***- 9.8 %***	***- 16.8 %***

Table 1: Case study new supermarket – differential of calculated turnovers in the grocery sector

The German planning system requires an assessment of the effects on the availability of basic amenities in areas around settlements and in existing centres, and to weigh up whether the consequences can be supported

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or not (cf: Article 11 Section 3 BauNVO “Baunutzungsverordnung” (Land-use Ordinance) and/or Article 34 Section 3 BauGB “Baugesetzbuch” (German Federal Building Code)). Overall objectives include safeguarding the evolved urban structure, reduction of land consumption by avoiding expansion and any additional car traffic. As a rule, this information is not available until plans for the development and its location have progressed far down the line, and are at a stage when modifications are difficult to realise. The RegioProjektCheck and its toolbox aim to give local stakeholders the opportunity to compare alternative locations or different concepts at an early stage (before the actual development plan procedure has started).

The German building control procedure, in accordance with Article 11 Section 3 of the “BauNVO” (Land-use Ordinance) and/or Article 34 Section 3 of the “BauGB” (German Federal Building Code) – and the approach of the particular consultants appointed for the job – often triggers controversial discussion about what the threshold percentage of loss of sales is before having a negative impact on an existing urban area. Although several comments and court decisions have established that there is no blanket figure and each individual case must be considered and tested on its own merits (cf: BVerwG, 17. Dec. 2009 – 4 C 1.08; Fickert, H. C./Fieseler, H., 2008), planning practitioners generally apply a threshold of 10 percent (for whatever reason) as a blanket assessment criterion (cf: Vogels, K.-H.; Holl, S.; Birk, H.-J.,1998; Stadt und Handel (Ed.), 2007; Kuschnerus, U., 2007). RPC intervention will not be able to put a stop to these discussions. However, it does provide the opportunity to deliver objective figures at an early stage which can be verified by local planners and politicians. This may also reduce dependency on reports by external experts.

Further to providing information on economic effects of new supermarkets, RegioProjektCheck delivers a detailed index of supply amenities which can help to determine whether a new supermarket is recommended in a municipality or not.

- Retail centrality shows the ratio of turnover (gross) in a sector (in this case: food) to the existing purchasing power within a study area (in this case: municipality). For values over 100 percent the municipality has balanced purchasing power inflows; values below 100 percent ascertain balanced purchasing power outflows in the municipality.
- The index for density of retail selling space in the food sector (sqm sales area/population) indicates the ratio of total selling space for food to the number of inhabitants. The higher the figure, the better the existing amenities in the survey area.

Looking at Harburg: Implementation of the tested case study would result in the following index (see table).

	Index for density of retail selling space (sqm sales area/population)	Retail centrality – food
before	0.39	87 %
after	0.48	90 %
anticipated changes	***plus 0.09***	***plus 3 percentage points***
anticipated changes (%)	***plus 23.1 %***	***plus 2.4 %***

Table 2: Case study new supermarket – changes in density of retail selling space and retail centrality

As a rule, data required for the use of RegioProjektCheck varies according to the subject (housing, industry, retail) or depending on the field of activity under consideration. However, the toolbox is designed to work on the basis of relatively easily obtainable data. The only requirement for the “competitive locations of supermarkets” field is information on the region’s existing supermarkets, sorted according to retailer and retail type (entering the exact address in the GIS system) as well as population distribution in the municipality and/or districts/neighbourhoods. All other computations, including the proportional distribution of the municipalities’ population in the settlement cells (areas of 250 x 250 metres edge lengths) run automatically on the basis of the existing teledensity. The same applies to the calculation of distances between settlement cells and supermarkets (matrix).

5 CONCLUSION

So far, tests relating to this field of activity in the “Landkreis Harburg” (and the “Rheinisch-Bergischer Kreis”) have produced plausible results. Currently the test is being transferred to another two model regions in Germany and will be completed by the end of 2014. The model regions have shown great interest in the

RPC and it remains to be seen whether the knowledge gained in the process can be applied to other regions. RegioProjektCheck is still run with support from the joint research project in the model regions, however, the long-term aim is to allow RPC to run with the sole support of local stakeholders.

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Sharing Geographic Data: How to Update Distributed or Replicated Data

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1 ABSTRACT

Geographic data is expensive to collect and maintain and sharing data is crucial for its effective use in urban planning at all levels. For a few hardly ever changing themes the simple distribution of copies of data is feasible, but for other data, access to “live” data and updating, sometimes even distributed updating, of the data is necessary.

The organization of sharing data can be separated into three sets of issues: (1) *Interpretation*: how to understand the data, (2) *Authorization*: is a user permitted to use the data, and (3) *Access*: how to achieve effective and non-disturbing use and updating of data by several users? Solutions must take threats into account: hackers may try to steal or disturb the use of data, and the revelations of Snowden's documents only emphasize the danger of others reading data not intended for their eyes.

Effective sharing geographic data without conflicts requires integrating results from different areas of computer science research, including at least: cryptography, computer security, database management, and computer networking.

2 INTRODUCTION

Geographic data is expensive to collect and maintain, and sharing data is crucial for its effective use in urban planning at all levels. To use data collected by others is not without problems: one needs arrangements to understand the encoding, contracts to permit the use of the data, and finally methods to access the data. To have others use data that one has collected is not easy either: the owner of the data must insure that the data is only used by the users he has authorized, and only for the purposes permitted; it is too easy for any user to copy data and pass it on to others. Given the sensitivity of the European public, if data thought to be “personal” and given to a public agency appears on servers without protection, it quickly causes a public scandal. It is therefore important for public agencies to insure that all aspects of protecting the data are enforced, while at the same time allowing for maximal use of public data by others a contradictory charge!

The sharing of data can be organized into three sets of issues: (1) Interpretation: how to understand the data, (2) Authorization: is a user permitted to use the data and (3) Access: how to achieve effective and non-disturbing use and updating of data by several users? Solutions must take threats into account: hackers may try to steal data or disturb the use of data, and the revelations of Snowden’s documents only emphasize the danger of others reading data not intended for their eyes.

The effective sharing of geographic data without conflicts requires the integrating results from different areas of computer science research, including at least: cryptography, computer security, database management, and computer networking. The proper solution depends on the granularity of the data (the size of a data element that can be processed meaningfully), on network connectivity (high vs. low bandwidth, permanent vs. intermittent), on the frequency of updates, etc.. A layered approach of stacked protocols suitable for different situations is expected to allow adaptation to different needs.

Much of the complexity of organizing data sharing is caused by the unfortunate mixing of these three concerns. The technology available is sometimes offering similar technical services and comparable methods to control authorizations and access, but combining them quite differently. Further confusion is caused by results being described in alternative terminology. Part of the confusion is created by the multiple meanings of the same words, depending on whether the context is semantics, authorization, or technical access: the word “producer” for example may refer to the organization (the preferred meaning here); or it may refer to the person within the organization who collects and encodes the data. “Use” may refer to reading data only, or may include access to live data and changes to them. In a technical setting, the word “server” is used for the technical system (of the producer) where the data is stored, and “client” is used for the system where the data is used.

3 SEPARATION OF ISSUES REGARDING INTERPRETATION, AUTHORIZATION, AND ACCESS

The issues around sharing of data can be separated into three concerns:

Interpretation: does the data make sense in the context of the users?

Authorization: are users permitted to use the data?

Access: how to get the data?

In order to effectively share data, an arrangement on interpretation, authorization, and access must be found.

Sharing data between organizations confronts the meaning the producing organization (and in particular the person collecting the data) gives to the encoding, with an understanding of the codes used by the using organization. It is not required (and probably not feasible) to have the meanings correspond completely, but only that the differences in interpretation are not leading to errors in decision making.

Sharing data between organizations requires administrative arrangements in which the producing organization allows the using organization to use a set of data for certain tasks and in a certain modes, e.g. read or update. The arrangement must be made between the legal entities which produce respectively use the data, but bind persons acting on behalf of the organization as well; this includes the trivial case where the legal entity is a single person. The organizations can then use contractual and technical means to enforce the agreements and to ensure that all obligations are met. For example, map data provided by a cartography publisher is given with strict limits where and how often it can be used and, obviously, with the obligation not to make it available to others.

If the user is allowed or required to update data, then arrangements must cover accountability requirements of the original producer and keeper of the data; it is usually required that the name of the person changing the data as well as their function within the organization is included in the recording of the change.

Sharing data between organizations finally requires technical arrangements to transfer the data between the systems involved. The transport of media, where the data is stored, is a simple method; it implies arrangements to use compatible methods for the storage and encoding of the data. Data can be communicated through the internet, either the full data set at once or individual pieces as they are required, and feedback from the using organization can flow back via the same path.

4 THREATS

The data must be protected from dangers which threaten its long-term usability and which may compromise the confidentiality of the data. Threats can be differentiated according to the three topics above:

4.1 Changing Interpretation

The interpretation of natural language terms changes Fleck [1981] ; a geographic example is the changing definition of a habitat. Widely published was the change of the defintion of “planet” by the International Astronomic Union in 2006, which made Pluto not a planet anymore but a “dwarf planet” instead.

4.2 Unauthorized use

Unauthorized use of data is use by persons not authorized to use it or access by persons which are authorized in some organization, but try and access the data in an inorganizational environment that is not authorized. For example, a person could be authorized to access data for their job in a planing authority, but then accesses the data while working in another job, e.g. for a bank. Sometimes the producer of the data puts strict limits on what the data can be used for, and thus non-authorized use would also be any use for purposes other than the ones specifically permitted. For example, data about buildings may be available for planning, but its use for taxation may not be permitted. Often authorized use does not include making copies and carrying data outside of the permitted environment; famous examples are bank employees who make copies of lists of bank clients and their account details.

A specific threat is from a person masquerading as an authorized user and presenting the identity of this user to gain access to data. Unauthorized persons can learn the identity of authorized users by observing their actions, or by evasdroping on their communication with the system.

4.3 Failure of access

Data may be deleted and lost, making access impossible. But access can also be hindered temporarily by malfunctions in the software or hardware. Data sharing systems are often complex, and many softand hardware components have to cooperate properly in order for the sharing of data to work. Ordinary mishaps, failure of technical components, and accidents are frequent; human error (i.e. plain stupidity) is a major cause, but increasingly criminal actions against data are observed as well.

5 ACTIONS TO COUNTER THE THREATS

What are actions producers of data must take to protect their data? The actions to protect data can again be differentiated along the three issues listed above.

5.1 Document interpretation

Proper documentation of the intended meaning of codes is important; it is part of the metadata which can be described following accepted standards (eg. Weibel et al., 1998). The interpretation of common terms often differs between agencies, and may also drift over time. A well-known example is the evolution of terms describing habitats, which change with the progress of science and may be confused with real changes in the habitat [Comber et al., 2004]. The use of qualified names following the RDF standard [Manola et al., 2004] allows differentiation between two agencies' use of the same term, or connecting a term with its proper meaning according to the year of the definition, thus differentiating the meaning of a term in an earlier and a later defintion.

5.2 Check changes to preserve interpretation

Data can degrade if updates include errors in the data. To prevent this, changes by users are checked against rules which fix the interpretation of the data. A person must have a name, a building must have a number of floors, etc. At the end of each changing operation by a user, the new data is checked against these so-called consistency rules, and an update is only performed if the new data conforms to these rules.

Changes are recorded with the time and date of the change, the authorized person that entered the change, and finally some justification for the change, e.g. a reference to a document or a contract. These records of changes guarantee auditability, which means that all changes in the data can be traced back to an authorized person who can justify the change. This is obviously of prime importance in systems dealing with ownership of land, but it is equally important for maintaining restrictions in urban planning.

5.3 Check authorization

Authorization is the process of connecting a real person or organization with an identity within a computerized system. The most common form is a user name (associated with individual persons) and password, which demonstrate that a particular technical client is acting on behalf of the person with the given user name. This of course works only if the passwords are kept secret, and not written down on small post-it notes and pasted on the monitor but then again: who can remember all their passwords? And how often is it an assistant performing some action on behalf of their superior, requiring the password to be passed on, defeating the purpose of it?

Authorization can be organized better than with a simple username and password. One effective method is certification, where a trusted party signs credentials for another, which then signs credentials in turn. Credentials are electronic documents which are protected by cryptographic means against forgery. Authorized users are given credentials which are properly issued and presented to gain access. The technical solutions are such that credentials are never transmitted as clear text, so others cannot eavesdrop on them.

5.4 Protect data during transmission

Confidentiality is threatened during the transfer of data between the technical systems of the organizations involved. Safeguarding the transport of the medium on which the data is stored is the least expensive method (e.g. through transport by a trusted person). For transfer over the web, encryption is effective, easy, and inexpensive.

5.5 Prevent loss of data

Replicating data together with recorded logs of all changes guards against accidental loss of data due to technical or human failures. The current state of the data collection can be reconstructed from snapshots and the log: all changes performed since the shapshot was made are applied to reconstruct the last state before the loss of the data occurred.

5.6 Prevent loss of use and access to data

Even a temporary loss of access to data may cause problems for a client. Technical systems are often duplicated, so that in case of the failure of one system the duplicated system can take over. High-availability systems achieve nearly 100% continuous service at a cost: the shorter the maximum tolerated interval without service, the more technical effort is required to achieve it, and the higher the cost. The outage of a town planning system for several days may be painful, but tolerable; a system to keep track of the current positions of a taxi fleet will quickly incur additional costs during the time that it is not accessible, and thus duplication of some crucial components may be justified.

6 TECHNICAL CONSIDERATIONS

6.1 Semantics

The meaning of the data, i.e. how the facts reported are encoded, is often described in additional documents, formalized as metadata or in informal descriptions.

Essential to sharing data is an understanding of the data by the user: what does the code used mean? The producer gives meaning to the data according to his viewpoint and the aspects important for the intended use of the data collected. The user uses the data with a semantic schema, which must at least be coherent with the one used by the producer. Semantic coherence does not imply that the data has the same meaning, but only that the conclusions the user draws from the data are not in contradiction to the producer's interpretation.

6.2 Authorization

The legal agreement permitting a user to use a data set from organization must be mapped to the realm of data. Specifically, the user and the organization (short "legal entities") must be represented in the data realm. A "token", i.e. a small set of data, is uniquely assigned to each user so that no two users have the same token, and there is a method to confirm the association.

The construction of a personal token is trivial any random data with sufficiently small chance of accidental duplication is suitable. The association of a token with a legal entity is either through a hierarchy, or a network of trust. Organizations typically use a hierarchy and get a certificate signed by a trusted certification organization, which associates their token with their name (important is the U.S. company Verisign, which issues "root" signing certificates). Persons more often use a network of trust: other people sign associations between persons and their tokens, and users of the tokens can inspect who signed for them. [http://en.wikipedia.org/wiki/Pretty_Good_Privacy].

The method is based on public and private keys [http://en.wikipedia.org/wiki/Publickey_cryptography], so that each user can publish their public key (derived from their token) and must keep their private key secret. Other users can decode documents signed by a user with their private key (which only they know) and are then assured that the document really is from that user (e.g. an email sent to them). Other users can encode documents with the public key of another person and send them away; they are guaranteed that only the intended person can decode the document with their private key.

6.3 Digital Watermark

Authorized users of data may be tempted to give the data to others despite the fact that their authorization to use the data does not allow them to do so. To prevent such unintended distribution, which may cause commercial losses, the data can be watermarked [http://en.wikipedia.org/wiki/Digital_watermarking]. For each authorized user, invisible marks are included in the data before they are given to the user. If later the same data appears with an unauthorized user, the hidden digital watermark allows the copy to be traced back to the authorized user who has leaked the data in violation of their obligation to keep the data secret. For geographic data, digital watermarks have been proposed not only for image data but also for vector data; the difficulty lies in hiding the marks within the data so that they are not detectable by others, and do not disappear through simple coordinate transformations [Ohbuchi et al., 2002].

6.4 Keeping data current

Most GIS data changes with time. Very few data sets are static and remain the same forever (not even digital terrain data). But how to distribute the changes?

Distribution of snapshots. A snapshot of updated data can be delivered periodically to the user; this limits how "out of date" the used data can become. Problems emerge if the users connect the data they receive with their own data (and not just graphically overlay them); the connection between the data received and the own data of the user is through some data elements which serve as identifiers these must not be changed by the provider from snapshot to snapshot.

Distribution of live data can be solved technically by an initial transfer of a copy and later regular transfer of changed data, or by giving the user access to the data the provider maintains through a network connection (so called "live data").

Distribution of data and updates is an optimization issue: how much delay between changes by the provider can the user tolerate, how often do data elements change, and how large are the meaningful data, i..e. granularity? Network access to data is technically not difficult, and the required connection to the internet is today usually in place; network access however requires very careful authorization control.

6.5 Transaction concept

Transaction management controls the effects of actions of different users and how they could interfere with each other [Gray and Reuter, 1993]. The management of transactions is necessary whenever data is shared, but often very simple solutions are sufficient, although they can sometimes be dangerous!

In case of distributions of *snapshots*: the copy that is to be distributed must be made when no changing operations are in progress.

More care is required when *live data* is distributed: changes and access must be done via a transaction management system to avoid the distribution of inconsistent data; a user who reads data must access data in a consistent state, i.e. effects of a change started after the first read must be 'held back'.

The most demanding controls are necessary when users *update* the data. Traditional databases allow updates in a transaction only if the user is connected to the database server; changes which are in conflict are thus detected and properly synchronized (i.e. forced to execute one after the other). In many GIS applications, data collection in the field updates the data base, but the user collecting the data is not connected to the server; in such cases, a novel form of transaction concept called "eventually consistent" can be applied [Vogels, 2009]. It allows updates which are not synchronized, and integration and the detection of conflicts follow later; it is possible that conflicts between teams that have collected data independently are discovered later and must be reconciled.

With an attitude of "transaction concepts are not required our application is so simple", data may be lost: the trivial transaction concept of "last wins" applies by default, and uncoordinated, later transactions wipe out previously entered data: data loss occurs!

7 DIFFERENT FORMS OF SHARING DATA

Different types of sharing data must be differentiated, to set the ground for different solutions and their applicability. Two decisions are dominant:

- is a complete data set communicated, or are smaller pieces accessed on demand?
- is changed data flowing back from user or not (two-way or one-way flow)?

Many of the differences between technical solutions for sharing data have to do with the granularity of the data: what is the unit of data which is typically interpreted, used, and transmitted? Examples for large granularity are satelite images; for small granularity, an example would be administrative applications: the name, address, and phone number of a person is a small amount of data.

The cost and delays involved in the transfer compared to the frequency of change and the difficulties of updating the data determine what the optimal solutions are. Optimality depends on the technical solutions of the time; changes in technology and new technological solutions change what arrangement is optimal.

7.1 Sharing data as backdrop and without feedback

The producer gives data or access to data to the user, but no updates flow back from the user. In general, the user does not change the data, because she may receive updated new versions without the changes she made. The arrangement is a simple “one-way street”: data flows from the producer to the user only.

7.1.1 Example: Distributing Geodata, e.g. ortophoto or images of maps, as backdrop

Many applications use satellite images, aerial photos, orthophotos or images of maps as background for their presentation of data of interest. The use of web services like Google Maps or Open Map Server is built into many web applications to serve as background to a geographic context. The spatial location is encoded as coordinate values and scale.

Semantics: The distributed data requires human interpretation and is not used for anything more than providing the context for some other data; humans are surprisingly flexible in the interpretation of images and are not confused by systematic changes of colors in images during the seasons etc.

The geographic data added to the background is registered by coordinate values; this works only if the coordinate systems are compatible and transformations between the coordinates used by the data provider and the coordinates used by the user are known.

Authorization: Data from Google Maps or OpenStreetMap [http://wiki.openstreetmap.org/wiki/Main_Page] is widely available; the restrictions are legal contracts (for open street map: http://wiki.openstreetmap.org/wiki/Open_Database_License) limiting the use.

Additionally, some checks to spot unusual behaviour and to restrict access to the web servers so that other users are not disturbed are implemented. Google may use digital watermarks to be able to trace and prove origin if its data appears somewhere without reference to the source.If images travel or are stored on media that are not well secured, they can be encrypted with secure keys, often done when the images are compressed.

Access: In general, satellite images and areal photos are very large data sets (terrabytes) and distribution is often done best by copying the data onto a medium (hard disk), which may still take several hours, and then transporting the medium physically.

7.2 Using structured geodata distributed as a snapshot and adding own content

Data about buildings with street addresses and geocodes can be used to localize other data, e.g. the location of clients of a company, or the members of a political party. Maps showing the density of clients may allow the planning of campaings, checking the service area etc.

7.2.1 Example: Street map to localize clients

If the map of clients needs to be maintained for extended periods, new clients are added and others are dropped by the user of the shared data; but the street map also changes, albeit more slowly. The changes in the street map must be introduced; in particular, newly constructed streets must be added in order to map clients from these new streets.

If the producer distributes a new snapshot from time to time the clients must be connected to the new snapshot. The identifiers used by the producer should remain the same from snapshot to snapshot to assure that the data linked to the map, i.e. linked using the identifiers, continue to work, and the user must not “relink” all the data, only the data linked to new units.

Semantics: Between the provider of the data and the user there must be a common understanding of the definition of the reference objects (e.g. streets and buildings, parcels). When adding content to data, a relationship between the added data and the data received from a producer must be established and the identifiers used (e.g. streetname and civic number) must be kept stable

Authorization: Data from public registries is often confidential (e.g. land registry) and access must be controlled; in simple cases, authorization is granted to organizations or to persons in authorized organizations, but some data may require higher levels of control and so all access to the data must be recorded.

Access: The data can be transferred by being stored on a medium and transported in a secured manner, or it can be encrypted and transmitted over the internet. The format of the data must be communicated, and access methods prepared to read the data.

7.3 Distribution of "live data"

The producer constantly updates the data to reflect the current situation; the user always accesses the current state of the data.

7.3.1 Example: traffic data used in dispatching emergency services

Traffic data is changing rapidly, and application to dispatch service vehicles need access to current, up-to-date data. But access to current data applies equally to other, slower-changing data; examples are ownership and occupancy data in planning.

The same issues as for data distributed as snapshots apply, but there are some additional ones, mostly regarding the methods to access the data. Access to live data requires that the provider opens an access port for the user on their system; if the user is only allowed to read but not update the data, the software servicing the port must be constructed so as not to allow updates (beware of the famous SQL injection attack! [Boyd and Keromytis, 2004]). The provider will, secondly, ensure that only authorized organizations or authorized persons are granted access this is best achieved via VPN (virtual private network [http://en.wikipedia.org/wiki/Vpn]) or SSH [http://en.wikipedia.org/wiki/SSH_Communications])

7.4 Sharing with updates by the user

The user is permitted, sometimes even required, to change the data if differences to the "real" situation are discovered: either to correct errors which were present in the data previously, or because "reality" has changed. Two very similar situations occur, which are mostly differentiated by the granularity of the units of data that are subject to update. Updates of land use of individual parcels is an example with small granules and asks for conventional database transaction management; maintaining a map archive is a situation where complete larger units of data are updated.

7.4.1 Shared maitenance of structured geodata

If multiple organizations cooperate not only in the use but also in the maintenance of the shared geodata, increased efficiency is possible. Take as an example a case where the maintenance of land use data is distributed among different agencies, which are notified in certain cases: the building permit department gets informed through buidling permit applications if land use changes from agricultural to building; the agriculture department is informed by applications for subsidizes of changes from e.g. pasture to wheat growing; and the forest department collects information about logging. Together, they can maintain the land use data better.

Semantics: The classification and encoding must be integrated and agreed upon. Different departments will desire finer classifications for the parts they are interested in the joint classification must be the finest of all[Frank et al., 1997].

Authorization: records of which authorized persons caused which changes are highly recommended to avoid problems later on, when a change is questionable and responsibilities and justifications need to be found.

Access: A transaction system is necessary.

7.4.2 Shared map archive

A common situation are organizations which have a shared map archive: geodata is stored in form of plots (i.e. CAD files) and these are the units of data which are managed. In these cases, the semantics of the symbolization are typically well-standardized and the authorization rules are administratively fixed. What is missing is often a transaction management system; the rules that physical map originals automatically enforce, namely only one person can have it at a time to make changes, is removed in a digital archive. Many people can have equally "original" datasets for update, but changes applied in parallel do not get merged at

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the end; only the changes of the last person to check back the updated version survive, and all others are lost – the “last wins” transaction management rule applies by default.

8 SUMMARY

Sharing geographic data requires attention, but is generally beneficial. It reduces cost and can improve the quality of the geographic data used for planning. The concerns can be differentiated in three sets of issues:

Semantics: Definitions for classifications should be established as cleanly as possible and properly documented. The approach of RDF [Manola et al., 2004] to identify different definitions with the qualification of a code seems to be more promising than the standard approach of ontologists to pretend that there is one “correct” definition. Encoding classifications by codes qualified by the definition document (and its date) makes it clear if two data sets are using different codes (perhaps only slightly different, but different still).

Authorization: Authorization documents spell out what data can be used by which persons from which organizations for which purposes. If the data is sensitive, then records of who accessed or changed data must be kept.

To ensure that authorization rules are observed, data must be encoded when traveling over the internet (VPN or SSH are good tools for this) and access control mechanism must be in place when the data is stored on machines accessible by many.

Access: Standardization of data structures is advanced and only few methods remain (e.g. for storage and compression of image data); unfortunately, some are proprietary and restricted to (expensive) software. Often access to individual parts of the data collection is possible over the web through web interfaces for relational databases or SPARQL endpoints for RDF data [Prud’Hommeaux et al., 2008].

Great attention should be given to transaction management for spatial data. The CAP (or Brewer’s) theorem[Brewer, 2012] dictates that no perfect solution fulfilling all requirements is possible: consistency at all times is only achievable if updates are only permitted if all data collections are accessible; or, update of distributed and not always connected collections is only possible if we accept a system which will “eventually” be consistend, but tolerates intermediate, non-consistent states.

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Smart Cities as a Tool to Tackle Global Challenges

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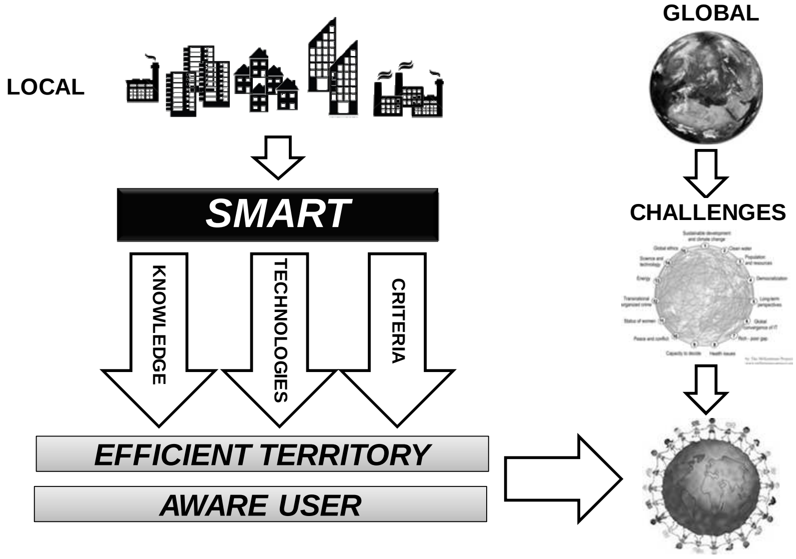
1 ABSTRACT

We live in a planet with limited resources and our way of life is based on resources consumption. This consumption generates externalities as a result of urban metabolism. One of the main resources we always need is energy; we need it for obtaining raw materials, for processing them, for commuting every day, for communicating, for watertreatment, or for our own cellular metabolism; and as our society is becoming more technified we are getting more energy dependent. We must reduce energy consumption and increase efficiency, we have started this race and the actions we undertook had good results but there is more we can do to go forward in this field.

Cities are complex systems, connected and dependent. Cities are the main consumers of resources, and it makes them play an important role as a drivers to change. To make smart cities we need real time data. Technology and knowledge must arrive to final user and the user needs criteria for decision making to make that possible. In the last decade there have been great advances in technologies, in sensor's development, ways and speed for data communication, and tools and applications to visualize data. The challenge now is integrating all of this in order to make the cities smart.



Urbanization, the demographic transition from rural to urban, is associated with shifts from an agriculture-based economy to mass industry, technology, and service. For the first time ever, the majority of the world's population lives in a city, and this proportion continues to grow. One hundred years ago, 2 out of every 10 people lived in an urban area. By 1990, less than 40% of the global population lived in a city, but as of 2010, more than half of all people live in an urban area. By 2030, 6 out of every 10 people will live in a city, and by 2050, this proportion will increase to 7 out of 10 people. Currently, around half of all urban dwellers live in cities with between 100 000 - 500 000 people, and fewer than 10% of urban dwellers live in megacities (defined by UN HABITAT as a city with a population of more than 10 million).[1]

Cities also consume 75% of global energy production, generate more than 70% of the total wastes and are directly responsible for more than 80% of global GHG emissions.[2] So doing cities more efficient, less energy and resources demandant and reducing their ecological footprint is one of the key factors to tackel global

[1] Hugo Ahlenius, UNEP/GRID-Arenda. UNEP 2009. Trends in urban and rural populations, less developed regions, 1960-2030 (estimates and projections)

[2] Ash C, Jasny BR, Roberts L, Stone R, Sugden A (2008) Reimagining cities - Introduction. Science 319(5864): 739-739.

challenges. Cities should also contribute to energy generation. One of the main problems is that European cities have old dwellings that they ussually don't acomplish the actual standards. Building brand new efficient urban districts is relativelly easy to acomplish nowadays, but what do we do with the already existing city?

2 SMART CITY BARCELONA

Barcelona is working to be a smart city. The city and metropolitan area are working to get more knowledge and data of the current situation of territory and its potential for being more efficient. New technologies such as satellite data or parameterization are being used to get more information. And the relevance of citizen's role towards a smart city is being more recognized, so the administration is working to provide them with more data and tools to make good decisions.

2.1 Generation of local and renewable enenrgy

Metropolitan area of Barcelona is energy dependent as the main part of urban systems. However there is a part of the needed electrical energy generation that is being produced in the territory. In 2012, about 41% of electrical energy demand could be covered with the energy generated in the metropolitan area. Energy generation in big energy plants, with a combined cycle power of 2.591 MW, cover about 30% of electrical consumption while an important number of small energy plants distributed around the territory contribute in 8% to selfproduction.

If we analyse the electricity consumption in the 36 municipalities that conform the Metropolitan Area we can observe that the ones with highest urban density have less electricity consumption. For example Santa Coloma de Gramenet has a density of 17.147 inhab/km² and the average electricity consumtion per inhabitat is 983 kWh in the other extrem we find La Palma de Cervelló with a urban density of 547,8 inhab/km² and the avergae electricity consumptions is 2.062 kWh/inhab. You can find similar relations with water consumption and CO_2 generation.

URBAN MORFOLOGY AND ENVIRONMENTAL BEHAVIOR IN BARCELONA

	Low density Begues	Medium density Sant Feliu	High density L'Hospitalet
inh	6.520	43.671	257.057
Inh/km²	131	3.703	20.488
m/inh	12,25	1,58	0,92
kWh/year	1.909	1.214	1.095
l/inh/day	137	97	93
tn CO_2/inh	0,73	1,42	0,99
Kg/inh/day	1,87	1,00	1,03
/1000 inh	508	411	316

Urban areas need to use energy in a wiser and smarter way. Dense and compact cities in mild weathers facilitate to implement an efficient public transportation and also they make more easy to implement sustainable mobility (pedestrian and bikes). Barcelona has a mediterranean climate so mainly the energy demand comes from domestic sector. To achieve better energy behavears we will have to work with the existing dwellings but also we will need to use the renewal energy potentials that we have in our area.

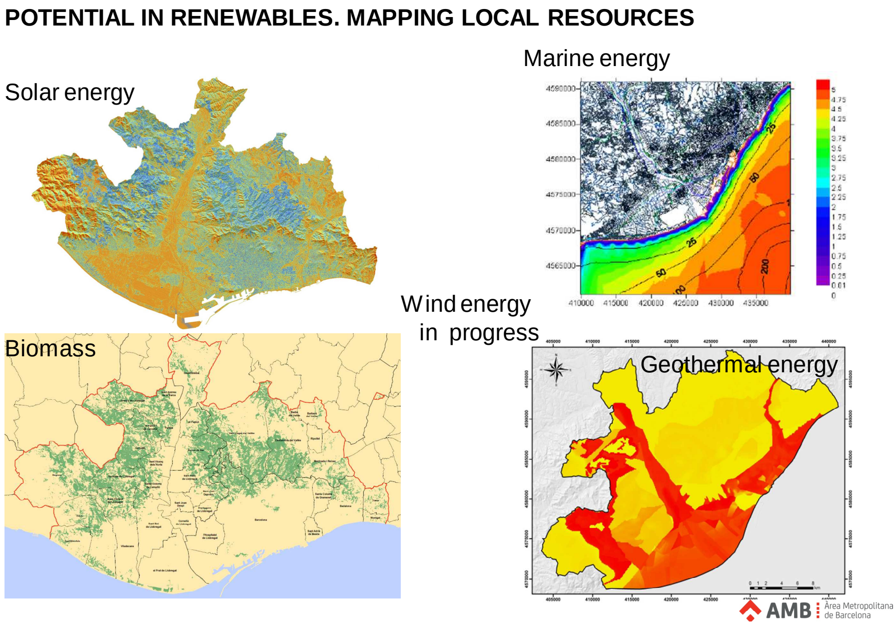
How to solve energy supply is an essential and strategical issue that the city and metropolitan area has to deal with, and the selection of the sources will define the degree of fossil fuel dependency or selfsuficiency. Renewable energy production is a suitable way to decrease fossil fuel dependency while increasing selfsuficciency degree, and makes the city more environmentally friendly and resilient. Barcelona and its metropolitan area are working on how to increase renewable energy generation but furthermore the city is making an effort to use as own resources some that for a long time has been forgotten and unused, being only some of the urban metabolism outputs.

The first infrastructure integrated in the energy system was the incineration plant of domestic waste. A part from the electriciy production, residual heat is now integrated in a district heating and cooling system of more than 13 km of pipe extension supplying 68 buildings (2011). With a heating capacity of 44,6 MW and cooling capacity of 69,2 MW this DHC system, consolidated but with a long way for extension planned, improve energy efficiency and reduce fossil energy consumption in the urban transfomation of 22@ District and Forum area.

The second DHC system of the city combines several systems that make it particularly efficient: on the one hand, the use of residual cold gasification process that takes place in the Port, I+D project completely new, and on the other hand, the use of biomass that comes from municipal parks and gardens.

Regarding to renewable energies, Sustainability Metropolitan Plan has started the study of renewable energy potentials in its territory. Lidar technology was used to create a 3D model so solar radiation could be calculated in detail to create a solar radiation map. Downscaling the results it would be possible to estimate the energy potential of each roof. It will be a tool created with the knowledge of local data, advanced technologies and directed to a specific result. The solar potential could be translated into how many or which type of sollar panels could be installed or how much would be the necessary investment for it, giving criteria to citizens to decide if they want to contribute to energy generation and also to public administrations to priorize some investments to make one step forward towards smart city.

Wind energy was also in study to know the metropolitan potential. From a simplified 3D model it is expected to get generation potential at different height levels. Other renewables as getothermal energy, forest biomass energy or marine energy were studied also with the same vision of identifying and measuring metropolitan renewable energy potentials.



3 SMART CITY CHALLENGES

Sustainable development and climate change is one of the main global challenges facing humanity. According to the main role cities play in that sense, working to be climate neutral is one of the main aims in the agenda of the global cities.

Climate neutrality can be approached by different scales in city context, from metropolitan to citizen behavior passing through the whole city, districts, buildings or households. District level is probably the one that can have the most impact. The European Project CLUE (Climate Neutral Urban Districts in Europe) is working to define some solutions at this scale.

The consideration of new districts or existing urban tissues is one of the things that need to be discerned when working towards climate neutrality. Most of the good practices are new developments, but the very real challenge is how existing urban tissues can be transformed to be more climate friendly.

There is one more challenge to consider which is density factor. Urban density can be a parameter that allows cities to be more efficient in many senses, but also a conditioning for the quality of life of their inhabitants. Furthermore, and again, there are many good practices around for planning ecodistricts of low urban densities but the real challenge is how can be built a dense ecodistrict, or a dense climate neutral district.

In the last decades there has been several ecodistricts or green neigborhoods developed all over. When you analize some of these new ecodistricts like Bo01 in Malmö, Kronsberg in Hannover, BedZed in London, or many others you realize that usually they have low densities compared to many other realities or dense and compact cities. As we have seen the world will increase it’s population and many of this popoulation is going to be located in cities. New constructions could be more efficient but we will have to consider compacity, density and compact areas as a main goal, which is the equilibrium related to the energy balance of a compact and dense city?

Hong Kong is extremly dense city 56.200 inhab/km². How we can improve all the existing dwellings. In those extremly high skycrapers? how do we implement solar panels or other type of renewals?

Working with passive mesures, reducing demands by increasing building standards, using high efficiency technologies, implementing renewals, using sinergies like waste to energy and with an important behavioral change. Maybe those are only some of the issues to work with. Cities are already using several of this strategies. Changing business as usal way of developing cities is also important.

4 CONCLUSION

One of the main ways to face planet challenges is to focus on cities, so working towards smart cities. In this path is necessary to have and use knowledge, technologies and criteria to make the right decisions to go forward it.

Knowing the potential of renewables in the metropolitan area of Barcelona is only a first step. We can not solve the energy problem of cities only with technology, we also need knowledge, social compromise and to change the economic model based in fossil fuel consumption. Citizens need information, what is their energy consumption? Which elements of their houses or of their style of live is contributing more to climate change? If they’ve got information and tools to act over the mechanisms they could react and change their behaviors.

Energy is for sure one of the challenges that we have ahead. We have limited resources of fossil fuels and uranium. Energy consumption and population keeps growing although cars, electrodomestics, computers, diveces are getting more efficient. We have a very technified society that demands more energy. Ericsson has calculated that by 2019 there will be more than 9.3 billion of mobile subscriptions,[3] that is more than the estimated population that United Nations reports are estimating for that year.

How cities challenge global issues related to energy and climate change will be determinant for the future of our plannet. Working with climate neutral urban districts will be necessary, but also dealing with adaptation to climate change will be crucial, making more reasilient cities.

We, humans are the only specie that is capable to observe their habitat from outside, we can get information, data from the space, we can mesure how GHG are changing, how the ocean is warming or acidifying, so we don’t have excuses to search, to act and to tackle global challenges.

[3] Ericsson Mobility Report November 2013.

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Smart City Labs als Möglichkeitsraum für technologische und soziale Innovationen zur Steigerung der Lebensqualität in Städten

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1 ABSTRACT

Der Begriff „Smart City" ist seit einigen Jahren fest im Sprachgebrauch der Stadtplanungsszene verankert. Während „smart" für die einen insbesondere für den Einsatz von Informations- und Kommunikationstechnologien (IKT) steht, sehen andere den Schwerpunkt von „smart" im Kontext der ökologischen Nachhaltigkeit und des Klimawandels (Stichwort Energieeffizienz, Ressourcenschonung, Zero Emissions) . In beiden Fällen – und das zeigt sich auch in der inhaltlichen Ausrichtung nationaler und europäischer Forschungsförderungsprogramme – stehen technologische Innovationen (green urban technologies) im Zentrum der Überlegungen, während soziale Innovationen, Überlegungen zur (subjektiven) Lebensqualität von Bürgerinnen und Bürgern oder Motivations- und Akzeptanzfragen für ein gewünschtes Nutzerverhalten nur von untergeordneter Bedeutung sind.

In diesem Paper werden drei Thesen vorgestellt und diskutiert, die dieses Ungleichgewicht zwischen technologischen und sozialen Innovationen aufgreifen und auch die Notwendigkeit des kritischen Diskurses von Lebenskonzepten und Werthaltungen hervorheben.

These 1: Es gibt keine „Smart City" ohne „Smart Citizens"

Den verschiedenen existierenden Zugängen und Umsetzungprojekten einer „Smart City" ist gemein, dass sie vorwiegend auf der Ebene von (Planungs-)Expertinnen und (Planungs-)Experten diskutiert und konzipiert werden und somit einer top down Tradition folgen. Fertige Lösungen und technische Neuerungen (Gebäudekonzepte, Elektromobilität, IKT-Lösungen,…) werden den Bürgerinnen und Bürgern schmackhaft gemacht, die Enttäuschung über mangelnde Akzeptanz und Nachfrage bleibt oft nicht aus. Zudem wird den Menschen suggeriert, dass man so weiter tun kann, wie bisher (weil die neue Technologie Effizienzsteigerungen garantiert) sodass Bürgerinnen und Bürger ihre Verantwortung für tägliche Verhaltensroutinen und Konsumentscheidungen zu unrecht abgenommen wird. An dieser Stelle braucht es mehr Mut und Kreativität, um die Ziele einer Smart City in die Köpfe und Herzen der Menschen zu bringen und auch das Thema Verhaltensänderungen bewusst anzusprechen.

These 2: Die erfolgreiche Realisierung einer „Smart City" benötigt qualitätsvolle Multi-Akteurs-Prozesse

Eine grobes Screening der Smart City-Leit- und Leuchtturmprojekte zeigt, dass sehr viel Überlegungen in die inhaltlich/fachlichen Aspekte (energetische und technische Fragestellungen) einfließen, während die Planung und Gestaltung qualitätsvoller Prozess- und Beteiligungsstrukturen meist nicht über klassisches Projektmanagement hinausgehen. Um Reibungs- und Qualitätsverluste in Smart City Projekten - als typische Multi-Akteursprozesse – möglichst zu vermeiden, muss ein besonderes Augenmerk auf transparente Informations-, Kommunikations- und Entscheidungsstrukturen gelegt werden, das sich auch budgetär entsprechend niederschlägt. Zudem müssen Beteiligungs- und Smart Governance Prozesse selbst inhaltlicher Teil in diesen Projekten werden (z.B Quartiersmanagement).

These 3: Smart City Labs als Möglichkeitsraum für Innovationen für urbane Lebensqualität

Ein „Smart City Lab" als temporäre oder stehende, inter- und transdisziplinäre Plattform kann städtische Entwicklungsprozesse maßgeblich unterstützen, indem relevante Fragestellungen einer Smart City in einem kritischen aber auch lustvollen Diskurs mit möglichst breitem Methodeneinsatz bearbeitet werden und eine Art Möglichkeitsraum für Innovationen und Kooperationen geschaffen wird. Dies erfordert seitens der Planungsverantwortlichen eine grundsätzliche Offenheit, Neues auszuprobieren und ausgetretene Pfade zu verlassen sowie die Bereitschaft, sich auf wechselseitige Lernprozesse einzulassen.

2 THESE 1 – ES GIBT KEINE SMART CITY OHNE SMART CITIZENS

2.1 Smart City - die energieeffiziente, ressourcenschonende Stadt

Der Begriff „Smart City" steht für eine energieeffiziente, ressourcenschonende und emissionsarme Stadt, die ihren Bewohnerinnen und Bewohnern höchste Lebensqualität bietet sowie die Bereiche Wohnen, Arbeiten, Freizeit und Nahversorgung kombiniert. Derzeit gibt es kaum eine Stadt, die sich nicht als „smart"

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bezeichnet oder „Smartness“ zumindest anstrebt, wobei das Thema kein Neues ist. Bereits beim UN-Umweltgipfel 1992 in Rio de Janeiro werden im Kapitel 28 der sog. Agenda 21 alle Kommunen aufgefordert, die Umsetzung von Nachhaltigkeit auf lokaler Ebene zu unterstützen. „Think global, act local“ lautete das Motto der Lokalen Agenda 21 – diese war damals ebenso wenig wie das Thema Nachhaltigkeit eine Selbstverständlichkeit und es mussten erhebliche Widerstände überwunden und Vertrauen aufgebaut werden. Dennoch haben seither weltweit in über 10.000 Städten und Gemeinden Bürgerinnen und BÜrger, Gruppen, Vereine, Verbände und Initiativen bottom-up gemeinsam mit den Verwaltungen und Vertretern aus der Wirtschaft Handlungsprogramme erarbeitet, die sich insbesondere an ökologischen und auch sozialen Nachhhaltigkeitszielen orientieren.

Neu an den gegenwärtigen Smart City Projekten ist, dass sie vor allem auch von großen Technologiekonzernen (Siemens, Cisco, IBM, SAP, …) sowie Wohnbauträgern und Investoren getrieben werden und eher top-down gesteuert sind. Das Thema Smart City hat auch in großem Stil Eingang in nationale und europäische (Forschungs)Förderungsprogramme gefunden haben. Der Hauptfokus dieser Programme liegt meist auf technologischen Innovationen. Dennoch hinken die Akzeptanz von smart meter (intelligenten Stromzählern), Elektromobilität und Co zum Teil deutlich hinter den Erwartungen hinterher. Fragen zur Attraktivität und Lebensqualität von Städten sowie zum spürbaren Nutzen einer Smart City mit ihren dazugehörigen „green urban technologies“ für die Bewohnerinnen und Bewohner wurden bis dato nicht zufriedenstellend angesprochen, geschweige denn gelöst.

Die zukünftigen Herausforderungen bestehen daher darin, den Menschen ebenso alltagsnah wie lustvoll aufzuzeigen, dass alle Themen und Handlungsfelder einer nachhaltigen, zukunftsfähigen Stadt ihre Lebensqualität betreffen – Mobilität, Wohnen, Energie, Konsum, Freizeit, Grün- und öffentliche Räume etc.

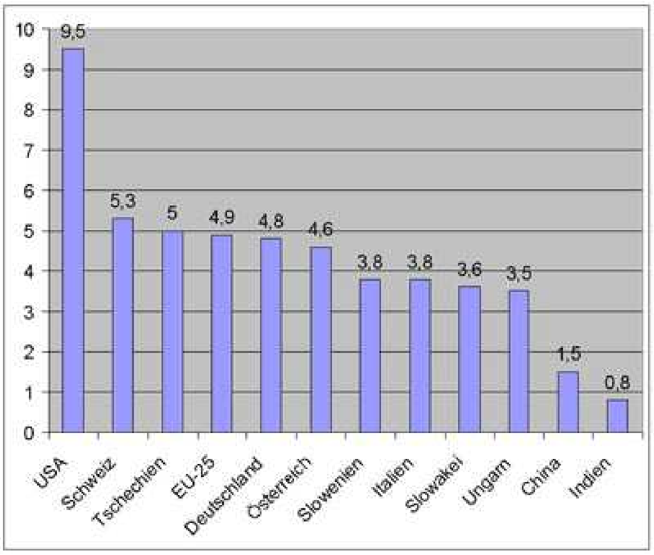

Abb. 1: ökologischer Fußabdruck im Ländervergleich, WWF 2012

2.2 Konsumverhalten und Ressourcenverbrauch

Jeder Mensch beeinflusst durch seinen Lebensstil und seine täglichen Verhaltensroutinen den globalen Ressourcenverbrauch. Wir alle brauchen Raum, um zu wohnen und uns zu entfalten, wir brauchen fruchtbaren Boden auf dem unsere Nahrung wächst, wir brauchen Verkehrswege (Straßen, Schienen) und Transportmittel (Auto, Bahn, Flugzeug) um mobil zu sein und wir benötigen Produktionsnalagen für die Herstellung von Gütern und Produkten. Die Größe des Flächenverbrauchs hängt vom tatsächlichen Konsumverhalten ab und ist somit eine Frage des Lebensstils. Das Modell des ökologischen Fussabdrucks gibt in Hektar an, wie viel Fläche jemand aufgrund seines Konsumverhaltens zur Befridigung seiner Bedürfnisse benötigt [REES, WACKERNAGEL 1997].

Im Living Planet Report des WWF wird für alle Staaten regelmäßig der ökologische Fussabdruck berechnet [WWF 2012]. Abbildung 1 zeigt die Ergebnisse ausgewählter Staaten im Vergleich (Hektar Fläche pro Einwohner). Der Wert für Österreich liegt mit 4,8 Hektar Fläche pro Einwohner deutlich unter jenem der USA (9,5 ha/EW) sowie knapp unter dem EU-Durchschnitt aber noch weit über dem als umweltverträglich berechneten Grenzwert von 1,8 ha/EW.

Im österreichischen Ressourceneffizienz-Aktionsplan (REAP) wird als mittelfristiges Ziel definiert, die Ressourceneffizienz bis zum Jahr 2020 um mindestens 50% anzuheben und den Ressourcenverbrauch insgesamt deutlich zu reduzieren [Lebensministerium 2012]. Im Aktionsfeld „Ressourceneffiziente Produktion" geht es u. a. um die Forcierung von Umwelttechnologien sowie ressourceneffizienten Produkten und Dienstleistungen. Der REAP enthält weiters ein eigenes Aktionsfeld „Bewusstseinsbildung", in dem anerkannt wird, dass „bewusstseinsbildende Maßnahmen in der Erreichung umfassender Ressourceneffizienzziele eine Schlüsselrolle einnehmen"[LEBENSMINISTERIUM 2012, S.31].

2.3 Coaching Ansätze für smart citizens – Ideen aus dem Smart City Graz Projekt

Die vorhin skizzierten Befunde legen nahe, dass für die „Rettung unserer Welt" effiziente Technik ebenso notwendig ist, wie engagierte und reflektierte Menschen, die die Auswirkungen ihrer täglichen Konsumentscheidungen kennen. Globale Trends wie die zunehmende Urbanisierung und die damit verbundene Verantwortung von Städten für globale Ressourcenverbräuche und Treibhausgasemissionen machen weiters deutlich, dass Nachhaltigkeit in Städten bzw. urbanen Ballungsräumen entschieden wird bzw. entschieden werden muss.

Nachhaltigkeit im urbanen Kontext erfordert somit neben Effizienz- und Konsistenzstrategien auch Suffizienzansätze, also die Einschränkung oder den Verzicht umwelt- und ressourcenbelastender Praktiken. Das klingt auf den ersten Blick wenig attraktiv. Umso wichtiger ist es, ohne erhobenen Zeigefinger dafür umso inspirierender und kreativer eine Wertediskussion auf allen gesellschaftlichen Ebenen zu führen: Wie wollen/sollen wir leben? Welche Lebensstile sind zukunftsfähig bzw. enkeltauglich? Wie können langfristig Verhaltensänderungen herbeigeführt werden?

Durch Verhaltensänderungen in Richtung eines nachhaltigeren Lebensstils können Menschen einen wesentlichen Beitrag zur Ressourcenschonung sowie zu einer höheren Umwelt- und Lebensqualität in ihrer Stadt leisten. Verhaltensänderungen sind nur dann von Dauer, wenn sie zu einem messbaren oder zumindest fühlbaren individuellen Nutzen führen, etwa einer als höher wahrgenommenen Lebensqualität oder geringeren Haushaltskosten. Die Erfahrung zeigt, dass Information und Wissen alleine für eine Änderung von Gewohnheiten und Verhaltensweisen nicht ausreichend sind. Um vom Wissen ins Tun zu kommen, braucht es (intrinsisch) motivierte Menschen und dazu wiederum braucht es neue Herangehensweisen, die nicht nur die Vernunft, sondern vor allem auch Emotionen ansprechen sowie die individuellen Bedürfnisse und Ausgangslagen der Menschen berücksichtigen.

Abb. 2: Smart Consumer Coach Ausbildungsmodule, ARGE Abfallvermeidung/Zero Waste Akademie 2012

Das Smart City Project Graz[1] geht hier neue Wege und erprobt im Zuge des Stadtteilmanagements (siehe Kapitel 3.3) innovative Ansätze für Verhaltensänderungen. Zwischen Oktober 2013 und Juni 2014 werden sog. „Smart Consumer Coaches" als Multiplikatoren für Smart Cities und nachhaltigen Lebensstil ausgebildet. Die Ausbildung basiert auf einem von der ARGE Abfallvermeidung in Kooperation mit der TU

[1] Das erste österreichische Smart-City-Leitprojekt „Smart City Project Graz" vereint unter der Federführung der Stadt Graz 13 Konsortialpartner und wird vom Klima- und Energiefonds mit 4,2 Millionen Euro gefördert. Ziel ist es, ein ehemaliges Gewerbe- und Industriegebiet in der Nähe des Grazer Hauptbahnhofes in einen energieoptimierten Stadtteil zu verwandeln, der bis zu 2000 Menschen Platz zum Leben, Wohnen und Arbeiten bietet. Weitere Informationen unter www.smartcitygraz.at.

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Graz und dem StadtLABOR Graz entwickelten Curriculum [HAMMERL 2013]. Abbildung 2 gibt einen Überblick über die Ausbildungsmodule.

Smart Consumer Coaches begleiten als „Expertinnen und Experten des Wandels“ Menschen auf Ihrem Weg vom Wissen über Nachhaltigkeit zum Tun. Quartiersbewohnerinnen und Quartiersbewohner werden über unterschiedlichste Formate und Aktivitäten mit den Ideen, Zielsetzungen und Handlungsfeldern einer Smart City sowie mit konkreten Ansatzpunkten für Verhaltensänderungen vertraut gemacht. Smart Consumer Coaches gehen in ihrer Tätigkeit ganz wesentlich über reine Informations- und Wissensvermittler hinaus. Vielmehr agieren sie im Sinne des Coachings als erste Ansprechperson und Begleiter für ihre „Schützlinge“. Die Rolle der Coaches ist somit nicht nur jene zu sensibilisieren, zu informieren, Impulse zu geben oder konkrete Maßnahmen und Optimierungspotenziale aufzuzeigen, sondern vor allem auch aktiv zu begleiten, „dran zu bleiben“ und zu motivieren.

Erste Pilot-Coachings sind derzeit in Kooperation mit Wohnbauträgern bzw. Hausverwaltungen in Vorbereitung und sollen im Herbst 2014 starten.

3 THESE 2: DIE ERFOLGREICHE REALISIERUNG EINER „SMART CITY“ BENÖTIGT QUALITÄTSVOLLE MULTI-AKTEURS-PROZESSE

3.1 Stakeholder in urbanen Entwicklungsprojekten

Betrachtet man die smarten Stadt(teil)entwicklungsprojekte der letzten Jahre so liegt deren Fokus häufig auf technischen Innovationen, etwa in den Bereichen Gebäudetechnologien, erneuerbare Energien, Infrastruktur oder Mobilitäts-/Verkehrslösungen. Die zentralen Projektbeteiligten sind neben Stadtverwaltungen, Planerinnen und Planer und Architektinnen und Architekten vor allem Technologieanbieter, Energieversorger, Mobilitätsdienstleister sowie Wissenschaft und Forschung. Einen großen Einfluss haben auch Investoren, Bauträger oder Grundstückseigentümer (Wohnbau). Darüber hinaus gibt es jedoch eine Vielzahl weiterer städtischer Akteure, die von einem konkreten Projektvorhaben in ihrer Stadt bzw. ihrem Stadtteil nicht nur direkt betroffen sein können bzw. sind, sondern die auch lokales Wissen, Anregungen, Ideen und Ressourcen in die Planungsprozesse einbringen könnten. Tabelle 1 gibt einen Überblick über typische Stakeholdergruppen, die nicht direkt (d.h. als Konsortialpartner) in städtischen Entwicklungsprojekten eingebunden sind:

Stakeholder/städtische Akteure	Interessen	Bedürfnisse
Anrainer (direkt betroffene Bürgerinnen und Bürger)	Frühzeitige Information, Transparenz, Mitgestaltung, (Einbringen von lokalem Wissen, Ideen, Anregungen)	Ernst-genommen-werden; Abfedern/Ausgleich möglicher Nachteile - (Baustellen-)Lärm, Verkehrsbelastungen durch Zuzug, Parkplätze, Erhalt von Grünraum (Spielplätze, Hundewiese)
(Aktiv)Bürgerinnen und (Aktiv)Bürger, Bürgerinitiativen	Frühzeitige Information, Transparenz, Mitgestaltung, (Einbringen von Beteiligungs-erfahrung); Institutionalisierung von Beteiligung	Ernst-genommen-werden; Abfedern/Ausgleich möglicher Nachteile für direkt Betroffene;
Bezirkspolitik	Frühzeitige Information, Transparenz, Mitgestaltung (Einbringen von lokalem Wissen, Ideen, Anregungen)	Mittlerrolle zwischen betroffenen Bürgerinnen und Bürgern und Verwaltung und Politik
Lokale Unternehmen	Frühzeitige Information, Transparenz, Mitgestaltung, Einbringen von lokalem Wissen; Beteiligung an Ausschreibungen, neue Geschäftslokale (Erdgeschosszonen), Wohnungen für Mitarbeiterinnen und Mitarbeiter, lokale Kooperationen	Abfedern/Ausgleich möglicher Nachteile – Nutzungsmischung (Wohnbau vs. produzierendes Gewerbe);
Vereine (Jugend-, Senioren-, Sport-, Kunst-, Kulturvereine)	Impuls- und Zwischennutzungen (urban gardening, Graffiti, Lauf-, Yogatreffs …); Erhalt/Nutzung öffentlicher/konsumfreier Räume	Gehört- und Ernst-genommen-werden; Entfaltungsmöglichkeiten sichern
Bildungseinrichtungen (Kinderkrippen, -gärten, Schulen)	Frühzeitige Information, Transparenz	
Kirchen	Frühzeitige Information, Transparenz	
Medien	Frühzeitige Information, Medienpartnerschaften	Themenführerschaft,
Nicht direkt eingebundene Verwaltungsabteilungen	Kontinuierliche Information, Transparenz, Kooperation	Anknüpfungspunkte für Projekte der eigenen Zielgruppe;
…		

Tabelle 1: indirekt betroffene städtische Akteure und ihre möglichen Interessen und Bedürfnisse in urbanen Entwicklungsprojekten

Die Projektkommunikation und PR-Maschinerie in Smart City Projekten erzeugt vielerorts high-tech Hochglanz-Bilder und Computeranimationen, mit wenig Platz für kritische Stimmen, offene Fragen oder Alltagsprobleme der Menschen. Dies hat zur Folge, dass Smart City Projekte von den betroffenen Bürgerinnen und Bürgern meist als elitäre Investorenprojekte wahrgenommen werden, die top-down gesteuert sind und wenig Einfluss-, Beteiligungs- oder Mitbestimmungsmöglichkeiten bieten. Das ist erstens schade und zweitens für den Erfolg der Sache kontraproduktiv. Die erfolgreiche, zeitgerechte Realisierung großer städtischer Entwicklungsprojekte erfordert ein Mindestmaß an Interesse und Akzeptanz bei den direkt und indirekt betroffenen Stakeholdergruppen.

3.2 Design von Multi-Akteursprozessen

Es gibt (leider) keine Patentrezepte für die Stadtentwicklung - jedes städtische Entwicklungsprojekt ist hinsichtlich seiner Ausgangssituation, (politischen, finanziellen) Rahmenbedingungen, seiner Projektbeteiligten und Akteure oder inhaltlichen Schwerpunkte anders. Fakt ist, dass jedes Projekt eine Vielzahl von teils gegensätzlichen Interessen unter einen Hut bringen muss. Als Voraussetzung dafür gilt es, ein Minimum an Vertrauen sowie eine gemeinsame Sprache bzw. ein gemeinsames Verständnis von einer Sache zu erarbeiten. Diese Erkenntnis ist nicht neu, dennoch zeigt die Empirie, dass in städtischen Entwicklungsvorhaben erschreckend wenig Überlegungen und noch weniger Budget in die Gestaltung geeigneter Kooperations-, Beteiligungs- und Aushandlungsprozesse einfließen.

Das hat vor allem zwei Gründe: Erstens ist die inhaltliche Ausrichtung der meisten nationalen und europäischen Förderprogramme stark technologiefokussiert und erlaubt prozessbezogene Fragestellungen meist nur im Rahmen sog. „Begleitmaßnahmen". Das Prozessdesign wird häufig mit Projektmanagment gleichgesetzt, Öffentlichkeitsbeteiligung mit Öffentichkeitsarbeit. Zweitens ist ein ernsthaftes Auseinandersetzen mit Multi-Akteursprozessen von der Haltung der handelnden Entscheidungsträger als Menschen abhängig. Projektleiterinnen und Projektleiter mit rein technischem Background sind dem Thema gegenüber tendenziell weniger aufgeschlossen, verfügen nicht ausreichend über die notwendigen kommunikativen und integrierenden Skills oder über das entsprechende Prozess-Knowhow.

3.3 Stadtteilmanagement im Rahmen von Smart City Project Graz

Im „Smart City Project Graz" werden die Entwicklungen und Bauvorhaben im zukünftigen Smart City Quartier Waagner-Biro von einem eigens errichteten Stadtteilmanagement begleitet, das vom StadtLABOR Graz aufgebaut und betreut wird. Im Sinne einer integrativen, nachhaltigen Stadtteilentwicklung dient das Stadtteilmanagement als Brückeninstanz zwischen Verwaltung bzw. Projektkonsortium, Investoren und Bewohnerinnen und Bewohnern, lokalen Akteuren und Einrichtungen.

In einem Baucontainer im Projektgebiet wurde ein Treffpunkt als Informationsdrehscheibe, Möglichkeitsraum und Vernetzungsplattform eingerichtet. Die zentralen Ziele des Stadtteilmanagements „VorOrt" sind (1) Akzeptanz für die Stadtteilentwicklung schaffen (2) Stadtteilidentität schaffen/Wir-Gefühl/Smart City Vision verankern (3) Akzeptanz und Planungssicherheit von Projekten erhöhen und (4) öffentliches Interesse vermitteln und verankern.

Abb. 3: Ziele und Ansprüche des Stadtteilmanagements VorOrt, Quelle: StadtLABOR Graz 2014

Die konkreten Informations-, Konsultations- und Mitgestaltungsformate werden innerhalb von fünf Handlungsfeldern umgesetzt: (1) Leben im Quartier/Öffentlicher Raum, Grünraum (2) Wohnen im Quartier/innovative Wohnformen und Begegnungsräume (3) Mobilität im Quartier/sanfte Mobilität (4) Veränderungen im Quartier/Impulsnutzungen und (5) Urbane Vielfalt im Quartier/Sockelzonen, Erdgeschoss.

Als ein wichtiges Ziel des Stadtteilmanagements werden im Vorfeld der Wettbewerbsverfahren (öffentlicher Raum, Städtebau, Architektur) Anregungen und Ideen der Akteure vor Ort gesammelt, um sie nach Möglichkeit als Vorgaben in die Ausschreibungsunterlagen zu integrieren.

4 THESE 3: SMART CITY LABS ALS MÖGLICHKEITSRAUM FÜR INNOVATIONEN FÜR URBANE LEBENSQUALITÄT

4.1 Strategien für die nachhaltige Stadt der Zukunft

Im Mittelpunkt einer flächensparenden, energieeffizienten und sozial gerechten Stadtentwicklung steht die kompakte Stadt mit ihren typischen Merkmalen, wie hohe Dichte, zentrumsorientierte Entwicklung und Mischnutzungen. Dem Leitbild der reinen Innenentwicklung stehen auch Strategien wie die gesteuerte Außenentwicklung entgegen (z.B punktaxiale Entwicklung) [vgl. OECD 2012]. Entscheidend neben positiven ökologischen Effekten sind immer auch Fragen der Akzeptanz und Lebensqualität seitens der Bewohnerinnen und Bewohner. Die Planung und Gestaltung des Lebensumfeldes von Menschen hat unmittelbare Auswirkungen auf deren Lebensqualität und auf zukünftige Entwicklungen. Gleichzeitig beeinflussen Bürgerinnen und Bürgern durch ihren Lebensstil und ihre täglichen Verhaltensweisen ihren „ökologischen Fussabdruck“ und somit die Zukunftsfähigkeit globaler Ökosysteme (siehe These 1). Die Aktivierung und Beteiligung von Bürgerinnen und Bürgern oder Vertreterinnen und Vertretern von Interessengruppen an Planungen und Entwicklungen im urbanen Raum wird daher als notwendige Ergänzung von Strategie- und Planungsprozessen eingefordert. „Strategieorientierte Planung ist der Versuch, der Stadtentwicklung eine strategische Richtung, ein Ziel zu geben (z. B. Nachhaltigkeit) und gleichzeitig steuerbare Projekte in einen übergeordneten Rahmen zu setzen …“ [FREY, HAMEDINGER, DANGSCHAT 2008].

Governance bezeichnet in diesem Zusammenhang die Steuerungs –und Regelungsmechanismen in einer Gesellschaft. Nicht nur der Staat (top down), sondern auch Wirtschaft und Öffentlichkeit bzw. Zivilgesellschaft (Vereine, Interessensvertretungen, Bürgerinnen und Bürger, …) – bottom up - sind daran beteiligt und wirken über formelle und informelle Netzwerke zusammen. Die Anforderungen an die Prozesse der Stadt- und Quartiersentwicklung sind durch die aktuellen Herausforderungen (Urbanisierung, demographischer Wandel, Klimawandel, bürgerschaftliches Engagement…) enorm gestiegen. Die Organisation der Planung entscheidet immer häufiger über die Qualität der Ergebnisse. Die Bedeutung adäquat strukturierter sowie situationsbezogen, angepasster, integrativer Planungs- und Umsetzungsprozesse, welche der Komplexität der Themenstellungen und der großen Anzahl von Beteiligten und Betroffenen Rechnung tragen, wird zunehmend erkannt. Ziel muss es sein, Verfahren zu entwickeln und anzuwenden, die „dazu geeignet sind einen fachlichen Diskurs aller Beteiligten mit dem Schwerpunkt auf Informationsaustausch, Kreativitätsanregung und Konsensorientierung zu fördern,…“ [vgl. MESSERSCHMIED, von ZADOW 2013]. Partizipation, Kooperation, Inklusion, Transparenz und Vertrauen spielen dabei eine große Rolle, die letztlich zu „Win-Win-Situationen“ mit positiven Effekten für möglichst viele Beteiligten führen [vgl. SCHOLZ/SELLE, 1996].

4.2 Smart City Labs

Der Aufbau bzw. die Durchführung von Smart City Labs[2] wird seit einigen Jahren als eine spezielle Methode kooperativer Strategieentwicklungs- und Planungsverfahren im urbanen Kontext forciert. Ursprünglich stammt die Idee aus der Produktentwicklung (v.a .im IT-Bereich) bzw. aus open innovation Ansätzen, bei denen Konsumentinnen und Konsumenten frühzeitig und proaktiv in die Entwicklung und Gestaltung von Produktinnovationsprozessen eingebunden werden. Der Einsatz von Web 2.0 spielt dabei eine große Rolle, um eine möglichst große Zahl an Endnutzerinnen und Endnutzern ansprechen, aktivieren und einbinden zu können. Eine aktuelle Evaluation von living labs zeigt auf, dass diese hinsichtlich Begriffsinterpretationen und Gestaltungsformen in der Praxis extrem heterogen sind [MULVENNA, MARTIN 2012].

Auch das European Network of living labs (ENoLL[3]) vereint knapp 100 temporäre oder permanente Einrichtungen, die sich als living lab bezeichnen. Das Netzwerk betreibt Untergruppen zu 11 urbanen Themenschwerpunkten – “Energy Efficiency/Sustainable Energy/Climate change, Well Being and Health,

[2] häufig synonym verwendet werden auch die Begriffe „urban living lab“, „open living lab“
[3] siehe www.openlivinglabs.eu

Smart Cities/Future Internet/Internet of things, Social Innovation/Social Inclusion, e-Government/e-Participation, Creative Media/User driven contents/Social Networks/Web 2.0, Thematic Tourism/Culture Services, Regional, territorial and rural development of Smart Regions, Sustainable Mobility, Industrial and logistics development, Security".

In Österreich gibt es erste Versuche zur Einführung von living labs, etwa im Rahmen des Smart City Projects in Villach. Im sogenannten „LIVING lab Villach" treten Bürgerinnen und Bürger in einen Dialogprozess mit Planerinnen und Planer und Expertinnen und Experten, um einerseits das eigene Energieverhalten zu evaluieren und zu verbessern, und andererseits wertvolle Informationen zur bedürfnisgerechten Gestaltung der Smart City Villach zu liefern.

Viele dieser living labs setzen somit die mit der Lokalen Agenda 21 vor über 20 Jahren begonnenen partizipativen Planungsansätze fort und nutzen die Potenziale neuer Medien für ihre Zwecke. Trotz vorhandener begrifflicher Unschärfen können Gemeinsamkeiten und verbindende Grundsätze identifiziert werden, die diesen Ansätzen zugrunde liegen. Dies sind u. a.

- Inklusion: Einbinden möglichst vieler städtischer Akteursgruppen und dialog auf gleicher Augenhöhe
- Methodenvielfalt: von face-to-face-Formaten bis zu e-participation
- Vielfalt inhaltlicher Schwerpunkte
- Verknüpfung von top-down und bottom-up Strukturen
- Wechselseitige Lernprozesse,
- Trial and error: Kultur des Ausprobierens, Ermöglichens und Lernens aus Fehlern
- Einsatz von Web 2.0, neuen Medien und sozialen Netzwerken

5 CONCLUSIO

Zusammenfassend wird an dieser Stelle für ein projektintegriertes, budgetär angemessen dotiertes und für jedes städtische Entwicklungsprojekt verpflichtendes Design von Multi-Akteursprozessen plädiert. Integrierte (kooperative, partizipative) Planungsprozesse können sich positiv auf Qualität, Realisierungschancen und Akzeptanz von Smart City Projekten bzw. urbanen Entwicklungsprojekten im Sinne der ressourcenschonenden, energieeffizienten und attraktiven „Stadt der Zukunft" auswirken. Smart City Labs können städtische Entwicklungsprojekte dabei im Sinne der nachhaltigen Stadt der Zukunft maßgeblich unterstützen. Um jedoch angesichts der heterogenen Begriffsverwendung der Gefahr der Beliebigkeit zu entgehen, bedarf es zukünftig einer praktikablen Konkretisierung/Spezifizierung von Smart City Labs hinsichtlich Aufbau, Zusammensetzung, Zweck/Rollen/Funktionen, Anwendungsfeldern, Methodeneinsatz, Qualitätskriterien oder möglichen Ergebnissen.

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Smart Governance for Smart Region: The Yaroslavl Region Case

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1 ABSTRACT

As the main values of public administration could be distinguished several fundamental principles, for instance, the rule of law, expression the will of the people in terms of politics, efficiency and obtaining a preferable result of socio-economic outcome articulated as possible, in quantifiable (measurable) form. It refers to the concept of smart management or smart governing, in this case the more solutions, methods and tools are corresponding with the values the "smarter" they are. Idea of "Smart city" or "Smart region" in Russia is often associated with high quality of life, livability on par with favorable investment climate.

This paper focused on the role of public administration for creation "Smart region" and consider issues of spatial planning and management that as a tools for improving living conditions . How information about different aspects of territory can be taken into account and affect the decision making process? How existing instruments of spatial planning and development may contribute to livability and sustainability?

In this paper we follow two lines. Firstly, we try to analyze how to optimize the allocation of power and responsibility between state and municipal levels of power in Russia aimed to provide better management of the territory. Second, how to develop more flexible instruments of spatial development for some particular needs of the Yaroslavl Region.

2 INTRODUCTION

The Yaroslavl region is located in European part of Russia in Central Federal District and borders the Moscow region. Total area of the Yaroslavl region is 36,2 thousands of square kilometers and according to statistic data, about 1,271 thousands of people live there and 81 % of population concentrated in Yaroslavl, Rybinsk, Pereslavl-Zalessky and in 10 smaller towns. Territory of the region crossed by the Volga river with navigable waterways regulated by chain of reservoirs, included Uglichsky, Gorkovsky and Rybinsk reservoir, one of the biggest in Russia. By waterways the Yaroslavl region connected with Baltic Sea and White Sea to the North, Caspian Sea, Black Sea and sea of Azov to the South.

Federal highways Moscow - Arkhangelsk and Yaroslavl - Kostroma pass through the region, that has access to the north-west of Vologda - Cherepovets and then to St. Petersburg, Karelia, on the northern route to Arkhangelsk, in the north-eastern segment of the ring around Moscow (Vladimir, Kostroma, Tutaev, Rybinsk and Uglich), south-west direction through Moscow. Also the Northern railway and part of the Transsib pass through the region and international airport exist in the capitol of the region - Yaroslavl.

Region is specialized in the manufacturing industries, that also include, construction, transport, communications and energy production. At the same time there is a significant potential of development chemistry, high-tech engineering, (gas turbines and aircraft engines, diesel engines and equipment, electrical and instrumentation, etc.) pharmaceuticals, logistics, agricultural complex and agro-processing. Furthermore, the Yaroslavl region in several recent years demonstrates growth in number of tourists, International as well as Russian, that come to the region due to the numerous culture and historical monuments, events, nature and another attractions.

The Yaroslavl region displays good positions in ratings, for instance it took 12th place in the ranking of Russian regions for the quality of life, prepared by RIA-rating in 2013. At the same time, faced the challenge of stiff competition with another regions what measures Yaroslavl region can apply to become "smarter" in term of quality of life? If public management is concerned, all stages of decision making should be taken into account from setting the goal to monitoring the results of its implementation.

Currently in the region are implemented elements of strategic management system, includes the development of the concept of socio-economic development of the Yaroslavl region until 2025, that took eleventh place in the ranking of strategical documents "Leaders of planning", prepared by an international group of rating agencies "RAExpert". Being not only a declaration of intentions strategy provides a number of tools to

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implement its priorities in practices of management, and one of the most important steps towards this is the development of spatial planning documents, designed for the regional and municipal level of public authorities. Using this instrument must be ensured unity of socio-economic spatial planning as far as this documents establish commitment to the creation of objects in accordance with the authority.

Smarte Städte brauchen smarte Unternehmungen

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1 ABSTRACT

Die Entwicklung von Städten war immer eng mit der Entwicklung von Produktionstechniken und Energiesystemen verbunden. Die nun anlaufende „Dritte Industrielle Revolution“ bringt einen Wandel vom linearen System „Produzent – Konsument“ auf ein vernetzes, mit vielen Produzenten die gleichzeitig Konsumenten sind. Was in der Kommunikationstechnik mit dem INTERNET geschah, steht der Energiewirtschaft mit vielen kleinen Stomproduzenten (Photovoltaik, Wind, Kleinwasserkraft,..) bevor. Die Kleinstlandwirtschaft (Urban Gardening) steht als Gegenstück zur industriellen Landwirtschaft vor einem Boom.

Auch die klassiche Produktionstechnik wird sich nicht von dieser Entwicklung abkoppeln können. Für Smart Cities werden Produktionsbetriebe wieder in urbane Regionen rückkehren müssen. Hierdurch können nicht nur Wege für Arbeiterinnen und Arbeiter und Produkte verkürzt werden, sondern es wird sich auch ein größeres Bewußtsein für den Wert von Produkten etnwickeln.

Städte, die derzeit einen Bevölkerungszuzug erleben, werden nicht nur Wohnung und Ausbildungsmöglichkeiten zur Verfügung stellen müssen, sondern auch Arbeitsplätze. Hierzu müssen sie für Firmen attraktiv werden und diese in einer Konkurrenzsituation zu anderen Städten anziehen. Smarte Infrastrkturen werden dabei eine große Rolle spielen.

2 ENERGIE – MOBILITÄT – INFORMATION – PRODUKTION/EIN RÜCKBLICK

Städte, Energiesysteme, Produktionstechniken und Kommunikationssysteme waren immer eng miteinander verknüpft.

Die Dampfmaschine – erfunden um 1700 – ermöglichte die großtechnische Nutzung der Kohle für den Verkehr (Dampflokomotive) und industrielle Produktion. In der Folge verlagerte sich die Produktion von Waren aller Art von Privathäusern in große zentrale Fabriken. Die Leute zogen in die Städte nach und lebten zu einem großen Teil in Arbeiterslums. Spezialisierung und Arbeitsteilung ersetzten ein ganzheitliches Handwerk. Im 19. Jahrhundert vollzog sich mit der Einführung von dampfgetriebenen Druckmaschinen und Rotationsmaschinen der Übergang zur industriellen Massenproduktion von Druckwerken. Druckpressen und -maschinen verbreiteten sich auf der ganzen Welt und die westliche Buchdrucktechnik wurde zur Grundlage für den Massendruck unserer Zeit. Man nennt diese Zeit die „Erste Industrielle Revolution“. Vor dieser Zeit basiert die Energieversorgung fast ausnahmslos auf erneuerbaren Energieträgern.

Ca. 100 Jahre später begann die Zeit der „fluiden“ Energieträger, die den festen Energieträger Kohle ablösten. Öl, Gas und Elektrizität ermöglichten völlig neue Methoden der Produktion und Mobilität. Das Telefon als Kommunikationsmittel wurde entwickelt, später dann Radio und Fernsehen. Der elektrische Strom ermöglichte gutes Licht und damit lesen und lernen bis in die Nacht. Das Automobil wurde zum wichtigsten Verkehrsmittel und ermöglichte es vielen Personen die Städte wieder zu verlassen und sich in den „Speckgürteln“ anzusiedeln. Die Städteplaner trennten Wohnbereiche von den Arbeitsstätten, Einkaufszentren außerhalb der Wohngebiete wurden gebaut und alle Strukturen wurden autogerecht geplant. Die Fließbänder ermöglichten die billige Massenproduktion aller Arten von Konsumgütern, gleichzeitig wurden durch Luft- und Wasseremissionen die Nahbereiche um die Industrien praktisch unbewohnbar. Billige Transportmöglichkeiten führten in weiterer Folge zur Globalisierung der Produktionen und zu einem weltweiten Transportaufkommen von ungeahntem Maße. Man nennt diese Zeit die „Zweite Industrielle Revolution“.

Heute vollzieht sich die „Dritte Industrielle Revolution“, am besten erkennbar an den Entwicklungen der Kommunikationstechnik. Das Internet ermöglicht es jedem sowohl Konsument als auch Produzent von Information zu sein. Ähnliches entwickelt sich in der Energietechnik, wo durch eine stark steigenden Zahl von „Prosumern“, also Personen und Einrichtungen, die sowohl Energie konsumieren als auch Produzieren die klassischen Strukturen der Energiewirtschaft (Kraftwerke zur Produktion – Netze zur Verteilung – Kunden als Verbraucher) zu einem Umdenken gezwungen werden. In der Produktionstechnik setzt sich die

„tailor-made mass-production“ immer mehr durch, wo jeder Konsument sein personifiziertes Produkt entwirft und fertigen lässt – vielleicht sich auch bald selber „druckt“, wie die rasante Entwicklung der 3D-Drucker erwarten lässt.

3 ENTWICKLUNG DES ÖKOLOGISCHEN UND SOZIALEN VERANTWORTUNGS-BEWUSSTSEINS DER INDUSTRIE

Ab ca. 1980 entwickelte sich in Europa zunehmend ein Umweltbewusstsein in breiten Teilen der Bevölkerung. Seitens der Industrie wurden diese Initiativen zuerst als feindlich betrachtet, da sie Investitionen in nicht-produktive Bereiche erforderten und auch die Betriebskosten erhöhten. Die durchgeführten Maßnahmen waren großteils End-of-Pipe-Technologien, also nach¬ge¬schaltete Umwelt¬techniken, die keinen Einfluss in die Produktion und die Menge der Emissionen nahmen, sondern diese nur behandelten. Die nachhaltige Entwicklung begann mit dem technischen Umwelt-schutz, brachte aber in der ersten Phase eine Verminderung der Umwelt¬belastung aber einen erhöhten Ressourceneinsatz und besonders auch zusätzliche Investitionen in unproduktive Bereiche.

Einige Jahre später begann sich der „integrierte Umweltschutz“ zu verbreiten. Nun wurden durch effizientere Verfahren und Produktionstechniken nicht nur Emissionen vermindert, sondern auch Kosten eingespart. Seitens der Industrie begann das Interesse an ressourceneffizienten Produktionsverfahren zu steigen, die Kosten für Materialien und Energieträger die Personalkosten zu übersteigen begannen. In zahl¬reichen Fällen wurde die Ver¬minderung von Emissionen wegen der gestiegenen Roh¬stoffnutzung betriebs¬wirt¬schaft¬lich sinnvoll. Der produktionsintegrierte Umwelt¬schutz konnte erstmals Profit und Emissionsminderung unter einen Hut bringen: ÖKO-PROFIT.

Die drauf folgenende Diskussionen über die gesellschaftliche Ver¬antwortung der Unternehmen gegenüber der Gesellschaft brachten mit der „Corporate Social Responsibility“ endlich das dritte Standbein der nachhaltigen Wirtschaftentwicklung in die Betriebe.

Ray Anderson, CEO und Gründer der Teppichbodenfabrik Interface beschreibt den Übergang von einer typischen Firma des 20. Jahrhunderts auf eine des 21ten durch sieben Schritte [Anderson R.C., 2011]:

Fig. 1: Die nachhaltige Wirtschaftsentwicklung begann mit dem technischen Umweltschutz

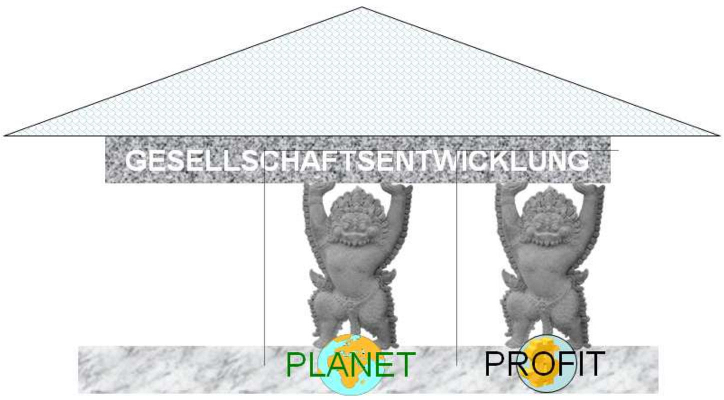

Fig. 2: Der produktionsintegrierte Umweltschutz brachte Wirtschaftlichkeits-überlegungen in die Umweltdiskussion

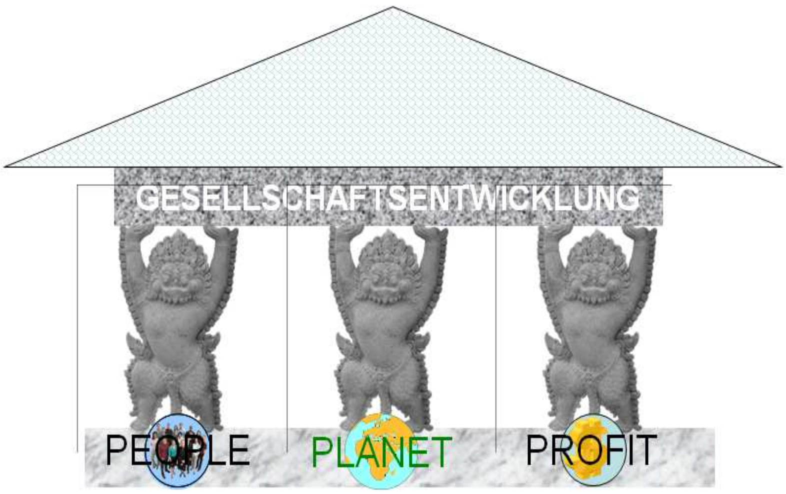

Fig. 3: Mit der Corporate Social Responsibility bekam die nachhaltige Wirtschaftsentwicklung ihr drittes Standbein

(1) Feste Abfälle vermeiden

(2) Flüssige und gasförmige Emissionen vermindern

(3) Erneuerbare Energien ein¬setzen

(4) Kreisläufe schließen

(5) Transport ressourceneffizient gestalten

(6) Stakeholder sensitivieren

(7) Neue Produkte und Dienst¬leistungen entwerfen

Die Beziehgungen zwischen Unternehmen, Natur und Gesellschaft haben sich dann grundsätzlich geändert.

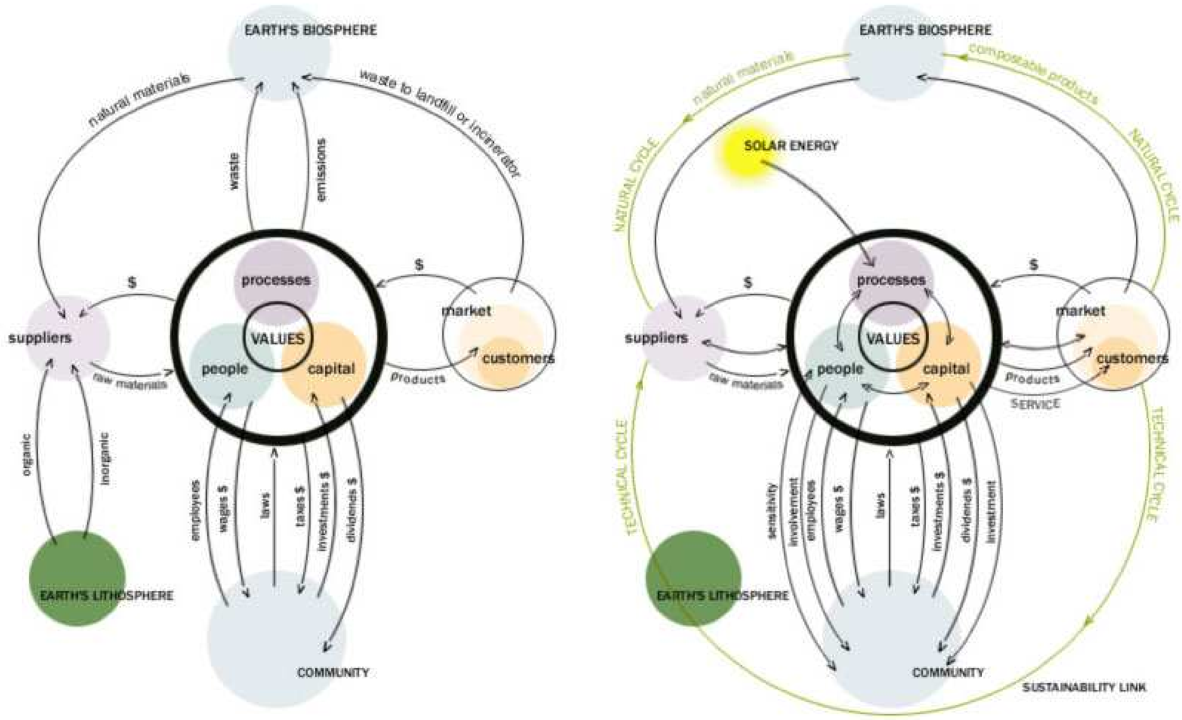

Fig. 4: Während das typische Unternehmen des 20. Jahrhunderts Rohstoffe aus der Lithosphäre entnimmt und in die Biosphäre entsorgt ist das typische Unternehmen des 21. Jahrhunderts in Kreisläufe eingebunden und hat verstärkte Beziehungen zur Gesellschaft. [Anderson R.C., 2011]

Hieraus ergibt sich dass die Unternehmen nicht mehr durch ihre Emissionen und Umweltbelastungen zur Kenntnis genommen werden, sondern durch ihre Interaktion mit der Gesellschaft.

Das World Business Council for Sustainable Development, eine freiwillige Vereingung zahlreicher multinationaler Unternehmungen zur Unterstützung einer nachhaltigen Wirtschaftentwicklung hat die Ziele für Unternehmungen für 2050 definiert.

Neben den eher technologischen Forderungen zu Energie, Produktion und Mobilität (Fig. 5) beschreiben die Mitglieder des WBCSD auch sozial relevante Visionen (Fig. 6).

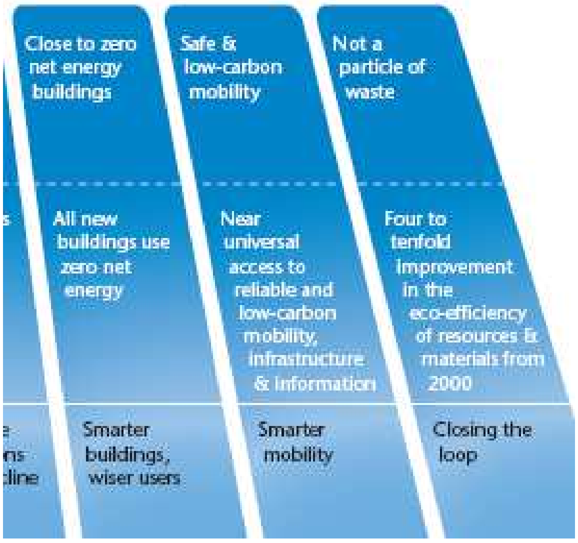

Fig. 5: Die WBCSD-Visionen für die Bereiche Gebäude, Mobilität und Produktion [WBCSD, undated]

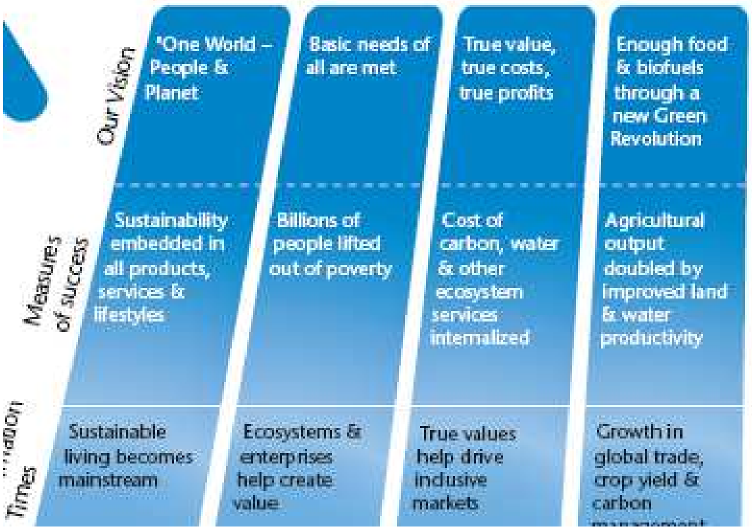

Fig. 5: Die WBCSD-Visionen für die Bereiche Werte, Human Development, Wirtschaft und Landwirtschaft [WBCSD, undated]

4 WIRTSCHAFTLICHE AKTIVITÄTEN IN SMART CITIES

Es ist ein zentrales Anliegen vieler Planungsvorhaben zu Smart Cities“ die neuen Stadtteile mit vielen Funktionen auszuführen. Hierzu gehört auch eine gewerbliche Nutzung der Gebäude, besonders in den Erdgeschosszonen. Auch der Smart-City Call für Demonstrationsvorhaben unter HORIZON2020 fordert:

Integrated Infrastructures: through the integration of physical infrastructures such as core networks, repurposing. This should lead to quantifiable benefits such as reduction of capital /operational expenditure as well as reduced carbon/energy footprints. This might also imply exploitation of synergies between requirements for smart grids, broadband infrastructures and in general poly networks (eg district heating and cooling)

Hieraus erheben sich vor allem zwei Fragen:

- Warum tragen integrierte Infrastrukturen zur „Smartness“ eines Stadtteiles bei, und

- Was sind andererseits die Anforderungen an Unternehmen, dass sie in urbanen Systemen als smart akzeptiert werden.

Im Laufe der Visionsentwicklungen zu „I Live Graz“ wurden Kriterien und Indikatoren zu einem Leitbild für eine smarte Stadtentwicklung in Graz definiert. Die arbeiten erfolgten in sieben Arbeitsgruppen und wurden in der gruppe „Stadtentwicklung“ zusammengefasst.

Basis der Überlegungen waren einige Parameter, die im Zuge der Entwicklung erhöht bzw. vermindert werden sollten [Hoffer K-U et al: 2013]:

LOWs	**HIGHs**
KURZE WEGE: Wohnen, Arbeiten, Lernen, Einkaufen und Erholen sind in einem nahen Umfeld möglich, sodass hierzu (fast) kein motorisierter Individualverkehr erforderlich ist.	HOHE PRODUKTIVITÄT: Eine Smart City trägt zum BSP zumindest so viel bei wie eine vergleichbare konventionelle Stadt. D.h., es gibt Unternehmen und Arbeitsplätze.
GERINGE BAU- UND VERKEHRSFLÄCHEN-BEANSPRUCHUNG durch kompakte und flächensparende Bau- und Nutzungsstrukturen	HOHE NUTZERDICHTE an infrastrukturell bestens erschlossenen Standorten
GERINGE TREIBHAUSEMISSIONEN: Energie und Materialien in der Smart City sind (nahezu) frei von Nettoemissionen an CO_2. Dies gelingt, indem Energie aus erneuerbaren Quellen oder Abwärme gewonnen wird. Materialien für die technische Infrastruktur bestehen so weit wie möglich aus rezyklierten oder regionalen Rohstoffen.	HOHE INTERAKTION: Eine Smart City interagiert intensiv mit ihrer Umgebung (Austausch von Personen, Materialien, Information, Energie,…). Sie ist keine „Insel der Nachhaltigkeit“, sondern aktiv vernetzt in ihrer Region.
GERINGE MATERIALSTRÖME MIT UMWELTWIRKUNGEN: Materialströme, die das Betrachtungsgebiet verlassen, sind so gering wie möglich zu halten und beeinflussen Natur, Umwelt und Nachbarschaft in keiner negativen Weise.	HOHE (BIO)DIVERSITÄT In einer Smart City leben Personen unterschiedlicher Herkunft und Ausbildung, Familien und Singles, Arbeiterinnen und Arbeiter und Akademikerinnen und Akademiker, Kinder und Pensionistinnen und Pensionisten. Es ist Platz für eine große Vielfalt an Tieren und Pflanzen.
KLEINER FUSSABDRUCK: Der ökologische Fußabdruck (oder ein vergleichbares Maß des Ressourcenverbrauchs) ist signifikant kleiner als in einer vergleichbaren konventionellen Stadtregion. Dies beinhaltet die technische Infrastruktur und die Wirkungen des täglichen Verbrauchs.	HOHE LEBENSQUALITÄTEN: Eine Smart City schreibt ihren Bewohnerinnen und Bewohner keine bestimmte Lebensweise (Vegetarierin oder Vegetarier, Radfahrerin oder Radfahrer, …) vor, sondern bietet flexible Rahmenbedingungen für eine nachhaltige Entwicklung.
GERINGE MEHRKOSTEN: Eine Smart City hat ähnliche Lebensdauerkosten für ihre Bürgerinnen und Bürger wie ein vergleichbares konventionelles urbanes System. Höhere Errichtungskosten sollen sich durch geringere Betriebskosten rechnen. Innovative Finanzierungsmodelle können größere Anfangsinvestitionen ausgleichen.	HOHES ENTWICKLUNGSPOTENTIAL: Eine Smart City muss offen für Entwicklungen und Änderungen sein. Sie ist kein Zustand, sondern ein Prozess der Änderung und Steuerung.

Tabelle 1: Übersicht über die LOWs und HIGHs einer Smart City Graz

Obwohl sich eine eigene Arbeitsgruppe mit dem Bereich „Ökonomie“ auseinandersetzte, wurde dieses Themenfeld direkt oder indirekt von praktisch allen anderen ebenfalls tangiert.

- Unternehmen in einem zukunftsfähigen Quartier schaffen Arbeitsplätze und vermindern so die Notwendigkeit für lange Fahrten zum Arbeitsplatz.
- Sie ermöglichen eine integrierte Energie- und Materialnutzung und tragen zur Ressourceneffizienz bei.
- Sie ziehen qualifizierte Menschen an und erhöhen hierdurch Einkommen und Lebensqualität und ziehen ihrerseits weitere Dienstleistungsunternehmen an.
- Durch die gewerbliche Nutzung von Erdgeschosszonen können Grundstücke effizienter genutzt werden und Wohnungspreise können sinken.

Gleichzeitig bestehen aber gegenüber Unternehmungen im Wohnbereich verständliche Vorbehalte. Emissionen von Lärm und Luftschadstoffen sowie zusätzlicher Verkehr sind die Hauptargumente gegen eine intensive Integration von Unternehmen – besonders wenn sie echte Produktionsbetriebe sind.

Smarte Städte und urbane Viertel sind aber nur zukunftsfähig, wenn sie auch Arbeitsplätze bieten und eine nennenswerte Wertschöpfung kreieren. Nur die Integration von Wohnen, Bildung, Arbeiten, Freizeit und Einkaufen ermöglicht die geforderte Reduktion von Energie- und Warenströmen.

Unternehmen müssen sich dieser Herausforderung stellen und ihre Produktionsverfahren und die notwendige Logistik entsprechend gestalten. Die bisher erarbeiteten Ansätze zu Cleaner Production und Zero Waste Production werden für innerstädtische Unternehmungen erweitert werden und außerdem verstärkt Aspekte der Corporate Social Responsibility enthalten müssen.

Die Arbeitsgruppe „Ökonomie“ bei I live Graz erarbeitete folgende Vision: Graz ist eine dynamische, lebenswerte und international führende medium-sized City und wird von seinen Bürgerinnen und Bürgern in hohem Maße geschätzt. Als Forschungs-, Qualifizierungs- und Wirtschaftsstandort im „Green Tech Valley“

ist die Smart City Graz internationaler Benchmark für Wertschöpfung mit grünen Technologien (Energie, Mobilität, Ressourcen) sowie Gesundheit und Design

5 FOLGERUNGEN

Eine „Smart City" erfordert die Integration von Produktionsbetrieben. Diese Betriebe müssen ihrerseits stadttauglich werden, als keine merkbaren Belastungen für die Nachbarschaft erbringen. Die betrifft einerseits die klassischen Luft- und Wasseremissionen, aber auch Lärm und Verkehr. Gleichzeitig werden die Betriebe soziale und wirtschaftliche Funktionen im Stadtteil übernehmen, die seitens der Stadtverwaltung nicht geleistet werden können. Betriebe werden durch ihre Anwesenheit wesentlich zum Selbstverständnis des Stadtteiles beitragen und Teil der Identität werden.

Die Anwesenheit von produzierenden Unternehmungen in der unmittelbaren Nachbarschaft wird dazu beitragen, in der Bevölkerung eine realistischere Beziehung zu Produkten zu haben. Es geht darum, dass jedermann erkennt, dass der Strom nicht nur aus der Steckdose kommt, das T-Shirt nicht nur aus dem Modegeschäft und das Bier nicht nur aus dem Zapfhahn. Ein bewussterer Umgang mit Produkten könnte eine mögliche Folge der Anwesenheit von Betrieben in der Nachbarschaft sein.

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Smartes Straßendesign für Smart Cities

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1 ABSTRACT

Dieser Beitrag beschäftigt sich mit einer „smarten“ Lösung für den Bereich Mobilität in einer Smart City, der nicht primär von Überlegungen zu technologischen Innovationen geprägt ist. Vielmehr soll gezeigt werden, dass gerade im Bereich der Mobilität die soziale Innovation eine wichtige Rolle spielt. Das Umfeld, also die Gestaltung des Straßenraums, wird sich dementsprechend auch anpassen müssen. In der aktuellen Diskussion um Begegnungszonen, Koexistenzbereiche und Shared Space, werden eben solche Lösungsansätze diskutiert. Es handelt sich dabei nicht nur um „Zukunftsmusik“, wie österreichische und internationale Beispiele belegen. Es kommt vor allem darauf an, es zu schaffen die Bedürfnisse aller Verkehrsteilnehmerinnen und Verkehrsteilnehmer, vor allem der „Schwächeren“ zu berücksichtigen. Dazu benötigt es ein „Design for all“ oder eben ein „Smart Street Design“, das vor allem über die aktive Einbindung der Betroffenen ermöglicht werden kann.

2 SMART STREET DESIGN

Im Zuge der Diskussion um Smart Cities wird oftmals ausschließlich bzw. vor allem über technologische Innovationen gesprochen. So auch im Bereich der Mobilität. Die Mobilität der Zukunft in einer Smart City wird meist als elektrisch angetrieben in Form von E-Bus, E-Cars, E-Bikes, etc. beschrieben. Die wesentlich „smartere“ Alternative der aktiven Mobilität, also dem klassichen Radfahren und Zufußgehen, wird dabei kaum bzw. wenig beachtet. Es wird nach wie vor im alten Denkmuster einer technologieorientierten Gesellschaft gedacht. Akteulle Entwicklungen in Städten, beispielsweise in Wien, zeigen jedoch, dass der Trend weg vom motorisierten Individualverkehr hin zu mehr öffentlichem Verkehr, Rad- und Fußverkehr geht. Eine zukunftsfähige smarte Stadt muss sich daher auch mit sozialen Innovationen, die mit einem veränderten Verkehrsverhalten einhergehen, beschäftigen. Eine wichtige Rolle wird dabei die künftige Gestaltung des Straßenraums spielen. Eine Stadt oder Gemeinde, die es sich zum Ziel setzt, eine smarte Mobilität zu ermöglichen, ist daher eine Stadt/Gemeinde, die eine fußgängerfreundliche Gestaltung schon heute beginnt umzusetzen oder bereits eine Tradition darin hat und diese verstärkt.

2.1 Die Wichtigkeit von Gestaltung

Ganz generell ist anzumerken, dass sich sowohl die Verkehrs- als auch die Stadtplanung in den letzten Jahrzehnten sehr an den Bedürfnissen der Verkehrsträger, anstatt der Verkehrsteilnehmerinnen und Verkehrsteilnehmer orientiert haben. Dieses Planungsverständnis führte in weiterer Folge zu einer Veränderung im Straßen- und Siedlungsbild. Das diese Veränderungen keine besonders positiven Auswirkungen auf die Bewohnerinnen und Bewohner der Städte haben, bekommen wir langsam zu spüren. Ausgestorbene Ortskerne, Ziersiedelung und eine steigende Abhängigkeit vom Pkw, sowie nicht zuletzt auch die Umweltverschmutzung und in diesem Zusammenhang auch zu nennen der Klimawandel, sind u. a. die Quittung für jahrzehntelange Verfehlungen.

Für die räumlichen Strukturen bedeutet das, dass die zukünftige Entwicklung eine „Umkehrung“ des bisherigen Prozesses, also eine Beeinflussung der Verkehrsmittelwahl durch die Schaffung entsprechender Rahmenbedingungen, darstellt. Dazu braucht es auch eine Visionen, wie ein Straßenraum der Zukunft aussehen könnte.

Die verstärkte „Umkehrung“ dieses Prozesses scheint für viele in der Planungspraxis und Politik ein „schwierig umzusetzendes“ Unterfangen zu sein. Besonders die flächendeckende Bereitstellung eines hochqualitativen Fußwegenetzes ist, z. B. aufgrund der etwaigen Kompetenzverteilungen und mangelnden Verständnisses, dass es sich dabei um die „Basisinfrastruktur“ handelt, ein komplexes Unterfangen. Dass es dennoch gelingen kann, zeigen sowohl internationale als auch österreichische Lösungsansätze.

Fig 1: Visionen für einen lebenswerten Straßenraum. Beispiel Vision 2030[1].

3 ÖSTERREICHISCHE UND INTERNATIONALE (LÖSUNGS)-ANSÄTZE

Eine Möglichkeit für eine soziale Innovation in der Gestaltung und Organisation des Straßenraumes bieten sogenannte Koexistenzlösungen. Die beiden meistdiskutierten Ansätze dazu sind in Österreich im Moment die Begnungszone und der Shared Space. Beide sind moderne zeitgemäße Lösungsansätze an dafür geeigneten Örtlichkeiten, die zu einer Gleichstellung der Verkehrsteilnehmerinnen und Verkehrsteilnehmer beitragen. Dabei ist nicht nur die Verkehrsorganisation zu erwähnen, sondern auch eine damit einhergehende Umgestaltung des Straßenraums, die einerseits eine gleichwertige Nutzung aller Verkehrsteilnehmerinnen und Verkehrsteilnehmer ermöglicht und andererseits die Verkehrsregeln anstatt von Verkehrszeichen kommuniziert.

In Österreich sind diese Konzepte ein wenig erprobt – langjährige Erfahrungen fehlen. Die Einführung der Begegnungszone im Jahr 2013 könnten jedoch mittelfristig einen Schub für dieses Modell der Verkehrsorganisation bedeuten, da es die Umsetzung durch einen normativen Rahmen für viele player erleichtert. Als Vorzeigebeispiel für einen „Shared Space“, der bereits vor der Einführung der Begegnungszone in Österreich realisiert worden ist, kann die Straße im Ortszentrum der Gemeinde Thalgau genannt werden.

Fig. 2: Mutige Lösung für ein Miteinander auf einer Ortsdurchfahrt. Beispiel Thalgau.

Bei diesem Beispiel ist nicht nur die Gestaltung vorbildlich auch die Maßnahmen die im Vorfeld und auch nach der Einführung des Shared Space durchgeführt wurden (z. B. Bürgerbeteiligung, Mobilitätssensibilisierung bei Schulkindern, etc.) haben absoluten Vorbild-Charakter.

[1] http://www.visions2030.org.uk./aStart.html

Fig. 3: Die Gestaltung des Straßenraums wirkt sich auf das Verhalten der Verkehrsteilnehmerinnen und Verkehrsteilnehmer aus. Beispiel Mariahilfer Straße, Wien.

Wie wichtig die Kommunikation bei der Umgestaltung eines Straßenraumes ist, zeigt das Beispiel der Mariahilferstraße in Wien. Selten war ein Straßenbauprojekt - vor allem, wenn es nicht um eine mehrspurige Umfahrungsautobahn geht – so stark in den Medien vertreten. Gleichzeitig zeigte sich in der sogenannten „Probephase“, dass eine Gestaltung nach dem Koexistenzprinzip ohne die dazu passende Gestaltung des Straßenraums nicht ausreichend gut funktioniert und die Verkehrsteilnehmerinnen und Verkehrsteilnehmer zumindest teilweise in ihren alten Verhaltensmustern verharren. Der Straßenraum lädt Fußgängerinnen und Fußgänger nur in Teilbereichen ein, sich den Straßenraum anzueignen, zu verweilen, der zuvor Fahrbahn des motorisierten Individualverkehrs war. Insofern wird die „Kraft der Gestaltung“ auch im Probebetrieb teilweise augenfällig.

Das eine Begegnungszone auf Einkaufsstraßen, aber auch Plätzen und Verkehrsknotenpunkten durchaus gut funktionieren kann und zu einem lebendigen öffentlichen Raum führen kann, der nicht nur das Miteinander der Verkehrsteilnehmerinnen und Verkehrsteilnehmer, sondern auch ein Nebeneinander unterschiedlicher Nutzungen ermöglicht, zeigen Beispiele wie die Exhibition Road in London, der Columbus Circle in New York City oder auch der Hauptplatz in Biel.

Fig. 4: Eine einheitliche Gestaltung des Straßenraums erlaubt nicht nur das nebeneinander von unterschiedlichen Verkehrsteilnehmerinnen und Verkehrsteilnehmer, sondern auch unterschiedlicher Nutzungen. Beispiel Exhibition Road, London.

Fig. 5: "If you can make it there you can make it everywhere" – Mut für neue Lösungen. Beispiel Columbus Circle, New York City.

Fig. 6: Rücksichtsvolles Miteinander von öffentlichem Verkehr, Radfahrerinnen, Radfahrern, Fußgängerinnen und Fußgänger. Beispiel Zentralplatz, Biel.

Die Präsentation bei der CORP wird auch den neuen Stadtteil Seestadt Aspern zu Fuß zeigen – ein Beispiel, wie mit diesem Thema in Neubaugebieten innovativ & smart agiert werden kann.

4 DESIGN FOR ALL

All diese Beispiele zeigen die Wichtigkeit eines Smart Street Design. Was sind jedoch konkrete Elemente, die die Gestaltung eines Straßenraums „smart" machen? Die Frage nach einzelnen Elementen einer fußgängerfreundlichen Gestaltung kann pauschal nicht beantwortet werden. Zu heterogen sind die Anforderungen der Fußgängerinnen und Fußgänger und auch die Zielgruppe der Fußgängerinnen und Fußgänger selbst. Als grundlegende Form der Fortbewegung ist es gerade in Bezug auf das Zufußgehen wichtig alle Bevölkerungsgruppen zu berücksichtigen. Die Gestaltung für die „schwächsten" Verkehrsteilnehmerinnen und Verkehrsteilnehmer bringt dabei immer auch Vorteile im Komfort für alle anderen.

Es benötigt jedenfalls der Situation angepasste Lösungen. Teil einer fußgängerfreundlichen Gestaltung des öffentlichen Raums ist daher immer auch der vorausgehende Prozess. Hierbei empfiehlt sich, die Gestaltung unter möglichst aktiver Beteiligung der Betroffenen durchzuführen. Denn nur eine Gestaltung die auch angenommen wird, kann letztendlich auch als gelungen bezeichnet werden. Ein Beispiel dafür bietet der sogenannte Fußgänger-Check von Walk-space.at.

4.1 Der „Fußgänger-Check" für Städte und Gemeinden

Wer viel zu Fuß unterwegs ist, ärgert sich über Schwachstellen des Wegnetzes. Bei fehlenden Straßenübergängen oder Behinderungen des Weges kann es zu gefährlichen Situationen kommen. Der „Fußgänger-Check" für Städte und Gemeinden zeigt die Möglichkeiten zur Verbesserung der Qualität um für die Fußgängerinnen und Fußgänger das Umfeld so attraktiv und sicher wie möglich zu gestalten.

Eine qualitätsvolle Fußgängerplanung bezieht nicht nur punktuelle Verbesserungsmaßnahmen ein, sondern schafft ein engmaschiges Fußwegenetz ohne Hürden und Unterbrechungen. Verbesserte Querungen, geöffnete Durchgänge, kurze Wege und gute Orientierungsmöglichkeiten sind einige der wesentlichen Anforderungen an ein gutes Wegenetz für Fußgängerinnen und Fußgänger. Mit ununterbrochenen Fußgängernetzen und dem Mut, Straßenfläche für Fußgängerinnen und Fußgänger umzuwidmen, kann nicht nur das Gehen, sondern auch die Verkehrssicherheit, die Umwelt und das gesamte urbane Leben, gefördert werden.

Der «Fußgänger-Check» bringt Fußgängerinnen und Fußgänger mit verantwortlichen Behörden zusammen und schafft so den Rahmen für einen Dialog und Maßnahmensetzungen. Mit der Einbeziehung jener Personen, welche das Gebiet täglich als Fußgängerin oder Fußgänger benutzen, können lokale Erfahrungen und regionales Wissen in den Prozess einfließen. Herzstück des Vorgehens ist eine gemeinsame Begehung, bei der die spezifischen Bedürfnisse im Wegenetz der Fußgängerinnen und Fußgänger vor Ort gesammelt werden. Die gemeinsame Arbeit mit der jeweiligen Nutzerinnen- und Nutzergruppe ermöglicht klare Prioritäten festzustellen. Ziel dieses Prozesses ist, gemeinsam realisierbare Maßnahmen zu finden und eine rasche Umsetzbarkeit erster Resultate zu erreichen. Das Instrument bietet eine „maßgeschneiderte Vorgehensweise", um den finanziellen und personellen Aufwand gering zu halten. Die bisherigen Projekterfahrungen u. a. aus Graz, St. Pölten, und mehreren Gemeinden, wie z. B. Perchtoldsdorf in Niederösterreich zeigen die Chancen und Potentiale des „Fußgänger-Check" für Städte und Gemeinden auf. Details: http://www.walk-space.at/Service/fusscheck.html

4.1.1 Einbeziehung besonderer Gruppen

Angesichts der demografischen Entwicklung und der „zunehmenden Überalterung" der Bevölkerung, sollte bei Maßnahmen für den Fußverkehr der Zielgruppe „ältere Menschen" besondere Bedeutung zukommen. Die Zahl der Menschen im höheren Alter wird mittel- und langfristig stärker ansteigen, weshalb der bevorstehende Alterungsprozess eine der größten gesellschaftlichen Herausforderungen der Zukunft darstellen wird. Je älter wir Menschen werden, desto mehr sind wir auf das Transportmittel „Füße" angewiesen. Damit steigt jedoch auch der Anspruch an eine qualitätsvolle Verkehrsinfrastruktur. Doch das zu Fuß gehen im Alter hält auch fit! Eine umfassende Übersicht über die daraus folgenden Veränderungen und Anforderungen an ein Verkehrssystem der Zukunft, sowie Verkehrssicherheitsaspekte und das Mobilitätsverhalten älterer Menschen wurden in der Broschüre „Zu Fuß im höheren Alter" herausgebracht: http://www.walk-space.at/Zu-Fuss-im-hoheren-Alter/zu-fuss-im-hoeheren-alter.html

4.1.2 Dialog Rad/Fuß

Dialog ist insofern dort bedeutsam, wo es um das Erlernen von Mobilitätsmustern oder ein verbessertes Miteinander der Verkehrsteilnehmerinnen und Verkehrsteilnehmer geht – wie beim Thema Radfahren und zu Fuß gehen. Der „FAIRness AKTIONstag" am Donaukanal in Wien bot unterschiedliche Angebote für ein faires Miteinander. Walk-space.at sammelte gemeinsam mit IG-Fahrrad u. a. Verbesserungen zur Begegnung von Radfahrerinnen und Radfahrern sowie Fußgängerinnen und Fußgängern. Aufgrund der Erfahrungen aus dem Pilotprojekt „Gut Zu Fuß in St. Pölten" wird die Bedeutung von Mobilitätssensibilisierungen von Schülerinnen und Schülern samt Eltern deutlich.

Siehe auch: http://www.walkspace.at/pages/projekte.html und http://www.walk-space.at/images/stories/pdf/wissen_kompakt_sondernummer_walk21.pdf

5 CONCLUSION

Smart Street Design für Smart Cities bedeutet mehr als nur technologische Lösungen für die gegenwärtigen und zukünftigen Verkehrsprobleme zu finden. Es bedeutet vor allem eine Gleichstellung der

Verkehrsteilnehmerinnen und Verkehrsteilnehmer im Straßenraum. Diese kann durch eine „smarte“ Gestaltung unterstützt werden. Der Straßenraum gewinnt gleichzeitig auch seine Funktion als lebendiger öffentlicher Raum zurück. Besonders ist bei der Gestaltung auf die Bedürfnisse der „schwächeren“ Verkehrsteilnehmerinnen und Verkehrsteilnehmer rücksichtzunehmen. Diverse Beiteiligungsverfahren, beispielsweise der Fußgänger-Check, bieten dafür eine Möglichkeit. Eine soziale Innovation, im Sinne von mehr Rücksichtnahme und Miteinander kann dadurch erfolgen, wie zahlreiche österreichische und internationale Beispiele belegen. Die Theorie, wie auch die Praxisbeispiele exsistieren bereits, es liegt nun an den Entscheidungsträgerinnen und Entscheidungsträgern, diese konsequent umzusetzen.

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Social Media Data in Tourism Planning: Analysing Tourists' Satisfaction in Space and Time

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1 ABSTRACT

Social media are playing an increasingly important role as information resource in tourism both for customers (i.e. the tourists), who gather trustworthy information supporting the choice of destinations and services from peers, and for businesses, which can use the same information for improving their marketing strategies. The use of social media data can also offer new opportunities for decision- support in tourism planning. With improved understanding of the motivations of tourists and tailoring tourism service supply, decision making can be facilitated by emphasizing the strengths of tourist destinations for past and potential visitors. However, this kind of information about tourists perceptions and opinions is not always properly analysed by planners. Understanding the user satisfaction, which depend on factors related to both the location and the services that the local industry propose, may offers valuable information in tourism planning at regional and local level.

In the light of the above premises, the goal of the study presented in this paper is to propose an integrated approach to investigate the relationships between tourists satisfaction, destination resources and tourism industry for supporting design and decision-making in regional tourism planning. The methodology developed in the study includes data collection from popular tourism social media platforms (i.e. Booking.com and TripAdvisor.com.com), and their integration with territorial and tourism data. Spatial and statistical analysis techniques are then applied to elicit insights from tourists perceptions on success factors which may be used in decision-making and planning support. The case study demonstrates the value of social media data and computational social science techniques in tourism planning. The paper concludes with a critical discussion on the potential of using such an approach in more general urban and regional planning setting.

2 INTRODUCTION

This study focuses on tourism phenomenon, analysing relationship between demand, industry and location identified as fundamental variables. The research aims to study tourist preferences on destination and tourism industry services as represented by review judgments collected by two major tourism social networks, namely Tripadvisor.com and Booking.com. The investigations are carried on exploring the potential of publically volunteered comments, for providing useful knowledge about people preferences in space and time. For research purposes, a traditional method for collecting information about such preferences, performed via ad-hoc surveys can be expensive and time consuming. For this reason this work presents an alternative approach, by which tourist preferences for location and services are discovered by processing and analysing publically available social media data. The paper explores three questions related to tourists preferences:

(1) Which are the most popular destinations?

(2) Why people chose those destinations?

(3) What attracts tourists attention and what do they appreciate/disregard?

The underlying assumption is that this kind of study and underlying methods and tolls can be used as successfully in urban and regional planning as in tourist planning for in both cases they contribute to take into account a pluralist customer- (or citizens) –oriented view on strategic development issues. From the methodological perspective, the central challenge in answering the questions above is to manage the big amount of available data to discover useful knowledge.

The method builds on a set of spatial analysis and statistics techniques, useful in describing and visualizing the spatial distribution and detecting patterns and hot-spots. In addiction textual analytics techniques (Campagna et Al, 2013; Campagna, forthcoming), have been applied in order to discover the knowledge enclosed in the huge amount of qualitative social media comments. The findings provide insights into the Sardinia tourism industry which could aid in the development of new planning approaches. They also offer a benchmark for future comparative trend analysis and directions for tourism policy design. After examining the past studies on the travel consumers online social networks and the most popular web sites, the paper focuses on the destination choices and judgments represented in numerical and linguistic terms. Then, the research methodology and the early results of the case study are summarized and briefly discussed. The paper concludes with the summary of findings and future steps for extending the presented work.

3 DEVELOPMENTS IN TOURISM SOCIAL MEDIA

In the last decade the degree of interactivity established by the Web 2.0 paradigm enhanced the role of Internet as information source, with a secondary role as opinion source (Grabner et Al, 2012). Tourism is one of the sectors which exploited the advantage of the advances in ICT and in the development of online communities. As a matter of facts, on the supply side the tourism marketing (i.e. the way to promote tourism industry, the different destinations, or the holiday packages) have been totally transformed (Dippelreiter, 2010). It is no surprise to observe that travel and tourism related topics are among the most popular topics in on-line social networks. (Baggio et Al, 2008). Likewise, on the demand side, the travellers use the Internet to obtain tourist information, to share their experiences, to estabilish relationships with people from various destinations or to purchase travel related products.

According to Chung and Buhalis (2008) Internet supports i) the pre-travel phase, where all the search and bookings can take place online; ii) the in-travel phase, through interactive forums and/or blogging while on the road; and iii) the post-travel phase where people can share experiences, review hotels and destinations, and post photographs and videos from their trips (Conrady, 2007). TripAdvisor and Booking.com are among the most popular platform of the latter kind, and they play a significant role into the online tourism market. They represent an important marketing channel through which destinations and tourism enterprises can reach and persuade potential visitors (Biassoulis, 2002). In fact travellers opinions and personal experiences based on reconstruction of their trips in turn serve as information for others.

In case location is available all these type of information, as all information derived from social network, could be considered as Volunteer Geographic Information (VGI). The term VGI indicates the avalanche of information which every second is shared on the web by users acting as sensors (Goodchild, 2007). According to Sui and Goodchild (2011), more recently the convergence of GIS and social media granted by interoperability of geo-web tools is further enriching the possibility of sharing the knowledge not only about the Earth surface but also about all the social and cultural phenomena there happening. In facts, as Campagna et Al argue (2013), VGI may include both geographic information collected by groups of people within crowdsourcing initiatives and geo-tagged multimedia collected for personal purposes by the Internet users and publicly shared through archives in the cloud.

4 DESTINATION CHOICES AND TOURISTS' PREFERENCES

Knowledge of consumer psychology is extremely important in determining the success of a destination (Rodriguez del Bosque and San Martin, 2008). In this sense, an exploration of psychological concepts such as attitudes, decision-making processes, emotions, experience and satisfaction is necessary for understanding costumers choices and preferences in tourist destination. According to Kuang Hsu et Al (2009) travel motivation is a dynamic concept; it changes from one person to another and from one destination to another. Cooper (2009) pointed out that one popular typology for understanding travel motivation is the push and pull model by Crompton (1979). The push motivations is useful for explaining the desire for travel while the pull motivations explains the actual choice of destination. The Crompton model identifies seven socio-psychological (push) motivations (escape, self-exploration, relaxation, prestige, regression, kinship-enhancement, and social interaction) and two cultural (pull) motivations (novelty and education). According to Crouch et Al (2004), consumers judgments depend basically on the strength of their beliefs or expectations about the quality of various features or attributes associated with services. Personal preferences, like motivations, may be both intrinsic, reflecting individual likes and dislikes, and extrinsic, or socially conditioned. Each opinion strictly depends on tourists direct past experiences with other services of analogous nature Kuang Hsu et Al (2009). Benitez et Al (2007) argue that the "quality that consumers perceive in a service is a function of the magnitude and direction of the gap between expected service and perceived service". Judgments expressed by numbers are easy to interpret, but linguistic information is more difficult to measure through a mathematical function. Linguistic information characterizes subjective knowledge and are characterized by uncertainty, imprecision and ambiguity (Benitez et Al, 2007).

In the light of the above premises the next section reports on the analysis from the spatial perspective of visitors perceptions of tourism businesses in Sardinia. This approach requires to identify regional patterns and key tourism areas, considering tourists preferences, domain location and their connection. The analysis was developed thanks to the interpretation of Social Media Geographic Information (SMGI) with authoritative geographic information (A-GI) in GIS environment.

5 MULTIDIMENSIONAL ANALYSES OF TOURISM SOCIAL MEDIA INFORMATION

In order to understand the tourist preference dynamics in Sardinia, as expressed by SMGI, a two scales approach was adopted. Firstly analyses at the regional scale were carried on to describe tourists preferences spatial patterns and to identify location of interest; the latter may include clusters of positive or negative preferences, or individual spots of interest. Then, at the local level (i.e. within the single cluster or spot of interest) further analysis were carried on aiming at understanding the possible reasons beneath the patterns and singularities with the assumption that they may help in explaining success or failure factors with regards to destination and services features. Both at the regional and the local levels, an investigation method was adopted including descriptive spatial analysis and spatial statistics coupled with explanatory SMGI analyses, including Spatial-Temporal Textual analysis, which can be defined as the textual analysis constrained by space and time boundaries (STTx; Campagna, forthcoming).

Operationally the study was carried on according to the following workflow: i) Data collection and geocoding: data were extracted by Booking.com and TripAdvisor.com.com, geocoded and integrated in a geodatabase for analyses; ii) Regional preferences dynamics analysis: data were analysed for all the region at the municipal unit of analysis with spatial analysis, spatial statistics, and STTx in order to detect clusters and hot/cold-spot; iii) Local preferences dynamics analysis: data were integrated with authoritative data from the regional Spatial Data Infrastructure and other official open data sources in order to find explanatory hints on the preference dynamics and to get deeper insights on the relationships among tourist preferences, local territorial features and quality of industry services in selected destinations. The last two steps were carried on iteratively on the relevant clusters and spots as in the examples reported in the remainder of this section.

5.1 Data collection and geocoding

In the first step, of the study a database was created extracting data from TripAdvisor.com.com and Booking.com in the period between May 2012 and May 2013. Through these applications customers can book, rank and review hotels, flights and restaurants (or Tourism Services, TS). The focus of the portals is to filter content based on rankings that are derived from other users ratings. Thus, rankings are split into several categories, such as value/price, rooms, location, cleanliness and sleep quality. Available rating categories however are determined by the type of reviewed item. The reviews are enriched by the possibility to add multimedia elements or travel maps of previous trips or to take part in discussion forums.

Thanks to the availability of the location of the services they can thus be considered SMGI (Campagna, forthcoming). Thus, the study required the adoption of a mixed methods approach, in which quantitative and qualitative information were collected in a database for analyses. The quantitative information concerns the score of tourist evaluation criteria, while qualitative information includes customers textual descriptive review. Concerning the quantitative analysis it should be noted that in TripAdvisor.com a rating scale consists of five ordinal values (or stars), ranging from ‘terrible’ to ‘excellent’. A separate mandatory overall rating summarizes the total customer satisfaction. In Booking.com a rating scale consist of numerical integer ordinal values, ranging from 1 to 10 (i.e. the higher the better). Beside quantitative assessment, in both platforms, a text box records qualitative natural language reviews. The title is a concise short text formulation of the assessment, while the comment is a long text field. After the data collection, a geodatabase was created including 992 Tourism Lodging Service (TLS) records extracted from TripAdvisor.com and Booking.com (the same TLS from both websites). The records provide TLS name, category, location, and related quantitative score. It should be noted that the TLS category includes not only hotels, but also other types of accommodation such as resort, bed&breakfast or agritourism. In order to analyse spatially the location of the tourism business patterns in Sardinia, geocoding was performed on the extracted addresses, providing the exact location of the tourism operators.

TLS were divided into 5 main categories: agritourisms (6%), bed and breakfast (15.7%), hotels (42%), private accommodations (29%), residences and resorts (7.3% of total numbers of operators). the analysis by

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provinces revealed that the 3 provinces have emerged as important tourist destinations in the tourists perception: Olbia-Tempio (27,8%) Sassari (24%) and Cagliari (20,6%). Other 4 provinces (Nuoro 8,6%, Oristano 7,3%, Ogliastra 5%; Carbonia-Iglesias 4%) are well represented by tourism businesses; whilst the province of Medio Campidano is only represented by the 3% tourism businesses. In addition, analysis of the significance of tourist appreciation in the coast and in inner areas in Sardinia revealed that 92% of tourism reviews sample concern LTS (917) in the coastal areas, while only less than 8% of popular tourism businesses are found inland. Nevertheless, Nuoro and Medio Campidano Provinces together provide notable inland popular TLS with almost the 13% of the total number of reviewed tourism businesses. This may mean that tourists visit these areas to discover a less popular side of the island, which is characterized by its nature, cultural heritage and traditions.

5.2 Spatial analysis of ourism preferences

After the preliminary descriptive analyses of the preferences dataset, the second step of the methodology is the application of spatial analyses of tourism preferences to explore spatial patterns of positive visitors judgments at the regional level. The application of spatial analytical techniques allows the exploration of the spatial dynamics of visitors perception and their relationships with different variables. For each TLS the database includes a score record, which is the average of six main attributes: 1) Location, which is related to the geographic position of the structure; 2) Services, referring to all transport facilities, shopping areas, bars and restaurants; 3) Price/quality ratio, referring to structure clearness, staff kindness and all type of comforts offered by the operators; 4) Staff (kindness); 5) Room cleanness (Cleaning); 6) Comfort, referring to all facilities and services that hotels provide to their customers.

It should be noted that the attributes Location and Services are those which explain the territorial features of the destination while the others express the perceived quality of the TLS supply.

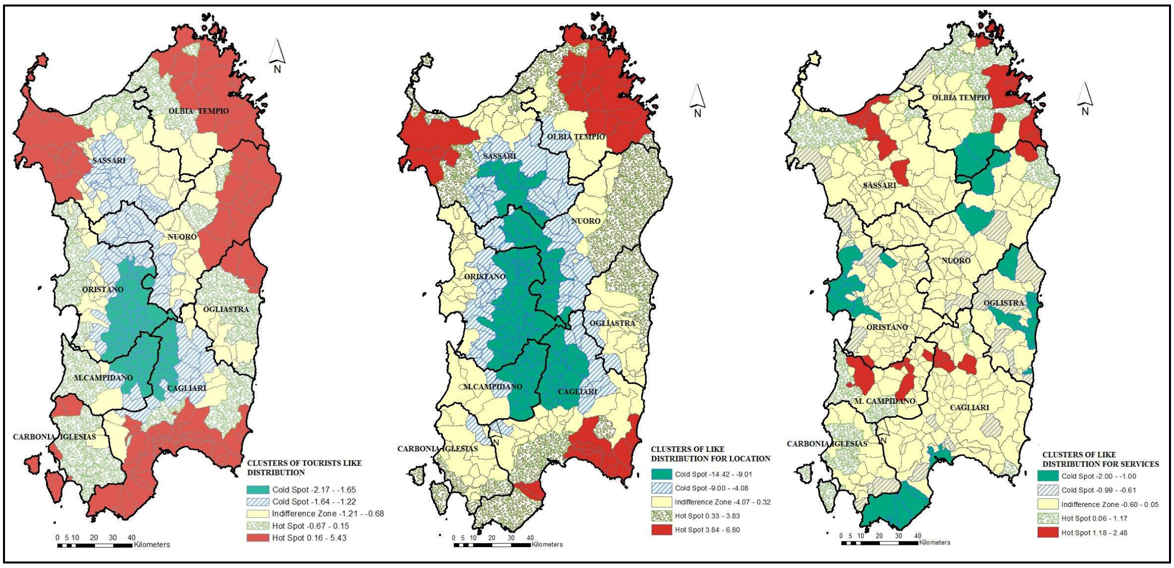

Figure 1 Areas characterized by positive preferences (TPPI): global (left), location (center) , and services (right).

Thus the data model allows the investigation of the spatial patterns of both preferences on territorial and tourism industry features at the local level across the all region. The following analyses show some examples, which explains which are globally the favourite destinations and by the two perspectives. The analysis starts by mapping the Tourist Positive Preferences Incidence (TPPI, i.e. the ratio between the positive scores and the TLS by municipality) in Sardinia. Figure 1 shows the distribution of the TPPI (left). The TPPI shows an overall high spatial concentration in the North-East of Sardinia. The Costa Smeralda district appears as the only area where the global tourism preferences fulfil overall visitors expectations. Looking at individual municipalities, the analysis shows that Alghero is the one with the highest TPPI rate. The other two municipalities with a high TPPI are Cagliari and Olbia. Also in Figure 1, two maps show the pattern of TPPI by destination territorial features (centre) and by tourist industry services quality (right).

5.3 SMGI analysis at the local level

After the analysis of the tourism dynamics described the preference patterns at the regional level identifying clusters and spots of successful destinations the methodology adopted for this study shifted to the local scale for further analyses aiming at finding explanatory answers for the phenomena under observation. The shift from the regional to the local scale is also carried on relying on spatial analysis and spatial statistics techniques on an integrated SMGI/A-GI data database. As an example case study for the sake of illustrating the methodology steps, the tourist destination of Alghero have been chosen as the regional analyses demonstrated its highly successful performance. The analyses at the local scale are intended to investigate the success factors within the single destination in order to extract useful hints to be used for further planning in the same or other destinations.

Alghero has been recognized as a best-selling destination from different tourists typologies. Thus, the following questions one should answer were Why tourists interest concentrates in Alghero? and What exactly in the destination does attract the tourists attention? In order to answer these questions, summarising the review by neighbourhoods the analisys of preferences spatial clusters reveals that the historic city centre of Alghero attracted the main attention of the visitors, while the modern residential districts in the outskirts, in this case, represents a cold spot. This kind of research can be supported by the integration of SMGI data with other A-GI on demographic, land use, transport facilities or socio-economic data coming from the regional SDI. In this sense, one interesting research question is whether spatial statistic methods such as regression analysis can be used to understand whether the spatial interest of the participant is influenced by environmental or socio-cultural variables. This is represents the next future step in the extension of the study.

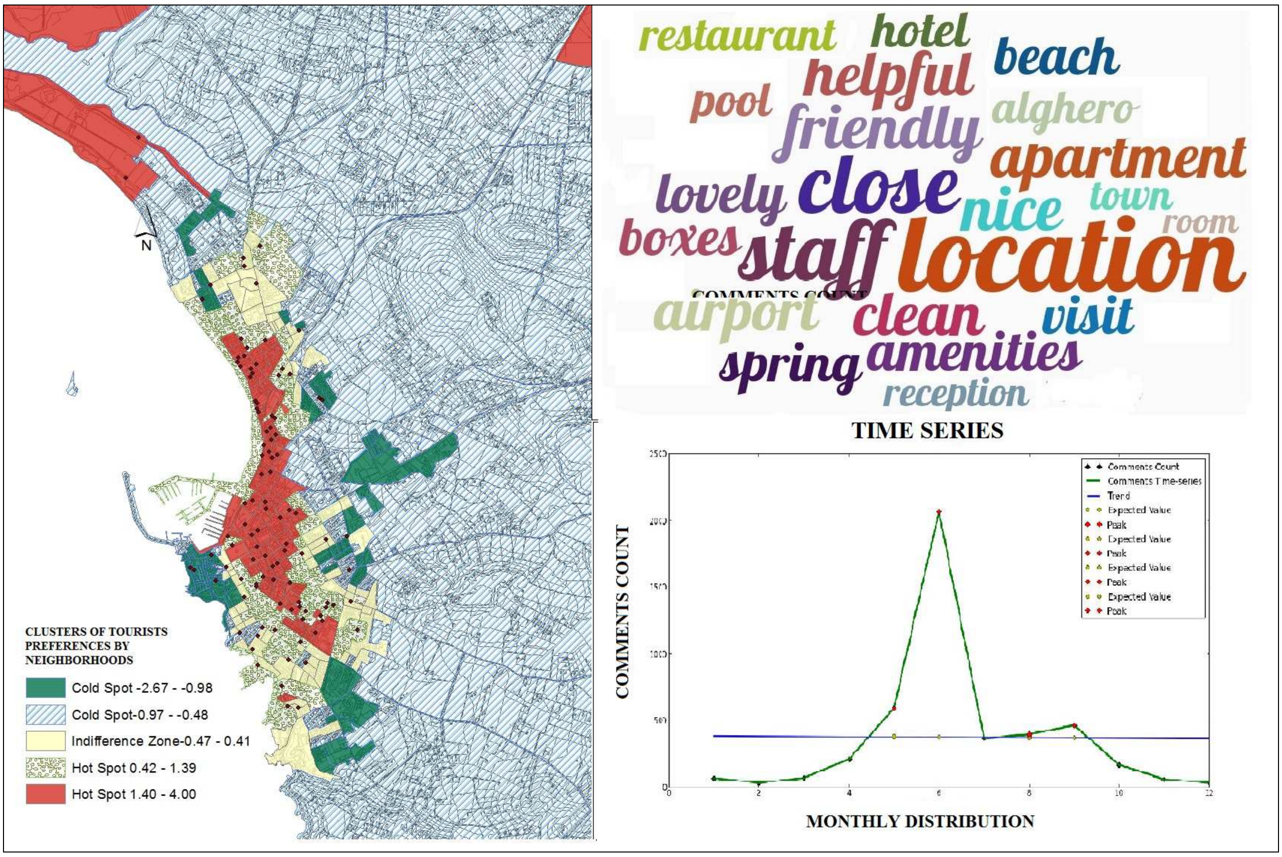

Figure 2 Significant patterns in Alghero (left), tag cloud for hot spots affected areas (top right) and time series (bottom right)

Another effective way to investigate the why tourist demonstrate to prefer certain areas or destinations rather than other may be given by the STTx analysis on their reviews. We want understand not only where but also what people think, analysing the reviews content. The analysis was carried out using the tourist comment database, which collected data regarding tourist user origin, language used, time comment and the textual judgment (positive and negative). For the overall Sardinia more than 880.000 reviews were extracted in 5 different languages (Italian, Spanish, English, French and Portuguese).

The textual analysis using Tag Cloud led to discover knowledge enclosed into this huge amount of text comments. The Tag cloud is essentially a visual representation of labels (tag) or keywords contained in different word strings. Generally, this representation is presented with a weighted word list in alphabetical order, where the larger font is attributed to the most repeated words (Kaser, 2007). In this example (Figure 2, left part), the most popular 20 words were extracted. The analysis reveals that the majority of the words in the posts refer to spatial or physical aspects of Alghero, such as location, beach, town, and city centre. Other frequent words are related to tourism structures, such as hotel, stuff, room and pool. Outcomes of the textual analysis also indicate higher levels of satisfaction with location, facilities and services.

According to the results, the main reason for tourists to visit Alghero seems to be related to both its natural attractions, which include natural sites, such as beaches, and the presence of a unique cultural heritage. These facts generate a positive tourism location image, which are the most influential psychological factors at play when tourists decide where to travel. Results also indicate a high level of satisfaction with the destination leisure sites, such as typical restaurants and typical food. In addition, results expressed a high level of satisfaction with the supply of accommodation, the cleanliness of structures and the kindness of the employed stuff.

In order to identify other significant patterns, the outcomes of the spatial distribution of tourist comments analysis, have been further investigated using the temporal analysis. Figure 2 (bottom right) reports the tourists activity degree by month. The activity is higher in the beginning of the summer season, especially in June and July. This is a very interesting time behaviour to analyse and represents an addictional step of the study.

6 DISCUSSIONS AND CONCLUSIONS

The results presented in this paper rely on the first outcome of an exploratory study to get insight on what kind of analysis may be carried on in order to extract from Social Media and Geographic Information meaningful knowledge relevant for planning and decision-making. The case study falls in the domain of tourist planning which is closely related to urban and regional planning. In fact, as the results of this study demonstrate, the success of tourist destination is closely dependent not only by the quality of the tourist industry offer but also by the territorial setting of the destinations, including the natural, cultural and the physical character of the places, as well as infrastructure and services. Further analyses are currently ongoing to extend this early framework and to earn deeper insights on the one hand on the functioning of tourism preference dynamics, and on the other hand, from the methodology perspective, on the formalization of a novel and robust integrated A-GI/SMGI analytics.

Still, this study gives empirical contributions to the evaluation of social media data using spatial analysis tools in tourism literature. The first one is related to the use of exploratory spatial analysis as a method to visualize and interpret visitors perception based scores. The literature on tourism services distribution highlights several issues and debates, but often the spatial dimensions of visitors subjective perception was omitted so far. In addition, the measure of this spatial dimension and its representation may open new opportunities for planners as well as new research challenges, in order to use authoritative and social media GI for a pluralist and customer-oriented policy-making in tourism planning. Many of the assumptions and findings can be anyway applied to the more general field of urban and regional analysis, design and planning.

Additional analyses are currently under development aiming at understating possible the integrations of SMGI with a more complex territorial model relying on further official spatial data resources on demographic, land use, transport facilities or socio-economic data coming from regional SDI. In this sense, one interesting research question which will be tested is whether spatial statistic methods such as spatial regression analysis can be used to investigate quantitatively how the spatial interest of the participant is influenced by environmental or socio-cultural variables.

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Spatial Plan of the Republic of Serbia in the light of Digital Agenda for Europe 2020

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1 ABSTRACT

European Union (EU) needs to overcome and counteract negative effects of the global economic crisis. In this respect, EU has decided to strategically build its social, economic and other development potentials, and to make them able to respond efficiently and effectively on dynamic life and work challenges within Information Society paradigm. Therefore, European Commission (EC) has adopted and, since March 2010, has implemented the Europe 2020 strategy. Its aim is to establish preconditions for common vision of sustainable future in Europe by 7 flagship initiatives, directed to smart, sustainable and inclusive growth throughout EU Member states as well as Candidate states and other bordering regions.

Therefore, in order to assure further increase in standards of life in Europe while facing sharp demographic ageing and increasing global competition, one of those Europe 2020's 7 initiatives –namely, Digital Agenda 2020- has been launched for 'smart growth' implementation. This Agenda consists of common digital priorities and set of targets needed for full utilization of ICT enabling role in every Member states and other relevant territories relying on knowledge and innovation of its citizens. It is expected that wider and better deployment of ICT capabilities, particularly broadband Internet within social and economic domains, would improve daily life quality for both businesses and citizens in Europe, including better health care, more efficient transport solutions, easier access to public services and cultural contents, cleaner environment, etc.

In the same time, spatial planning and plans, especially those on national level, present platform for long-term and strategic thinking, planning, directing, coordinating, implementing and managing development policies and decisions from different domains within certain territories. Because of these characteristics, national spatial plan should be one of crucial policy instruments in any country for Digital Agenda 2020 priorities and 'smart growth' features implementation. On one side, being development blueprint of each country, national spatial plans have role to provide territorial dimension for integrated, balanced and coordinated implementation of different sectoral policies and interests; on the other side, national spatial plans have obligation to promote various and progressive territorial cohesive development principles for inclusive economic and society development in future.

Based on the above recognised national spatial plans strategic role in each country development process, the aim of the article is to identify potentials and capacities of national spatial plan in Serbia for implementing Digital Agenda 2020. To this end, national spatial plan, namely Spatial Plan of the Republic of Serbia 2010-2020 (Plan), is reviewed and analysed in order for relevant Digital Agenda 2020 digital priorities and targets to be recognised and evaluate, and proposal for 'smart development' features and policies integration to be made. Also, since mentioned Spatial plan is adopted in 2010, and Serbia is lagging in ICT advantages utilization in general, expected lacks in support to digital technologies objectives and solutions implementation within this document should provide relevant information and argument for its revision in future.

2 INTRODUCTION

Digital Agenda 2020 (URL 2) claims that today development of high-speed networks for Internet access have the same revolutionary impact on the socio-economic progress and prosperity as the development of electricity and transportation networks had a century ago. This is due to the high influence ICT technologies have on the way we live and work today. Furthermore, this observation is specially going to be truth in near future when all digital contents and applications we use today in everyday life and work are expected to be delivered online. For EU year 2020 is estimated to be beginning of smart growth for all by establishment of Digital Single Market based on innovation and knowledge, delivering sustainable economic and social benefits.

In fact, after the economic shock and induced negative effects of global financial crisis from 2008 and onwards, EC has developed and implemented Europe Strategy 2020 (URL 1) with the aim to stimulate and establish smart, sustainable and inclusive economy throughout Member states as well as Candidate states and

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bordering regions. In this document, it is envisaged that in 2020 EU economy would have high-level of employment, continually increasing productivity and strong social cohesion, despite rapid ageing as well as fierce economic competition in global scale. In other words, this means that EU has aim till 2020 to establish competitive –namely, digital- economy that would be able to serve needs of inclusive digital society (URL 4, URL 1) and support sustainability relying on resource efficiency and greener growth (URL 1).

These goals of digital economy and digital society for cohesive development throughout EU and in bordering regions would be specially instrumented by the Cohesion Policy (URL 7) and targeted by its priorities decided for European Regional Development Fund and related development (i.e. financial) instruments in period 2014-2020.

In domain of spatial development planning and spatial plans, Territorial Agenda 2020 of EU (URL 3) provide content and provisions requirement and recommendations for future. This Agenda claims that Europe 2020 strategic goals needs also to include territorial dimension, as critical factor, due to big difference among European regions' development opportunities and capacities for reaching smart, sustainable and inclusive growth targets.

This means that goal of smart growth for all in future through sustainable digital economy advantages creation, where the fast and ultra-fast Internet access plays critical role, needs particularly territorial dimension to have elaborated. In other words, digital economy concept needs strategic coverage by broadband networks within every European territory, e.g. country like Serbia, in future as main precondition for virtuous cycle of the digital economy for digital society well-being to be spun (URL 2).

The aim of this article is, thus, to explore concept and action areas of the Digital Agenda 2020 and to review them in comparative and evaluating manner against the Spatial plan of the Republic of Serbia in order for argued revision recommendations for better and inclusive Internet access to be proposed in future (approaching midterm evaluation of this Plan).

3 DIGITAL AGENDA 2020

As already stated above, Digital Agenda 2020 is one of the 7 flagship initiatives of the Europe 2020 strategy aimed at operationalising smart economy concept by universal internet access for all, and thus reaching sustainable economic and social benefits within the future EU single digital market. In other words, this Agenda‘s actions are targeted at full utilization of ICT technologies enabling role till year 2020, by providing fast and ultra-fast internet access and interoperable applications to every business and citizen regardless of their location within domains of health care, education, transport, cultural content, public services, etc.

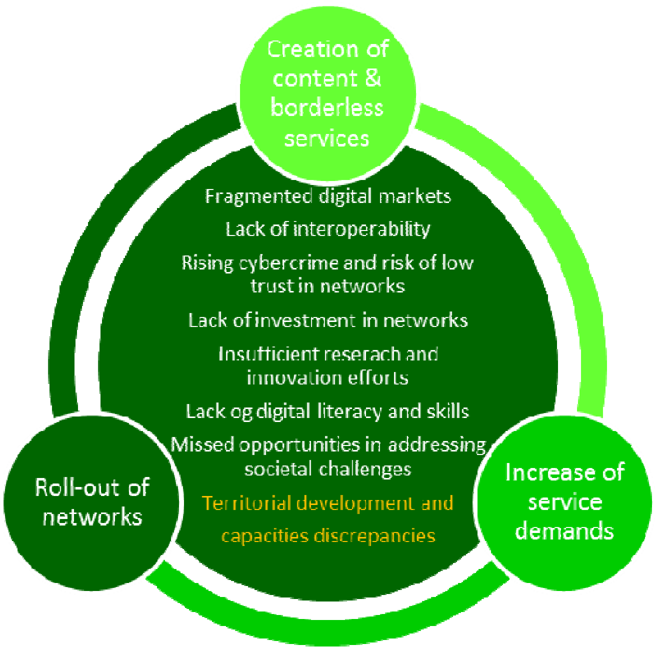

Figure 1: Digital Agenda 2020 virtuous cycle of the digital economy with 7 obstacles extended with Territorial Agenda 2020 territorial development and capacities discrepancies between European regions (URL 2, URL 3)

The prescribed approach for comprehensive and cohesive ICT technologies deployment, so called virtuous cycle of digital economy spinning (URL 2), assumes firstly creation of attractive, interoperable and borderless digital contents, applications and services which would in return increase end-users demand, and thus provide justification for new and/or higher investments in internet access, i.e. broadband networks roll-out. At the moment, Digital Agenda 2020 has identified 7 main obstacles for mentioned digital economy cycle to spin, and thus main aim of sustainable benefits for digital inclusive growth for economy and society to be achieved (Figure 1). If we add here territorial dimension from Territorial Agenda 2020 as obstacle, due to different socio-economic development levels and opportunities between European regions, it's clear that principle of solidarity and/or public subsidies would be necessary for smart development for all to become reality.

Additionally, Digital Agenda calls for actions and responsibilities to be taken both on EU and national level, where the role of national/public policy creators and strategic decision-makers would play special role in providing conditions for achieving digital economy and inclusiveness goals.

In this respect, analysis performed in this article would try to estimate how government could support Digital Agenda aim achievement in long-term and by comprehensive national spatial development planning concept and management in relevant areas, like: opening of public data and registers, providing e-services and e-content, planning broadband network development, etc. being promoted by different sectoral policies.

4 SPATIAL PLAN OF REPUBLIC SERBIA

Spatial Plan of the Republic of Serbia (Plan) presents umbrella strategic document for spatial development in Serbia in period 2010-2020. This comprehensive document includes development vision, principles and goals, as well as development scenarios and concepts, which should provide all policy creators and decision-makers in Serbia with platform for planned, manageable and integrated development of dynamic, growing and diversifying social, economic and environmental processes and phenomena towards sustainable future. Besides listed elements, rest of the Plan document consists of more detailed elaboration of main sectoral plans information as well as sectoral policies and development principles.

Comparing to the previous national and other spatial plans, this Plan includes set of measures and instruments as well as direct responsibilities of development stakeholders in Serbia for the Plan implementation, by its translation and elaboration within lower level plans (spatial and urban ones) and other development documents. Also, this Plan includes monitoring and evaluation model using set of spatial development indicators, where each indicator is related to particular operational and main goals of the Plan. Finally, Plan offers list of key development priorities, i.e. strategic projects, categorised by sectors, responsible parties for implementation (on national, regional or municipality level), as well as by five general development goals of spatial development in Serbia till 2020.

Among the other sectors, Plan in its chapter dedicated to sustainable development in domain of infrastructures elaborates long-term development goals and policy principles relevant for electronic communications in Serbia. (Figure 2) Within text volume of modest length, it's concluded that development of this communication infrastructure is distracted and slowed down by the bombing during 1999. Also, chapter includes summarized description of present status and list of reached and unrealized strategic goals between 2 national plans (that from 1996 and this one, 2010) in domain of public electronic communication networks. As the main goal within this domain till 2020, it is emphasized that development would be directed towards further building and efficient organization of modern electro-communication network, as well as towards making conditions for universal service availability by universal broadband access in each household in Serbia. As support to identified list of operational objectives for development of electronic communications in Serbia in future, concrete development concepts, strategic priorities, measures and instruments are provided as well.

Figure 2: Spatial Plan of the Republic of Serbia - Development of optical cables network and other communications in Serbia till 2020 (existing optical cables presented in green and planned in dark lilac colour) (URL 5)

However, despite highlighted importance of horizontal and vertical coordination of sectoral plans and policies at the beginning of Plan, multidisciplinary in proposed sectoral development scenarios is generally missing. In other words, in sectoral policies and plans presented in Plan, like economy, environment protection, polycentric development, cultural heritage, demography, etc., there are no clear commitment and/or orientation towards new e-based priorities and services provisions for life and work in Serbia in future, like different public e-contents, e-services and/or e-applications development and implementation.

Thus, the aim of this article is to analyse in comparative manner Plan against Digital Agenda 2020, and to identify and propose spatial planning, i.e. national spatial plan, role in making preconditions for smart growth by better internet access for both businesses and citizens in Serbia. Also, performed analysis includes identification of possibilities for increasing e-services offer and demand, and thus provides preconditions for universal services and universal internet access by broadband to be support in coming revision of this Plan.

5 METHODOLOGY

In order for Plan's provisions to be evaluated and justifiable and argued proposals for its revision and modernisation to be identified and formulated, Digital Agenda 2020 together with related documents, namely Europe 2020 strategy, Cohesion Policy 2014-2020 (URL 7) and Territorial Agenda 2020, were read and analysed. Since Serbia has status and responsibilities of EU Candidate state, the aim of performed analysis included inquiry of common EU development vision and goals, particularly prescribed actions, targets and recommendations for smart development till 2020.

Since the 'smart growth' dimension is attracting increasing interests and implementation efforts of many socio-economic-environmental development stakeholders in recent years, the performed analysis and inquiry included also worldwide experiences in building inclusive digital societies. These experiences with recommendations for building 'smart economy' that changes the way we work, live and communicate today in fast, irreversible and qualitatively different way, have been reviewed within the UN's Commission on Science and Technology for Development report (URL 4).

On the other side, in order for Plan's provisions verification to be conducted and relevant 'smart growth' for economy and society proposals for Plan revision to be formulated, the Spatial Plan of the Republic Serbia 2010-2020 (URL 5) together with its preceding studies on status and perspectives of ICT-support deployment in Serbia (Milovanović Rodić, 2009; Lalović, 2009) have been read and analyse. Also, the telecommunication market status and features in Serbia for 2012 (URL 6) has been reviewed in order for the same to be assessed and support proposed changes of Plan.

The general and specific questions posed and leading here presented analysis included: What is the national spatial planning and spatial plan role in development of certain state? Can national spatial plan supports common EU vision and goals implementation, and how? What can be the role of national spatial planning and spatial plan in providing conditions for smart growth within national economy and inclusive digital society? etc.

6 ANALYSIS RESULTS

As already mentioned above, Serbia has received EU Candidate status and has responsibility to adjust to this Union before joining it in coming years. This means, among the other things, that relevant sectoral and other development regulations, policies and strategies, as well as practices, processes and procedures, need to be adjusted and/or adopted to common EU vision, goals, principles and standards.

Although national spatial planning domain with related policy, principles and practice, is neither regulated nor prescribed within EU in any particular way (for example, by some programme, directive or regulation), this public sector has been strongly impacted by adjustments of other related national sectors (like transport, water management, environment protection, agriculture, culture, economy, mining, etc.). This means that since national spatial planning is about coordination of different sectoral policies and strategic priorities, and national spatial plan is model for their optimal balancing in particular –longer- time period, then national spatial plan provisions of each Member or Candidate state should be affected and appropriately reflect EU common development framework. And, this should be true for every part of integrated and sustainable development planning paradigm: economy, society and environment.

However, in current national Plan of Serbia it was neither possible for elements of Europe 2020 vision and its strategic priorities to be identified, nor Digital Agenda 2020 action plan recommendations for improving access to fast and ultra-fast internet to be noted. In other words, except telecommunication sector's policy and plan to expand and improve capacity of broadband networks in Serbia till 2020, there are no other sectors' policies or plans to stimulate 'smart growth', by providing innovative services, applications, contents or other 'investing' incentives for businesses or citizens benefits. This lack is discouraging since internet promoting activities are specially expected on side of public sector, that is Government, which should stimulate the smart economy development in Serbia today by providing open access to public data registries and databases, as well as by supporting private investments and/or investing directly in ICT technologies advantages, especially in remote and other non-commercial or low profitable areas and domains.

Also, Digital Agenda 2020 targets are not fully presented within set of territorial development indicators identified for monitoring and evaluation of Plan implementation, for its 5 general goals achievement.

Digital Agenda 2020	Spatial Plan of the Republic of Serbia	ICT-UNESCO Development Index
Broadband targets:	Competitiveness and accessibility of regional economies:	Access indicators:
Basic broadband for all by 2013: basic broadband coverage for 100% of EU citizens	Territorial coverage by broadband network	International Internet bandwidth Bit/s per Internet user
Fast broadband by 2020: broadband coverage at 30 Mbps or more for 100% of EU citizens	Equal accessibility to transport and other infrastructures and information:	Percentage of households with compute
Ultra-fast broadband by 2020: 50% of European households should have subscriptions above 100Mbps	Pecentage of houshold with internet access	Percentage of households with Internet access
Digital single market:		Use indicators:
Promoting eCommerce: 50% of the population should be buying online by 2015		Percentage of individuals using the Internet
Cross-border eCommerce: 20% of the population should buy cross border online by 2015		Fixed (wired)-broadband subscriptions per 100 inhabitants
eCommerce for business: 33% of SMEs should conduct online purchases/sales by 2015		Active mobile-broadband subscriptions per 100 inhabitants
Single market for telecoms services: the difference between roaming and national tariffs should approach zero by 2015		
Digital inclusion:		
Increase regular internet use from 60% to 75% by 2015 and from 41% to 60% for disadvantaged people		
Halve the proportion of population that has never used the internet by 2015		
Public services:		
eGovernment by 2015: 50% of citizens using eGovernment, with more than half of them returning filled in forms		
Cross-border public services: by 2015 online availability of all the key cross border public services contained in the list to be agreed by Member States by 2011		
Research & innovation:		
ICT R&D increase: Double public investment to €11 billion		
Low Carbon Economy:		
Promotion of low energy lighting: By 2020 at least 20% overall reduction in energy use on lighting		

Table 1: Comparative view of internat and broadband access-related references: Digital Agenda 2020 targets, Spatial Plan of the Republic of Serbia and ITU-UNESCO indicators (URL 2, URL 5, URL 9)

Although Plan's enactment year (i.e. 2010) could be used as argument for lack of elements of these strategic EU documents, there is no reason for lack of strong ICT enabling role features elaboration and support in both preceding studies (Milovanović Rodić, 2009; Lalović, 2009) as well as Plan itself, since other relevant paradigm and initiatives have been promoted and implemented within EU in longer period (like e-Government, Information Society, ESPON, INSPIRE, etc.). However, recommendations of the Territorial Agenda 2020 on territorial connectivity and cohesive development could be somewhat recognised within Plan development concept and provisions.

And, although other related sectors –including spatial development domain- didn't prioritized for coming decade ICT support building as their areas of responsibilities, part of Plan related to development of public electronic communication networks has recognised importance of providing universal broadband access and universal service in Serbia, as preconditions for inclusive digital and cohesive territorial development within Serbia, both on country and within country levels (region, county, municipality).

Finally, noted lack of mutual sectoral activities and priorities coordination and synergy between telecommunication and other sectors, and actually failure to recognise modern life and work needs on side of spatial development sectors, is one of the main reasons why multidisciplinary dimension of Plan stayed unclear.

All identified disadvantages of Plan for building 'smart' economy and society in Serbia in this chapter, could be used as platform for revision and improvement of this strategic document in future. Some of the findings have been outlined in next chapter.

7 IMPLICATIONS AND PROPOSAL FOR FUTURE

In Digital Agenda 2020 (URL 2) and UN report (URL 4), it is claimed that today development of high-speed networks for internet access has revolutionary impact on number of sectors, like economic development (namely, GDP), education, health care, social and cultural enrichment as well as political engagement. This irreversible and qualitatively differentiation of services and products that build and constitute our life and work today emerge and are provided by fast and ultra-fast internet networks and accessed by various applications and contents for mobile and other internet devices. While the number of advantages and benefits from internet access is growing, supporting progress of every business and inclusion to every citizen, the important question is how developing countries, like Serbia, could keep pace with the developed world by spatial plan and planning in general.

Although the huge e-development leap is hard to be expected in short-term, in sense of development and usage of Internet access, services, contents and applications in Serbia, especially in public sector, elements and principles of Digital Agenda 2020 could be initiated and move forward with appropriate revision of Plan.

However, first broad consensus among sectoral policy and decision-makers should be reached on importance and focus on 'e-'development in future. (URL 8) This consensus should be reflected and highlighted in Plan as common awareness and directions towards new socio-economic paradigm in Serbia, namely Information society. This new 'e-' territorial development direction should be clear, for example, from Plan's vision statement, stated spatial development principles, proposed conceptual model of development, as well as indicated development scenarios; but, on the first place, within sectoral policies and plans as well.

Although new spatial planning paradigm in Serbia, particularly reflected in national plan preparation approach (Živković, 2012, 2013), has included early involvement and continuous responsibility of all development and planning stakeholders, it is important for cross-sectoral planning and development areas and approaches to be identified, motivated and supported. This means that different sectors common interests and fields of cooperation, as well as resulting strategic development priorities and projects, should be also supported clearly and separately by appropriate financial instruments and set of responsibilities, in order for those projects to be implemented and cross-sectoral synergies to be further stimulated.

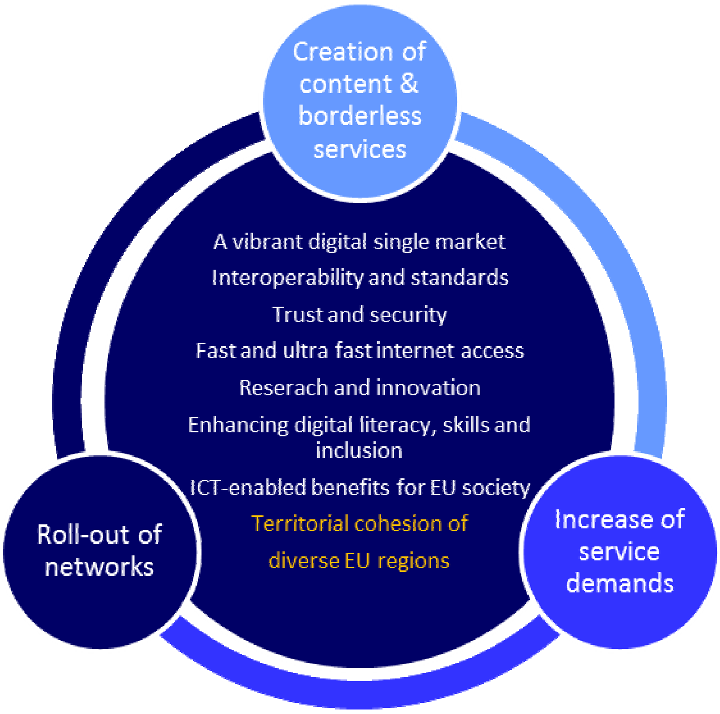

Figure 1: Digital Agenda 2020 virtuous cycle of the digital economy with 7 action areas extended with Territorial Agenda 2020 territorial development and capacities discrepancies between European regions action (URL 2, URL 3)

Since national spatial plan, like one analysed here, is implementing though its provisions elaboration and translation into lower level plans, like regional, municipal and urban ones, it is of strategic importance that Information society features are introduced on this very level, in order for described vicious cycle of digital economy to be start in systematic and structured way.

However, although it’s not topic of this article, it should be noted that in implementation of new ICT supports and EU policies, it should be avoided technology deterministic approach.

8 CONCLUSION

Since national spatial plan presents blueprint for every country strategic development in longer run, through combining and planning in balanced and sustainable way different sectoral policies’ principles and plans implementation, there is a high capacity and potential of this document and spatial planning in general to route new socio-economic development model.

This means that Digital Agenda 20202 -and other EU strategic documents and Information Society in general- priorities and targets could be supported in Serbia by their integration in national Plan, both within spatial development policy and other sectoral policies and plans. For this aim to take effect there should be first national consensus reached on broadband access importance and its optimal deployment model in Serbia, while national Plan for Serbia content and priorities should be adapted during next revision.

The main limitation of article and performed analysis refer to lack of insights into other national spatial plans (for example, for some EU Member state), and their practices and experiences in Digital Agenda 2020 priorities and actions integration mode and implementation.

In future, it should be analysed modes of Digital Agenda and information Society in general features and actions influence on spatial planning and development domain, as well as universal service and universal broadband access integration and implementation within different spatial planning documents. Also, cross-sectoral collaboration models and interests should be analysed and best practices and lessons learn from developed countries in EU applied in Serbia.

9 REFERENCES

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Städtebauliche Kalkulation mit Decision Support Infrastructure – das Beispiel der Analyse ökonomischer Wirkungen eines kommunalen Baulandmodells

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1 ABSTRACT

Die Kenntnis der Kosten von Stadtentwicklungs- und Wohnbaulandprojekten und die Abschätzung, inwieweit die entstehenden Lasten an Investoren übertragen werden können, ist für Kommunen von hoher Bedeutung. Diese Informationen, die in in Entscheidungen über den richtigen Standort, oder die richtige Dichte und städtebauliche Ausrichtung einer Fläche einfließen können mit dem GIS-basierten Instrument decision support infrastructure dsi analysiert und bewertet werden. Im weiteren Verlauf wird zunächst die Idee der Software Plattform dsi dargestellt. Es folgt die Beschreibung, wie dieses Instrument auch für die Kalkulationen im Zusammenhang mit kommunalen Baulandmodellen angewendet werden kann. Dazu wird der Hintergrund und die Regulierungsfunktion des Kölner Baulandmodells beschrieben und dann anhand eines Fallbeispiels Ergebnisse verschiedene Kostenübertragungen bei unterschiedlicher baulicher Dichte dargestellt.

2 HINTERGRUND VON DECISION SUPPORT INFRASTRUCTURE (DSI)

Decision Support Infrastructure (DSI) ist ein Projekt, das Kommunen und andere Akteure der Stadtentwicklung bei der integrierten Planung und Entscheidungsfindung unterstützt. Mit DSI können vielfältige Datenquellen kombiniert und mit einer wissenschaftlichen Methodenbibliothek raumbezogen ausgewertet und visualisiert werden. Die neuen Analysemöglichkeiten basieren auf der Nutzung von Standards (z. B. OGC, Inspire und ALKIS), die die erforderliche Interoperabilität von Geodaten gewährleisten. Auf diese Weise können externe Datenquellen mit dem Bestand der kommunalen Daten in einer einheitlichen Arbeitsumgebung kombiniert werden, was die Informationsbasis und die Analysemöglichkeiten im Rahmen der städtebaulichen Planung vergrößert.

Technisch betrachtet ist DSI eine Methodenbibliothek, die in ein webbasiertes Geoinformationssystem integriert ist. Das Geoinformationssystem verwaltet und verarbeitet alle relevanten räumlichen Daten, die dem Nutzer zur Verfügung stehen. Für die Verarbeitung stehen alle Geoprocessing-Funktionen und kartographischen und algebraischen Operationen bereit, die auch in einem klassischen Desktop GIS vorhanden sind. Die Methodenbibliothek ist fachlich thematisch strukturiert und besteht aus vordefinierten Algorithmen einem entsprechendem Klassenschema, das vom Benutzer mit den eigenen Daten gefüllt wird. Da dsi auf die Datenstruktur des ALKIS-Modells und ausgerichtet ist, können die notwendigen Geodaten über ein sogenanntes Schema-Mapping zuordnet werden. Neben den Geodaten werden je nach Analyse individuelle Angaben und Spezifikationen abgefragt. Die Nutzereingaben erfolgen je nach Art der Analyse sowohl über die Auswahl vorgegebener Alternativen, freie Eingaben oder über Gis-Funktionen wie Digitalisierung oder Markierung von kartographischen Objekten. Diese Orientierung am derzeitigen Stand der Technik gewährleistet, dass die verwendeten Geoinformationen turnusmäßig aktualisiert werden und keine veralteten Ergebnisse produziert werden.

Innenentwicklung, Stadtumbau und Redevelopment spielen immer wichtigere Rolle in der Stadtentwiclklung spielen, und erfordern als komplexe Planungsaufgaben eine integrierte Datenanalyse. Deshalb dressieren und verknüpfen die in DSI implementierten Methoden die kleinräumige Sozialstruktur, die ökologische Situation, den Immobilienmarkt, und die Infrastrukturkosten. DSI bildet im Sinne einer integrierten Stadtplanung die Prozesse Monitoring, Konzeptionierung und Bewertung städtebaulicher Entwicklung ab. Diese Analysen lassen sich zum einen für bereits bestehende Infra- und Sozialstrukturen durchführen und zum anderen für geplante Umstrukturierungen und Nutzungsänderungen in der Stadt. Zu diesem Zweck eröffnet DSI mit Kalkulationen zur Beurteilung von Standortentwicklungen und einer Flächenpotenzialanalyse die Möglichkeit, städtebauliche Konzeptionen zu modellieren und einer Nutzen-Kosten-Betrachtung zu unterziehen. Die datenbankorientierte Struktur von dsi ermöglicht es, räumlich verteilte Daten, beispielsweise regional unterschiedliche Baupreise, Liegenschaftszinssätze, Boden- und Immobileinpreise mit Entwicklungsprojekten auf konkreten Standorten zu verknüpfen. Aus den verschiedenen in DSI hinterlegten Geodaten und den Nutzereingaben werden den so definierten potentiellen Entwicklungsflächen

Informationen von der planerischen Festsetzung über aktuelle bzw. ehemalige Nutzungen bis zu den geschätzten Entwicklungs- und Folgekosten zugeordnet, sodass mit DSI auch ein umfangreiches Entwicklungsflächenkataster angelegt werden kann. Nutzungsideen und Bauvorhaben, die beispielsweise aufgrund der vorstehenden Analysen sinnvoll erscheinen oder auch schon im FNP vorgesehen sind, lassen sich mit dem Modul städtebaulichen Kalkulation modellieren und bewerten. Auf dieser Funktionalität aufbauend sollen die Regelungen von Baulandmodellen in dsi hinterlegt werden. Ziel ist es, die Potenzialflächen sowohl unter Standardbedingungen als auch unter einer lokal etablierten Regulierung, wie sie Baulandmodelle darstellen, zu bewerten.

3 STÄDTEBAULICHE KALKULATION IM RAHMEN VON BAULANDMODELLEN

3.1 Fragestellungen bei Baulandmodellen zur Innenentwicklung

Angesichts des hohen Siedlungsdrucks und des Mangels an bezahlbarem Wohnraum in vielen Ballungzentren sollen Baulandmodelle auch in den Innenbereichen der Städte angewendet werden. Deshalb besteht ein grundsätzlicher Bedarf, die Wirtschaftlichkeitl der Erschließung und Umnutzung von Standorten zu bewerten. Insbesondere die mit der städtebaulichen Entwicklung verbundenen Investitions- und Folgekosten der Infrastruktur sind für die Kommunen und Investoren von hoher Bedeutung.

Die Verteilung der Kosten, die bei der Erschließung oder Neuordnung von Baugrundstücken entstehen kann über das Instrument städtebaulicher Verträge mit den Investoren bzw. Grundstückseigentümern die von der neuen Planung und Inwertsetzung profitieren, vereinbart und gesichert werden. Um eine an wichtigen Grundprinzipien orientierte Gleichbehandlung der Planungsbegünstigten zu erreichen, haben zahlreiche Städte und Gemeinden ein strategisches Flächenmanagement mit verbindlichen Standards und Vorgehensweisen für die Baulandbereitstellung etabliert. Einschlägig sind die Beispiele aus München und Stuttgart (vgl. Fricke 2012, Veit 2005). Kommunale Baulandmodelle werden in der Praxis mit Erfolg eingesetzt, nicht nur um Dritte an den Kosten und Folgekosten städtebaulicher Maßnahmen zu beteiligen, sondern zunehmend auch, um die vielfältigen sonstigen strategischen Ziele der Stadtentwicklung damit zu erreichen (vgl. Kötter 2007). So lassen sich etwa Vereinbarungen über den einen Anteil preisgedämpfter Wohnungen oder Freiraumnutzungen und Klimaschutzaspekte in derartigen Modellen vereinbaren.

Die Heranziehung der Eigentümer eines Baugebietes zu den Kosten der Infrastrukur und des geförderten Wohnraums und damit die vertraglichen Refinanzierungspotenziale werden jedoch durch die planungs- und maßnahmenbedingten Bodenwertsteigerungen begrenzt. Dazu muss die Nettobodenwertsteigerung ermittelt werden, die sich aus der Differenz zwischen dem Anfangswert vor Planungsbeginn und dem Endwert nach Satzungsbeschluss, Bodenordnung und Herstellung der Infrastrukturanlagen und Einrichtungen ergibt, also nach rechtlicher und tatsächlicher Neuordnung des Gebietes. Um die Unsicherheiten der Wertermittlung ausreichend zu berücksichtigen und um einen hinreichend hohen Anreiz für die Grundstückseigentümer zu bieten, an der Maßnahme mitzuwirken, ist es sinnvoll, dass ein Anteil der Bodenwertsteigerung bei den Eigentümern verbleibt. Dabei ist von zentraler Bedeutung, welche Kostenübernahme für den Investors als angemessen wird. Etabliert hat sich vielfach wie z. B. im Münchener Modell ein Anteil von einem Drittel der Nettobodenwertsteigerung.

Sowohl für die Stadt als auch für den Investor stellen sich bei der Anwendung einer solchen Regulierung von eine Reihe von wirtschaftlichen Fragen:

- Wie hoch sind das Bodenpreisniveau und die zur Erschließung erforderlichen Infrastrukturkosten?
- Welches Maß und welche Ausstattung an infrastrukturellen Leistungen kann von den Investoren übernommen werden?
- Inweit kann über eine Veränderung der Bebauungsdichte die Fähigkeit des Investors zur Übernahme von Infrastrukturleistungen ermöglicht werden?
- Wie hoch ist ggf. der Anteil, den die Stadt übernehmen muss, um eine angemessene Renditemöglichkeit für den Investor zu gewährleisten?
- Wie stellt sich die Kostensituation auf alternativen Standorten dar und und welche Ausnutzung des Standortes hat den höchsten Nutzen?

Klarheit und Transparenz über Kosten und Erträge sind im Verhandlungsprozess für die städtebaulichen Verträge für Investoren und Stadt von großer Wichtigkeit. Daher ist es wünschenswert, wenn dies durch ein einheitliches und für Investoren und Stadt gleichsam zugängliches Analysetool unterstützt werden kann.

3.2 Das Baulandmodell Köln

Angesichts der Entwicklungen auf dem Wohnungsmarkt soll das Kooperative Baulandmodell Köln dazu beitragen, das Angebot an preiswerten Wohnungen (öffentlich geförderter Wohnraum in zwei Förderwegen A und B) zu erhöhen, indem dafür entsprechendes Bauland bereitgestellt wird. Insgesamt sollen mit dem Modell folgende generellen Ziele bei der Entwicklung neuer Wohngebiete in Köln verfolgt werden:

- Anteil des geförderten Wohnungsbaus bei neuen Wohnungsbauvorhaben von stadtweit mindestens 30 %.
- Beteiligung der Planungsbegünstigten an den Entwicklungs- und Folgekosten der Baugebiete, insbesondere an den Kosten der technischen und sozialen Infrastruktur.
- Qualitätssicherung bei der Baugebietsentwicklung (obligatorische städtebauliche Wettbewerbe).

Das Kooperative Baulandmodell Köln soll eine Gleichbehandlung aller Planungsbegünstigten sicherstellen und Transparenz bei Verhandlungswegen und Planungsabläufen für Investoren und aller Akteure der Wohnbaulandentwicklung schaffen.

Das Modell findet ausschließlich bei Bebauungsplänen (§§ 12, 13a und 30 BauGB) Anwendung und nicht im unbeplanten Innenbereich (§ 34 BauGB). Als weitere Voraussetzung wird eine Mindestgröße von 25 Wohneinheiten für die Neubauvorhaben festgelegt.

Wesentlicher Kern des kooperativen Baulandmodells ist die 30 %-Quote für den geförderten Wohnungsbau.

Die durch die Planung ausgelösten Planungs-, Her einschließlich der sozialen Infrastruktur werden bis zu einer Höhe von 2/3 der planungs- und maßnahmenbedingten Bodenwerterhöhungen auf die Planungsbegünstigten übergewälzt, so dass 1/3 des entwicklungsbedingten Bodenwertwertzuwachses bei diesen verbleibt. Dies soll die Mitwirkungsbereitschaft der Eigentümer sichern und dem rechtlichen Prinzip der Angemessenheit bei städtebaulichen Verträ-gen Rechnung tragen (Verhältnismäßigkeitsgebot).

Die Kostenbeteiligung der Planungsbegünstigten erfasst folgende Maßnahmen und Aufwendungen bei der Entwicklung neuer Baugebiete: Städtebauliche Planung: Städtebauliche Wettbewerbe, Fachplanungen, Fachgutachten wie Baugrunduntersuchungen und archäologische Untersuchungen (ansätze nach HOAI)

- Ordnungsmaßnahmen: Die Beseitigung von Altlasten durch Bodensanierung und Grundstücksfreilegung durch Gebäudeabrissmaßnahmen werden auf Grundlage von individuellen Kostenschätzungen berücksichtigt.
- Flächenbereitstellungen für öffentliche, technische und soziale Infrastruktur Anlage- und Einrichtung: Die Flächen werden mit dem Anfangswert zu Beginn der Maßnahme eingesetzt.
- Technische Erschließung: Herstellungskosten für Erschließungsstraßen einschließlich Kanal, 150,- €/m² Erschließungsfläche.
- Öffentliche Grünflächen: 40,- €/m²
- Ausgleichsmaßnahmen: 6,- €/m²
- Geförderter Wohnraum: Die Realisierung des geförderten Wohnungsbaus setzt voraus, dass der Bodenanteil pro Quadratmeter Geschossfläche Wohnen einen maximalen Betrag nicht überschreitet. Dieser Wert wird für Köln mit 400,- €/m²Wohnfläche angesetzt, so dass die Differenz zu dem tatsächlichen Endwert als Kosten aus Sicht des Planungsbegünstigten aufgefasst und in Ansatz gebracht werden müssen (Renditeverzicht).
- Soziale Infrastruktur: Auf Grundlage der Ausstattungsstandards in der Stadt Köln wird hier eine pauschale Kostenbeteiligung von 49,- €/m² GF Wohnfläche angesetzt. Dieser Wert entspricht etwa 2/3 der tatsächlich anfallenden Kosten für soziale Infrastruktur in durchschnittlich ausgestatteten Neubaugebieten in Köln.

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Abbildung 1 Bestandssituation, Rahmenplanung und Eingabe der Entwicklungsfläche in der Software dsi

4 KALKULATION FÜR EIN NEUES STADTQUARTIER

Um die Konfiguration der Festlegungen des Baulandmodell in der Software dsi zu implementieren und die damit erzielbaren Ergebnisse zu prüfen, wird auf ein in der Umsetzung befindliches Entwicklungsprojekt zurückgegriffen in der Stadt Köln.

Zur Beurteilung der Auswirkungen des Baulandmodells werden folgende Modellvarianten an diesem Beispiel berechnet und gegenübergestellt:

- Modell 1: Der Investor übernimmt die Kosten der Grundstücksaufbereitung und technische Infrastruktur
- Modell 2: Zusätzliche Übertragung der Kosten für Soziale Infrastruktur auf dem Investor
- Modell 3: Übertragung der Kosten für Soziale Infrastruktur und zusätzlich die Verpflichtung zur Erstellung geförderten Wohnraums im Umfang von 30% der Geschossfläche für Wohnraum.

Alle drei Modelle werden jeweils in drei Dichtestufen berechnet und bei unterschiedlichem Bodenwertniveau betrachtet.

4.1 Städtebauliche Eckdaten des Fallbeispiels

Das Projekt an dem die zu erwartenden Auswirkungen der angedachten Regulierung auf den Bodenmarkt und die Investoren dargestellt werden, ist die Umwandlung einer innerstädtischen Industriebrache in ein urbanes Stadtquartier. Abbildung 1 zeigt den Zustand vor Beginn der Maßnahme und den städtebaulichen Rahmenplan des Gebietes. Diese Planungsideen und daraus resultierenden Flächenanteile für Verkehrs- und Grünflächen werden über ein Digitalisierungswerkzeug in die Software übernommen. Ebenso sind Eingabefelder für die Dichte und Nutzung vorhanden. Wahlweise ist es möglich die vorgesehene Nutzung in Form von definierten Baustrukturtypen in das System einzugeben. Tabelle 1 bietet in gerundeten Werten einen Überblick über die resultierende Aufteilung der Fläche:

Bruttobauland	162 000 m²	Bauland Gebietstypen	
Verkehrsfläche	44 000 m²	Allgemeines Wohngebiet (WA)	69 000 m²
Gemeinbedarfsfläche	3 000 m²	Gemisches Baugebiet (MI)	40 000 m²
Grünanlage	6 000 m²	Nettobauland	109 000 m²

Tabelle 1 :Flächenbilanz

4.2 Kalkulation der Kosten

Anhand der vorgesehenen Erschließungs- und Grünflächen werden mit überschlägigen Kostenansätzen die Gesamtkosten für die technische Infrastruktur ermittelt. (vgl. Tabelle 2)

Abgesehen vom Erhalt von drei größeren Hallen für soziale und Kulturelle Nutzungen und der südlichen Randbebauung werden die übrigen Gebäude auf dem Gelände abgerissen. Die Position der Abrisskosten ist daher ebenfalls in der Kalkulation zu berücksichtigen. Aufgrund der industriellen Vornutzung befinden sich auf dem Geländere umfangreiche Verunreinigungen des Bodens, deren Beseitigungskosten pauschaliert veranschlagt werden.

Kostenansätze	Gesamtkosten
Technische Infrastruktur, Straße/Kanal (150€/m²)	6 600 000 €
Grünfläche/Spielplatz (40€/m²)	240 000 €
Altlastensanierung (pauschal geschätzt)	10 000 000 €
Grundstücksfreilegung und Abriss (25 €/m²)	2 000 000€

Tabelle 2: Kostenansätze ohne Einfluss der GFZ

Die vorgenannten Kostenarten sind Bestandteil aller Kalkulationsmodelle und werden unter der Annahme, dass die Rahmenplanung eine Variation der Geschossflächenzahl erlaubt, nicht weiterverändert. Ebenfalls in allen Modellen gleich sind die Annahmen zur Finanzierung. Die tatsächlich anfallen Kosten werden während der 5 jährigen Entwicklungsdauer in jährlichen Tranchen zu 2% finanziert.

Die Kosten für die soziale Infrastruktur werden im Rahmen des Baulandmodells mit 49 €/m² Geschossfläche Wohnen angesetzt. Sie steigen also mit zunehmender GFZ. Allerdings steht diesen Werten aufgrund des GFZ-bedingt höheren Bodenwertes auch ein höherer Erlös gegenüber.

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Dichte (Gebietstyp/GFZ)	Geringe Dichte (WA/1,0; MI/1,4)	Mittlere Dichte (WA/1,4; MI/1,8)	Hohe Dichte (WA/1,8; MI/2,2)
Geschossfläche Wohnen*	85 800 m²	118 200 m²	150 600 m²
Kostenbeteiligung soziale Infrastruktur	4 204 200 €	5 791 800 €	7 379 400 €
Renditeverzicht Soziale Wohnraumförderung	997 000 €	490 000 €	420 000€

*Für den Wohnflächenanteil im Mischgebiet wird eine Quote von 30 % angesetzt.

Tabelle 3: Kosten für Soziale Infrastruktur und sozialen Wohnungsbau in Abhängigkeit von der Geschossflächenzahl

Die Berücksichtigung der Lasten für geförderten Wohnraum gehen als fiktive Kosten in die Kalkulation des tragfähigen Anfangswertes ein. Sie werden als Renditeverzicht bezeichnet und stellen die Differenz zwischen dem am Markt erzielbaren Bodenwert je Quadratmeter Geschossfläche Wohnraum und dem für die Stadt Köln ermittelten maximal tragfähigen Bodenwert von 400€ je m²GF für geförderten Wohnraum dar.

4.3 Ermittlung des Marktwertes nach Entwicklung und des tragfähigen Ankaufswertes

Die zu erwartenden am Markt erzielbaren Werte für das erschlossene Nettobauland der Entwicklungsfläche sind aus geeigneten Bodenrichtwerten abzuleiten. In der Nähe des Entwicklungsgebietes liegt eine Bodenrichtwertzone von 500 € für Wohnbebauung bei einer GFZ von 1,5 vor. Dieser wird zum einen über die höhere Gewichtung von Geschäfts- und Ladenflächen für die als MI-Gebiet ausgewiesenen Flächen angepasst. Zum anderen wird mit Hilfe von gutachterlich bestimmten Wertzahlen eine Anpassung an die Variation der GFZ vorgenommen. Die entsprechend der Anteile von MI- und WA-Flächen ermittelten durchschnittlichen Endwerte sind in Tabelle 4 dargestellt.

Weiterhin ist der Anfangswert zu bestimmen. Bei Gewerbebrachen, die durch eine Bebauungsplanänderung zu Wohngebiet entwickelt werden soll, der aktuelle Bodenwert der Gewerbebrache als Anfangswert angenommen werden. Da eine Entsprechende Bewertung nicht vorliegt ergibt sich die Möglichkeit eines residualen Verfahren um den tragähigen Anfangswert zu bestimmen. Alternativ könnte der Wert von Rohbauland angewendet werden, da die Fläche aufgrund der Vornutzung bereits für eine bauliche Nutzung bestimmt, aber noch nicht entsprechend der geplanten Wohnnutzung erschlossen und gesichert ist.

Nach Angaben der Baulandstatistik liegt der Wert sowohl im Land Nordrhein Westfalen als auch in der Gruppe der Städte über 500 000 Einwohner bei 40 % des wertes von baureifem Wohnbauland. Anhand dieser pauschalen Quote wird ausgehend von den Endwerten der Anfangswerte in allen Dichtevarianten ermittelt. Tabelle 4 zeigt erwartungsgemäß einen Anstieg der Anfangs und Endwerte mit der baulichen Dichte. Aus der Differenz zwischen Endwert und Anfangswert ergibt sich die entwicklungsbedingte Wertsteigerung.

Dichte (Gebietstyp/GFZ)	Geringe Dichte (WA/1,0; MI/1,4)	Mittlere Dichte (WA/1,4; MI/1,8)	Hohe Dichte (WA/1,8; MI/2,2)
Durchschnittlicher Endwert	536 €	620 €	719 €
Anfangswert	214 €	248 €	288 €
Entwicklungsbedingte Wertsteigerung	321 €	372 €	432 €

Tabelle 4: Bodenwerte vor und nach Entwicklung in den Modellvarianten

4.4 Auswirkung der erhöhten Abschöpfung im Rahmen des Baulandmodells

Unter der Annahme, dass die Investoren das Rohbauland erwerben müssen bzw. bereits erwoben haben, müssen sowohl die Entwicklungskosten als auch die Kosten für die Abtretung der Erschließungsflächen und für den Gemeinbedarf, Grünanlagen etc. aus der Wertsteigerung gedecktwerden. Diese Flächen von insgesamt 53 000 m² entspechen einem Flächen abzug von 33% in Bezug auf das Bruttobauland und werden mit dem Anfangswert zu Beginn der Maßnahme eingesetzt. Die Entwicklungskosten, die je nach Modell variieren, fallen nicht zu Beginn der Maßnahme an und werden daher über den mit n Jahren angesetzen Entwicklungszeitraum mit einem Zins i zu diskontieren.

Um die Belastung der Investoren und Grundeigentümer durch das Baulandmodell zu begrenzen wurde wie weiter oben beschrieben festgesetzt, dass dem planungsbegünstigten Eigentümer mindestens ein Drittel des entwicklungsbedingten Wertzuwachses der Grundstücke als Investitionsanreiz und zur Deckung der individuellen Kosten einschließlich eines angemessenen Ansatzes für Wagnis und Gewinn verbleiben sollen.

Das Ergebnis der folgenden Rechnung stellt je nach Vorzeichen eine höhere Profitmöglichkiet des Investors oder eine Unterdeckung der Kosten, die entsprechend der Regelung des Baulandmodells durch die Stadt übernommen wird:

$$\frac{Planungsbedingte Wertsteigerung \times \frac{2}{3} - Flächenabzug \times Anfangswert - Entwicklungskosten}{m^2 \, Bruttobauland}$$

Tabelle 5 stellt die Über- und Unterschreitung der 1/3 Grenze dar. In der Bebauungsvariante mit der geringen Dichte verbleiben unter Anwendung des Baulandmodells (Modell 2 und Modell 3) nach Abzug der Entwicklungskosten weniger als 1/3 der entwicklungsbedingten Wertsteigerung. Die negativen Werte sind von der Stadt auszugleichen bzw. zu übernehmen. Um die Kostenbelastung der Stadt zu vermeiden ist eine höhere Dichte erforderlich. Nur im Modell 1 kommt in allen Dichtevarianten noch zu einem Überschuss, der über einem Drittel der Nettowertsteigerung liegt. Da außerhalb des Baulandmodells aber die Stadt keine Kosten übernimmt sind die hier dargestellten rechnerischen Werte ohne praktische Relevanz.

Dichte (Gebietstyp/GFZ)	Geringe Dichte (WA/1,0; MI/1,4)	Mittlere Dichte (WA/1,4; MI/1,8)	Hohe Dichte (WA/1,8; MI/2,2)
Modell 1	19 €/m²	42 €/m²	69 €/m²
Modell 2	-7 €/m²	5 €/m²	22 €/ m²
Modell 3	-13 €/m²	2 €/m²	19 € /m²

Tabelle 5: Kostenausgleich/m² Bauland durch die Stadt

5 FAZIT

Regelungen kooperativer Baulandmodelle können mit der Software Plattform dsi konfiguriert werden. Die Ausführungen und Ergebnisse dazu geben zum einen methodischen Aufschluss über die Möglichkeiten, dsi flexibel für spezielle Fachfragen zu nutzen. Die automatische Anbindung und Speicherung der Ergebnisse für unterschiedliche Projekte und die Nutzung von Geoinformationen zur Charakterisierung des Bestands stellt dabei einen Mehrwert gegenüber einer ebenso denkbaren Lösung mit einer Tabellenkalkulation dar.

Zum anderen zeigt das realistische Rechenbeispiel, dass durch die im Baulandmodell vorgesehene Kostenüberwälzung Planungsgewinne wirksam abgeschöpft werden. Tatsächlich wird im Fallbeispiel die Kappungsgrenze als Selbstbehalt von 1/3 der planungsbedingten Wertsteigerung nur bei geringer Dichte ausgereizt oder überschritten. Mit diesem Ansatz können leicht Varianten der Rahmenplanung, z. B. eine Vergrößerung der Grünflächen oder auch die schrittweise Anpassung der Dichte und des Verkehrsflächen anteils abgebildet werden.

Ohne Baulandmodell ist davon auszugehen, dass ein Investor von höheren baulichen Dichte profitiert. Ebenso ist dies bei Anwendung des Baulandmodells oberhalb der Kappungsgrenze. Wie Stadt und Projektentwickler generell mit der Kappungsgrenze und dnen dadurch garantierten Planungsgewinn bzw. Kostenübernahmen umgehen. Möglicherweise lässt sich für Für Projekte mit weniger dichten, aber bei weiten Bevölkerungskreisen tendenziell beliebten Wohnform von Ein- und Zweifamilienhäusern nur ein eigeschränkter Kreis von Entwicklern gewinnen. Ein geringeres Angebot in diesem Marktsegment könnte Preisanstiege zur Folge haben.

Ein kritisches Element der Analyse ist die Ermittlung des Anfangswertes. Hier ist eine statistische Analyse durchzuführen, um den Zusammenhang zwischen den zu erwartenten Endwerten und dem Anfangswert abzusichern. Alternativ wären Werte anzunehmen, die den anfänglichen Wert des Bodens ohne die Fiktion der Entwicklung, die sich im Endwert manifestiert darstellen.

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The Path Towards Smart Cities in China: From the Case of Shanghai Expo 2010

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1 ABSTRACT

With the development of the digital technology, physical buildings are becoming more and more intelligent, high-efficiency and ecological; partial physical situational functions could be transferred to the virtual building world in a more efficient, intensive and convenient way. With these great achievement, we should believe that the digital technology will create more chances for the future of the smart buildings, and the smart city will be the most important foundation. To create the best human dwelling environment, we should construct smart buildings on the microscopic level and smart city on the macroscopic level. Smart city is not just about technology, but also the all-round innovation of the urban space, economic, society, system and management. The promotion for smart city will improve the quality of the urbanization, and the integrated development of the informatization, industrialization and urbanization, which will result in a wide influence on the city development and reform.

Being a developing country severely hit by information and technology revolution, China met a small climax of smart city construction after 2010 Expo. As the theme of 2010 Expo, the idea of 'better city better life' was implemented through the process of the planning, construction, development operation and utilization in the Expo Park of 5.28 km2 area, which made the best use of information and intelligent technology, as well as the idea of sustainable development. Intelligent and ecological buildings in Shanghai 2010 Expo have been the most important practice in China, which had effected profoundly on the construction of smart buildings and smart city.

At the beginning, this paper will introduce the background of of 'smart city', as well as it's meaning and feature. Then, through the case study of 2010 Expo, this paper will present a real scene of the development of smart cities in China. It reflected the path to smart cities in China, and the policies and achievements in large pilot cities during this process. It will also talk about the influence on urban planning and authorities. Obviously, when we talk about smart city, we should not only pay attention to its present, but also look forward to future, which is the last part in this paper.

2 SMART CITY

2.1 The background of smart city

With the growth of cities and urban population, city has been endowed unprecendent power on economic, politics and technology and plays a leading role in the world. According to historical experience, every global financial or energy crisis triggers a technical revolution competition, and the winner will lead the global economic development(figure 1). Traditional city development pattern based on straightforward resource use of industry revelution, electric revelution and information revelution, with the result of resource shortage and low potential of urban function promotin which has been the problems that people are working hard to overcome since the 20th century. 'Sustainable development', 'smart growth', 'intensive development' have been proposed by the governments academia and both domestic and abroad. Now, the focal point of resource scramble has extended from natural resource, high-tech products and financial capital to information resource. As the response, the concept of 'smart city' was proposed by IBM company at the end of 2009 following 'smart earth', and received attention of governments, scholars and citizens.

In China,‘smart' is a word which describes human's mental ability to understand and deal with things quickly, flexibly and correctly. From global perspective, as the residence container, urban also should have this ability to deal with urban problems. 'Smart city' was proposed based on the global energy crisis background, and the focus is on the promotion of urban operation quality and urban development policies which conforms to the complex concept of post-modern society.

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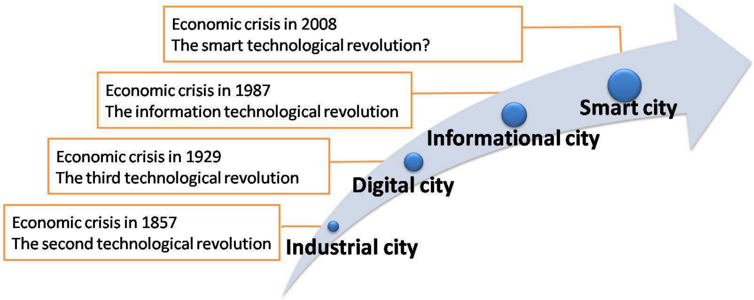

Fig. 1: The background of smart city.

2.2 The meaning and characteristic of smart city

Different with information city that relies on communication technology, smart city is proposed based on new generation of information communicaiton technology of IOT, cloud computing, etc., and has more detailed and accurate connovation. Meanwhile, compared with intelligent city that over-emphasized technicism, smart city pays more attention on the integration of the human-oriented and technical urban development. Entity city is the physical city which is conprized by governments, industry, citizen and infrustrcture. It's the main body and the goal; digital city is the method to control the entity city by communication, GIS, internet, etc.; while smart city is to link entity city and digital city with advanced technology(figure 2). Scholars such as Giffinger and Fertner consider that, smart city includes 6 dimensions: smart economic, smart transportation, smart environment, smart citizen, smart life and smart management; IBM thinks that, smart city is the core system integration of human, business, transportation, communication, water, energy, etc. based on advanced ICT technology, to enable city to operate smarter as a grand 'system of systems'. To be simple, the meaning of smart city is the coordinating operation of each smart subsystems—not just relys on technicism, but more important is the humanity factor throughout urban activities.

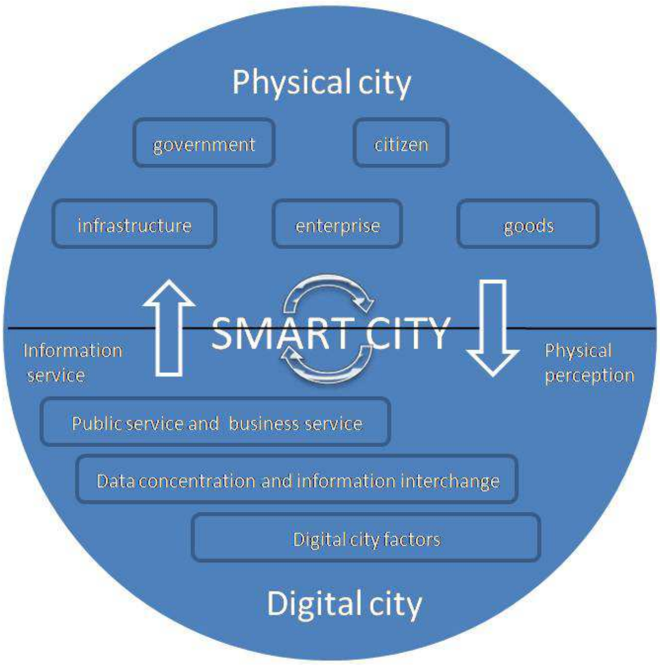

Fig. 2: The relationship of smart city, physical city and digital city.

3 SHANGHAI 2010 EXPO

3.1 The background

With the topic 'Better city, Better life' , the planning, construction, operation and pro exibition development of 2010 Expo park(figure 3), which covered 5.28 km2 area and has the biggest participation in the history of world exibition, aimed to implement the principles of smart and sustainable planning, applying information and intelligent technology in order to become a model example. At the same time it provided valuable opportunities for its visitors to learn how to creat an eco-friendly building and clever solutions for smart city.

Fig. 3: The mast plan of 2010 Expo park.

3.2 Smart solutions for Expo 2010

In order to be visual, controllable, and sustainable, 2010 Expo provided high level planning information communication infrastucture and fully used information technology in the park construction¬. Nearly 40 information application systems were integrated into the Expo operation, supplying the model for the city administration, management, security, operation, transport and citizen service. As the common technical support, image information was not just for the security department, but also shared by transport, cleasing, equipment or other departments, and the intelligent image processing program was used as the basis for certificate system, passenger flow system, security system, traffic dispatching system, etc. In order to comprehensively command and coordinate, the intelligent transport information management system converged the real-time information of both inside and outside passenger flow and public transportation. The energy and environment monitoring system was fully used on the electricity, water, gas, operation of renewable energy, humidity, carbon dioxide, light pollution, noise, etc. reflecting the achivement on the energy saving and emission. Meanwhile, all of the the planning and design, construction, operation and exibition worked on an unified GIS system platform, which assembled the real-time information of security, tranportation, tickets, activity, energy, sanitation, logistics, visitors, organizers, etc., coordinating with the government, army and police systems, to command the normal operation and emergency in the Expo park. Even on the highest peak day of 1.03 million visitors, the park could also run orderly.

3.3 Towards smart cities in China

Actually, since the 1980s in China, the intelligent building standards have guided the public buildings or residence construction which operated in modern way. Early it was based on single buildings, until the recent years, intelligent buidlings construction is becoming the new trend. Moreover, the intelligent building construction is undergoing industry division which can provide personalized solution. Intelligent residence, hospital, museum, stadium, school, court,etc. are sprouting across the country. It's worth mentioning that the new concept of IOT and cloud computing technology was integrated into intelligent buildings as early as 10 years ago.

Now, the successful application of intelligent buildings and planning of 2010 Expo has drived nationwide construcion of smart city, as well as the relative research. Many big cities in China set 'smart city' as the crux and breakthrough of transitional development. In Jan. 2013, the National Conference on Pilot Smart City

Construction, organised by the Ministry of Housing and Urban-Rural Development, published the first 90 piolt smart cities construction, including 37 prefecture-level cities, 50 districts, 3 towns, which will be evaluated after 3-5 years. The conference pointed out that, new-type urbanization is the strategic plan for the formation of sustainable new-economy pattern which will integrate advanced concepts of intensive, low carbon, eco-friendly and smart city into the process of urbanaztion. The construction of these pilot smart cities will support from different angles to recognize smart development and planning—fine management in Beijing, informational development and strategy in Shanghai, smart logistics leading modernized international port city construction in Ningbo. At the same time, cities such as Shenzhen, Wuhan, Guangzhou, Nanjing have set their goals for smart city construction(table 1).

City	Main moves	Main achievements
Beijing	'Smart Beijing' progaganda on the 14th China Beijng International High-Tech Expo, aiming at 'smart life' for everyone.	First proposed 'Smart Beijing'
Shanghai	'Smart City Construction Promotion Act 2011-2013', including 10 IOT demonstration projects in transportation, medical, logistics, etc..	Explore comrehensive smart city construction.
Shenzhen	The development of IOT and RFID Standards Alliance support 'smart city'construction from science, humanities and ecological.	First proposed 'Smart Shenzhen'; most advanced IOT industry.
Wuxi	National sensor network industry model base; promoting the integration of TD and sensor network.	Acquired high reputation from Premier Wen; proposed 'Sensing China'.
Wuhan	Bring 'smart city' into line with the 12th Five-Years Plan; construct smart city infrustructure and smart processing platform based on 'China Cloud'.	Becoming the centre of national smart city technical innovation.
Nanjing	First published smart city specialized planning-'Nanjing IOT industry development planning', and specified 10 model industries.	Becoming 'Smart Nanjing', based on several model projects.
Ningbo	'Ningbo Municipal Government Decisions about Smart City Construction', 'Ningbo Master Plan of Smart City Development'.	Construct smart industrial cluster and smart Ningbo with international port city characteristics.
Shenyang	Ecological City United Institute combined with IBM and Northeastern Unversity to construct 'Eco Shengyang' with green science and smart smart technology.	Construct eco and smart city model.
Hangzhou	'Smart Hangzhou Master Plan(2012-2015)'.	Leading IOT economic and construct national e-commerce city model.

Table 1:The analysis of main moves and achievements in typical pilot smart cities in China

4 INFLUENCE OF SMART CITY DEVELOPMENT ON URBAN PLANNING

4.1 Influence on urban and urban planning system

Smart city not only opens up a new angle of view for urban cognition and development, but also becomes a new development model. The concept of smart city brings about reforms of urban development goals, urban space structure, management mode, etc. While the most notably effect on urban planning is the innovation of planning type and the improvement of urban plannnig system. The innovation of planning type is bound to brings about series of new related specialized planning types, such as 'smart city development strategic planning', ' smart city development overall planning', 'pilot smart city construction planning'. etc. Besides, even the related palanning has not been brought onto urban planning systems, smart city development demands the correction and renovation of traditional urban planning from the aspects of compiling technique, concept, contents, procedure, etc.

4.2 Influence on urban planning formulation authority

Smart city planning is a systematical project which has not been well studied on formulation mode, successful cases, systematical study in the world.The most direct effect of smart city on urban planning formulation authority is shown on the task type and quantity, including related planning and standards formulation, new type of industry development planning and supporting policies. The indirect influence of smart city on the formulation authority is the profitability and operation benefit. While the study content extents to IOT development planning, new generation information technique development planning, as well as related supporting policies, such as smart city development policy study, typical pilot project study, sharing platform study, smart city construction standards study, etc.

5 CONCLUSION

Advanced technology such as IOT and clouds computing, the continuous publishing of smart city planning and development policies as well as the persistent hot rising of smart cities reflects that the world is ushering a new age of smart city. Nowadays, more and more smart cities have been constructed around the world. As the starting point, 2010 Expo has drived smart city development in China. It is a grand system project which cannot be completed without the integration of technology, ideology and practice, as well as the appropriate adjustment of our urban planning system.

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The Role of Logistics Services in Smart Cities: the Experience of ENCLOSE Project

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1 ABSTRACT

Freight transport is one of the primary components of the economic and social system not only in European towns. It is now widely recognised that sustainable goods distribution, particularly in urban areas and city centres (indicated also as City Logistics), is the objective to be achieved as environmental issues play an increasingly dominant role in the overall mobility governance and also in the emerging “smart city” initiatives.

Of course there is a link between transport efficiency and infrastructures, but traffic congestion in urban areas and city centres can be reduced also by efficient freight distribution processes based innovative organizational and business models.

In EU, the interest in city logistics solutions, is growing among Local Authorities, not only for more efficient and higher quality services and traffic congestion reduction but also for achieving an increased territory governance.

A significant number of real applications have implemented in many EU towns and under EU programmes with an emerging city logistics approach indicated as SULP (Sustainable Urban Logistics Plan) based an appropriate mix of different measures to be selected among different already demonstrated services like: Urban Consolidation Centres, optimised urban freight transport and delivery plans, clean vehicles and low emission technologies, restrictions and public incentive policies, ICT platform, last mile and value added services, etc. The SULP is the tool with related guidelines for integrating the city logistics processes within the overall management of urban mobility currently indicated at European level as Sustainable Urban Mobility Plan - SUMP.

In this context ENCLOSE Project, started in May 2012 under IEE - Intelligent Energy Europe programme, has the main objective of raising awareness about the challenges of energy efficient and sustainable urban logistics in European Small-/Mid-size Historic Towns (SMHTs) and about the concrete opportunities to achieve highly significant improvements and benefits by implementing and operating suitable and effective measures, schemes and framework approaches specifically targeted to such class of urban environments.

ENCLOSE Project aims to develop Sustainable Urban Logistics Plans (SULP) for Small-/Mid-size towns (SMTs) integrated in Sustainable Urban Mobility Plans (SUMP).

2 KEY LOGISTICS MEASURES AND PRIORITIES FOR THE EUROPEAN SMART CITIES

In the first year of ENCLOSE project activities, an analysis of the most relevant best practices currently introduced in Europe, particularly regarding small and mid-sized historyc towns, was performed, concerning the measures with the highest potential for the ENCLOSE towns (and for European Smart Cities in general). The key findings are summarized as follows:

- Urban Consolidation Centres (UCC) represent one of the most common and successful measures implemented in European SMHTs, with several notable experiences reviewed in Italy (Vicenza, Lucca, Padua, Parma, Modena), France (La Rochelle), and the UK (Bristol). The required investment pays off in terms of several benefits for the environment and population: optimizing vehicle load and runs, reducing the number of trips, direct goods mobility towards less environmental impact conditions, etc. However, in most cases, the (relevant) support from the local administration is still necessary to ensure financial sustainability of UCC operation. Overall, critical factors to be considered include: the build-up of a consensus around the “UCC project” among all the key stakeholder categories involved, the location and accessibility of the UCC and the role of public authorities and regulations.
- The implementation of Low Emission Zones (LEZ) is also an emerging measure in European cities and towns (e.g. Bologna, London, Maastricht, Prague, Randstad, Rotterdam, Utrecht, etc.). This

measure is naturally linked to other city policies, plans or measures, such as Air Quality Plans, Controlled Access Zones, etc. Access to the LEZ and transits may be controlled by barriers of tollbooths, or simply signalised and left without any special control infrastructure/technology. Pricing and enforcement systems may be also applied, e.g. through fixed and mobile cameras. The positive impacts and benefits of LEZs are generally relevant, leading to air quality improvements by reduced traffic emissions (PM10, CO, NOx, etc.). On the other hand, several kind of obstacles may be faced prior to and during their introduction: the consultation process with the involved stakeholders may be long (and often controversial), the costs of enforcement may be rather high for the authority, etc.

- The introduction of "eco-vehicles", particularly Fully Electric and Hybrid Vehicles (FEVs, PHEVs) for city logistics operation is becoming a viable option for local administrations and logistics service providers addressing sustainability policies. In most cases electric vehicles are vans and small trucks (up to 3,5t) but also other types of FEVs that started to be used for operating last mile and several forms of B2C services, like the cargo cycles used in the Petite Reine scheme in Rouen (FR) or Gnewt Cargo scheme in London. Besides last mile services, FEVs are also often used to support sustainable own-transport services (for shops, businesses and citizens) like in van sharing schemes. Overall, the surveyed best practices operating FEVs have shown that electric vehicles bring clear benefits as regards the abatement of exhausted gases, CO2 and noise emissions. Not least, FEVs are accepted by the public and have an "image" which may be an helping factor for the introduction of new sustainable logistics services introduction in a site.
- ITS and technologies have also gained an almost essential role in the operation of advanced city logistics solutions. Over 50% of surveyed best practices involves the implementation and operation of ITS and various technical facilities, from load and delivery planning software, to fleet monitoring systems, track-and-trace solutions, vehicle occupancy/transit detection technologies, automated vehicle identification (e.g. number plate reading), monitoring and enforcement systems.

The importance of the interaction between new urban logistics measures and urban planning has also clearly emerged from European best practices surveyed. The relationships that were more frequently identified in ENCLOSE survey concern: the location of Urban Consolidation Centres and their integration within the overall urban (and regional) transport network; the location of other urban logistics infrastructures such a "Proximity Logistics Spaces" (ELP), dedicated freight load/unload areas, etc.; the development of Urban Mobility Plans, Freight Distribution Plans, Low Emission Zones, etc. The integration of sustainable urban logistics development plans in the larger context of urban planning development represents a strategic issue for ENCLOSE cities to investigate when considering the design and implementation of a particular sustainable logistics measure.

3 THE IEE ENCLOSE PROJECT

The IEE-ENCLOSE project involves 16 partners, including 9 European towns, from 12 EU countries (Austria, Bulgaria, Greece, Ireland, Italy, Norway, Poland, Portugal, Spain, Sweden, Netherlands and the UK) and is focused on the following main issues:

- Assessment of the applicability and benefits of energy-efficient and sustainable urban logistics measures, specifically targeted to European small/mid-size historic towns, by implementation of (i) pilot measures in 3 forerunner towns: Lucca - Italy, Trondheim - Norway and s'Hertogenbosch - Netherlands and (ii) feasibility study and implementation of soft-measures in 6 mid-size (follower) follower towns: Balchik - Bulgaria, Serres - Greece, Almada - Portugal, Alba Julia -Romania, Burgos - Spain, Dundee – UK;
- Development of Sustainable Urban Logistics Plans, integrated in the related Sustainable Urban Mobility Plans (SUMP), in 9 European towns;
- Investigation into policy-level issues and definition of suitable strategies to ensure long-term sustainability of SULP for small/mid-size towns;
- Assessment of the efficiency of "green vehicles" (FEVs, PHEVs, Bio-gas) in urban logistics schemes for achieving energy savings and CO2 reductions.

4 THE LOGISTICS MEASURES IMPLEMENTED IN ENCLOSE TOWNS

The exchange of experiences and knowledge sharing activities, carried out in the first project months by the 3 pilot towns towards the follower towns, enabled ENCLOSE cities to define and implement different measures dealing with logistics processes: follower towns implemented "soft" measures, that do not require an high level of investment but can have important positive impacts on city logistics, while pilot towns realised further logistics services complementary to the ones that are currently being operated at their sites.

A summary of measures implemented in ENCLOSE follower and pilot towns is provided in Fig. 1 and Fig. 2 below.

	Alba Julia Rumania	**Almada** Portugal	**Balchick** Bulgaria	**Burgos** Spain	**Dundee** UK	**Serres** Greece
						
Soft measures in ENCLOSE follower towns	Regulation in the Transylvania Boulevard area of commercial vehicles time windows, restrictions for high capacity vehicles, penalties for no respecting the rules, etc.	Create a loading & unloading regulation	Limitation of the vehicles' access to the coastal area. Limitation of the space accessibility of the logistics and public transportation as well as private cars during the touristic season	New regulation for the historical centre access, with special processing for loading-unloading tasks	Increase the enforcement levels of loading bays within the city centre	Awareness campaigns to the shopkeepers, transport operators and general public regarding the need to respect the city logistics policy
	Organizing an Awareness Raising Campaign involves a partnership between the Municipality and the media	Loading & unloading timeframes	Time limitation of the vehicles' access to the near coastal area, as well as to other heavy trafficked ways. Limitation of the time accessibility of the logistics and public transportation as well as private cars during the touristic season.	Card system on loading and unloading for shop owners and hostelry owners (for non-labelled vehicles).	The council intends to procure 39 Electric Vehicles as replacements for existing Diesel/ Petrol vehicles	Improving the visibility of the (un)loading areas. Increasing the number of these places according to the shop keepers' needs. Development of a booking platform in order to properly assign these areas to the transport operators.

Fig. 1: Soft measures in ENCLOSE follower towns

	Lucca Italy	**Trondheim** Norway	**'s-Hertogenbosch** The Netherlands
			
Services/ Measures implemented in ENCLOSE Pilot towns	B2B services for freight operators concerning the provision of palletized goods transportation to businesses with FEV;	Mail distribution (large and small envelopes) in Trondheim city centre by using electric-vehicles replacing 5 diesel vehicles	Set up of specific partnership agreements (B2B) between shopkeepers, transport companies and other stakeholders aimed at improving the efficiency of town delivery services by using biogas or CNG vehicles
	B2B services for local businesses concerning the provision of forwarding services toward any destination outside the target area, operated by FEV, in partnership with other national or international freight operators (reverse logistics processes)	Parcel distribution in Trondheim city centre by using electric and hybrid vehicles replacing 5 diesel vans	Demonstrating and enhancing the use of fully electric busses for transport of people with bulky purchases
	Freight operations integrated with leisure mobility, operated by FEV: dedicated delivery programmes providing services for tourists and travelers, luggage transport to/from hotels, etc	Pallets distribution in Trondheim city centre and transport between Trondheim city centre and Trondheim Post terminal by using electric and hybrid vehicles replacing 1 diesel truck	Town delivery services using biogas vehicles

Fig. 2: Services/measures in ENCLOSE pilot towns

5 ENCLOSE FIRST RESULTS: NEEDS AND PRIORITIES

A cross site assessment of needs and priorities of ENCLOSE Towns was carried-out for identifying the key high-level requirements common to all ENCLOSE sites. These are grouped into the four investigation categories – socio-economic, commercial, operational, technical – related to each site and showing the corresponding relevance: strong interest (■■■), interest (■■), moderate interest (■) as showed in the following Fig. 3.

	Key needs & reqts.	Lucca	Trond.	Den'B.	Burgos	Almad.	Dund.	Alba I.	Serres	Balch.
Socio-economic	Reducing traffic impacts in the historical centre	■■■	■■■	■■■	■	■	■■■	■■	■■	■■■
	Increasing livability of urban environment	■■■	■	■	■■	■■	■■	■■	■■	■■
	Enhancing local economic development	■■			■■	■■	■■	■■	■■	■■
Commercial	Generate benefits on competitivn. & business	■■■	■■■	■■■	■■■	■■■	■■■	■■	■■■	■■
	Optimise logistics operations	■■■	■■■	■■	■■	■■	■■	■■	■■	■■
	Reduce costs, improve knowldg of delivery cost	■■■	■■■	■■■	■■	■■	■■■	■■	■■■	■
Operational	Improved city access regulations	■■■	■■■	■■■	■■	■■	■■	■■	■■■	■■■
	Support adoption/use of sustainable vehicles	■■	■■	■■	■■	■■			■■	
	Measures supporting transp. operators market	■■	■	■	■	■	■■	■	■■	■
Technical	Systems to optimise fleet and delivery operations	■■■	■■■	■■	■■	■	■■	■	■■■	■■■
	Systems to optimise logistics operations	■■■	■■■	■■■	■■■	■■	■■	■■	■	■■
	Improved integration of logistics in urb. mobility	■■■	■■	■■	■■	■	■■	■■■	■■■	■■

Fig. 3: ENCLOSE Logistics priorities

These key findings can be outlined as follows:

- Implementing more sustainable city logistics solutions to contribute reducing traffic impacts in the historic centres is the highest priority for ENCLOSE towns. Forerunner towns have already measures in place and consider this as a top goal in their urban mobility policies. Most part of follower towns too report this as the highest priority.
- The goal of providing more sustainable city logistics entails the objective of increasing the liveability of the urban centre, also reported as a main high level need in almost all ENCLOSE sites.
- Increasing the competitiveness of the commerce and retail system and of the connected business services is the highest priority for ENCLOSE towns as regards commercial and business needs.
- Due to their current experiences, the ENCLOSE pilot towns are also very focused on looking for business models enabling a substantial reduction of the operational costs.
- Improve the regulation for accessing to the urban centre is one of the priorities for all ENCLOSE towns due to the direct involvement of the Local Authorities and to the perception that they can act directly (i.e. formulating new rules by-local law), fast (as the normative is under their duties) and receive prompt benefits.
- From the technical point of view the focus is concentrated on several technology options but mainly on the "system" for managing all the operation/logistics cycle. The attention shown by most of the towns for the integration of logistics policies in the overall urban mobility plan mitigates to some extent the possible approach "buy technology and solve the problems", that is currently a key trend in the transport and mobility context.

6 THE SULP FOR ENCLOSE TOWNS

In the current phase of ENCLOSE project partner towns are working on the implementation of local SULPs, Sustainable Urban Mobility Plan, as a fundamental part of the Sustainable Urban Mobility Plan, as recommended by the relevant EU recommendations aiming to face traffic congestion, improving mobility and transport services and reducing CO_2 emissions.

The SULP methodology, from the planning and operation point of view, is structured along two main stages: the feasibility study and the process to be performed by the Local Municipality to adopt the measures and services defined in the previous phase.

The figure below provides an idea of the SULP approach, more details and the specific contents of the SULP are available at www.encloseproject.eu.

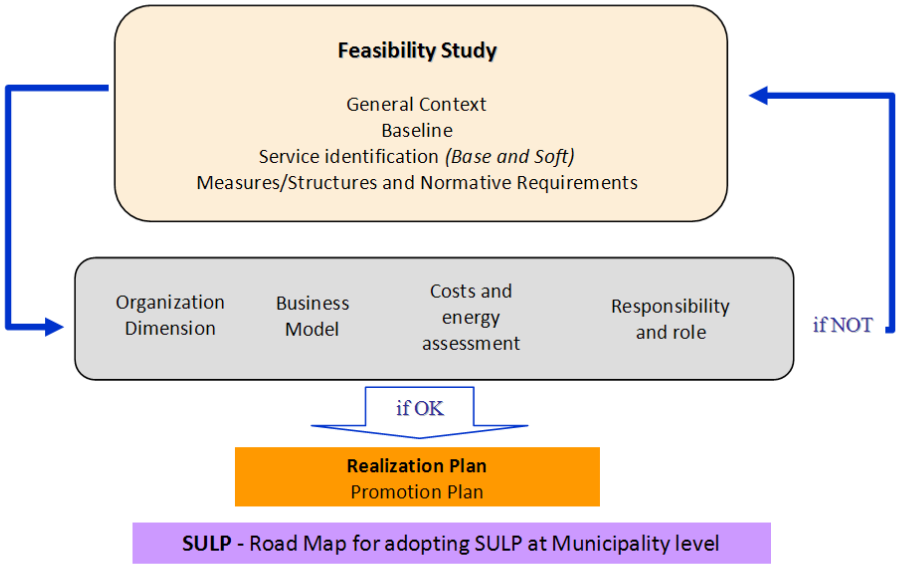

Fig. 4: ENCLOSE SULP methodology

The approach defined by the ENCLOSE consortium for elaborating SULPs is a very practical one, focused on the provision of real and operation working recommendations, based on a participatory approach and on the involvement of political level starting, firstly from user needs. The defined analysis methodology covers, among the others, the following aspects:

- Institutional Level: legal framework, rules;
- Political Level: consensus among the different city actors and stakeholders (Authority, Associations, Operators, citizens groups, etc.);
- Operation Level: freight distribution schemes and services, integration in the mobility management plan and technological framework;
- Infrastructures/Technology Level: ICT platform, systems, innovative vans/vehicles, web services, etc.
- Furthermore, ENCLOSE methodology includes the following tasks to be carried out by each town:
- status analysis and baseline scenario;
- definition of vision, objectives and targets;
- selection of policies and measures;
- assignment of responsibilities and resources;
- arrangements for monitoring and evaluation.

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Urban Living – Smart & Sustainable!? – Tool für den Wohnungsvergleich

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1 ABSTRACT

Das auf der Plattform www.wohnungsvergleich.at verfügbare interaktive online-Wohnungsvergleich-Tool bietet Wohnungssuchenden im urbanen Raum eine konkrete Entscheidungshilfe bei der Wohnungswahl und informiert umfassend über Qualitätsmerkmale, die hinter Zielkriterien aus gängigen Nachhaltigkeitsbewertungssystemen von Gebäuden und Siedlungen - wie etwa dem klima:aktiv Gebäudestandard oder TQB – Total Quality Building - stehen. Indem die technische Dimension, in der diese Kriterien formuliert sind, auf eine für Userinnen und User verständliche Ebene übersetzt wird, werden persönliche Vorteile im Kontext des smarten, nachhaltigen Wohnens in Städten deutlich.

Das in einem partizipativen Prozess entwickelte Tool bietet damit eine wertvolle Hilfe bei der Strukturierung von Entscheidungsprozessen und erhöht die „Treffsicherheit“ von Wohnentscheidungen und in weiterer Folge die Wohnzufriedenheit wesentlich. Gleichzeitig kann der Zugewinn an Wissen und Bewusstsein zu Nachhaltigkeits- und Smart-City-relevanten Qualitätsmerkmalen auf Seiten der Endkundinnen und Endkunden auch stimulierend auf die Anbieterseite wirken und die Entwicklung der Immobilienwirtschaft in Richtung Nachhaltigkeit unterstützen.

Kern des Wohnungsvergleich-Tools sind 33 individuell, je nach persönlicher Präferenz auswählbare Wohnwunsch-Kriterien in acht Themenbereichen. Im Rahmen des Wohnungsvergleichs beurteilen die Userinnen und User, wie sehr die in Frage kommenden Wohnungen diese Kriterien erfüllen. Um diese Beurteilung zu erleichtern, werden in den Kriterien-Kurzbeschreibungen in der Rubrik „Worauf soll ich achten?“ Aspekte und Fragen angeführt, auf die, etwa im Rahmen von Wohnungsbesichtigungen, geachtet werden sollte. Zusätzlich zum Wohnungsvergleich über das online-Tool stehen die Wohnwunsch-Kriterien in Form von ausdruckbaren PDF-Checklisten zur Verfügung, die direkt vor Ort bei Wohnungsbesichtigungen verwendet werden können.

In den Wohnungsvergleich-Ergebnisdarstellungen sehen die Userinnen und User als zentrale Aussage den Grad der Wohnwunsch-Erfüllung der verglichenen Wohnungen. In den Detailauswertungen werden spezielle Effekte, wie der Smart-City-Effekt und der klima:aktiv-Effekt, angezeigt, die im Vorfeld allen Wohnwunsch-Kriterien auf Basis von Expertinnen und Experten-Einschätzungen zugewiesen wurden und einen Indikator für die Smartness bzw. Klimafreundlichkeit der verglichenen Wohnungen sowie des persönlichen Wohnwunsches darstellen. Zudem ist der Backend-Auswertebereich des Tools eine für Immobilienanbieter und –makler, aber auch Förderstellen interessante Datenquelle, aus der Hinweise zu den am Markt nachgefragten und auf Basis von Endkundinnen- und Endkundenbeurteilungen vorhandenen Qualitätsmerkmalen von Wohnungen abgeleitet werden können.

Das Wohnungsvergleich-Tool wurde von der ÖGUT in Kooperation mit dem auf multimediale Web-Applikationen spezialisierten Unternehmen akaryon in einem einjährigen, von der ZIT – Die Technologieagentur der Stadt Wien geförderten Kommunikationsprojekt entwickelt; einige weitere Aktivitäten auf Basis des Projekts wurden zudem seitens des Lebensministeriums über das Programm klima:atkiv Bauen und Sanieren sowie das BMVIT unterstützt.

2 DAS WOHNUNGSVERGLEICH-TOOL – KONTEXT, ZIELSETZUNG UND FUNKTIONALITÄTEN

Das webbasierte Wohnungsvergleich-Tool ist unter www.wohnungsvergleich.at (siehe Fig. 1) verfügbar und richtet sich primär an Wohnungssuchende in Wien. Das Tool referenziert auf vorhandene Gebäude- und Siedlungsbewertungssysteme wie etwa den klima:aktiv Gebäudestandard oder TQB – Total Quality Building und übersetzt die technische Dimension, in der Kriterien in derartigen Bewertungssystemen formuliert sind, auf eine für Endkundinnen und Endkunden verständliche – und damit beurteilbare - Ebene. Qualitäten, die hinter nachhaltigen, „smarten“ Wohnungen und innovativen Gebäudetechnologien stehen und die Vorteile, die sich daraus für die Bewohnerinnen und Bewohner ergeben, werden begreifbar gemacht.

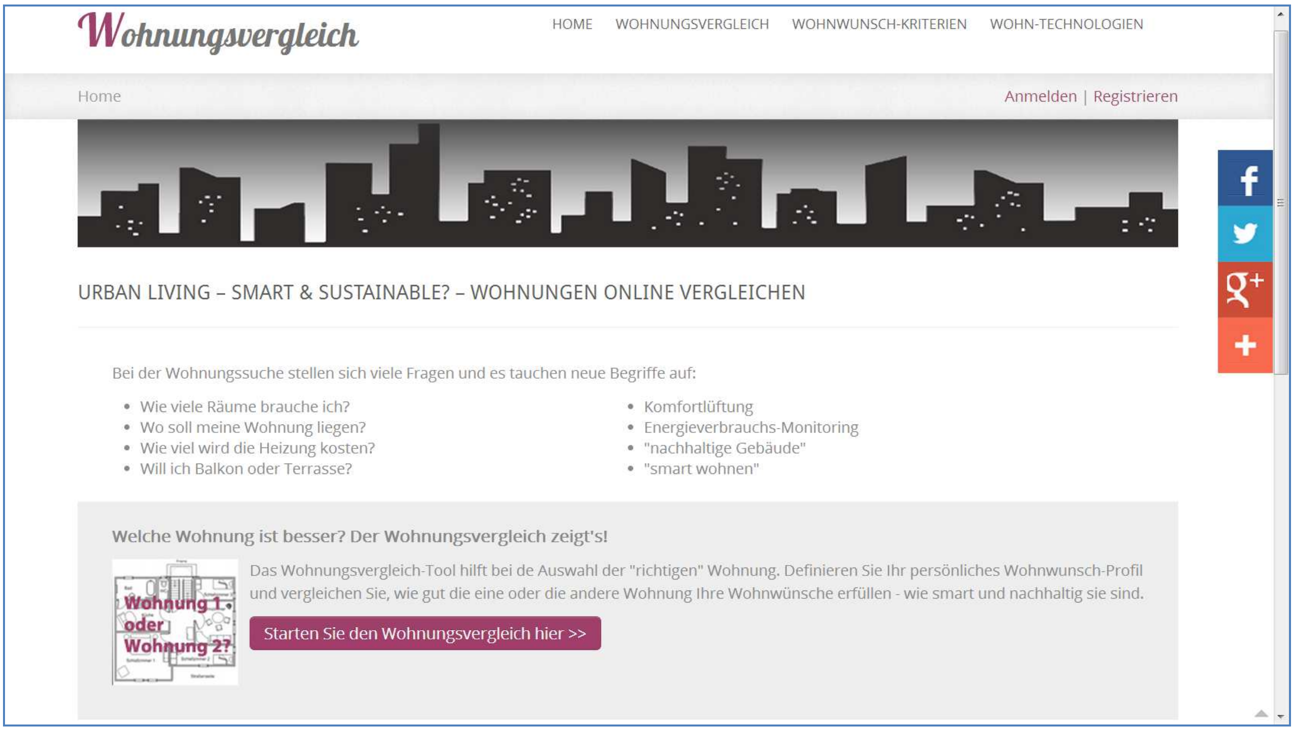

Fig. 1: Ansicht zum Wohnungsvergleich-Tool

2.1 Wohnwunsch-Kriterien und Wohn-Technologien

2.1.1 33 Wohnwunsch-Kriterien als Kern des Wohnungsvergleich-Tools

Kern des Wohnungsvergleich-Tools sind 33 Wohnwunsch-Kriterien in acht Themenbereichen (siehe Fig. 2): Der Themenbereich „Basisanforderungen“ deckt „klassische“ Kriterien für die Immobilien-Suche ab, wie „Raumanzahl“, „Größe der Wohnnutzfläche“ oder „Vorhandensein eines Stauraums“, die jedenfalls bei der Immobiliensuche eine Rolle spielen.

Die weiteren Themenbereiche „Lage“, „Kosten“, „Energie“, „Komfort & Lebensqualität“, „Gesundheit“, „Umwelt & Ressourcen“ sowie „Eigentumssicherheit“ setzen inhaltlich auf bestehenden Gebäude- und Siedlungsbewertungssystemen wie dem klima:aktiv Gebäudestandard oder dem TQB – Total Quality Building auf und umfassen wesentliche ökologische, ökonomische und soziale Aspekte des Wohnens.

Zu allen Wohnwunsch-Kriterien bietet das Tool gut aufbereitete Hintergrundinformationen. Diese zeigen, welche konkreten Nutzen sowohl für den/die EinzelneN als auch für die Gesellschaft insgesamt mit Wohnungen und Stadtquartieren verbunden sind, die bestimmte Nachhaltigkeits- und Smart City-bezogene Qualitätsmerkmale aufweisen.

So erfahren die Userinnen und User beispielsweise bei jenem Kriterium aus dem Themenbereich „Umwelt & Ressourcen“, das sich auf den Flächenverbrauch durch Wohnungsneubau bezieht, welche Umweltauswirkungen mit der Erschließung neuen Baugrunds verbunden sind, welche alternativen Konzepte es für die Schaffung von neuem Wohnraum gibt (z. B. im Rahmen von innerstädtischer Nachverdichtung) und welche Vorteile sich für die Bewohnerinnen und Bewohner von dichten städtischen Strukturen in Hinblick auf gute Nahversorgung und kurze Wege im Alltag ergeben. Ein anderes Kriterium aus dem Themenbereich „Gesundheit“ addressiert wiederum die Tageslichtversorgung, wobei unter den von den Wohnungssuchenden zu beachtenden Aspekten - gerade im urbanen Raum - die gegenseitige Verschattung durch Nachbargebäude angeführt ist. In Hinblick auf die Betriebskosten der Wohnung – insbesondere für Strom und Wärme – wird im Themenbereich „Kosten“ explizit auf Möglichkeiten des Verbrauchsmonitorings inkl. automatisierter Übermittlung der entsprechenden Daten an die Wohnungsnutzerinnen und Wohnungsnutzer eingegangen. Wohnwunsch-Kriterien im Themenbereich „Komfort & Lebensqualität“ umfassen neben Aspekten des Raumklimas bzw. der Behaglichkeit auch raum- und gebäudeplanerische sowie organisatorische Maßnahmen, die den sozialen Austausch fördern.

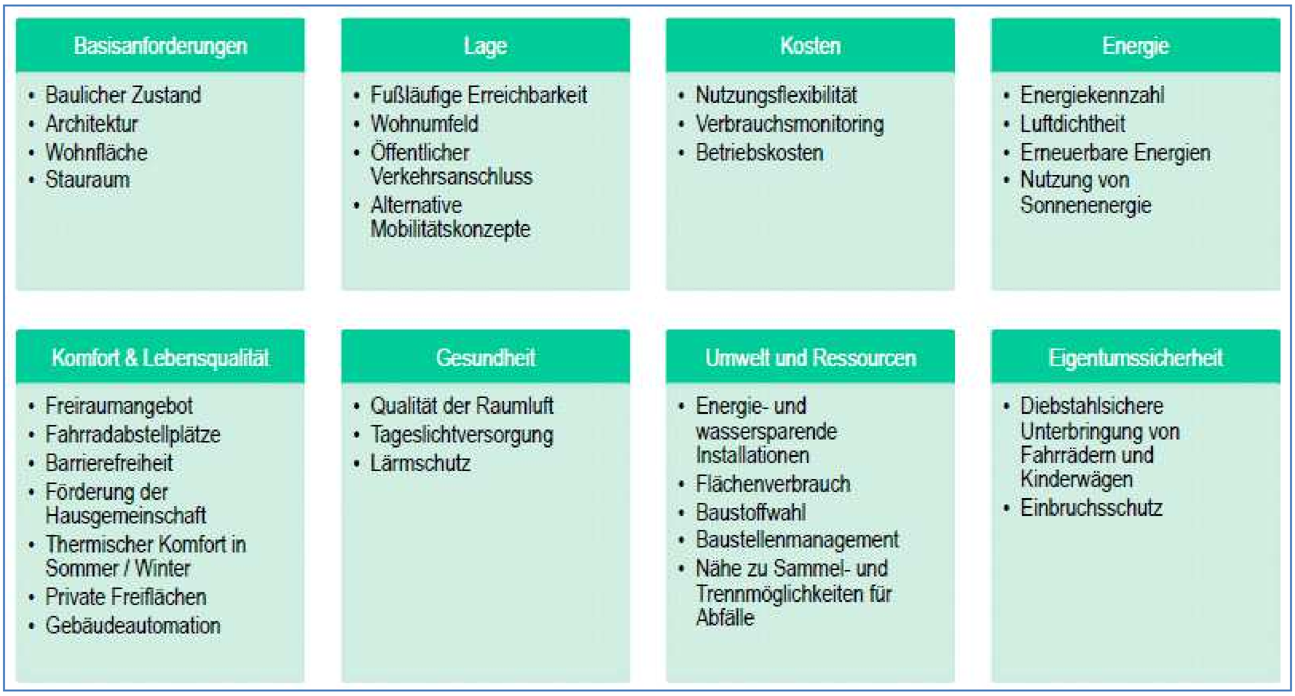

Fig. 2: Schematische Darstellung der Aspekte, die von den 33 Wohnwunsch-Kriterien in den acht Themenbereichen umfasst sind.

2.1.2 Wohnwunsch-Profile als Basis für den individuellen Wohnungsvergleich

Um den unterschiedlichen persönlichen Präferenzen Rechnung zu tragen, können die Userinnen und User jene Kriterien, die sie gemäß ihrem persönlichen „Wohnwunsch-Profil“ für den Wohnungsvergleich heranziehen wollen, individuell wählen. Im Rahmen des Wohnungsvergleichs, der mit dem Tool für beliebig viele Wohnungen durchgeführt werden kann, bewerten die Userinnen und User anhand einer vierstufigen Skala und auf Basis ihrer persönlichen Beurteilung, wie stark die jeweiligen Wohnungen die einzelnen Wohnwunsch-Kriterien erfüllen. Um diese Beurteilung zu erleichtern, werden in den Kriterien-Kurzbeschreibungen in der Rubrik „Worauf soll ich achten?“ Aspekte und Fragen angeführt, auf die, etwa im Rahmen von Wohnungsbesichtigungen, geachtet werden sollte. Zudem können die Kriterien als PDF-Checklisten ausgedruckt und - etwa im Rahmen von Wohnungsbesichtigungen - direkt vor Ort verwendet werden.

2.1.3 „Wohn-Technologien“ – Treiber für die Innovationsleistung im Gebäudebereich

Bei vielen Wohnwunsch-Kriterien spielen innovative Konzepte und neue Technologien eine Rolle. Nicht zuletzt im Smart City Kontext ist davon auszugehen, dass Gebäude zunehmend mit IKT-Anwendungen ausgestattet werden, mit welchen beispielsweise das Energieverbrauchsmonitoring in Haushalten verbessert oder die PV-Integration – etwa auch in Hinblick auf E-Mobilität – ermöglicht werden kann. Ein weiteres Technologie-Beispiel sind Komfortlüftungsanlagen, die großen Einfluss auf die Erfüllung jenes Wohnwunsch-Kriteriums haben, das sich auf die Innenraumluftqualität bezieht. Um die Vorteile derartiger Technologien und Konzepte für Wohnungssuchende verständlich zu machen und etwaige Technologieängste abzubauen, sind im Tool Kurzbeschreibungen zu „Wohn-Technologien“ implementiert und mit den entsprechenden „Wohnwunsch-Kriterien“ verlinkt. Zudem bietet das Tool Links zu weiterführenden Info-Materialien.

2.2 Der Wohnungsvergleich – Ergebnisse und Auswertung

Die Ergebnisdarstellung des Wohnungsvergleichs liefert eine Vielzahl an Informationen: Die Userinnen und User sehen auf einen Blick, wie gut die verglichenen Wohnungen auf Basis der individuell gewählten Kriterien abschneiden – und zwar sowohl aggregiert als Gesamtergebnis als auch spezifisch als Ergebnisse pro Themenbereich (siehe Fig. 3).

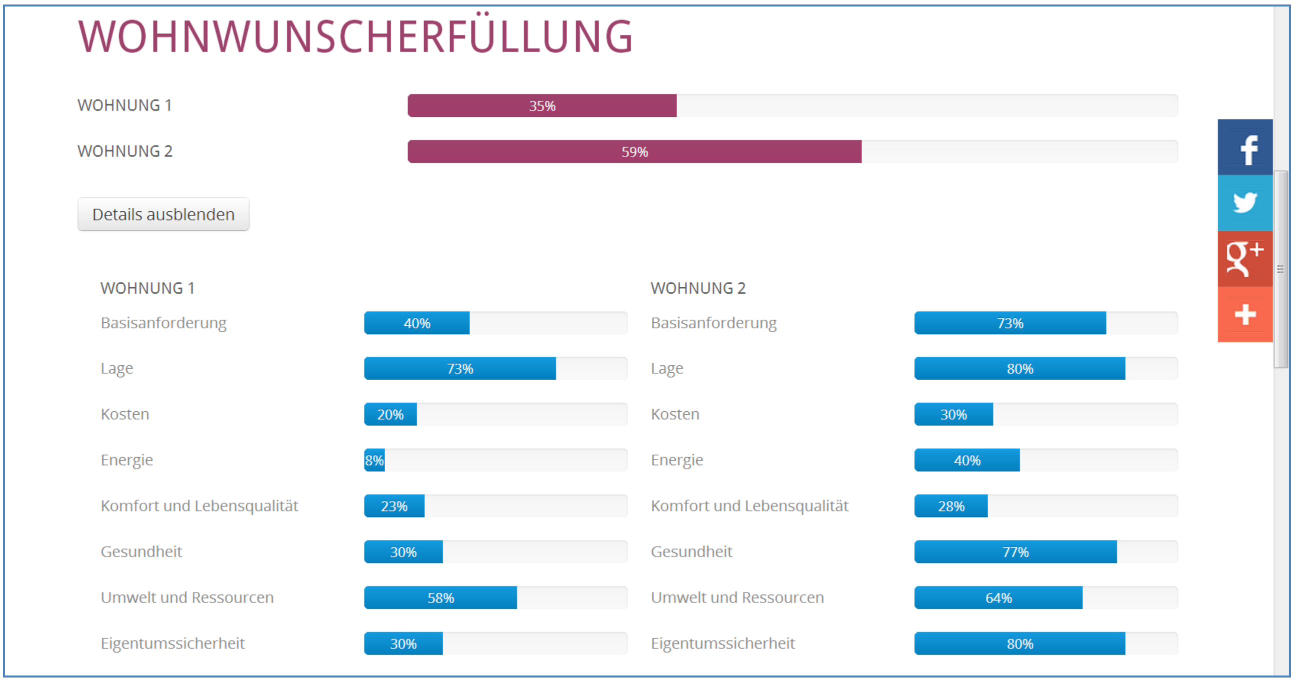

Fig. 3: Vergleich zweier Wohnungen – Ergebnisdarstellung im Wohnungsvergleich-Tool

2.2.1 Smart-City-Effekt und klima:aktiv-Effekt als Attribute zu den Wohnwunsch-Kriterien

Allen Wohnwunsch-Kriterien wurden zudem zwei im Kontext von „smart & sustainable" relevante Attribute zugeordnet, nämlich der „Smart City Effekt" und der „klima:aktiv Effekt". Die Beurteilung des „Smart City Effekts" erfolgte anhand der drei Merkmale „Lebensqualität", „Umwelt" und „Innovation" und wurde im Vorfeld von Expertinnen und Experten vorgenommen. Ein Wohnwunsch-Kriterium ist umso „smarter", je stärker die Erfüllung dieses Kriteriums zu Zielen in den Bereichen Lebensqualität, Umwelt und Innovation – und in Summe zum Smart City Effekt - beiträgt. Werden nun im Rahmen des Wohnungsvergleichs einzelne Wohnungen anhand der Kriterien bewertet bzw. werden die Kriterien zur Definition des persönlichen Wohnwunsch-Profils herangezogen, erhalten die Userinnen und User eine Aussage zur Smartness der jeweiligen Wohnung bzw. des persönlichen Wohnwunsches.

Der „klima:aktiv Effekt" zeigt an, wie viele Wohnwunsch-Kriterien mit klima:aktiv-Bezug Teil der persönlichen Wohnwunsch-Profile der Userinnen und User sind und wie gut die einzelnen verglichenen Wohnungen in Hinblick auf diese Kriterien abschneiden.

Die Ausprägung des Smart-City-Effekts und des klima:aktiv-Effekts sind somit ein Maß für die Smartness bzw. Klimafreundlichkeit der verglichenen Wohnungen sowie des persönlichen Wohnwunsches.

2.2.2 Das Wohnungsvergleich-Tool als „Wohnwunsch-Barometer

Abgesehen von diesen für die Userinnen und User ad hoc sichtbaren Ergebnisdarstellungen, bietet das Wohnungsvergleich-Tool vielfältige Auswertemöglichkeiten der eingegebenen Daten, die Rückschlüsse auf die nachgefragten Qualitätsmerkmale von Wohnungen sowie auf den Status quo des Wohnungsangebots zulassen. So zeigt etwa die Auswertung der Wohnwunsch-Profile der Userinnen und User, welche Kriterien am Markt nachgefragt werden und die daher von Seiten der Anbieter (Projektentwickler, Bauträger und Immobilienmakler) besonders berücksichtigt werden sollten. Im Umkehrschluss können Förderstellen aus jenen Kriterien, welche zwar im Kontext politisch-strategischer Nachhaltigkeits- und Smart City-Zielsetzungen als hoch relevant eingestuft werden, die aber in den Wohnwunsch-Profilen der Userinnen und User unterrepräsentiert sind, Hinweise zur entsprechenden Ausgestaltung von Fördersystemen – insbesondere der Wohnbauförderung – ableiten.

3 PROJEKTHINTERGRUND

Das Wohnungsvergleich-Tool wurde von der ÖGUT in Kooperation mit dem auf multimediale Web-Applikationen spezialisierten Unternehmen akaryon in einem einjährigen, von der ZIT – Die Technologieagentur der Stadt Wien geförderten Kommunikationsprojekt entwickelt; einige weitere

Aktivitäten auf Basis des Projekts wurden zudem seitens des Lebensministeriums über das Programm klima:atkiv Bauen und Sanieren sowie das BMVIT unterstützt.

Die Toolentwicklung inkl. Testphase erfolgte in einem partizipativen Prozess, in den Akteurinnen und Akteure aus Forschung und Wissenschaftskommunikatoin, Immobilienwirtschaft, Förderwesen und Verwaltung, aber auch Endkundinnen und Endkunden (Facebook-Schnittstelle) eingebunden waren.

4 CONCLUSIO

Mit seinem Anspruch, die auf technischer Ebene formulierten Kriterien aus gängigen Nachhaltigkeitsbewertungssystemen für Gebäude und Siedlungen in eine für Endkundinnen und Endkunden verständliche – und damit beurteilbare – Ebene zu übersetzen, regt das Wohnungsvergleich-Tool die Nachfrage nach nachhaltigen, smarten Wohnungan sowie damit im Zusammenhang stehender innovativer Gebäudetechnologien an.

Dies unterstützt in weiterer Folge die Entwicklung der Immobilienwirtschaft in Richtung Nachhaltigkeit, was vor dem Hintergrund steigender nachhaltigkeits- und klimaschutzbezogener Anforderungen immer bedeutsamer wird, und erleichtert die Marktdiffusion innovativer Gebäudetechnologien, da durch den Zugewinn an Wissen und Bewusstsein bei den Endkundinnen und Endkunden Technologieängste abgebaut werden können. Mit den implementierten Hintergrundinformationen und Best Practice Beispielen leistet das Tool zudem einen wertvollen Beitrag zur Positionierung Wiens als Innovations- und Technologie-Standort und als „Smart City".

Durch die klare Strukturierung von Entscheidungsprozessen erhöht das Wohnungsvergleich-Tool die „Treffsicherheit" von Wohnentscheidungen, was sich positiv auf die Wohnzufriedenheit auswirkt und nicht nur Vorteile für die Endkundinnen und Endkunden selbst bringt, sondern auch für Bauträger oder Immobilienverwaltungen, da u. a. häufige Mieter-/Eigentümerinnen- und Eigentümerwechsel vermieden und das Konfliktpotential innerhalb von Wohnanlagen minimiert werden.

Insgesamt kann das Wohnungsvergleich-Tool somit durch vielfältige Impulse und Wechselwirkungen Stadtentwicklungsprozesse im Kontext von Nachhaltigkeits- und Smart City-Zielssetzungn unterstützen.

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What could be the “Imaginary Institution” of the City?

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1 ABSTRACT

In his book “The imaginary institution of Society” the French philosopher Castoriadis wanted to explain the radical change of societies and their diversity. The social imaginary matters, and explains social change. But what is it today? The Castoriadis’s answer is mainly a criticism of the imaginary of the bureaucratic society (perfect anticipations). He hoped more autonomy. We propose this interpretation of the imaginary of the City: the main myths are personal strength, chance (here the reference is the Ulrich Beck’s book “The risk society”) and individual happiness (the reference being the works of the French philosopher Lipotevsky). We are able to explain the discrepancy between public policies (including city planning) and the real social needs. It exists because the doctrines used lag behind the “social imaginary significations”. The concerned fields are the beauty of cities, spatial segregation, women in the city, environment and drugs…

2 INTRODUCTION

In his book “The imaginary institution of Society” the French philosopher Castoriadis tried to explain social change thanks to social imaginary. We shall describe the intellectual backdrop of the Castoriadis’s works, and set out his hypothesis. Then we shall propose a hypothesis on the social imaginary “establishing” the city of today: the main myths are personal strength, chance and individual happiness.

We conclude on the discrepancy between public policies, including city planning, and the real social needs. The used doctrines lag behind the social needs because these needs depend on “social imaginary significations”, themselves elusive and always changing. Concerned fields are the beauty of cities, spatial segregation, women in the city, environment and drugs …

3 THE INTELLECTUAL BACKDROP OF THE CASTORIADIS’S WORKS

3.1 The French tradition in sociology

The French sociological tradition starts from Durkheim. These authors were very much influenced by anthropology. They took myths and culture very seriously, but they seem today unable to explain modern societies. This can be illustrated by examples of famous books. The celebrated Mauss’essay “The gift” is brilliant but of no help to explain modern societies. The Bourdieu’s book “Distinction: a social critique of the judgment of taste” insists on the stratification of the French society and describes the signs allowing to distinguish upper and lower statuses. But as early as the twenties, the American sociologist Sorokin warned that occidental societies are mixed for centuries, due to vertical and horizontal mobility. Today all is shared: tastes, fashion, spectacle … (Lipovetsky, 2013). And there is the equalizing effect of risk, since often public goods are concerned, pollution, security, health … (Beck, 2008). In the same way Bourdieu states that the domination of men on women is fixed in culture and language. But he is unable to explain why women struggle for new rights. They are often successful (Lipotevsky, 2006).

The books of Roger Caillois remain very interesting. In his book “Man and the sacred” he states that periodical feasts allowing breaking taboos are a necessity for societies, to re-establish their values. And he concluded that today these feasts should be replaced by inevitable wars… But in modern societies there are many feasts that are not (too much) violent. For instance, kitsch is a feast breaking the rules of the formatting of tastes by brands and advertising (Lipovetsky,). In another book, “Man, play and games” he stated the universality of game, taking four shapes: Agon (competition), Alea (chance), Mimicry and Ilinx (vertigo). He warns that there are excess and abuse… But in modern societies everyone plays games. The choice made is “general deregulation” (Lipovetsky, 2013). In some cases, society opposes its own players, the regulators, to players who deserve control (finance, telecommunications, health …). Even the cities play games: Agon (competition), Mimicry (when mid-sized cities imitate the most famous large cities). For instance, cities in China bet on economic growth whatever the consequences on environment are, while Boulder (Colorado) in the USA bets on struggle against any pollution.[1] However, in this book written in the fifties, Caillois gives us an explanation on modern societies: the cult of stars (through Medias, movies, fashion…) is described, thanks to Mimicry and the author anticipates the “democratic imaginary”. In a competitive and egalitarian society, the hopes of everyone are never achieved, but the cult of stars allows feeling as successful as those at the top.

Another interesting book is the Régis Messac’s essay “The detective novel and the influence of scientific thought”. The author quotes Edgar Poe: “The Universe is a plot of God”. All things are linked together, since everywhere and always there are causes and effects… It is the myth of serendipity. The detective uses his extraordinary abilities to break the enigma. Here, that the French sociological tradition explains more Culture than Society appears. On Society, Messac says only this: time in the detective novel is linear, as it is in all the novels, except Proust’s “In search of lost time” (since in this novel, at the end, the main character becomes a writer, achieving his quest). One can compare to the Siegfried Kracauer’s book “The detective novel”. He extends the scope of his topic to Society: the detective novel displays the realm of the Ratio. That is to say, the capitalist society works and it is enough, the human fails but this is forgotten and the question of the influence of Ethics on Law is not posed.

A last example is the book of the sociologist Fauconnet, “The responsibility”. He states that myths and values (or culture) are the causes of Law. Decades before the publication of the famous book of Michel Foucault “Discipline and punish” he shows the awkward dilemmas of any theory of Law. However this book is forgotten. Even if the idea of the influence of myths and values on Ethics and Law is very much relevant, there is no word in the book on the role of Medias, the power of Opinion, the egalitarian ideal etc.

We conclude that the French sociological tradition (between the two World Wars) rightly insisted on myths and values, their impact on Society, but failed to describe social change and the modern society.

3.2 The discovery of the consumers society. The consumers society was anticipated by the Frankfort School and discovered in the USA after the Second World War. One can quote the Kracauer’s book “The salaried masses” and other books on popular culture, life in metropolises and movies. Adorno wrote books on cultural industries. The discovery of the consumers society dates from the David Riesman’s book “The lonely crowd”. One can also quote the Vance Packard’s essays on marketing, waste, the tastes of American people (pets, statuses, social climbing…) and the very rich etc. In France the ideas of Mac Luhan were popularized and modernity was described in the books of the sociologist Edgar Morin “The spirit of the time” (on popular culture), “The stars” and “Cinema or the imaginary man”.

4 THE CASTORIADIS’S THESIS

Castoriadis explains radical social change thanks to the social imaginary. All our actions, ordinary or extraordinary involve “social imaginary significations”. These social imaginary significations make up a “magma” which is coherent at some time. This explains the “specificity” of a given society. The magma is also “arbitrary”, meaning that it changes in a way which is not determined.

In the Castoriadis’s works there are these characteristics:

- He abandoned Marxism because the law of decreasing profits is not observed (he was also an economist).
- Being also a psychoanalyst he abandoned Freudianism because this theory does not explain the diversity of societies. But he kept the hypothesis of Oedipus complex, which explains the socialization of the individual. The infant is submitted to a constant flow of images and representations, and “selects” some of them to make up his (her) personality (character, vocation…). The coherence of the “magma” grants that the social roles are consistent: for instance, in our society characterized by technological change, vocations like innovation (in a technological field), technician and financier are coherent.
- The Castoriadis’s thesis is not merely a return to the “totality” of Marcel Mauss. He criticized the “inherited thought” as being deterministic. He wanted to save the idea that social change is not determined, but “arbitrary”, or unpredictable. He hoped an evolution of society towards more

[1] Sometimes some games seem too violent, and a majority appears which obtains the ban. A real foe of games is … mathematics, since when mathematics discover the winning strategy, a game looses any interest (Caillois, 2012).

autonomy, rejecting “heteronomy”. Indeed, according to Castoriadis, it is uneasy to “guess” or “interpret” how the magma (of imaginary social significations) changes. He criticized the myth of the “bureaucratic society”, the perfect anticipations. Perfect anticipations are impossible. Unpredictable events can always occur, as it has been stated by Taleb in his famous book “The black swan”. The most serious prospective will only propose scenarios without any given probability, which cannot cover all that is possible. In technical terms, one can propose two scenarios with unknown probabilities p1 and p2, and $p1 + p2 < 1$. It is “imprecise information”. Add to this that the theory on optimal decision in the context of imprecise information is only a mathematical theory in progress… The consequence is that complex modeling (in prospective) is uneasily understood by Opinion (also, it is sensitive to imaginary significations). To take an example, the scenarios of the IPPC (Intergovernmental Panel on Climate Change) are uneasily understood by Opinion. But the “precautionary principle” is more understandable, being a qualitative reasoning (and corresponding to some imaginary signification, prevention from the worst environmental risks).

- Castoriadis did not forget economy. There are two ontologies. One is practical, economic and codified thanks to logics. It is Thought and Action, codified and deterministic. This ontology is ensemblist / identitarian. The other ontology is historical / social, submitted to the social imaginary.[2] The myths are “shored up” in economy and practice. Society and social change are explained only when one considers the two ontologies.[3] Of course, what Castoriadis forecast (or hoped) for Society did not occur. Instead of Revolution and its agents (the workers councils), there was the Opinion directed society, instead of participation, there was sharing and a division of labor more and more sophisticated, instead of autonomy, there were rights which are granted only if Opinion feels concerned, instead of the end of privileges, there was the appearance of new privileges (like visibility) …But Castoriadis understood the role of social imaginary and the end of the influence of any transcendent doctrine

5 WHAT COULD BE THE “IMAGINARY INSTITUTION” OF THE CITY?

There is no clear method to “interpret” the social imaginary (concerning the City). One could have recourse to analysis of Cinema, since it is the art of our time (Lipovetsky, 2013). In his two books on Cinema, “From Caligari to Hitler: a psychological theory of German film” and “Theory of film: the redemption of physical reality”, Kracauer shows the metropolis as the place where meetings occur, allowing anyone to construct his (her) life.[4] All depends on chance. Kracauer commented the Grune’s movie “The street” several times: the main character is fascinated by the street, representing risk and chance, but finally prefers security at home. If myths are “shored up” in economy, chance should be accepted as a kind of value. Chance is everywhere in the economy of today: deregulation, refusal of the “too big to fail” and venture capital… Regulation is required only when the failure of some actors will trigger other failures (effect of contagion). In the Taleb’s words, antifragility requires exposure to risk. According to Lipovetsky other myths are individual happiness and success, and equality. It is the consequence of an individualistic and democratic revolution in the seventies and eighties, generating the “second modernity”. Many movies show the narratives which concern individuals, the dramas they live, the particular problems they meet and the dilemmas they cope with… There are still privileges, but they are not popular. For the Opinion, matter only equality and meritocracy. The abilities of any individual are tested: he (she) has to achieve success (here we see that myths are “shored up” in practice and economy) and also happiness. We conclude that personal strength, chance, individual happiness and success and equality are important myths (in cities). Other myths exist like Feminity, Manliness, Childhood, Maturity, Nature and Technology etc. but are subordinate to the most important myths.

[2] One can take the example of Ethics and Law (not dealt with by Castoriadis). The historical / social ontology determines Ethics. And Theory of Law is in accordance with Ethics and submitted to the ensemblist / identitarian ontology. Theory of Law is part of codified knowledge (called Legein by Castoriadis). The difficulty of Theory of Law is explained by the opposite characters of the two ontologies.

[3] In the detective novel, according to Messac, the ensemblist / identitarian ontology explains Society. Therefore crime is only an enigma to be broken. If we take into account the historical / social ontology, crime has to be ethically judged. It is the point of view of Fauconnet.

[4] This includes anomic people who need to meet persons to share ideas and projects. They meet them in the city.

6 THE DISCREPANCY BETWEEN AUTHORITIES’ POLICIES AND SOCIAL NEEDS

The “imaginary social significations” matter and it is difficult to interpret them. Therefore their consequences are uneasily understood. That is why there is a discrepancy between the authorities ‘policies (including city planning) and the real social needs.

This problem has two aspects:

- According to Lipovetsky we have to create a sustainable consumers society, and this project is replete with double binds: production has to be abundant, but not polluting, eaters should be satisfied, but not fat, (hyper)consumption requires using natural resources but they should be preserved, Information Technologies should develop but individual liberty being preserved (it is the stake of data privacy) etc. In a few words, the (hyper)modern society requires quality of life.
- When science and technology create new devices, this diffusion generates unexpected social effects. Sometimes Opinion, which is worried about some risk, makes a narrative (concerning the risk) of its own, neglecting all that was said by experts in the past. Decisions follow. It is the appearance of a “risk community” (Beck, 2008). Examples in Germany are sulfur disseminated in the atmosphere by plants and the decision to end nuclear production of electricity after the Fukushima accident.

Some examples can be quoted:

- Beauty of cities. We are at the time of “artist capitalism” (Lipovetsky, 2013). Beauty is required everywhere in large cities. At least, ugliness is banned. Elias Canetti in his book “Crowds and power” remarks that Metamorphosis is an attribute of Power. Therefore large cities, playing the game of Agon (competition), wanting to be models ant to trigger dreams, are tempted to create new quarters: it is spectacular, in particular when a mega-event occurs in the city. There is a trend for large cities to be covered with building sites lasting years. What about the quality of life for those living in these cities?
- Spatial segregation. According to Lipovetsky what matters is not all the people living in the prestigious and nice places existing in the cities. That matters is that youngsters can go to these places, wearing Nikes or Pumas, to have fun there. Finally what matters is jobs (for the youngsters). Of course, all the places in cities have to be well equipped, which allows provision of basic services. But social mixing should be bearable, provided that youngsters have jobs and have access to consumption (since it is their real desire). Indeed, spatial segregation has a bad effect according to Jane Jacobs: those needing advices (to cope with adversity) are away from those able to give these advices. And this matters: according to Lipovetsky, today ethics is not forgotten but it has to be painless because it involves narcissist people (Lipovetsky, 2000).

It is better if there are fewer obstacles (that is to say, if those needing advices are near those able to give advices).

- Women in the cities. As there is a strong demand of nurseries, municipalities (and sometimes firms) provide them. It allows women working while having and raising kids. Perhaps in doing so one favors a society of single men and women raising kids (Beck, 2008). Often women who do not work and divorce, raising one or several kids, fall into poverty. They are numerous, benefitting from social assistance. It is a consequence of the strong “egalitarian imaginary”. Women want to be equal to men, working while having kids. Beck forecast a “war between genders” as a consequence of this strong women ‘desire for equality.
- Environment. Municipal authorities have the choice between two policies, preserving environment or not. Of course the choice is political and …electoral. Many cities are active in this field: clean public transportation, attrition of car traffic, reduction of carbon dissemination in the atmosphere, public gardens and even measures in favor of biodiversity… They have made up a world association. Indeed, the artificiality of the City has won (at least in large cities). Nature is a myth subordinate to the myth of individual happiness, which is achieved thanks to hyperconsumption. That is to say, some “natural products” are good for health, landscapes provide décor for holidays and remote places allow nice movies etc. Nature is more a strong myth in many mid-sized cities. All this has bad consequences if we consider the future: Opinion should take seriously the stake of saving the Planet, in particular when global warming is concerned.

- Drugs. Today Opinion has not made some clear choice, concerning drugs. In general repression is approved, but this could change. Let us recall that there are two shapes of liberalization: decriminalization (sales of drugs are not punished) and legalization (sales of drugs are licit and organized under the control of the State). For instance, in the USA two States, Colorado and Washington have liberalized drugs. Another stake is "supervised injection sites", which are permitted in several European countries (Germany, The Netherlands …). It is controversial. In some cities people refuse the opening of such sites. Here we see myths in conflict. On one side, the myth of the second modernity being individual happiness, all that allows individual happiness, including use of drugs, should be permitted. On the other side, the myth dating from the first modernity is self-control (Lipovetsky, 2013). Using drugs is disapproved because it is a lack of self-control since health is supposed to be destroyed. Lipovetsky quotes the criteria of women's beauty: it remains thinness, which means self-control.

7 CONCLUSION

We have insisted very much on the works of authors like Castoriadis or Kracauer, who knew and analyzed the first modernity. This is justified, because the second modernity is only the accentuation of the features of the first modernity, individualism, search for happiness and equality … (Lipovetsky, 2013).

We conclude examining the role of Technology.

At the time of the first modernity, Technology was one of the main myths, since it was the means to achieve an abundant production and win shortage. Today (at the time of the second modernity) Technology is more a myth submitted to other ones like individualism and happiness: Technology is valued as a means to achieve health, beauty, allowing nice trips and attractive spectacles etc. An example is when a drone flies among birds, shooting images of them and the ground.

The first to study life in the metropolises (authors like Simmel and Benjamin) noticed that people living in cities are submitted to "shocks". The citizens parry the shocks thanks to indifference, blunting or snobbery (or coquetry) according to Simmel. According to Benjamin the remedy to shocks is …shocks, which can be found in movies or architecture in glass. Today new ways to look at the physical reality appear: drones shooting images, special effects and visual effects in movies, computer graphics, creation of imaginary worlds generated by computers for videogames, cameras fixed on the bodies of sportsmen or animals and 3D television or movies… Perhaps there is the appearance of a new "perception" of the urban environment by citizens, allowing overcoming the "shock" of urban life (Fuzessery, 2008).

An example is the serious game Blockholm, organized by the municipality of Stockholm. They use the virtual platform of a very popular videogame, Minecraft. It allows building "blocks" to obtain a virtual environment, in which the player plays the game (there are several modes, the player has to survive, or to win monsters etc.). A player playing the game Blockholm acquires a plot and builds the building he wants on it. The virtual environment replicates the site of Stockholm. The result will be a kind of virtual Stockholm. The most beautiful buildings will be converted into mock-ups and shown in an exhibition (Geoinformatics, 2014). It is taking into account the imaginary dimension of the city. The result of this serious game could show the dreams triggered by some city, which are expressed in the buildings imagined by the players.

It is an example of exploring the imaginary dimension of the city (in the field of architecture). More generally, the "reflexive modernity" (Beck, 2008) requires examining the "social imaginary significations" of the City and their consequences. It is a condition to remove the discrepancy between authorities' policies and real social needs.

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Will the Guidebook "Green and Blue Spatial Planning" be a Value Help for Styrian Cities to Become a "Smart City"

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1 ABSTRACT

The department of spatial planning in the provincial government of Styria in Austria was participating from 2008 till 2011 in the INTERREG IVC project GRaBS. GRaBS stands for Green and Blue Space Adaptation for Urban Areas and Eco Towns. The main ideas of the project were the exchange of experiences among the 14 partners from 8 european countries and to produce an adaptation action plan concerning climate change. Due to scientific researches there are existing a lot of evidences that the climate is changing. The atmospheric carbon dioxide concentrations are at their highest level for 3 million years and temperatures are increasing. Climate change is no longer simply something that will need to be addressed in the future, it is happening now and we will have to draw up climate change adaptation policies and strategies and implement them. Regional planning systems and urban spatial planning can help to reduce the vulnerability to the risks of flooding and heat island effects in cities. Green infrastructures including public and private parks, productive landscapes, green corridors and nets, green roofs and facades and also blue infrastructure such as water bodies, rivers, streams, sustainable drainage systems a.s.o. can mitigate the impacts of climate change. As a result of the GRaBS project and its outcome the Styrian Adaptation Action Plan, the department of spatial planning in Styria produced together with with an external office a guidebook of "Green and Blue spatial planning". This guidebook was introduced to the planners and the biggest cities in Styria in December 2012.

2 CONTENT AND AIMS OF THE GUIDEBOOK

2.1 Aims and tasksetting for the guidebook

The tasksetting for the guidebook was to show up that integrating green and blue infrastructure in the spatial planning instruments, can be easily done by the municipalities. Spatial planning is a good mean to deal with the risks of climate change in a strategic way. Usefull measures for adaptation can be done on the level of planning for towns and municipalities. The main aim according to climate change is to increase the resilience of the citystructure and the use of the area. The aims of spatial planning with regard to spatial planning are:

- Maintainance of microclimatic functions, temperature balance
- Protection of the use of the area against natural hazards
- Protection of groundwater, quality of streams a.s.o.
- Protection of soil and soilquality

These aims are the results of the given risks caused by climate change: hot islandeffects, aridity, heatstress, landslide, avalanches, forestfire, floddingdamages, the descent of groundwaterlevel, loss of soil through erosion a.s.o.

The matrix in table 1 shows up how green and blue infrastructure can be used to reach the aims, mentioned before:

2.2 Content

The guidebook itself delivers at the beginning a survey of the legal bases in the Styrian spatial planning and other law matters. In the Styrian spatial planning law from 2010 for example it is determined that the municipalities have to plan according to climate protection aims. Further on the guidebook describes the 3 spatial planning instruments, the local development concept, the landuse map and the masterplan. In the decription you will find the law background and the different paragraphes to find a sort of legal base for implementing the blue and green infrastructure and further on there are given advices how to integrate green and blue infrastructure in these instruments. The guidebook is not delivering all the possible measures in spatial planning but it shows up the possiblilities which are already existing in the spatial planning law. It might be a basis for the strategy of risk avoidance and could be the basis for the future planning.

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The heart of the guidebook is the so called risk catatogue. It was created according to the climate check lists of the Styrian Adaptation Action Plan of the GRaBS project.

	Temperature raising	Minimizing the risks of natural hazards	Saving and protection of water resources and water quality	Soil and subsoil
Gardens, Parcs, green courtyards, streetgreen				
Greenareas and open spaces				
Flowing water and area along riverbanks				
Green roofs and green facades				
Ponds and lakes				
Retention areas				

Table 1: Green and Blue Infrastructure and their most important function for adapting to climate change

Climate check		Local Development Concept		Goal achievement Please fill in	Partial result
Green space	20%	Number of open and green areas - Increasing the proportion of open and green areas in the densely-populated area - Safeguarding a high proportion of open and green areas in new building areas	45%	Taken into account very well	
		Keeping strategically important green areas free of building development - Preventing the fragmentation of green space corridors / green belt - Spatial outline/Green space concept	45%	Taken into account poorly	
		Other measures - Own description....	10%	Not taken into account	
Fresh air	30%	Taking climate-relevant areas into account - Keeping fresh air corridors (green zones) free of building development - Taking climatological reserved areas into account - Keeping areas important for cold air production free of building development	90%	Taken into account in part	
		Other measures - Own description....	10%	Taken into account very well	
Waterbodies/ Floods	20%	Safeguarding flood protection - Keeping areas free for flood protection structures - Keeping areas free for retention measures (e.g. local priority zone for recreation) - Keeping HQ30 or yellow hazard zone free of building development (implementing measures) - Implementation of measures from technical programmes on flood hazards	45%	Taken into account poorly	
		Safeguarding the good ecological state of the waterbodies - Keeping areas free for renaturation measures - Initiation of freshwater-ecological improvements - Conserving contiguous open areas bordering waterbodies	45%	Taken into account very well	
		Other measures - Own description....	10%	Taken into account very well	
Resource-protection and settlement development	30%	Settlement development in accordance with climate-relevant criteria - Avoidance of unplanned settlement - Prioritised settlement development in local settlement focuses - Consolidate inwards before expanding outwards - Settlement development along axes with public transport (within 300m of public transport stopping point)	90%	Taken into account very well	
		Other measures - Own description....	10%	Not taken into account	
Overall result		Climate Check: Local Development Concept			

Table 2: Climate check list for local development concepts

2.2.1 Climate check lists and Risk catalogue

The climate check lists of the Styrian Adaptation Action Plan are giving a quick help, how the result of climate change can be faced by green and blue infrastructure. The municipalities have to check which risks they might have and how and with which spatial planning instrument they can solve or at least mitigate the problem. They also have to make a sort of self assessment of their own spatial planning.

In the guidebook itself these checklists were transformed in a userfriendly risk catalogue which shows up the possible risks of climate change, which measures can be taken and which effects it will have. Finally it shows up the possibilites to implement them in the different spatial planning instruments.

Some good practice examples and case studies of the city of Graz and some other municipalities in Styria are also included in the guidebook concerning implementing green and blue infrastructure.

2.2.2 Good practice examples:

There are listed a lot of already existing examples in the city of Graz. Graz is the second biggest town in Austria with around 270.000 inhabitants and is already a very green city. The Green net of Graz, the outcome of the european project – revitalizing of the innercourtyards of Graz and the open space standards for the masterplans are good examples of the implementation of green infrastructure.

Fig. 1: Revitalizing of the innercourtyards of Graz

3 CONCLUSION

The guidebook "Green and Blue spatial planning" is not a directive in the spatial planning system in the province of Styria. It is more or less a helpfull handbook for interested planners and municipalities who are already dealing with the follow ups of the climate change or who are interested to prevent a lot of risks. And having more greener cities means for the inhabitants more recreation areas and makes the cities itself more attractive and "smarter". Nevertheless the guidebook is a first step for preparing a liveable area in the cities.

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Smart Governance Answers to Metropolitan Peripheries: Regenerating the Deprived Area of the Morandi Block in the Tor Sapienza Neighbourhood (Rome)

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1 ABSTRACT

A very alive and promising participatory planning process is on the run in the neighbourhood of Tor Sapienza in Rome. In the blocks settlement called Morandi, approximately 500 hundred families live in a modernistic settlement designed and realized in early 70's. As common in these peripheral dense settlements around Europe, the complete absence of mixité social caused by diverse reasons has led to strong phenomenon of socio-cultural exclusions and urban poverty. Current economic crisis has increased the tough and difficult conditions of Morandi inhabitants: high level of unemployment and early school leaving, scarce opportunities of professional growth in the neighbourhood, many expressions of marginalisation characterize the project area. Moreover, recent immigration movements determine in this part of the city a new multicultural dimension that not always breed in a collective amelioration, but on contrary, very often lead to conflicts, specifically when Rromi population are involved (it is worth remembering the proximity to the Morandi of the Rromi settlement of Via Salviati).

Improving decision making processes and transforming the ways that public services and answers are delivered in peripheries of European cities is a question of providing "smart governance schemes" for urban policies.

The University (Tor Vergata, Roma 2) has initiated this regeneration process considering three pillars of smart governance:

(1) Looking for mechanism of transparent governance.

(2) Promoting effective participation in decision-making and stakeholder based design of urban strategies.

(3) Re-thinking delivery of public and social services.

The University is the catalyser of a participatory planning process that currently is involving more than 20 local stakeholders. Local stakeholders have been organised in a local action group that regularly hold meetings finalised to the realization of a strategic local action plan, which is identifying priority projects to finance in short time through local/national and EU funds (focus 2014-2020). Projects deriving from this process aim at reducing condition of marginality afflicting this area and its population. Geographical marginality of this settlement of course still plays a strong role in determine peripheral conditions, but other form of marginalities determine the "isolation" of nowadays periphery, and specifically of the Morandi:

- High level of Unemployment (at the margin of knowledge/education and professional training)
- Rundown public and private spaces/buildings (marginal financial availability and sense of collectivity/community)
- Presence of illegal, sometimes criminal, activities (at the margin of rules and legality)

Innovative tools are currently under experimentation in Morandi-Tor Sapienza looking for providing three basic outputs:

(1) One effective strategic plan for this kind of settlements (having high grade of transferability at metropolitan area scale).

(2) One urban regeneration policy scheme to be replaced in the city of Rome and contextualized to the new EU 2014-2020 territorial cohesion tools (e.g. CLLD, ITI)

(3) A set of feasible projects to launch on the very short time providing viable, flexible, proper, effective and resilient answers to existing urban emergencies in the neighbourhood.

2 THE MORANDI-TOR SAPIENZA REGENERATION PROJECT: THE CASE DESCRIPTION

Deprived areas often suffer from economic decline (few economic activities, loss of economic actors, high rate of unemployment, low spending capacity, etc.). The purpose of local actions for urban regeneration is to build up the economic capacity of a local area to improve its present and future and the inhabitants quality of life. The action of regeneration initiated in Rome in Morandi Tor Sapienza has been possible thanks to the EU programme URBACT.[1] Specifically, the action is made possible by the Re-Block project.

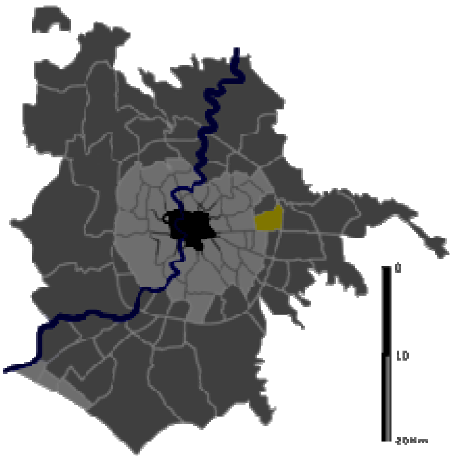
Re-Block is an acronim for: REviving high-rise Blocks for cohesive and green neighborhoods.[2] The territorial problems faced by RE-Block are those to promote efficient and effective regeneration of urban settlements, neighbourhoods, high population density, making them more attractive and improving their environmental quality through the activation of an integrated urban approach. A tailored approach designed to combat urban poverty, poor quality housing, lack of services. The main objective of the RE-Block project is to achieve, in the areas of the involved partners, a number of local action plans. These plans are designed through a participatory and inclusive of local actors. Local actors are organized in a ULSG (URBACT Local Support Groups), in order to carry out area based strategic plans. A series of international meetings will help the local action groups to come in contact with other partners in Europe where they face similar problems with the same methodology. The comparison with international experts (knowledge ambassadors) from the different partner countries can expand their horizons and perspectives in the design of solutions for local development. The local action plan, of high strategic value, resulted from this participatory process, will identify a set of projects and define their priority. These projects should have a high degree of maturity, in other words, must be shared by institutions and local actors and to be associated with a clear path to financing funds (EU, national, regional, local). In Rome, The University of Tor Vergata was the actor / project partner that has promoted to implement the participatory process in the complex Morandi in Tor Sapienza. The University has identified and coordinated the active forces in the area, which already had previous experience of participation at the neighborhood level, but they had to be coordinated within a process, through strategic oriented objectives, structured through a shared methodology. First action promoted have been;

(1) Creation of the Local Support Group (not starting from scratch, but paying attention to previous participatory planning experiences operated in the same neighbourhood, and considering local proactive stakeholders).

(2) Proceeding with an analysis of major current urban issues

Location of Morandi-Tor Sapienza

It is located in the Eastern part of Rome, behind and inside the ring road (GRA), between the Via Prenestina and the urban stretch of the motorway A24.



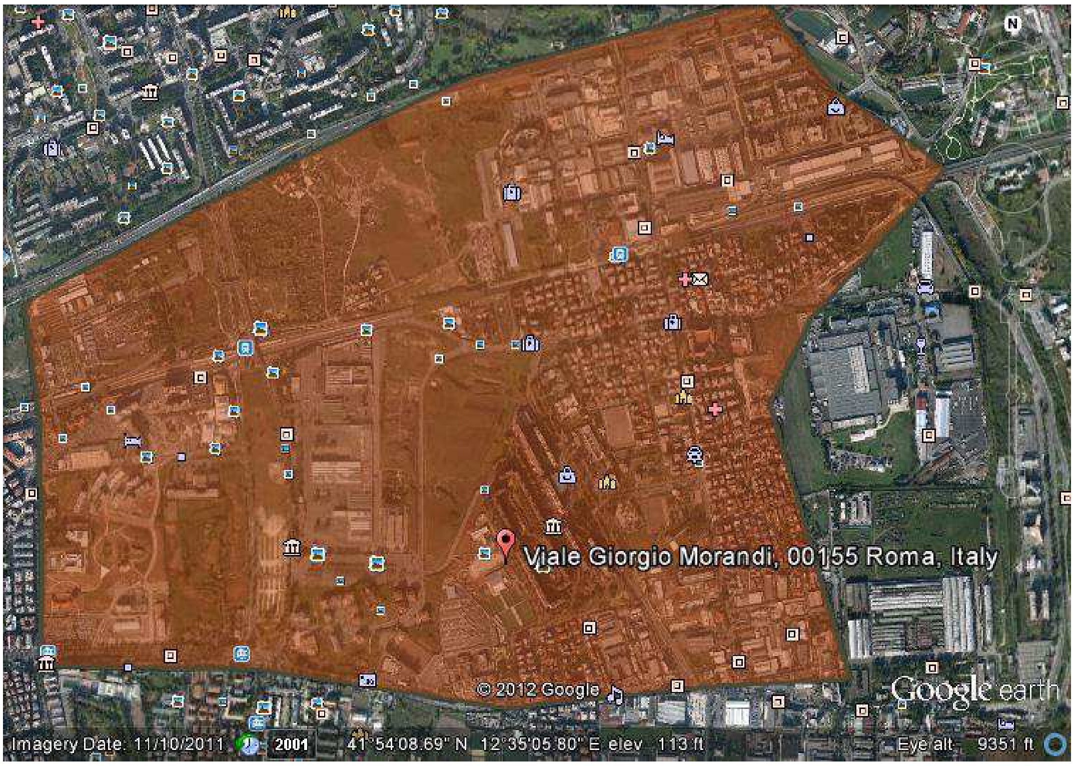
Extension 7.747 km², Inhabitants 25.867 inhab. (2010), Density 3.339 inhab./km²

[1] URBACT is a European exchange and learning programme (*) promoting sustainable urban development. More at: http://urbact.eu/en/about-urbact/urbact-at-a-glance/urbact-in-words/

[2] Project website: http://URBACT.eu/en/projects/disadvantaged-neighbourhoods/re-block/homepage/ Projects partners are Budabest, Gelsenkirchen, Magedeburg, Malaga, Salford, Soedertalie, Iasi, Komotini and Rome (University of Tor Vergata).

3 AREA WHERE TO DEVELOP THE LOCAL ACTION PLAN: AN AREA BASED INITIATIVE

The map here below (fig. 1) define the area of intervention that will be considered through the RE-Block initiative.



The bullet point on Viale Giorgio Morandi identifies the Blocks area (the most problematic in the whole area). Eastern of Morandi you can see the original core (borgata storica) built in early years of the XX century. Northern part industrial areas, while in Western part a mix of commercial, industrial and agricultural areas.

Results of the analytical phase can be summed up in the following SWOT table:

Internal factors	
Strengths	Weaknesses
High number of local association in the area, a relevant critical mass in the third sector, some of local association has relevance not just at local scale.	Especially in the Morandi Neighbourhood area, high level of unemployment, low level of schooling and a number of immigrants family living in occupied spaces (illegal and invented dwellings)
In the oldest part of the selected area, mainly built at the beginning of the XX century, all services, facilities and amenities are available.	
Multimodal mobility means available	Both the Morandi settlements (Viale Giorgio Morandi) and the old part of Tor Sapienza (Via di Tor Sapienza) are not good connected with public transport means
The neighbourhood is situated near main transport infrastructures (railway, main access roads to city centre)	The Morandi settlement is still an unconnected island within the peripheral urban fabric of Eastern Rome. This has determined a strong physical, cultural, social and economic isolation of the blocks area.
A rooted identity of inhabitants (memory and social/intellectual capital)	Many people living in the area, especially in the Morandi settlement, have/had criminal records, this determines additional prejudices on the area perception
A number of industrial area and SMEs areas are situated near the selected area	Network of local micro-economies, at neighbourhood scale, is extremely fragmented and not relevant in achieving its critical mass.
Public Urban Policies Heritage (URBACT is not the first initiative in the area)	
A number of urban facilities/services (schools, shops, church…)	Many public spaces are rundown and not usable by local inhabitants. There is a general need of refurbishing spaces and re-design use of common spaces.
Diversity in urban fabric (residential, industrial, agricultural land use is foreseen in the area)	
Good urban density in the historical part of Tor Sapienza	
External factors	
Opportunities	Threats
Designing a LOCAL ACTION PLAN in this area could be a way to re-launch socio-economic activities and empower the local fragmented relational networks among inhabitants, associations (civic, cultural, recreational, religious…) and private actors (especially small and micro enterprises)	The presence of many illegal dwellings generated by immigrants and the Romi settlement positioned in via Salviati generate conflicts in the area, conflicts especially involving young people, often unemployed and low-skilled.
The URBACT LOCAL ACTION PLAN in this area is even an opportunity to re-think the way of designing policies for such deprived area in the periphery of Rome: very often to formal planning procedure and very few based on participatory planning processes based on the creation of a LOCAL ACTION GROUP	In the last ten years, and especially in the last period because of the economic crisis, the isolation of this area is growing and socio-economic problems of families are increasing.

A relevant opportunity is in trying to solve the housing issue in the Quartiere Morandi, and provide a solution for the many families currently living in temporary conditions, unacceptable form the quality of life viewpoint.	Relevant phenomenon of social exclusion is already visible in the selected area, in this moment no relevant specific local (regional, municipal) policy/initiative is in progress in the area. No relevant measures are currently taken for moving out this part of Rome from its condition of deprived urban area.
An important opportunity is in the connection of local working force with the near rural areas. A number of local innovative project could be launched in order to trigger forms of urban and social local economies. This could be a way of creating employment through initiatives, which, at the same time, increase the quality of the living environment and of urban landscape.	
Presence of important railway infrastructures	
Close to external ring road quickly linking major motorways	
Ethnical diversity	

Survey on previous planning actions, instruments used in the area in the following table:

Analysis of Previous "planning" actions

The first relevant planning actions in the area, after the post war reconstruction period, has properly been the building of the Morandi's neighbourhood. A sort of unexpected UFO landing in the area at the beginning of the 70s (like other settlements in Rome in that period, e.g. Corviale, which with due differences, resembles a lot the operation did in Tor Sapienza, but even the Tor Bella Monaca settlement recalls similar planning approach). There was a need to find a place for many families, several of them immigrated/urbanised to Rome, from poor Italian rural areas and properly living in informal housing settlements.

As in many parts of Europe, these settlements concentrated households whose components having low grade of school education, and essentially constituted not specialised working class. From the beginning the Morandi's is a socially polarized area in the urban/civic fabric of Tor Sapienza, which had already developed a proper story/identity: the "urban" dialogue between Tor Sapienza's historical core and the Morandi settlement has been, and it still remains, difficult.

Other important official planning instruments applied in the area:

- Contratto di quartiere (beginning of 2000), a complex integrated policy for urban regeneration (national promoted policy) named "Contratto di quartiere Tor Sapienza"
- Piano regolatore sociale: A plan promoted by the local level authority (Municipio VII - now renamed Municipio V), it rules and organises all social services for the population (at local level)
- Piano Regolatore (General Master Plan of Rome): The land use planning tool at municipal level (it is a zoning/normative plan providing indications on use and functions of land plots, it has poor strategic dimension)

Additional specific urban policies connected to the RE-BLOCK topic in Rome are/have been:

- Programmi complessi (Complex Programmes) Roma: http://www.urbanistica.comune.roma.it/news-programmazione55/uo-complex38.html
- Città Periferica (Peripheral City): http://www.urbanistica.comune.roma.it/uo-periferica-prusst15.html, http://www.urbanistica.comune.roma.it/uo-periferica-zoneo22.html

The analysis phase has been conducted without splitting the Local Support Group (LSG). After this initial phase the group started to work on solutions, it has been divided in different thematic working groups (public space, social inclusion, local (micro) economy. The RE-BLOCK methodology has foreseen an intermediate assessment of the local process operated by the knowledge ambassador (every partner put at disposal of project a knowledge ambassador, these are itinerant international/national experts in urban regeneration and/or requalification of blocks areas). A peer review meeting has been held in Rome in the Morandi- Tor Sapienza area.

The international experts related to partners who complement each other, together with the University of Tor Vergata, which supports this project and have actively and carefully participated in the Peer Review Meeting. The knowledge ambassadors have been prepared through a handbook that has driven them to discover problems and potential of Morandi-Tor Sapienza. It is to put in evidence that project's partners share the same problematic in their neighbourhoods. In fact, many problems facing this type of neighbourhoods with high-density social housing construction follow more or less the same logic in other European cities. These problems can be classified and conveyed within certain specific categories:

- Type, configuration, construction methods and layout of the buildings (problems of the architectural design)

- Measure, layout and conceptualization of public spaces and services
- Lack of social mixity among the inhabitants (socially polarized places since the beginning of their operation)
- Inability of administration and management of these living spaces related to the extent of the buildings, the mess of property rights, absence of management bodies prone to maintenance of these "cities concentrated" (the governability of these structures, whether it is due only to the public or as well when mutated to forms of public-private partnership, is extremely complex).

The observations originated by the knowledge ambassadors in Morandi – Tor Sapienza can be summarized as follows:

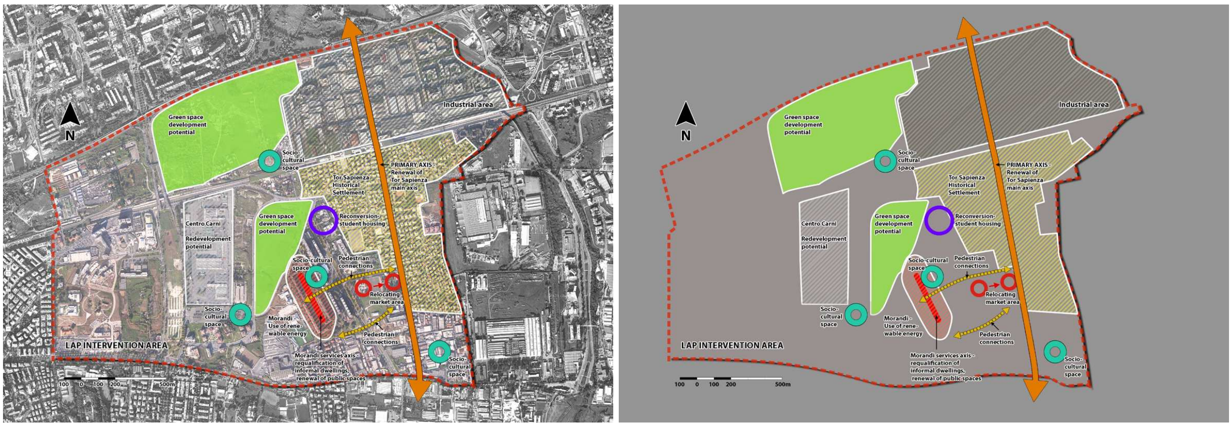
(1) The unexpected presence in Rome of a real slum (reference om the settlement of Via Salviati), the situation is perceived as urgent and it is recommended to put on the agendas of local institutions the resolution of problems related to this settlement; formally, this is certainly the most serious situation in Morandi-Tor Sapienza.

(2) The need to strengthen communication, the connection (even in a strictly physical-material) between the settlement Morandi and the district of Tor Sapienza: place some services in the spine of Morandi, after it has been redeveloped to promote a flow from Tor Sapienza towards Morandi, and not just the opposite.

(3) To systematize and develop as a potential, to make it attractive also for other citizens of Rome-Tor Sapienza area Morandi, the various "spots" of multiculturalism, multi-ethnicity in the neighbourhood: to develop this robust cultural diversity to launch events based on an exchange of knowledge (cooking, music, stories, meetings and comparison ...), events that can create some real exchange places social, economic and cultural cooperation between the recent Roman citizens and residents of long-term, in the district and in the city;

(4) Launching initiatives in public spaces to intercept the time of the youth, especially those who do not attend for various reasons the activities promoted by schools. Thinking of events, even simple, with an informal nature, which are able to stop the drift of young people to behaviors and actions that could damage their physical and mental health, as well as their ability to define their own path of scholar-professional maturation.

The ULSG working groups, with help of University of Tor Vergata team, and keeping into consideration the knowledge ambassadors suggestions formulated a first draft of the local action Plan (see figures here below) and proposed a first list of project as priority actions needed to regenerate the area (see table here below)



Conceptual local action plan for the regeneration of the Morandi-Tor Sapienza area elaborated by the LSG and the University of Tor Vergata

Preliminary list of identified projects

- Involve the ATER and the region primarily, but also other levels of territorial governance, in a process of regeneration of the Complex Morandi (Plug central services, and public spaces inside and outside the complex, energy efficiency projects).
- Establish a natural shopping centrality on Via di Tor Sapienza (axis Tor Sapienza), and transferring the local market in order to create a center that can strengthen the local economy.
- Promote social re-use of the Market Street for aggregation activities of the Youth

- Launch a redevelopment project of the Vittorini School for social activities (public library, actions to reduce early school leaving, promote housing for college students away from home, allocate space for the activities of associations dedicated to the promotion and management of urban-territorial issues, enable branches to respond to issues relating to youth)
- To promote the conversion of spaces like the Centro Carni, where there might find place a training school of crafts, as well as workshops
- Create a relationship between the activities of Urban Agriculture that start in the nearby Mistica Park with the local fabric of Tor Sapienza
- Strengthen pedestrian access between the complex Morandi and the District of Tor Sapienza
- Promoting local production chain linked to the area of reuse and recycling, connected to a short craft chain that involves the work of the informal collectors of waste and municipal solid waste, mainly Roma and immigrant families already active in this field.
- Promote cultural activities and socializing using the key of multiculturalism and integration, through the enhancement of the Municipal Cultural Centres Morandi and Michele Testa, which at this time are underutilized relying only on voluntary forces without economic resources
- Creation of a center to support small local businesses (within the new market)

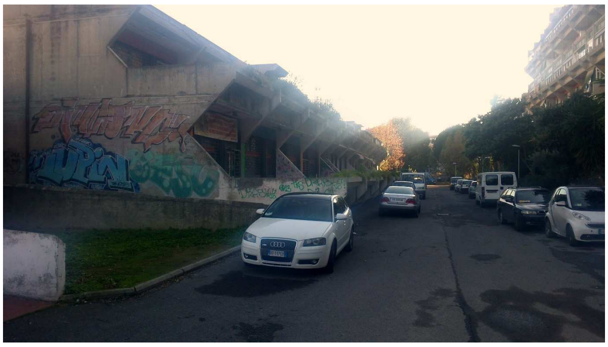
The draft Local Action Plan has been presented in a public meeting in the ULSG group seat (the Morandi a Colori). Three planning commissioners (periphery, urban planning, environment) of the City of Roma were at the meeting. The practice is still running, there are six months more to go and another international meeting to hold in Rome in September. For its first results and its particular participatory planning approach, based on the URBACT methodology, this practice is becoming a benchmark for other Roman neighbourhoods, and it starts to get well known even in other EU cities. Local politics is interested in results coming from this practice, but until now the political engagements are still to weak, even if the dialogue with the commissioners has been positive: The Project is still running, there is still time for all involved stakeholders, from politicians to institutions and private parties, for contributing the projects definition and for defining their financing.

LSG meet citizens, politicians and institution representative at the cultural center Morandi a Colori (March 2014)

Morandi settlement, possible connection with Tor Sapienza (current situation)

Morandi settlement, possible connection with Tor Sapienza (improvement of the pedestrian pathway – design URBASOFIA.EU)

Pedestrian bridge between Morandi settlement and Tor Sapienza old neighbourhood (improvement of the public space and of the pedestrian link - design URBASOFIA.EU)



Current situation (left) of planned services/facilities buildings inside the Morandi settlement (currently occupied by immigrants families)

A possible smart renewal of the occupied buildings, families are integrated in the settlements (design URBASOFIA.EU)

4 PERIPHERIES AND SMART GOVERNANCE

Periphery, a term derived from the Greek words "peri" (around) and "pherein "(to lead) to indicate a space surrounded by a closed line, indicates all the areas of a city outside of its historic center. It is to say that at present this original definition is no more sufficient to identify what is peripheral. Peripheries can be found in different parts of the urban fabric; periphery can be everywhere and not just outside of the mutable,

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geometrical line that surround an hypothetical city-center. However, the etymological definition has still sense if we intend peri as margin. In fact, multiple marginality characterizes the periphery. The steady growth urbanization, coupled with a rise in the expectations of citizens and the ongoing period of economic stagnation that is sweeping Europe are putting increasingly more pressure on cities, especially metropolitan areas, to be more competitive, inclusive, efficient and livable. They are also challenging the cities to think ahead and find new ways to sustain themselves in the future – a hard task for local administrations, which in turn have to offer attractiveness at a price that's affordable for them (Dimitriu, S., Elisei, P., 2014). The investment in being smart, in principle, should help cities in having major perspective. It is to pay attention to avoid that - in focussing on current smart offers available for cities - administrators forget less competitive, in terms of knowledge and economic potential, parts of the city fabric.

Effectively, it seems that the "smart cities approach" to the contemporary cities is holistically facing the many current urban issues, this approach would help a lot the practices of urban regeneration. Most advanced practices mix the need of promoting an economic sustainable development with human, territorial and social capital concerns, and always giving centrality to mobility and environmental challenges. Another (ranking) approach worth a mention, is the one proposed by Cohen (2013) leveraging on a dozen global and regional rankings of smart-city components in order to develop a global ranking of smart cities. His ranking stems from "the smart city wheel" model, based on observing the city using the following lenses: Economy, Environment, Governance, Mobility, Living, and People. This ranking suggest to work on the city considering the harmonization of the many component of urban development, smart is to integrate actions in strategic urban domains.

The Morandi-Tor Sapienza area is just one of the many neighbourhoods suffering multiple deprivation in European metropolitan cities, both in western and eastern Europe. There are millions of EU citizens living very close to poverty threshold and often planning instruments/policies provided by member states and EU are not yet so effective and efficient. The question is in understanding if this new paradigm, or simply new fashion, of the smart cities could help to move the stagnation of many EU peripheries:

What does it mean "smart city" in deprived areas with urgent need of regeneration?

More than technologies, that are anyway a source for many needed solutions especially to infrastructural problems, smartness should be promoted in governance mechanisms. Smart governance mechanisms to facilitate the regeneration of peripheral areas. The running practice of Morandi-Tor Sapienza can provide some indications about this point; nevertheless, it is worth considering two basic aspects in order to contextualize this example: a) it is a periphery in a metropolitan area; 2) it is a periphery having a particular construction typology that is high-density blocks.

The experience of the Morandi-Tor Sapienza, in the context of the URBACT Re-Block project, consents to make several considerations about necessary governance answers to metropolitan peripheries. Of course, all here above listed domains of action are important, but more important is to know how to address them in a situation of scarce available resources and daily urgent problem to solve for local inhabitants. The approached pursued by the coordinating team and the LSG was that of defining major domain of action, for every domain a working group has been activated, this has been the way to manage the local/horizontal connections among the involved stakeholders, namely:

(1) investment in regeneration and re- conceptualization of public space

(2) definition of a project oriented to strengthen initiatives for social inclusion

(3) implementation of projects aimed at the local level to trigger local micro economies

The setting of this strategic area based plan, tied to a specific and limited urban area, is providing first answers to the obvious short-medium term emergencies of the selected area: high youth unemployment, school abandonment, useless public spaces, unproductive and functionally inadequate, lack of a real integrated local economic network with the remains of an industrial system that was one of the most important at the Roman metropolitan scale.

Once more, in terms of Governance, the project is trying to align the two main platforms, as explained, the horizontal one, inherent in matters of interaction between actors and institutions operating in the specific area and a first set of solutions/projects. The dialogue between actors and institutions characterize the vertical one. Institutions as main sources of resources or carriers for access to mainstreaming financing linked to the next Structural Funds (2014-2020), which define the prospective horizon of the Morandi-Tor Sapienza regeneration actions.

In terms of lessons learned in implementing the participatory process, it is worth underlying:

(1) To bring into a dialogue of local clarification main stakeholders and all level of institutions using an area based approach, inspired by a logic of problem solving.

(2) To identify the problems with those stakeholders having long experience in the area and adopting an inclusive approach towards the different capabilities included in the LSG.

(3) To provide institutions and politicians with continuous feedbacks about every action taken at neighbourhood scale.

(4) To organize a dense and continuous programme with the working group and lead them to feasible projects (right scale of action), in every case it is to avoid projects not in line with local forces and potential available funds.

(5) To help stakeholders to think “out of the box” and be open to new form economies connected to ecological solutions and new smart technologies (from energy to IT): to be extremely creative in order to invent new local economies based on social interactions (real/virtual) and innovative uses of public space, green areas and all available facilities (public/private, private in public use…).

Smart governance for urban areas, at least for the deprived and peripheral neighbourhoods, requires an integrated approach and involvement of the inhabitants. Smartness is not just in methodologies, instruments and new technological solutions, one basic ingredient is to promote an active citizenship, especially the targeted ones, process ownership. Smart citizenship is definitively accompanying discussion linked to the efficiency and effectiveness of smart processes for urban transformations: The software code that constitutes the core subject of the smart city technology can embed the conduct code of intelligent citizenship. This is happening in the case that the design of the new city is not limited to considering the issues of the efficiency of public services, but also their effectiveness in terms of improvement of civil society (De Biase, L., 2013). The topic of smart citizenship open the discussion even to new way of making community in the cities, a way where the citizen, thanks to the web 2.0 tools, can be member of community not strictly related to logics of proximity in a specific neighborhood. Nowadays, we currently use the contraposition between virtual and real communities: Individualism in the network is the new model of sociality; it manifests itself through network focused on partial interests and values. These networks sometimes are able to establish stable virtual communities, more often fragmented and changing ones. Openness and bottom up participation/input to strategic planning processes, these are important factors for linking the projects ‘results to citizens, stake/shareholders proposals. To create a clear link in this context determines the success, in terms of sustainability and resilience, of an urban transformation. Moreover, openness is not just referring to capabilities to act interdisciplinary (essential in the realm of smart cities) or intercultural, but in shaping governance structures based on open data, this open a completely new perspective towards smart governance and smart policies. Finally, creativity is a decisive feature. Creativity as thread between wire and head, the material components of city and the immaterial one, the hardware and the software, the physical infrastructure and the soft policy.

5 FINAL REMARKS

Smart implies joint capitalization, means not just a(nother) prêt-a-portrait concept, and triggers a multifaceted approach ("quick & dirty" ideas / solutions). Drawbacks so far relate to fragmented territorial intelligence and the need for a certain critical mass willing to get involved (Cinta, W.L. 2014). When speaking about governance, we mean an approach allowing for a spontaneous development of a territory or city potentials, exploiting its internal resources through the choice of shared projects and rules started by the public management ability in creating a competences/resources network among all concerned parties (Prezioso, 2008).When speaking about smart, we mean the creating models for strategic sustainable planning by addressing the efficiency of technology across various sectors (energy, environment, public services, accessibility and transportation, etc.) in various typologies and dimension of cities. In other words, it means supporting cities with the development of ambitious and innovative projects embedded in comprehensive urban planning.

Being smart in the design of contemporary city means to pursue a holistic, interdisciplinary and multi-scalar approach to urban issues. To be open in attitude and in use of information is of basic importance: smart cities creates and share data, culture, and knowledge. Smart urban designers collect planning information through use and interpretation of those potentialities embedded in innovative devices and apps (smart phones, social apps, open data repositories…), and in optimizing basic infrastructural networks through inter-related informative system (i-mobility, smart grids…). Lastly, smartness in design consist in understanding and channelling into participated planning processes the many instances generated within the real and virtual communities (even community development planning is becoming 2.0): to towards smart governance. The following points sum up the most significant considerations:

(1) Smart cities are not just based on application of innovative technologies in the urban space, but they should define techniques for promoting both cities competitiveness and reinforcement/improvement of ongoing welfare systems: basic ingredients for quality of life.

(2) Smart cities is not a pret-a portait concept to be standardized around some IT/ICT/energy/ products and services and promoted through central directive: smart cities are based on capability of reading the local context and to adapt/integrate smart solutions to specific problems and needs of the different urban areas.

(3) There are no smart cities without smart citizens: smart urban contexts are those capable a) to share key decisional processes on a multi-level governance base and b) to absorb local communities requests/inputs into decisional mainstreaming.

(4) The process of generating smart cities is based on a strong pact among institutions, enterprises, universities/research centers and third sector stakeholders, Smart cities platform should be based on multi-actors dialogue, within a context facilitated by central and regional institutions, maybe even through a coordination of new EU promoted territorial instruments, and expected funds for territorial cohesion.

To do Smart Governance in metropolitan Peripheries as in the Rome case, a set of rules needs, acting according to the urban and territorial governance, for contributing to build and achieve the strategic planning goals of cohesion. In order to provide an effective impact of network activities on local policies, the URBACT methodology in Morandi-Tor Sapienza projects have been identified and prioritized through the creation of:

(a) The URBACT Local Support Groups, which help to bring together the main players in local authorities (public and private), this network of actors, through the coordination of local technicians (planners, architects, economists, anthropologists and other professionals responsible in matters of urban and regional planning), realizes

(b) The Local Action Plan of the neighbourhood/urban area to be redeveloped/regenerated. The scientific and technical coordination is operated by the University of Tor Vergata (Roma), rest is the work of the stakeholders organized in a LSG.

The plan for Tor Sapienza/Morandi is acting, taking into account the limited resources available for the preparation of the local plan, choosing a narrow sphere of action (Area Based Initiative) . In this area, it addresses the priorities that will enable to activate an economic revival of the area in question (focus on local micro-economies) and the identification of operational solutions for major social problems (focus on housing and social inclusion and upgrading of public spaces). Finally, creativity is even thinking out of the box, to simply understand that there are no ready-made solutions for cities. The era of the smart cities is not the one of standardization and parted functions, but the one of the ad hoc solutions (every city has its own way, new urban identities based on different way of applying/understanding/contextualizing technology), where integrating multiple functions/actors/effective initiatives in a clearly identified area space is often the winning option.

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A Smart "Cairo" in the Making: A Strategic Approach towards a Better Quality of Life

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1 ABSTRACT

Smart Cities is a term used to describe a development based on information and communication technologies. 'A Smart Community is a community that has made a conscious effort to use information technology to transform life and work within its region in significant and fundamental, rather than incremental ways. In the last two decades, the Smart Cities movement, spearheaded by software and hardware companies has injected advanced technology into the mix. European, Far Eastern and American initiatives are witnessed to implant infrastructures and develop communities that cope with and verify the concept. It is believed that "Smart city" as a concept has been introduced as a strategic method to encompass modern urban production factors in a common framework and to highlight the growing importance of Information and Communication Technologies, social and environmental capital in profiling the competitiveness of cities. The significance of these two later assets - social and environmental capital - itself goes a long way to distinguish smart cities from their more technology-laden counterparts, drawing a clear line between them and what goes under the name of either digital or intelligent cities.

In Egypt, it seems almost impossible to adopt such a concept due to the multi-layered and multifaceted urban and sociocultural problems altogether. A closer look at our capital Cairo and its over-population, over-densification, deteriorated urbanism and pollution brings a doubt about the possibility that it can ever be listed as a "smart city". The answer was an attempt to create independent self-sufficient cities and compounds as a prologue to embedding smart infrastructure and to develop smart social and environmental communities. For that, several fully-fledged communities, creating comprehensive integrated residential schemes within the New Cairo plan were launched. One of those was El-Rehab city, covering an area of 10 million m2 to accommodate 200,000 residents. The city has its own transportation system and infra structures, as well as its own facilities including educational, medical, commercial, sports club, recreational and maintenance facilities. After its success, "Madinaty" was ten times a larger city. With international standards, intended to act as a modern extension to New Cairo. Pivoted on the existence of educational institutions, the city includes hospitals, business centers, hotels, sports and social clubs, household services, and entertainment facilities, which meet the day-to-day needs of its inhabitants. The city has several innovative and unique services on its fringes, which caters to the needs of nearby towns and even to the needs of the inhabitants of Greater Cairo. These services include: water sports areas, shopping centers, and varied educational institutions.

Can those cities be considered „smart"? Are they really planned smart? What features of smartness do they posses? How do their residents perceive them? Can they put Cairo on the list of smart cities by hook or by crook? Do they pave the way ahead of planning smart cities in Egypt? What, then are the criteria of Egyptian smart cities to be? The paper at hand aims at answering those questions. It examines the concept within the Egyptian context with the aim of debating its validity and the liability of its application of its underlying implications in the developing countries. The objective is to propose local vision of smart cities in Egypt. The methodology is based on reviewing the concept of smart city and its various applications. Then an evaluation of the experiment of "Madinaty" city will be undertaken in lights of the elected dominant principles of the concept. It is expected that the discussion of the findings will set new norms on how to "plan it smart" in Egypt.

2 INTRODUCTION: THE NEED FOR A CONTEXTUAL DEFINITION OF THE CONCEPT

Reviews of a number of international examples, as well as of the available literature prove that there are two main approaches to tackling the concept. On one hand is an approach that describes „smart city" as the digitally networked and technology-advanced, spearheaded by software and hardware companies has injected advanced technology into the urban mix. On the other hand is an approach that describes smart city that is related to the organic integration of social and environmental systems, where an organic urbanism whole if orchestrated. Between the two approaches, it is argued that „smart city" is an urban labeling phenomenon of an icon of a sustainable and livable city. It can be then implemented where innovation responds to the needs of the community through focusing on their objectives, and where strategic management responds to the social challenges and benefits the citizens.

Making a city smart is an extremely emerging strategy to mitigate the problems generated by the urban population growth and rapid urbanization. Smart cities, generally rely on some criteria, or at least try to achieve them: demography, social aspects, economic aspects, civic involvement, training and education, environment, travel and transport, information society, culture and recreation. Utilization of networked infrastructure to improve economic and political efficiency is core to this process. According to literature, E-government, information science, urban studies public administration, are also determinants of a smart cities. The ultimate manifestation of the idea is when investments in human and social capital and traditional (transport) and modern ICT communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.

There are several workable definitions of the term "smart city" and there are several related idioms. However, it is argued that ambiguity is always associated with the explanations and practical approaches to implementation. Descriptions of a city that has characteristics like: forward-looking way, awareness, flexibility, transformability, synergy, individuality, self-decisiveness and strategic behavior are rather vague, and keep the explanation of the concept uncertain. Several planning and urban conferences accentuate that smart cities as a concept refers to making sustainable communities happen. This requires flexibility of planning criteria by introducing socio-cultural indicators that change from a place to the other. Analysis of socio-spatial phenomena and the everyday practices are paramount; understanding places and their impact on people, and their perceptions of and hence their definitions of "smartness" in their cities. Identifying the maximum number of inhabitants, emphasizing the urge for a large percentage of open/green public spaces, calculating and considering transportations means, maximizing the use of renewable energy sources, while determining to decrease the harmful effect of energy consumption. High standard of services and infra structures, separation of urban functions, and the special fragmentation of the city. Socially oriented city that involves its inhabitants' awareness and sensitivity, sense of belonging through participation, all under foresighted governance and management describe a holistic a smart planning approach that relies on developing theoretical research to be manifested and evaluated. All considerations that make smart cities and deal with smartness as a continuous innovation process are regarded as a political and economic issue in the first place.

Along the past two decades, sustainable, resilient, livable, green and other terms were in fashion, and nowadays the term smart city is envogue and without acurate specifications for deferentiations. Jane Jacobs described the city as "cities have the capability of providing something for everybody only because and only when they are created by everyone". Hence, a smart city is this city that primarily identifies its challenges and hence struggles to find new innovative and efficient solutions for such challenges, and regularly observes its indicators of "smartness". The challenge therefore is rooted in the need for tailored planning solutions that affect place making where quality of place is reflected on the quality of life. Revisiting the concept of smart city, therefor, suggests that there should be more flexible parameters for city planning. From which are the development of more integrated and inclusive urban models, applying more strategic management of natural resources, applying new modes of mobility, greater valorization of all citizens, eventually expected to lead to an overall better quality of life.

While there is no single blue print for a specific description of a smart city, it bacomes prequisite to investigate peoples' identifications of places and to recognize what they really want out of their cities. The aim is to shed light on some issues that should exist in a city to become „smart", while at the same time link and bridge any gaps or misconceptions between aspects considerd by desicoin makers, planners and designersm and residents' perceptions. Based on a content analysis of available literature on the topic, I came to the construct such that features of smartness comprise five major ones (Governance, Technical Features, Pysical Measures, Socio-Cultural Attributes and Environmental articulations). Those aspects and their underlyig categories will be examied in the next part of the paper.

3 THE CASE OF CAIRO

As observed, documented and widely discussed ,the mismanagement and swelling of the metropolitan cities have resulted in a global shift towards prohibiting building new housing projects in the cities while promoting the concepts of gated communities. With respect to the case at hand, Egypt is one of the developing countries facing critical problems of environmental degradation that poses a threat to regional growth prospects and to human well-being. Along its modern history, dramatic changes occurred in Cairo's residential communities under different influences. In 200 years, the old medieval pattern, which housed a homogeneous social group, became a metropolitan city with a wide range of residential types and lifestyles. Blocks of flats represent the common form of housing in western urban pattern for middle class families, in the formally planned public housing for low-income and in the informal contemporary housing areas scattered on the capital's fringes (Christians et al. 1986). As a response, a national strategy has been proposed for sustainable development. The major goal was to satisfy human needs and attain social welfare over time, while maintaining the human and natural resources and avoiding environmental degradation. Implementing this strategy emphasised two important issues concerning the design field:

- Land reclamation, urban and rural development, and new communities were the major part of human and economic development that should be targeted to satisfy human needs and to attain social welfare.
- Human and economic development, environmental protection and resource management were considered the key aspects for sustainable development.

Evaluating the implementation of such issues fall beyond the scope of this paper. However, with its 18- 20 million inhabitants, 40 cm/person of open/green areas, and a 35000 inhabitant/feddan, the desert land around Cairo has witnessed dramatic changes. As part of the response to such overwhelming urban tragedy, the Egyptian government has allowed both the private and the holding sectors' involvement in developing the suburbia and creating new communities, In addition to several other governmental efforts for developing low-cost – out –of Cairo fringe huge projects (argued to be total failure as per theorists, critics and their inhabitants). The reason behind the private sector involvement aimed at the enhancement of competitiveness in applying recent affordable physical and technological advancements and to reduce environmental impacts of the city's over population and densification. Starting as opportunities of desert land reclamations for the agricultural projects, the foundation of the ring road and several road conjunctions attracted many investors who started new housing projects, hence, establishing new communities for upper middle class families, together with some educational, cultural, medical and commercial facilities (GOPP 1993).

In most cases the design features of these new communities were profit-oriented and determined by land developers. Presenting a global commodity and a cultural icon consumed by urban elites world wide, the compounds promote themselves as alternatives tot he hectic, polluted, congested and croded Cairo. Characteristics of the gated communities provided attractive new living conditions for the upper and upper-middle class Egyptian families: low density, extended green areas. Accordingly, a considerable portion of the population living in nearby overcrowded Cairo districts chose to move seeking a „better quality of life". In turn, conspicuous consumption, retreat of he elite from the city and its problems has created demands for new procedures and imposing an extensive use of cars for long distances commuting to and from the city, with a limited availability of public transportation (Abdel-Hadi & Elazhary 2009). Accompanying and following the January 2011 revolution and up to date, we are experiencing an era of tremendous change, geopolitical and economic frameworks; a complete sociocultural upheaval with new urban needs. This causes a rapid urban deterioration that in turn puts the entire residential essence at risk. While the details of the urban problems of Egypt fall beyond the scope of this paper, yet, it is worth mentioning that they are wicked and tangled. There are basic technical, physical and material problems that obstacle any urban development. These are:

- Messy disorganized urban fabric.
- Unique problems of subcultural conflicts.
- Difficulty in waste management.
- Scarcity of resources (water, electricity and fuel altogether)
- Air pollution.
- Human health concerns.
- Traffic congestion.
- Inadequate-deteriorating and aging infrastrcture.

More social and organizational problems include multiple and diverse stakeholders, high levels of interdependence, competing objectives and values, social and political complexity. Based in the preceding it is on top of the national necessities that the city should be rethought, with the recurring social and cultural changes. Such necessities include, but are not limited to:

- Development of more integrated and inclusive urban models.
- Strategic management of natural resources.
- New models of mobility.
- Greater valorization of all citizens.
- An overall better quality of life.

Back to the private sector contributions to the national developmental strategies, one of the large developers has initiated the idea of a fully-fledged community 15 minutes away of East Cairo in 1996 "El-Rehab city". East of Heliopolis on Cairo-Suez road, outside the ring road. El-Rehab is planned to accommodate 200 thousand residents. All facilities and services included schools, a sporting club, business and banking zone, medical center, clinics, transportation means. Residential clusters vary from apartments buildings to town houses to villas. All surrounded by greenery and connected through pedestrian passageways. Upon its success, and learning from its faults, a 10 times the area was "Madinaty", more 15 minutes far. Out of the city-borders gated residential communities that 15 minutes north of El-Rehab, close to the second ring road (under construction). Planned as a totally self-sufficient city, to accommodate a population of 600 thousand in 120 thousand housing units of apartment buildings, town houses and villas. Pavements and green areas, pedestrian walkways and bike paths are alongside all roads. Wide promenades for pedestrians lead to the service areas, limiting pollution and guaranteeing the safety and comfort of pedestrians and children. Exceeding the measurements of compounds, both EL-Rehab and Madinaty were attempted to create independent self-sufficient cities as a prologue to embedding smart infrastructure and to develop smart social and environmental communities.

El-Rehab City:

Primarily intended for the lower middle class in the mid nineties. Upon its success, it was transformed into one of the most expensive communities. An escape from the original crowded, overpopulated, noisy and polluted districts. Switching home from an apartment to a villa, residents chose El-Rehab city seeking for a better quality of life; private, quiet, green, and healthy environment, with all services included. One of the most successful aspects on which it was based on is the provision of services and transportation of bus lines to and from and from Cairo.

El-Rehab city Master Plan

Madinaty

Madinaty was initiated a decade after El-Rehab has proved to be one of the most attractive communities. The commercial areas contain shopping centers designed according to international standards. All local and international merchandise is readily available in addition to varied entertainment facilities.

The commercial areas also include districts situated within the zones that are near the residential areas, providing its inhabitants with their day-to-day needs. There are also districts clustered in different parts of

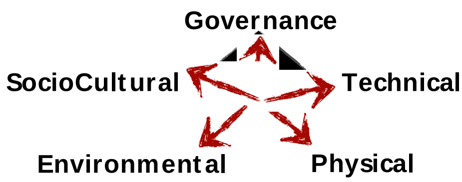
Madinaty that provide major services; open-air shopping areas (like the promenades, for pedestrians only) or malls for international brand names. Technology is utilized to optimize the water used for the irrigation of the existing gardens and golf courses available.

Madinaty Master Plan

Although Madinaty is a private sector gated community, however, in its advertisements, a claim of smartness was avowed. So I decided to examine the aspects of smartness claimed through my personal observation. Doing so, I will also be examining how do the residents perceive their city through participatory investigation. Accordingly, I would be able to read through both findings and achieve the objectives of the paper.

4 THE FIELD RESEARCH

The methodology of the next part of the paper is an in-depth qualitative study, exploratory in nature, based on a grounded observation included reflections of the smartness of Madinaty, and a field survey that investigated the residents' perception of the concept. Tools for data gathering relied on photographic and observation methods, together with an integrative multidimensional tool applied on a random sample of a number of thirty residents. Residents comprised different age groups, genders and affiliations. However, analysis oft he findings did not consider demoraphic or culrual backgrounds variations. Further more, there are other stakeholders that were nit included in the investigation, such as representatives oft he owner companym workers in the city, and frequent visitors.



The field research relied on that test aspects as listed in the following table:

Governance	Technical Features	Pysical Measures	Socio-Cultural Attributes	Environmental Articulations
Holistic/integrative vision Objectives and goals Strategic and action plans Decisin making policeis Monitoring and assessment research and development Operational costs and maintenace	Wired driven & netwroked Integrated data base Connectivety and accessibility Digitial divides Information & community gatekeeps powered	Landuse & activity locations Spatial fragmentation Infra structure ad mobility Pulic servies Open/public and green spaces Minimizing influence of roads &	Connectivity, awreness and solidarity Participation & partnership Creation of small jobs Sense of belonging, privacy, secutiry, identity	Monitoring ande decreasing environmental impact Renewable energy resources Energy efficiency & concumption Reducing environmental stress

5 FINDIGS: FEATURES OF “SMARTNESS” IN EL-REHAB AND MADINATY:

Both the personal observation as well as the residents’ investigations revealed the following:

Governance:

Governance showed no smartness. Although there is an attempt to involve residents in decision making through creating (owners’ council), However, vision, objectives, plans (strategic or action), decision making

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practices, are all central and city is entirely run by the owner company, There proved to be random residents satisfaction surveys but regretfully there was not a sign of action/participatory or post occupancy evaluation research that would feed any research and development decisions.

Technical Features:

Madinaty can be considered as on the correct path in developing into a digital city. However, technical smartness as described/defined of smart is still in its birth phase. The city is integrated with a wired-driven network. Indeed there are "community-connectivity" yet, residents are not connected to the city database. Residents have to run their errands and accomplish their chores physically rather than virtually.

Physical Measures:

There are several aspects can be described as smart. From which are the spatial fragmentation/separation of urban functions/landuse/info, structure and mobility, public services/ percentages/open-public and green spaces/ minimizing the influence of road and vehicles in the residential plots. However, there are other aspects that can be depicted as "not smart"; from which are the traditional building materials and building techniques that are not entirely climatic-responsive, high building and maintencae cost. Some residents also expressed dissatisfaction with the monotonous designs. More over, residents expressed their dissatisfaction with the energy/environmental unfriendly designs causing the consumption of a higher percentage of electricity in air conditioners, etc. Although the city provides transportation to and from sevral spots in Cario, and also offers transportation inside the city, however, relying on the car/vehicle is extensive.

Socio-Cultural Attributes:

Madinaty can be described as partially smart in this respect. People are connected via group websites, small groups and subgroups are developed, creating minor solidarity and partnership. More smart aspects were proved; sense of privacy, sense of security, sense of belonging, security from physical attacks, intrusio, insult,, invasion by unwanted social groups, etc. The overall life style seemed convenient to residents. It can be argued that a smart community is in its in birth phase.

Environmental Articulation:

Seems also environmental smartness in Madinaty is in its birth phase. However, the city proved to be on the track, with respect to the application of renewable energy, reducing environmental stress, recycling, waste management, minimizing resources. However, there proved to be no clue on the monitoring and decreasing environmental impact. There seem to be lack of awareness with respect to the concept of environmental smartness, as a core, basically- which is a dilemma in the Egyptian paradigm in general. Solar panels appeared here and there, use of recycled water was obvious, however, many other envirnmental aspects are missing.

waste managment and solar panels

green and play areas

This suggests that yes, indeed Madinaty has unconsciously applied several aspects of smartness. The case at hand can be considered as a pilot, underdeveloped project that can be developed into a real "smart city" example. Despite the fact that some aspects are still in their birth phase, and other aspects are still controversial, yet, it can be argued that such project is an integrative approach for understanding initiatives that smart cities revolve around, such as governance, policy context, economy, technology, roads, open/public spaces, buildings and infra structure, people and community and safegurading the natural environment.

As for residents' defintion of the concept (based on ranking and few open-ended questions in the investiagation tool), it can be asserted that residents define „smartness" based on socio-cultural aspects and their associated physical aspects. Activity locations, separation between urban funtions and the urban fragmentaion, affordability of services, greenery, privacy, security, children safety and landmarks are aspects that primarily involved in their defintions. Madinaty has really succeded in achieving the home zone scale; minimizing the influence of road and vehicles on the lay out, creating a perceptive of territorial geographic boundaries, a shared ownership and responsibility for communal space, while creating a more holistic mental image of the entire residential environment.

6 DISCUSSION: SOLUTIONS DEVELOPED OR QUESTIONS EVOKED?

While, Lynch emphasized people's perception of form and imageability leads to argue that the human side of the built environment is still not incorporated in the physical features of planning and housing design, codes and legislations also marginalize the socio-cultural attributes of resident user groups. Egyptian cities are really at risk, rapid and mismanaged swelling of the metropolitan has caused a socio-cultural confusion. Heterogeneous social mobility did lead to chaos in the residential areas in the city. The example at hand of Madinaty is an example for a private sector project. Hence, it has several potentials that can be easily developed into a smart city – only IF awareness of the urge to transform into a smart city became a belief for all involved stake holders, decision makers, investors, planners and designers. However, there are several questions evoked here:

- Will smartness be a previledge for only the upper and upper middle class gated communities, as reviwered in this case study?
- When will it be the approach for dealing with the new housing projects that are scattered everywhere in all Egyptian cities, that are constantly being built without any considerations for any of the mentioned smartness parameters mentioned in this paper, except for „shleter"?!

It is my belief that such an approach needs to be adopted and applied for low cost communities for the majority of under spoken cairenes who suffer from inhumane housing conditions.

7 CONCLUSION

This study at hand needs further work, it should target the other societal sectors, and it should focus on the governmental perspective; seeking a holistic explanation/definition of the concept and on practical integrative approach to its application. Any how, it is argued that, to really create a smart city, is to create the conditions of continuous learning and innovation. Understanding mechanisms and how cities are constructed, convert and manipulate relationships that grow in urban environment. On this basis, it has been proved that when dealing with the issue, an integrative multidimensional approach is required. This means that generating an integrative knowledge base which follows a research based design process; then, practicing with collaborative and shared attitudes; also, breaking the boundaries between the design field and other fields of specialisations; all previous approaches are essential for creating smart cities. Such integrative approach can be summarized as follows:

(1) Define a vision as part of national governmental plan.

(2) Prepare a strategic and action workable plan.

(3) Launch and apply a model for smart city innovation.

(4) Asses and develop initiatives.

(5) Set and promote short term challenging goals.

(6) Balance the optimal theories on smart cities with residents' perceptions and aspirations.

To sum up, this study draws on several directions for further reserach. As indicated in the results, perceiving „smart city" is still in ist birth phase with respect to the Egyptian decision makers, planners and designers. While for residents, smartness is related to identifying places that contribute to a better quality of life. Accordingly, it is believed that the study at hand is merely a prologue for future investigations concerning the awareness of what a „better quality of life" is. The design and maintenance of a better environment that grants the well-being of its inhabitants implies both the planning and the demonstration of the built-environment in accordance with the socio-cultural attributes of the residents, together with their psychological and intellectual needs and preferences. Such manifestation is a collaboration of political, economical and legal decisions, together with the physical planning and design (World Bank 2008). Accordingly, residents' identification of place is derivative for the generation of ideas and frameworks for all parties involved in the creation of cities.

To conclude, a smat city is this city that offers innovative solutions to its urban problems, hence insuring a better quality of life that results in the prosperous of satisfied residents. It is my hope that the current state of Egyptian upheaval would consider such priority.

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