

RESTRUCTURING CITIES FOR SUSTAINABILITY – A METABOLISM APPROACH

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Summary: (ten lines maximum; approximately 125 words)

The FP7-funded SUME project (**Sustainable Urban Metabolism for Europe**) is focusing on the way how future urban systems can be designed to be consistently less damaging to the environment and particularly to climate change than in the present. Urban development scenarios linked with an agent-based urban metabolism model will try to demonstrate the potential to build and rebuild existing (European) cities in ways which will extract much less of specific energy and material resources from the environmental system, thereby reducing green house gas emissions and improving the climate change performance of urban systems. The built environment – in a systems logic the stocks of the urban system – is using a substantial portion of resource flows to be built and maintained. On the other hand, the spatial qualities of the built urban systems, the so-called “urban form”, have an impact on quantities and qualities of resources needed to maintain urban life. That impact will be estimated and conclusions for future urban development strategies be drawn.

Key Words:

Impact of urban form on urban metabolism, on resource and energy use; impact of urban form on climate change; sustainable urban development; urban development scenarios; European 7th Framework Programme research project

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I. INTRODUCTION: NEW URBAN DEVELOPMENT STRATEGIES

‘...appropriate city sizes, efficient external and internal accessibility, ordered mobility, appropriate shape and structure of the urban system or the urban hierarchy, and levels of compactness of the settlements prove crucial in determining not just the wellbeing of local populations, but increasingly the attractiveness of the sites with respect to external firms and the efficiency of activities already located’ (OECD, 2001: p154).

Urban development is running environmental risks, consuming huge amounts of resources and putting strains on the environmental system. The FP7-funded SUME project (Sustainable Urban Metabolism for Europe) is focusing on the way how future urban systems can be designed to be consistently less damaging to the environment and to climate change in particular. With specific relevance to the climate change, the SUME-approach is focusing on the potential to reduce Green House Gas emissions and the use of fossil fuels by restructuring existing urban systems.

SUME will analyze the impacts of urban form on resource use. In a number of scenarios depicting the future development of selected European cities, the future potential to transform existing urban building and spatial structures into structures with significantly reduced resource/ energy consumption, shall be estimated. The approach thereby will take into account the great differences between various cities’ urban forms at the outset. Consequences for urban development strategies and planning instruments will be drawn from the results.

The project started in November 2008 and will be carried out over a period of 3 years (up to October 2011). This paper presents an overview of the project and identifies how a metabolism approach may be applied to urban development and planning issues, attempting to improve European cities’ climate change performance.

II. URBAN FORM IN EUROPEAN POLICY

The role of urban form in contributing to sustainable development has been recognised in a range of European policy documents over recent years. A number of these documents have called for a stronger role for land-use planning and argued for denser mixed-use urban development. This type of development generally equates to the idea of the ‘compact city’ (although few documents have explicitly referred to this concept). The merits of denser, mixed-use urban development have been frequently described in European policy documents in terms of environmental benefits although it is also clear that there may also be a variety of social and economic benefits.

The 1990 Green Paper on the Urban Environment argues for denser, more mixed land-uses, taking the traditional European city as its model (CEC, 1990). The ESDP advocates the idea of

the compact city, or the city of short distances (CSD, 1999). The European Commission's 2004 preparatory document on the Urban Thematic Strategy supports high density, mixed-use settlements, the reuse of 'brownfield' land and empty property, and planned expansions of urban areas rather than ad hoc urban sprawl (CEC, 2004). The Leipzig Charter on Sustainable European Cities (agreed in 2007 by the European Ministers responsible for urban development) asserts that compact settlement structures form an important basis for the efficient and sustainable use of resources (German Federal Ministry of Transport, Building and Urban Affairs, 2007). Mixing housing, employment, education and recreational use in urban neighbourhoods is identified as more sustainable.

Various reasons for managing the urban form can be identified in European policy documents. Many of these present environmental arguments although there are also a variety of social and economic justifications (see also OECD, 2001). The 1990 Green Paper on the Urban Environment recommends strategies for dense mixed-use developments as a way of increasing local accessibility to jobs and services, stating that dense mixed-use development is more likely to result in people living close to workplaces and the services they need for everyday life (CEC, 1990). The ESDP argues that spatial development policy 'can make an important contribution to climate protection through energy-saving from traffic-reducing settlement structures and locations' (CSD, 1999: p31). The 2006 Thematic Strategy on the Urban Environment asserts that avoiding urban sprawl through high density and mixed-use settlement patterns can help to reduce resource use, including land consumption and transport and heating requirements (CEC, 2006).

Many documents regard urban sprawl as a key issue to be addressed through urban development policies. The European Commission's 2004 preparatory document on the Urban Thematic Strategy (CEC, 2004), for example, states that poor land use decisions create urban areas that are environmentally unsustainable and also unattractive to residents. According to the 2007 European Green Paper on Urban Mobility, the suburbanisation of development and the resulting dispersal of home, work and leisure facilities has resulted in increased transport demand (CEC, 2007).

The 1990 Green Paper on the Urban Environment argues for 'a fundamental review of the principles on which town planning practice has been based' (CEC, 1990: p40), stating that strict zoning policies have led to the separation of land uses which in turn has contributed to large increases in traffic – one of the main contributors to many urban environmental problems. The Leipzig Charter calls for stronger land supply controls through spatial and urban planning (German Federal Ministry of Transport, Building and Urban Affairs, 2007).

A number of policy documents also recognise some of the difficulties in promoting higher density mixed-use development, especially via European policy. The European Commission's 2004 preparatory document on the Urban Thematic Strategy for example recognises that there are limits to acceptable urban densities (and that some urban areas suffer from poor quality environments due to overcrowding) and that reversing urban sprawl or increasing land-use densities is no easy task (CEC, 2004: p30). The issues of competence and subsidiarity (taking decisions at the lowest appropriate level) are clearly relevant to European policy in this area. This is also recognised in the European Commission's 2004 preparatory document on the Urban Thematic Strategy, which states that 'it is not for the Community to set a standard system for making land use decisions, or to define the "ideal" settlement pattern as each town and city is unique and the

solutions needed to achieve a sustainable urban environment are specific to each case' (CEC, 2004: p30).

III. THE SUME PROJECT – SUSTAINABLE URBAN METABOLISM FOR EUROPE

1. Project aims and structure

The driving forces behind the dynamic processes of urban development are demographic change, the individual performance of urban areas in (global) economic competition, the speed and direction of applying technological innovations under various societal/political conditions. While the dynamics of urban development in these components have been studied and debated for a long time, the interrelation between urban development and urban metabolism in the sense of physical interaction with the environment is far less understood. More specifically, the main challenge of this project is to find a link between the urban metabolism approach and urban spatial development concepts in a way to foster a more sustainable development path of urban areas in the future.

The outcome of the SUME project should provide answers to the following central questions:

- What are the most adequate assessment approaches to deal with the territorial dimension of sustainability in collaborative decision-making frameworks?
- How far do different types of urban forms and of growth and decline patterns which can be found in Europe determine sustainable use of material and energy and allow for efficient transport patterns?
- To what extent can urban planning and demand management incorporate and influence stakeholders' values in order to re-direct current patterns of space consumption and infrastructure utilization towards sustainable development?
- What shall a good practice guide, based on the on urban metabolism approach contain for the assessment of the impacts of various urban forms?

Based on the urban metabolism approach, the flows of resources, energy and waste are being used to maintain the urban system. The built environment – in a systems logic the stocks of the urban system – is using a substantial portion of flows to be built. The way cities are being built has a great impact on the quantities and the qualities of flows needed to maintain the urban system over time. The SUME approach will analyze the technological and spatial qualities of built urban systems (the stocks), and analyze the impacts of these “urban forms” on the qualities and quantities of resources needed and maintain them subsequently. This analysis of urban forms in a stocks & flows-model will show what kind of urban forms and which built structures can be used in order to reduce resource and energy consumption in urban systems.

The project comprises four main parts (work-packages) focusing on: (i) the dynamics of urban development; (ii) urban metabolism models; (iii) the relationships between urban form and structures on use of resources and energy; and (iv) policies and strategies for sustainable urban development (Figure 1). These four parts are described in turn below.

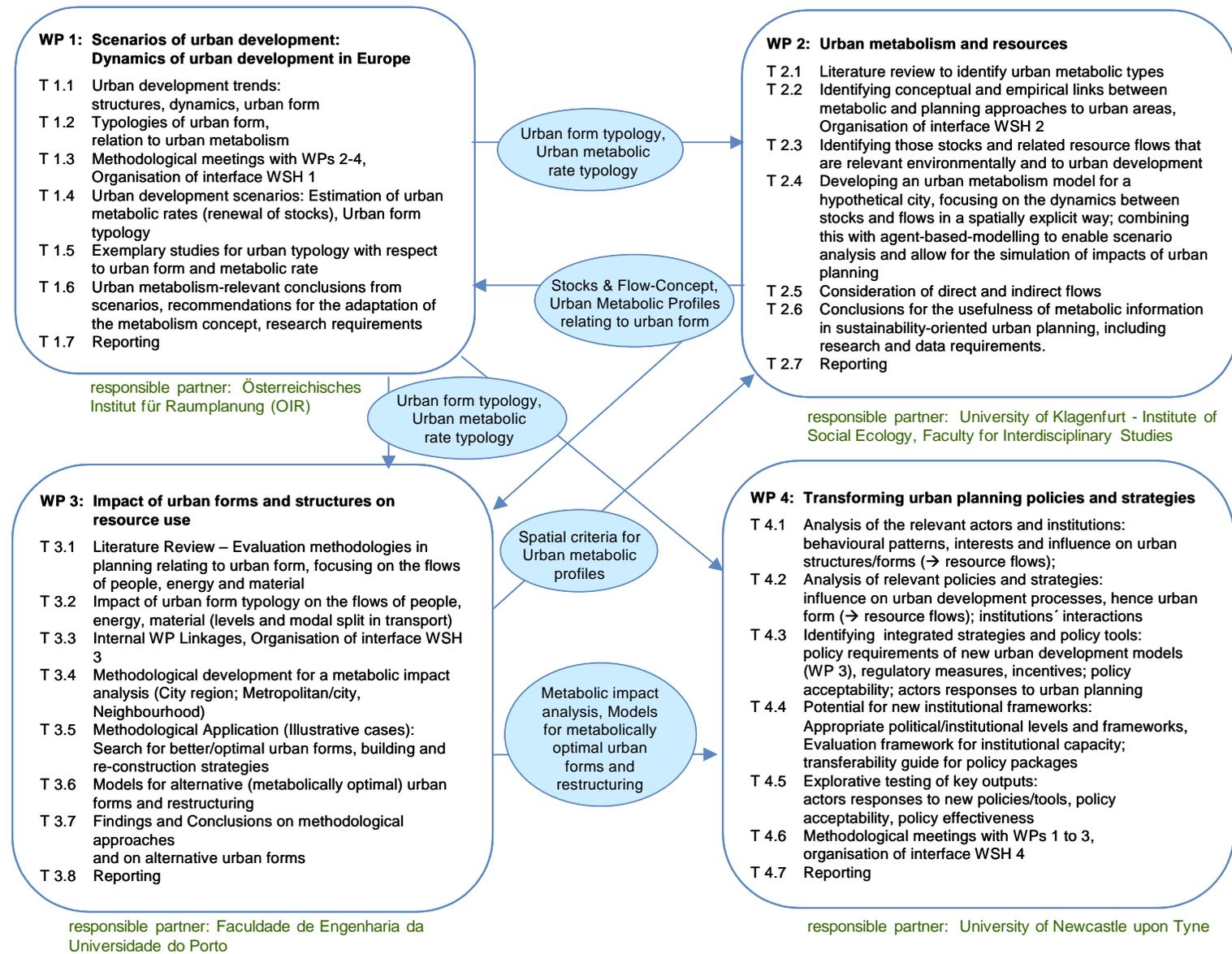


Figure 1: SUME project structure, tasks and links

2. Dynamics of urban development

Europe is one of the most urbanized continents in the world, with some 75% of its population living in cities. The continuing expansion of urban areas into surrounding countryside ("urban sprawl"), effected with little planning and driven by market forces, is fast becoming one of the main 'ignored' challenges facing Europe.

Increased consumption of energy, land and soil as well as the need for more transport infrastructure lead to serious environmental problems. Sprawling cities are also a source of increasing greenhouse-gas emissions.

The driving forces behind the trends of future urban development will be analyzed and applied to a typology of urban forms (densities, spatial patterns etc.) and a typology of transformation patterns (fast or slow growth, expansion or inner-city development etc.). Based on a set of quantitative input data, including population projections and assumptions on long-term economic development, scenarios of urban transformation will be drafted for a number of selected urban regions in Europe. The main steps in this stage of the research include:

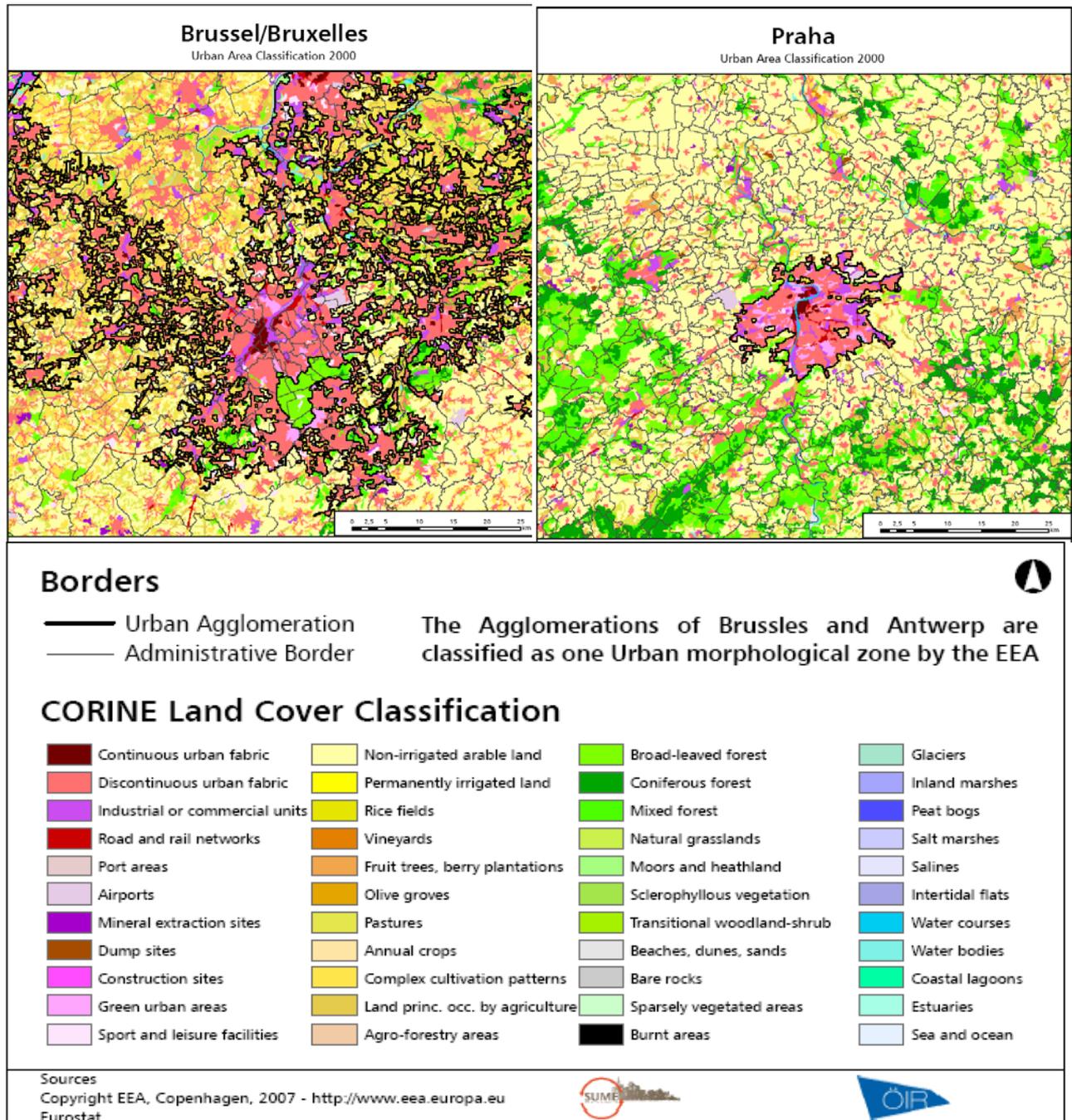
- elaborating the major driving forces behind the trends of future urban development, including population change, housing trends, economic trends;
- developing a typology of urban forms (densities, age of buildings) and defining specific urban stock profiles (as compositions of urban forms), representative for urban regions in Europe, which can be linked to the use of resources (space, energy, material)
- highlighting this linkage through analyzing empirical studies in the fields of energy, construction and transportation – in close cooperation with the metabolism model (see below)
- drafting urban development scenarios for selected cities/urban regions, by defining specific transformation paths (fast or slow growth, expansion or inner-city development etc.) and estimating the quantitative potential to change (to build and rebuild) the existing urban stocks,
- deriving generalized estimates of the change potential in selected urban regions based on the urban form and urban stock typology.

The understanding of the variety of urban development is essential as a systematic background in which urban metabolic modelling and the design of alternative urban development strategies will be applied in the future. It will be important to know, what type of urban development is of great (quantitative) relevance among European urban areas, and also which of the suggested development strategies is appropriate in which kind of urban development pattern. The mid- to long-range scenarios for selected European urban regions will allow quantitative estimates to be made regarding the potential to restructure existing urban forms.

Depending on the urban form at the outset and on the future development strategies applied, there will be a great variety of potential to change: Cities with low developmental dynamics and relatively young built structures are expected to have a lower change potential than cities which are expected to undergo a major transformation phase in the future. The spatial, material and

energetic qualities of the existing building stock will also be of great importance for the choice of strategies. By applying a metabolic approach, it will be possible to calculate a material/energy balance for the choice of renovating vs. rebuilding, using a life-cycle concept.

Using a basic urban form typology, an investigation will be undertaken, which urban forms may have varying impacts on different resource flows (by moving people and goods, using material and energy). Based on the typology of urban forms, the underlying spatial fabrics will be analyzed with empirical data. It will be the major task here to establish a methodological link to the urban metabolism concept. Detailed investigations will have to be done on the question of what types of urban forms have significantly different levels of transport distances and options to use public transport, energy consumption and in/output of (building) materials.



*Figure 2: Examples for variations of urban form:
Urban Morphological Zones Brussels and Prague
ÖIR, based on EEA, Copenhagen 2007*

Source:

To give an impression of how extremely different urban forms in agglomerations of comparable size can be, Figure 2 above is presenting two potential examples for the projects' empirical research focus: The qualitative assumptions concerning the impact of varying urban forms on

metabolically relevant flow parameters will be substantiated with evidence from different urban regions. The graph shows two examples from the Urban Area Classification of the EEA (EEA, Copenhagen 2007).

3. Urban metabolism models

Decisions made in urban planning have an important impact on the sustainability of Europe's cities – and urban developments worldwide. A dynamic, spatially explicit model of urban metabolism – which will be developed within SUME – can enable planners and other relevant actors to approximate how changes in urban structure will affect future material and energy flows, both qualitatively and quantitatively. Thus, it would constitute a useful basis for decision-making.

The present day form and structure of most major European cities is not the result of continuous planning efforts but rather of incremental and often unchecked development processes. The proposed urban metabolism model can take this particular situation into account by allowing for the assessment not only of material and energy flows but also of stocks and their specific contribution to the urban area's metabolic throughput across scales of space and time. Based on this knowledge of environmental impacts, future planning and restructuring of elements within a city can be more precisely targeted at increasing sustainability.

However, urban planning for sustainability is clearly not as straightforward as simply making decisions that might lead to the reduction of material and energy throughput. Instead, urban planners and other relevant actors face a number of explicit and implicit constraints under which they must make their decisions. The proposed urban metabolism model proposes to integrate these circumstances into the analyses of possible trajectories of urban development by combining the accounting of stocks and flows with an agent-based approach (Figure 3).

In order to develop a model that could thus positively support decision-making in urban planning, it is necessary to pull together what currently seem to be the loose ends in urban metabolism research into a joint European fabric: On the one hand, we can build upon the research on urban metabolism that has been done to date and make use of the associated empirical findings. On the other hand, making urban metabolism assessment into a powerful decision-making tool requires strong cooperation between the urban planning and the social metabolism communities.

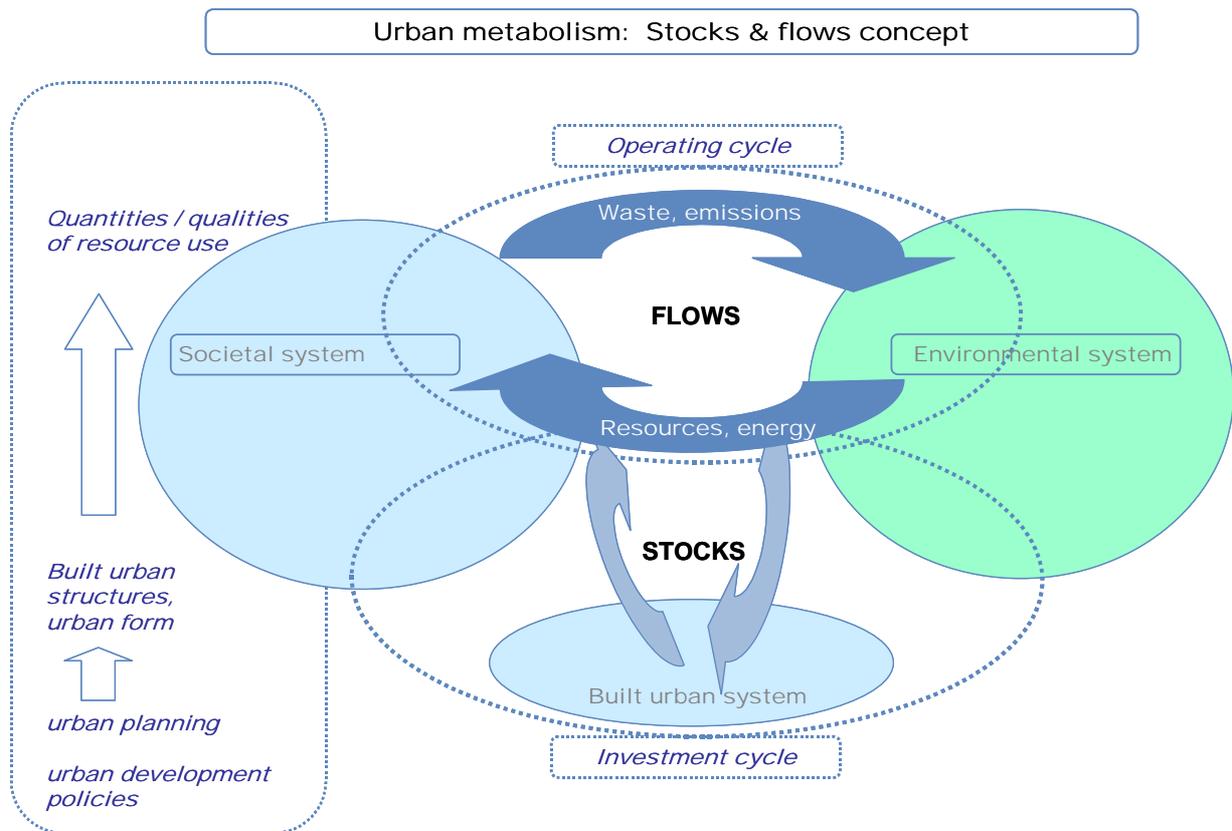


Figure 3: Stocks and flows concept within the SUME project

Progress beyond the state of the art will be achieved by developing a model that has the following features:

- It should assess relevant aspects of typical urban metabolic dynamics in a medium time perspective (c.30 years)
- It should implement the non-linear interactions between physical stocks (infrastructure, buildings, etc.) and flows (energy and material used to reproduce and maintain the stocks). This is in itself a major innovation, as all published urban metabolism studies are considering only flows
- It should be spatially explicit (i.e. go beyond the currently used black box models)
- The model should be able to simulate the consequences of different urban planning options in terms of future metabolic requirements (based on typical metabolic rates, which have to be identified yet)

In this context especially, the integration of an agent-based approach is of particular importance. Meso-scale urban spatial patterns can be simulated as to how they are also the result of processes concerning and the behaviour of micro-scale actors (Epstein and Axtell 1996; Axelrod 1997; Brown and Robinson 2006). For the proposed project it will be instrumental to recognize that urban planners are but one relevant actor determining the metabolism of a city. Thus other actors, such as households or firms will be included.

Results from analyses of a variety of processes such as land use (Berger 2004), material and energy flows, or time use can be integrated using this type of approach and effects of different urban planning strategies on infrastructure requirements, material and energy flows, settlement patterns, economic development and other relevant features of cities can be simulated. This supports the evaluation of future options and planning strategies.

The SUME modelling of urban metabolism will apply a specific approach, namely to analyze different material and energy flow levels being used in various urban settings, thus providing specific metabolic profiles to individual urban areas. It will be possible to compare these profiles between urban areas and in this way a contribution to the evaluating a 'degree of sustainability' will be created.

The metabolic approach as conceived here will encompass all the elements of the current debate on energy efficient cities and low carbon cities. This debate clearly points to the role of carbon emissions as an embracing and operational indicator of sustainability. The model will have four basic components:

1. A database component, providing the data required by the other components in a standardized format, which can thus be adapted for each urban area;
2. An urban form component, interpreting the urban form data;
3. A dynamic stocks & flows component. The stocks are derived from urban form and other urban statistical data. The related flows are determined by stock additions, renewal and maintenance, as well as use rates;
4. An Agent-Based component modelling the decision-making and influencing the evolution of urban form, stocks and flows.

The dynamic stocks & flows component will be further divided into specific functional modules based on different types of infrastructure: built environment, transport, etc. The relations between the urban form, stocks and flows model will be tested empirically through a benchmarking process relying on existing data.

The combination of urban form and stocks & flows metabolism will allow us to determine Urban Metabolic Profiles. These will be linked to spatial criteria (see below). The types of data which will be used by the different model components are in some case standard and available for most cities (population density, age, affluence, building ages), but in other cases may need to be extrapolated from EU or typical averages (building height, surface, most important material components, energy use). Regarding these aspects Vienna, Geneva and Gothenburg and an example of a shrinking city (probably in East Germany) would be prime candidates for study. For Vienna and Geneva, the available statistical data is well understood and is of good quality. Moreover, good contacts exist to the city administrations and to researchers who have compiled substantial databases on metabolic characteristics.

In addition to statistical data on urban forms, buildings, various infrastructures, demography, and economics, a number of more technical parameters will be needed (e.g. energy requirements of different types of buildings, transport requirements, emission coefficients, etc). These can be

found in the appropriate technical literature in data collected already by other groups of researchers.

While various attempts to use agent-based models for simulating different aspects of urban development have been made (e.g. Sembolini, 2007; Wagner and Wegener, 2007; van Leeuwen et al, 2007), the application of an agent-based model to understand the influence of different actors on urban metabolism is new. From the existing research, we will integrate ideas of important drivers and dynamics. The Agent-Based component in our model will describe the decision-making processes between important city actors which influence key factors in the urban form component its links with the stocks & flows component, and the stocks & flows component itself. For example, we will describe the influence of policy mixes on urban renewal, building renovation and transit mode choices (Breheny, 1992). These decisions will then be the basis of scenarios exploring the potential for energy use reduction of various policy mixes.

4. Relationships between urban form and structures on use of resources and energy

Looking at the European territory, the wide variety of urban growth patterns not only across vast European Regions, but also across urban and metropolitan areas within the same region is evident. Is this territory a unified one with a prevalent culture or are we in the presence of an embedded multiculturalism with specific and diversified spatial representations? Despite all the recent demographic trends and migration flows, within an increasingly global world, Europe still maintains its own cultural identity. And yet, it is an identity made of diversities. In this context - is it possible to search for a European path to sustainable urban growth and rural enhancement?

This part of the research project focuses on developing methods to assess the impact of urban forms on the use of resources and energy. As SUME's general methodological approach emphasizes, the design of planning policies for more efficient urban metabolisms has to be supported on a thorough understanding of the nature, diversity and changing dynamics of Europe's urban and peri-urban territories, and on our capacity to forecast and explore the whole range of the potentials and limitations of future urban scenarios. A variety of assessment instruments, geared towards the evaluation of resource uses and environmental impact and operating at different and complementary spatial scales, is needed.

Throughout the last decade, assessment theory and practice has clearly been at the centre of the planning debate (see for instance Khakee 1998, 2003; Faludi, 2000, 2006; Voogd, 2001; Lichfield, 2001, 2003; Alexander 2006a, 2006b). However, these debates did not always include matters related to the overall environmental efficiency of cities, as the urban metabolism school points out. And yet we are condemned to prepare a sustainable future for Europe, based on an ecologically balanced environment, on a competitive economy and on a just and cohesive society.

One of the first tasks included in this part of the research is the critical review of the main evaluation methodologies developed since the emergence of Cost-Benefit Analysis back in the 1950s. We have to stress that this critical review will be strictly concerned with the search for relevant assessment principles and ideas that, in a later stage of this project, may prove useful in the design process of our own methodological approach. The Planning Balance Sheet Analysis (Lich-

field, 1956) and the Community Impact Evaluation (Lichfield, 1988, 1996), the Goals-Achievement Matrix (Hill, 1968), the Multi-criteria Analysis (Voogd, 1983; Nijkamp et al, 1990), the Environmental Impact Assessment/EIA (Glasson et al, 2004), and the Strategic Environmental Assessment/SEA (Therivel et al, 1992), are some of the most important methodologies that will be revisited and debated. In addition to these eight ex-ante and somehow utilitarian methodologies (Alexander, 2006c), other approaches, namely the Policy-Plan/Program Implementation-Process (Alexander & Faludi, 1989) and the Plan Implementation Methodology (Laurian et al, 2004; Berke 2006, and also Brody et al, 2006a, 2006b), should be discussed. These approaches have an important role in bridging the gap between evaluation theory and practice. Nevertheless, some of these approaches tend to ignore considerations related to equity and sustainability (Lichfield et al., 1975; Lichfield, 1996; Alexander, 2006a; Moroni, 2006). In contrast, the more recent SEA is an instrument of impact evaluation, geared towards the evaluation of policies, plans and programs. It works with strategies and not on specific development proposals, operating on larger temporal and geographical scales, with growing uncertainty levels and, thus, requiring greater methodological flexibility (Partidário, 2003).

Potentials and limitations will be identified and, in particular, new areas of cross fertilization with the industrial ecology perspective will be explored. Under this perspective, an innovative methodological approach – the metabolic impact analysis – will be developed, tested and applied to a number of illustrative cases. The foundation principles of this approach will be supplied by the work carried out in the first stage of the research (see above) and be based on the urban metabolism concept. Other influential principles will be derived from recently developed assessment methodologies such as the Sustainability Impact Assessment (see Kirkpatrick, et. al., 1999), the Ecological Footprint Analysis, based on the pioneering working of Rees (1992) and Wackernagel, et. al. (1996) and the Low Carbon City approach currently developed by COST C23 (2005) as part of a technical and scientific cooperation action funded by the EU (see also Frame & Vale, 2006).

Present spatial trends and future development scenarios of the main European urban structures, are the evaluation objects of SUME. The challenge for this part of the research project is to develop an innovative evaluation methodology that can truly understand and appraise these scenarios, bearing in mind to make the concept of urban metabolism operational.

5. Policies and strategies for sustainable metabolism

The aim of this part of the research project is to develop new strategies, policy tools and a transferability guide for achieving sustainable urban settlement structures. The outputs will be communicated with and of direct benefit to key actors in urban development processes particularly urban planners and policy makers. In this respect, the research helps facilitate the decoupling of the demand for accommodating urban growth from the excessive consumption of finite resources including land. Its focus on application and knowledge transfer fills a major gap between knowledge and action and between policy and implementation. This is particularly important with regard to the implementation of the EU Directives on environment as well as the Thematic Strategies on the Urban Environment, the Sustainable Use of Natural Resources, and the Prevention and Recycling of Waste and Soil Protection.

How to achieve “more value – less impact – better alternatives” in urban development processes – in practice – remains a real challenge: What are the appropriate institutional frameworks; what combinations of policy packages are most effective; what is the right balance between regulatory measures (sticks) and positive incentives (carrots) for motivating sustainable behaviour in the use of resources? While there are several examples of attempts being made for addressing these questions, their transferability and acceptability is difficult to reach.

There is an increasing political, public and professional concerns about how best to accommodate new development: its scale, location and consequences for sustainable urban metabolism. The concern about emerging urban structures (including both expanding and shrinking cities) has grown substantially in the light of increasing evidence on the impact of development on environment and climate change (Breheny, et al, 1993; Owens & Cope, 1992). Influencing urban structures and promoting more sustainable forms of behavior will require more than single policy instruments. Integrated policy packages, comprising a mix of regulatory, pricing and technological measures will be necessary to achieve change. The research will also focus on the relationships between policies and how they can be combined effectively so that synergies are maximized and conflicts are minimized.

Parallel to the rising concerns about decoupling urban growth from wasteful use of energy and resources, new forms of institutional relationships are emerging (Grande 1996; Kohler-Koch 1996). Power to shape urban structure is now more diffused, with a large number of stakeholders (including public, private, NGO's, local organizations, interest groups, etc) involved in decision-making processes (Mathur et al., 2003; CEC, 2001). The diversity of institutional structures and relationships mean that same policy (or combination of policies) implemented in different regions or countries with differing institutional conditions might result in very different outcomes due to factors such as the division of responsibilities, the role of the private sector in policy implementation or mechanisms for dealing with cross-cutting issues. The way in which institutional conditions (not just the policies themselves) can affect the implementation and delivery of policies and the achievement sustainable urban metabolism will also be assessed.

The strict enforcement of laws and regulations for the implementation of policy programs is steadily giving place to participation procedures and bargaining processes among major stakeholders (Hibbard & Lurie, 2000). Decision-making processes related to the capacity and responsibility to guide the European cities along a more sustainable path has to adapt to the fall of the so called blueprint planning paradigms. The European comparative studies concerning the planning of metropolitan areas (Salet et al., 2003; Kübler & Heinelt, 2005), or the debate around strategic spatial planning and the local integration of public policies (like for example Albrechts et al., 2003; Vigar et al., 2000; Healey et al., 1997; Healey, 2004), show the importance of actors' behaviour and inter-institutional cooperation networks for the achievement of strategic development goals. The design and assessment of development scenarios as alternative futures assumes a particular importance within a collaborative framework (Healey, 1997). Hence, for policies to be effective, they need to be acceptable by key actors (including individuals). The challenge therefore is to identify how to increase the acceptability of policies through the right balance of incentives (pull measures/carrots) and regulation (push measure/sticks).

Hence, the outputs from this stage of the research are aimed at developing not only new strategies and policy tools, but also guidelines on the whether and how such tools can be transferred from one place to another in Europe and beyond.

IV. CONCLUSIONS AND EXPECTED RESULTS

Urban development includes processes of growth in new areas, decay and abandonment and also restructuring and rehabilitation in parallel. The weight and speed of these alternate components of urban development is varying strongly between different cities and countries, leading to different patterns of land use, resource and energy consumption.

The SUME project will analyse the potential to transform existing urban built environments (buildings and spatial structures) in order to significantly reduce resource/energy consumption, taking these differences into account. From a strategic point of view, it will be necessary to know whether existing rates of transforming urban structures should be increased in order to improve urban form and to reduce resource use.

The results will provide essential inputs for environmental and spatial policy making, for urban development policies and for transportation policies at both, national and local levels. It will be useful for scientific and practical application.

One of the potentially most fruitful impacts is the improved communication between until now rarely linked research communities -- if the suggested, innovative approach is producing new and applicable results as envisioned here, a strong impulse for future research and development activities across these communities' boundaries will be given.

The communication of the suggested approach and of the results produced to policy makers, stakeholders, urban planners, social networks will be an important impulse for deriving results of high quality and also will improve the tools to be used for future dissemination to a wider public.

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Further information about the project can be found at <www.sume.at>.

VI. BIBLIOGRAPHY

- Albrechts, L., Healey, P., Kunzmann, R. (2003) “Strategic spatial planning and regional governance in Europe”, *APA Journal*, 69(2), 113-129.
- Alexander, E., Faludi, A. (1989) “Planning and plan implementation: notes on evaluation criteria”, *Environment and Planning B: Planning & Design*, 16(1): 127-140.
- Alexander, E. (2006a) “Evolution and status: where is planning evaluation today and how did it get here?”, E. Alexander (ed) *Evaluation and Planning, evolution and prospects*, Ashgate, Aldershot: 3-16.
- Alexander, E. (2006b) “Problems and prospects: dilemmas in evaluation and directions for the future”, E. Alexander (ed) *Evaluation and Planning, evolution and prospects*, Ashgate, Aldershot: 267-276.
- Alexander, E. (2006c) “Dilemmas in evaluating planning, or back to basics: what is planning for?”, *2nd World Planning Schools Congress*, Mexico City.
- Axelrod, R. (1997) “The complexity of cooperation: agent-based models of competition and collaboration”, Princeton University Press, Princeton.
- Berger, T. (2004) „Agentenbasierte Modellierung von Landnutzungsdynamiken und Politikoptionen“, *Agrarwirtschaft*, 53(2)
- Berke, P., Backhurst, M., Day, M., Ericksen, N., Laurian, L., Crawford, J., Dixon, J. (2006) “What makes plan implementation successful? An evaluation of local plans and implementation practices in New Zealand”, *Environment and Planning B: Planning & Design*, 33: 581-600.
- Breheny, M J (1992) “Sustainable Urban Development and Urban Form Pion”
- Breheny, M., Gent, T. Lock, D. (1993) “*Alternative Development Patterns: New Settlements*”, HMSO, London.
- Brody, S., Carrasco, V., Highfield, W. (2006) “Measuring the adoption of local sprawl reduction planning policies in Florida”, *Journal of Planning Education and Research*, 25: 294-310.
- Brody, S., Highfield, W., Thornton, S. (2006) “Planning at the urban fringe: an examination of the factors influencing nonconforming development patterns in Southern Florida”, *Environment and Planning B: Planning & Design*, 33(1): 75-96.
- Brown, D. G., Robinson, D. T. (2006) “Effects of Heterogeneity in Residential Preferences on an Agent-Based”, *Ecology and Society* 11(1).
- Commission of the European Communities – CEC (1990) “Green Paper on the Urban Environment. Communication from the Commission to the Council and Parliament”. *COM(90)218 final*. Office for Official Publications of the European Communities, Luxembourg.
- Commission of the European Communities – CEC (2004) “Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions. Towards a thematic strategy on the urban environment.” *COM(2004)60 final*. Office for Official Publications of the European Communities, Luxembourg.

Commission of the European Communities – CEC (2006) “*Communication from the Commission to the Council and the European Parliament on Thematic Strategy on the Urban Environment.*” COM(2005)718 final. Office for Official Publications of the European Communities, Luxembourg.

Commission of the European Communities – CEC (2007) “Green Paper. Towards a new culture for urban mobility (presented by the Commission)” COM(2007)551 final. Office for Official Publications of the European Communities, Luxembourg.

Committee on Spatial Development – CSD (1999) “*European Spatial Development Perspective: Towards Balanced and Sustainable Development of the Territory of the EU.*” Office for Official Publications of the European Community, Luxembourg.

EEA, Copenhagen (2007) “*Urban Morphological Zones 2000 version F1v0, Definition and procedural steps*”, European Environment Agency, Copenhagen.

Epstein, J. M., R. Axtell (1996) “Growing artificial societies: social science from the bottom up.” The Brookings Institution, Washington, D.C.

Faludi, A. (2000) “The performance of spatial planning”, *Planning Practice & Research*, 15(4), 299-318.

Faludi, A. (2006) “Evaluating plans: the application of the European Spatial Development Perspective”, E. Alexander (ed) *Evaluation and Planning, evolution and prospects*, Ashgate, Aldershot: 119-143.

Frame, B., Vale, R. (2006) “Increasing Uptake of Low Impact Urban Design and Development: the Role of Sustainability Assessment Systems”, *Local Environment*, Vol 11, No 3, 287-306.

German Federal Ministry of Transport, Building and Urban Affairs (2007) “*Leipzig Charter on Sustainable European Cities. Agreed at the occasion of the Informal Ministerial Meeting on Urban Development and Territorial Cohesion on 24/25 May 2007*”, <www.bmvbs.de/en/dokumente/-,1872.982774/Artikel/dokument.htm> (accessed April 14, 2009).

Grande, E. (1996) “The state and interest groups in a framework of multi-level decision-making: the case of the European Union”, *Journal of European Public Policy*, 3(3), 313-38.

Healey, P. (1997) “Collaborative Planning: Shaping Places in Fragmented Societies”, London.

Healey, P., Khakee, A., Motte, A., Needham, B. (1997) “Making strategic spatial plans: Innovation in Europe”, Taylor and Francis, Basingstoke.

MacMillan Healey, P. (2004) “The treatment of space and place in the new strategic spatial planning in Europe”, *International Journal of Urban and Regional Research*, 28(1), 45-6.

Hibbard, M., Lurie, S. (2000) “Saving land but losing ground: challenges to community planning in an era of participation”, *Journal of Planning Education and Research*, 20, 187-195.

Hill, M. (1968) “A goals-achievement matrix for evaluating alternative plans”, *Journal of the American Institute of Planners*, 34 (1), 19-29.

Khakee, A. (1998) “Evaluation and the planning process: inseparable concepts”, *Town Planning Review*, 69(4), 359-374.

- Khakee, A. (2003) “The emerging gap between evaluation research and practice”, *Evaluation*, 9(3), 340-352.
- Kirkpatrick, C., Lee, N., Morrissey, O. (1999) “WTO New Round: Sustainability Impact Assessment Study”, EIA Centre, University of Manchester.
- Kohler-Koch, B. (1996) “The strength of weakness: the transformation of governance in the EU”, Gustavsson, S., Lewin, L. (Eds.) *The Future of the Nation State*, Stockholm, Nerius; Santerus, 169-210.
- Kübler, D., Heinelt, H. (2005) “Metropolitan governance, democracy and the dynamics of place”, Heinelt, H.; Kübler, D. (Eds.) *Metropolitan governance. Capacity, democracy and the dynamics of place*, London/New York: Routledge, 8-28.
- Laurian, L., Day, M., Berke, P., Ericksen, N., Backhurst, M., Crawford, J., Dixon, J. (2004) “Evaluating plan implementation. A conformance-based methodology”, *Journal of the American Planning Association*, 70(4): 471-480.
- Lichfield, N. (1956) “Economics of planned development”, Estates Gazette, London.
- Lichfield, N., Kettle, P., Whitbread, M. (1975) “Evaluation in the planning process”, Pergamon, Oxford.
- Lichfield, N. (1988) “Economics of urban conservation”, Cambridge University Press, Cambridge.
- Lichfield, N. (1996) “Community Impact Evaluation”, UCL Press, London.
- Lichfield, N. (2001) “Where do we go from here?” Voogd, H. (ed.) *Recent developments in evaluation*. Groningen, Geopress, 7-15.
- Lichfield, N. (2003) “The concept of planned development”, *Planning Theory & Practice*, 4(1), 48-65.
- Mathur, N., Skelcher, C., Smith, M. (2003) “Towards a Discursive Evaluation of Partnership Governance”, *Paper to European Consortium for Political Research joint sessions*, Edinburgh.
- Moroni, S. (2006) “The ethics behind evaluation: Lichfield’s approach and utilitarianism”, E. Alexander (ed) *Evaluation and Planning, evolution and prospects*, Ashgate, Aldershot: 21-38.
- Nijkamp, P., Rietveld, P., Voogd, H. (1990) “*Multicriteria evaluation in physical planning*”, Elsevier Science Publishers, Amsterdam.
- Organization for Economic Cooperation and Development – OECD (2001) “Territorial Outlook”, OECD, Paris.
- Owens, S., Cope, D. (1992) “Land-use planning policy and climate change”, HMSO, London.
- Partidário, M. (2003) “Guia para avaliação estratégica de impactes em ordenamento do território”, DGOTDU, Lisbon.
- Rees, W. (1992) “Ecological footprints and appropriated carrying capacity: what urban economics leaves out”, *Environment and Urbanisation*, Vol 4, no 2.

Salet, W., Thornley, A., Kreukels, A. (2003) “Practices of metropolitan governance in Europe: Experiences and lessons”, Salet, W.; Thornley, A.; Kreukels, A. (Eds.) *Metropolitan governance and spatial planning. Comparative case studies of European city regions*, London, Spon Press, 377-390.

Semboloni, F. (2007) “The management of urban Complexity through a Multi-Agent Participatory Simulation”, *disP 170*, 3/2007, 57-70.

van Leeuwen, E., Hagens, S., Janneke E., Nijkamp, P. (2007) “Multi-Agent Systems. An example of Micro-Simulation Use in Retail Development”, *disP 170*, 3/2007, 19-32.

Vigar, G., Healey, P., Hull, A., Davoudi, S. (2000) “Planning, governance and spatial strategy in Britain”, MacMillan Press, London.

Voogd, H. (1983) “Multicriteria evaluation for urban and regional planning”, Pion, London.

Voogd, H. (Ed., 2001) “Recent developments in evaluation”, Geopress, Groningen.

Wackernagel, M., Rees, W. (1996) “Our Ecological Footprint: Reducing Human Impact on the Earth”, Gabriola Island, BC: New Society Publishers.

Wagner, P., Wegener, M. (2007) “Urban Land Use, Transport and Environmental Models. Experiences with an integrated microscopic approach”, *disP 170*, 3/2007, 45-56.