SEVENTH FRAMEWORK PROGRAMME

THEME [8.2.1.1.]

[New socio-economic concepts, paradigm shift and territorial dynamics in a long term perspective]

Grant agreement for: **Collaborative Project – Small or medium-scale focused research project (STREP)**

Annex I - "Description of Work"

Project acronym: *SustainCity*

Project full title: Micro-simulation for the prospective of sustainable cities in Europe

Grant agreement no.: *FP7-244557*

Date of preparation of Annex I (latest version): Wednesday 6 January 2010

Date of approval of Annex I by Commission: ____________________

List of Beneficiaries

Beneficiary Number	Beneficiary name	Beneficiary short name	Country	Date enter project	Date exit project
1(coordinator)	Swiss Federal Institute of Technology Zurich	ETHZ	Switzerland	1	36
2	Ecole Normale Supérieure de Cachan	ENS	France	1	36
3	Institut National d'Etudes Démographiques	INED	France	1	36
4	Université Catholique de Louvain	UCL	Belgium	1	36
5	Katholieke Universiteit Leuven	KUL	Belgium	1	36
6	STRATEC SA	STR	Belgium	1	36
7	National Technical University of Athens	NTUA	Greece	1	36
8	Technical University Berlin	TUB	Germany	1	36
9	Ecole Polytechnique Fédérale de Lausanne	EPFL	Switzerland	1	36
10	Bocconi University	BU	Italy	1	36
11	Université de Cergy Pontoise	UCP	France	1	36
12	University of California, Berkeley	UCB	USA	1	36

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PART A

A1. Overall breakdown and project summary

A1:
Our project

Project Number [1]	244557	Project Acronym [2]	SustainCity

One form per project			
General information			
Project title [3]	Micro-simulation for the prospective of sustainable cities in Europe		
Starting date [4]	01/01/2010		
Duration in months [5]	36		
Call (part) identifier [6]	FP7-SSH-2009-A		
Activity code(s) most relevant to your topic [7]	SSH-2009-2.1.1.: New socio-economic concepts, paradigm shift and territorial dynamics in a long term perspective		
Free keywords [8]		Demography, urban and transport modeling, urban economics	
Abstract [9] (max. 2000 char.)			

Increasing concerns about sustainable development and the growth of urban areas have brought forth in recent years a renewed enthusiasm and need for the use of quantitative models in the field of transportation and spatial planning. This project proposes to improve urban simulation models and their interaction with transport models. Unified operational models that favour a microscopic approach, such as UrbanSim and ILUTE (Integrated Land Use, Transportation, and Environment Modelling System) have recently gained a lot of interest both in the land use and transport communities. Nevertheless, in their current forms these models still require further development to support a comprehensive analysis of the main environmental and socio-economic questions of the sustainability of urban growth and the relevant public policies. The goal of this project is to address the modelling and computational issues of integrating modern mobility simulations with the latest micro-simulation land use models. The project intends to advance the state-of-the-art in the field of the micro-simulation of prospective integrated models of Land-Use and Transport (LUTI). On the modelling side, the main challenges are to integrate a demographic evolution module, to add an environmental module, to improve the overall consistency and, last but not least, to deal with the multi-scale aspects of the problem: several time horizons and spatial resolutions are involved.

A2. Project summary form

A3.2:
What it costs

Project Number [1]	244557	Project Acronym [2]	SustainCity

One Form per Project

Participant number in this project [9]	Participant short name	Estimated eligible costs (whole duration of the project)					Total receipts	Requested EC contribution
		RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D		
1	ETH Zurich	410,336.00	185,800.00	96,008.00	17,456.00	709,600.00	0.00	509,729.00
2	ENSC	575,173.00	0.00	48,112.00	8,016.00	631,301.00	0.00	457,813.00
3	INED	228,544.00	0.00	12,064.00	8,040.00	248,648.00	0.00	124,000.00
4	UCL	282,576.00	0.00	11,936.00	7,960.00	302,472.00	0.00	229,829.00
5	KUL	169,936.00	0.00	11,856.00	7,904.00	189,696.00	0.00	145,226.00
6	STR	343,118.00	0.00	25,106.00	16,738.00	384,962.00	0.00	205,034.00
7	NTUA	116,344.00	0.00	12,032.00	8,024.00	136,400.00	0.00	105,308.00
8	TUB	231,080.00	0.00	13,080.00	17,440.00	261,600.00	0.00	199,457.00
9	EPFL	242,776.00	0.00	11,936.00	47,760.00	302,472.00	0.00	229,829.00
10	BU	72,272.00	0.00	11,408.00	7,608.00	91,288.00	0.00	71,320.00
11	UCP	379,848.00	0.00	11,744.00	7,832.00	399,424.00	0.00	283,107.00
12	UCB	130,311.00	0.00	18,616.00	24,821.00	173,748.00	0.00	135,000.00
TOTAL		3,182,314.00	185,800.00	283,898.00	179,599.00	3,831,611.00	0.00	2,695,652.00

Note that the budget mentioned in this table is the total budget requested by the Beneficiary and associated Third Parties.

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A3. List of beneficiaries

Participant No.	Organisation	Abbreviation	Country
1 (Co-ordinator)	Swiss Federal Institute of Technology Zurich	ETHZ	Switzerland
2	Ecole Normale Supérieure de Cachan	ENSC	France
3	Institut National d'Etudes Démographiques	INED	France
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6	STRATEC SA	STR	Belgium
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9	Ecole Polytechnique Fédérale de Lausanne	EPFL	Switzerland
10	Bocconi University	BU	Italy
11	Université de Cergy Pontoise	UCP	France
12	University of California, Berkeley	UCB	USA

PART B

Abstract

Increasing concerns about sustainable development and the growth of urban areas have brought forth in recent years a renewed enthusiasm and need for the use of quantitative models in the field of transportation and spatial planning. This project will improve urban simulation models and their interaction with transport models. Unified operational models that favour a microscopic approach, such as UrbanSim and ILUTE (Integrated Land Use, Transportation, and Environment Modelling System) have recently gained a lot of interest both in the land use and transport communities. Nevertheless, in their current forms these models still require further development to support a comprehensive analysis of the main environmental and socio-economic questions of the sustainability of urban growth and the relevant public policies.

The goal of this project is to address the modelling and computational issues of integrating modern mobility simulations with the latest micro-simulation land use models. The project will advance the state-of-the-art in the field of the micro-simulation of prospective integrated models of Land-Use and Transport (LUTI). On the modelling side, the main challenges are to integrate a demographic evolution module, to add an environmental module, to improve the overall consistency and, last but not least, to deal with the multi-scale aspects of the problem: several time horizons and spatial resolutions are involved.

Theoretical models (such as the monocentric textbook model) have proven useful in stating normative results, but remain of limited usefulness, when it comes to empirical applications that include any degree of disaggregation. However, they are useful benchmarks. Simulation tools are more suitable for dealing with realistic policy analysis. Integrated urban modelling is still a complex task and developing a complete and reliable tool remains out of reach of many professional organizations. The Open Platform for Urban Simulation (OPUS), is an Open Source modelling platform for a suite of behavioural-based models addressing (housing location decisions, employment decisions, and urban form). UrbanSim is an integrated model system implemented within the OPUS Platform.

UrbanSim has proved to be a very powerful and efficient tool in the context of American cities (Waddell et al, 2007, Waddell and Borning, 2004). However, various recent projects conducted in Europe (see below) point to the need to adapt the available modelling platform, to develop new tools consistent with the historical, political and social characteristics of European cities and with specific lifestyles and preferences. High-level academic research in transportation, planning, economics and in econometric modelling and in other fields such as geography, new economic geography, computer science and operations research happen to be particularly relevant for analysing urban development and building integrated land use and transportation models. These developments will aim at:

- Improving the integrated urban model specification, estimation and validation (and therefore the accuracy of predictions),
- Adapting UrbanSim to European contexts,
- Adding to UrbanSim the simulation of travel and daily behaviour,
- Adding to UrbanSim a sustainability and environmental module,
- Adding a demographic micro-simulation module to the integrated platform,
- Introducing some elements of collective decision process within households (taking into account potential conflicts of interests among different members of a household).

These developments will be analysed, tested and validated for three case studies in Europe. We promote this new prototype modelling platform UrbanSimE for Europe among the professional and academic communities in order to ease its application by European local and regional communities.

B1 Concept and objectives, progress beyond state-of-the-art, S/ T methodology and work plan

B1.1 Concept and project objectives

B1.1.1 Concept

The past decade has witnessed increasing concern about sustainable development. This concern is visible in public policy debates about the development of cities and their transportation systems but also about the transformation of rural to urban or suburban areas. The scarcity of natural resources and the maintenance of a liveable environment often conflict with the need for economic development, more housing and increased mobility. The amount of development one is willing to trade-off to protect the environment is a matter of political or social preference. However, the provision of quantitative forecasts of the impacts of policy measures can help voters, planners and elected officials to improve and to enlighten their policy discussions. Therefore, the use of state-of-the-art models is valuable to decision-makers in assessing alternative combinations of transport, economic, and environmental policies and investments in specific metropolitan areas in order to attain their social, economic and environmental objectives.

The increasing concerns about sustainable development and the growth of urban areas have facilitated a renewed enthusiasm for the use of quantitative models in the field of transportation and spatial planning. A major transition has taken place from analytical models (Fujita, 1989; Wegener, 1994) developed in the mid-20th century and mostly inspirational - to highly disaggregate computer simulations that are able to provide answers for detailed scenarios. The advances in information technology (IT) have made possible the collection, storage and processing of large volumes of geographical data to take into account the multi-dimensional aspects of these complex urban systems. The processing power to simulate more sophisticated and heterogeneous decision processes has also become available.

This project will advance the state-of-the-art of urban simulation models, and their underlying methodologies, and will improve their diffusion among planners and decision-makers in government. The interactions between the transportation sector and land use are seldom coupled in a consistent way in practice and professionals often used different tools to address specific policy problems. However, capturing these interactions is crucial to understand and forecast the impact of policies that affect the structure of the transportation systems, the land use patterns and the environment (see Metz, 2008 for a trenchant critique of current practise). Unified operational models that favour a microscopic approach, such as UrbanSim (Waddell *et al.*, 2007, Waddell, 2002), ILUTE (Salvini and Miller, 2005) or MATSim (Rieser *et al.*, forthcoming; Balmer *et al.*, 2007), have recently gained a lot of interest both in the land use and transport communities.

The development of integrated models spans multiple disciplines and is a long-term goal which requires the collaboration of committed research teams for many years. For these reasons, relatively few open source simulation platforms have emerged. OPUS/UrbanSim (Open Platform for Urban Simulation, see Waddell *et al.,* 2005, OPUS, 2008) is the platform that we will extend in this project. This platform is based on sound theoretical underpinnings. It has been pioneered at the University of Washington by a team directed by Dr. Paul Waddell; one of its many advantages is that the software is open-sourced which allows cumulative scientific contributions over the long run. Another advantage of OPUS is its growing user base in the academic world.

Paul Waddell has initiated collaborations with several researchers in Europe (Kay Axhausen, ETHZ; André de Palma, ENS; Nathalie Picard, UCP; Kai Nagel, TU Berlin; Michel Bierlaire, EPFL; Fabrice Marchal, LET; Daniel Felstenstein, Hebrew University, Armando Montanari, Rome). This led to preliminary studies to investigate the feasibility of an application of UrbanSim in Europe, in particular in France (Paris area), in Switzerland (Zürich) and in Belgium (Brussels). Further studies, in a less advanced stage, are on-going in Lyon, Lausanne, Rome and Tel-Aviv. These research efforts have highlighted the importance to set up an international team to exchange information and to improve the chances of success of these large-scale transport-land use applications. These preliminary projects have identified a number of key obstacles and capabilities that need to be developed. Several applications presented at the first meeting of the European users of UrbanSim, organized by Kay Axhausen (ETHZ, March 2008[1]) have demonstrated that the structure and urban form of European cities is quite different from that of US cities. UrbanSim was initially developed and then successfully used for US cities, which have specific car-oriented transport networks, specific housing markets, urban forms (typically square

[1] See http://www.ivt.ethz.ch/news/archive/20080317_seminar/index for the presentations. Several of these are being prepared as papers for a special issue of the Journal of Transport and Land Use.

cells) and development practices, inter alia. One of the main objectives of this project is to clearly identify and to accommodate these differences in UrbanSimE (the European version of UrbanSim).

UrbanSim includes several sub-models that describe the decision of individual households and firms in term of residential/ location choice as well as the formation of rent patterns. These sub-models are only loosely coupled to the mobility (i.e. travel) decisions, leaving the potential for inconsistencies between the location and travel decisions at the individual and household levels. We will address also the dynamic and endogenous structure of households since couple's decisions are crucial for housing (and other long-term) decisions, such as car-ownership or employment. The various modules (i.e. sub-models) of UrbanSim need to be properly calibrated with available data. The calibrated parameters are then used to perform simulations over typical time horizons of 20 to 40 years.

At each step (i.e. year) of these forecasts, user-defined indicators are computed. These can include environmental indicators as well as social inequality measures. Our goal is to improve the evaluation of the sustainability of public policies (such as congestion pricing or public transport investments) by developing these indicators for our empirical applications on three European test cases. The OPUS software platform contains an Indicator Framework that will facilitate the creation of many land use, transport and environmental indicators needed for this project.

Finally, our experience with urban models has taught us that they are not yet easily applied by professionals and decision makers. Obstacles of various natures have been identified: the learning curve for these models can be daunting and the time investment might be beyond what is available to a typical metropolitan planning organisation. However, we believe there are strong economies of scale offered by open-source platforms such as OPUS and we will improve the situation in two ways. First, guidelines and necessary tools in an accessible format will be released. Second, training courses and sessions and meetings between professionals, academics and local organisations will be organized.

B1.1.2 S&T objectives

The aims of the project are to make progress in seven areas within the OPUS/UrbanSim framework:

1. to identify the particularities of European cities (most importantly the high usage compared to U.S. cities of public transport, the rigidity of real estate markets, the significant role of the public and voluntary sector in the housing market, the irregular geometry of road networks and urban land parcels (as opposed to typical Manhattan network), and to construct *UrbanSimE*, a European configuration of the UrbanSim system that accommodates these requirements;
2. to integrate more realistic decision processes with regard to intra-household decisions and to describe the multiple dimensions linking residential choice, mobility tool ownership[2] and employment choices;
3. to add a demographic evolution module that represents immigration, emigration, births, deaths and the formation of households of different sizes in a given urban area;
4. to add environmental indicators that represent better the different types of urban amenities and negative externalities (pollution, noise, traffic accident, etc.);
5. to integrate agent-based travel demand and traffic flow micro-simulation, here the open source MATSim-T[3], to improve the accessibility estimates underlying the model structure;
6. to improve the accuracy of the estimation and calibration procedures of transport and urban models using a better representation of space (choice of spatial units, in particular);
7. to increase the visibility and the accessibility of simulation models to a larger audience, including political decision makers.

The basic platform has been developed in the North American context and has shown its ability and capacity in different applications, mainly outside Europe. The previous experiences in European cities highlighted several specific problems. Let us mention first the differences in urban structure and shape and size of relevant geographical units, which led us to use different spatial units. In the U.S. context, availability of parcel data and remote sensing data led to a widespread use of small rectangular grids to represent land, whereas the data available in European cities is different, and leads to other spatial configurations such as the use of administrative units or census geographies. Second, the European real estate markets are very different from the American one, and require studying the market for different types of real estate goods than those present in the U.S. market. A related point is that the real estate inventory and the spatial configuration of European cities are much more the result of a very long period of historical development, relative to the generally quite

[2] Bicycle, motorcycle, car and public transport season ticket ownership; driving license acquisition

[3] See www.matsim.org for the open-source code, examples, manual and example visualizations.

young US cities. We will study these differences in detailand try to highlight all the necessary modifications in the basic platform.

We also will improve the OPUS (UrbanSim) simulation methodology in many respects, both theoretical and applied:

1. the first improvement concerns the *demographic* evolution. The model system currently uses a database of households, but lacks appropriate models to simulate the evolution in those households over time. The objective is to design and test a micro-simulation model for demography that enables the platform to follow endogenously the evolution of individuals and households resulting from births, deaths, individuals changing households (marriage, divorce, children leaving parents' house, etc.), (re)location within the urban area under study, immigration and emigration between urban areas. In this case, *UrbanSimE* will keep a record of household history and take this information into account;
2. the second improvement involves the integration of an *agent-level model* of travel behaviour, allowing the choices made by households and persons with respect to long-term choices such as residential location, workplace location, ownership (e.g. vehicles, season tickets) be integrated in a behaviourally consistent way with the scheduling of daily activities and travel behaviours, including travel departure times, destinations, modes and routes;
3. the third improvement consists in introducing some elements of the *collective decision-making* process in household location choice model. More specifically, the model will take into account the heterogeneity of preferences and constraints within household (e.g. the respective locations of husband's and wife's jobs), as well as the heterogeneity (among households) of spouses bargaining powers.
4. The fourth improvement will address the *heterogeneity of the developers* prevalent in Europe, where commercial developers of different scale interact with a large public and voluntary non-profit sector. *UrbanSimE* will be expanded to accommodate the description of their regulations and incentive structures and the resulting behaviours with regards to tenant selection, rent setting, maintenance and investment decisions;
5. the fifth improvement consists in developing two modules for evaluating the sustainability *indicators* from *environmental* and *socio-economic* points of view. These indicators are based on an elementary modelling of urban amenities (e.g. green areas) and negative externalities (e.g. noise or pollution). The relevant indicators will be identified or developed and then implemented in the modelling platform.

All mentioned improvements, will be tested on real cases to be validated and also checked for relevance in the applications. We will apply the model in three case studies. These case studies have already used to some level earlier versions of UrbanSim and most of the necessary databases have been collected (for the basic version of UrbanSim). A fourth (potential) case study concerns Milano, a city preparing for the 2015 world exhibition. Note that this case study has to be co-financed.

B1.2 Progress beyond the state-of-the-art

B1.2.1 International state-of-the-art

The building of large urban forecast models that span several disciplines of social sciences and natural sciences is a major challenge for the upcoming years. In particular, disciplines that focus on sustainable development must be able to integrate in a consistent way economic models with physical and environmental ones. The interaction between mobility and land use provides an ideal example of such integration. So far, there is a need to develop a new consistent open-architecture framework that integrates state-of-the-art spatial economic models (of housing market, location choice, etc.) and modern transport models (i.e. travel demand and traffic) under the same umbrella. Several research teams have embarked on that task around the world: ILUTE (Canada: Salvini and Miller 2005), ILUMASS (Germany: Moeckel *et al.* 2002) and UrbanSim (USA: Waddell *et al.* 2003). Our approach is based on the UrbanSim philosophy. It consists in providing a flexible open source architecture which can incorporate different modules (to model demographics, household location, job location, housing price, land development and transport). Each module can be either shared by different partners or can be customized to a specific urban area. In any case, we advocate that a black box approach is not a good strategy for developing transport/land use models. Such black box models exist and are very difficult to adapt to specific urban areas and to calibrate. On the contrary, UrbanSim offers the opportunity to improve any module, in particular in order to make it more consistent with European specificities. The architecture is highly configurable and the recent implemented Graphical User Interface allows these models to be created and configured interactively. Our intent is to add any needed generalizations to the framework and specific models that are needed in order to support customizations to specific European cities.

The adaptations in the models needed for the European contexts may require more flexible model structures than have previously been supported by UrbanSim. In addition, technical challenges such as the need to use extremely large choice sets to represent the possible locations of households, firms, and activities need to be addressed.

Our scientific challenge is to bring together the skills from various disciplines: (a) sophisticated traffic models have been mainly developed by engineers without much concern about the socio-economic reasons why travel demand arises in the first place; (b) economists often treat the transport sector as a black box and tend to prefer the development of aggregate models (without explicit spatial representation); (c) demographers whose detailed models tend to ignore the urban dynamics underlying the population distribution (d) planners and geographers are concerned about spatial development and recognise the need for innovative tools but do not generally see the need to use complex simulation models. Developing a common computing platform with a standard interface for creating, specifying, and estimating models and adopting a consistent data structure, are key elements in our project to construct models for European cities that are broadly useful for analysing pathways towards sustainability.

The development of transport systems and the evolution of land use patterns are tightly intertwined. Indeed, economic activities have always favour locations close to transport network nodes. Conversely, those networks have evolved to satisfy the ever changing demand for fast and reliable connections between residents and economic actors. The impacts of transport systems and land use on the environment in terms of resource consumption, emissions of pollutants and biodiversity have been the focus of much attention. The complex interactions between land use and the transport sector have also been extensively studied in the literature of urban and regional planning, economics and geography. However, state-of-the-art operational models that could take into account those interactions and predict the impacts on the environment are still missing in practice.

B1.2.2 Technical limitations of existing products, processes and/or services

The term “integrated models” designates models that combine land use models and transport models with feedback mechanisms between them. Integrated models appeared as early as the 1960s but were largely unsuccessful (Lee, 1973, 1994). Most, if not all, integrated models which are operational and that are still used in practice have not yet integrated the latest advances made in transport planning, micro-economics and spatial econometrics. The interactions between the different sub-models generally consist of ad hoc feedback mechanisms that do not reflect the actual decision process (e.g. location choice and mode choice, four-step forecast process).

Despite these rather negative experiences, a new generation of models has arisen recently, fuelled by the public interest in sustainability and pushed both by methodological advances (among other sophisticated discrete choice models, activity-based models and dynamic traffic assignment models) and technological advances (mainly the emergence of GIS applications and the rise in computing power). The term "unified models" has been coined by Anas (1994, 2000) to designate models that describe simultaneous individual decisions at the microscopic level. Two of the most prominent unified models are UrbanSim (Waddell *et al.* 2003) and ILUTE (Salvini and Miller, 2005). Both models feature a so-called loose coupling with the transport model. In practice, this implies that accessibility measurements are computed via an external static traffic assignment model. Another missing link of the former integrated models was a proper travel demand model that could capture the full range of travel decisions: from long-term decisions such as car ownership or season ticket ownership to short-term decisions such as departure time choice. The travel demand model should also take into account both the location of activities and the time-dependent performance of the transport systems. ILUTE has taken some steps into that direction but it still relies on a static description of the transport system.

B1.2.3 Main innovations

We will develop *UrbanSimE* to be able to model European cities and undertake a number of improvements in the underlying models. We will run long-term simulations for three European cities and their surrounding regions, and to evaluate their environmental and social sustainability. The main innovations include:

1. development of operational, unified models of land use, transport and environment in three European metropolitan areas, suitable for undertaking policy analyses to address analyses of sustainability;
2. integrating demographic evolution of households to reflect ongoing demographic shifts in society;
3. integrating labour market behaviours to incorporate key aspects of economic dynamics that are not currently modelled;
4. integrating models to reflect business establishments and their evolution, rather than using jobs as the unit of analysis for economic activity;
5. integrate the heterogeneity of developers;
6. integrating agent-based models of travel behaviour;
7. integrating a broad set of indicators for policy evaluation;
8. addressing computational efficiency to ensure that the model system is usable in time frames relevant for policy analysis by decision-makers.

B1.2.4 Modelling Land-use and Activity Locations: How UrbanSim works and will be improved

UrbanSim has been developed by a research team led by Waddell at the Centre for Urban Simulation and Policy Analysis, University of Washington. It has been developed in response to limitations of existing land use models, and to support the capacity of planning agencies to respond to the need to model the feedbacks between land use, transportation and air quality. With significant funding from the National Science Foundation Information Technology Research Program (ITR), Digital Government Program, Biocomplexity Program, and Urban Research Initiative, in addition to grants from Federal Highway Administration and other state and local agencies, UrbanSim has been implemented as an Open Source software system and put into use in several metropolitan areas in the U.S. and Europe.

Applications of the model, integrated with a variety of existing four-step travel models to support regional transportation and air quality planning, have been completed or are in various stages of development in several metropolitan areas in the United States, including Denver, Colorado, Detroit, Michigan, Eugene-Springfield, Oregon, Houston, Texas, Honolulu, Hawaii, and Seattle, Washington. UrbanSim differs from prior land use models in many respects, but in particular because it emphasizes a behaviourally-explicit representation of household choices to move and make residential location choices within a metropolitan area, business location choices, real estate developer choices, and the interaction of these agents and choices in dynamic real estate markets. It is also very spatially-detailed, using 150 meter grid cells to represent sufficient spatial detail to begin to address behavioral and policy questions central to this solicitation: the influence of smart growth strategies such as neo-traditional neighbourhood design, or Transit-Oriented Development (TOD) to reduce urban sprawl, provide affordable housing, and alter travel behaviour.

UrbanSim has most recently been used to help settle a major lawsuit in the Salt Lake City region, where the Sierra Club and Utahan's for Better Transportation sued the Utah Department of Transportation and the Federal Highway Administration over conformity and other issues pertaining to sections of the planned Legacy Highway. The basis for the lawsuit was that the highway planning effort had not adequately addressed the feedback effects of the highway projects on land use, and therefore did not account for potential short and long-term induced demand effects. The settlement involved using UrbanSim in an integrated fashion with the regional travel model system to examine these feedback effects.

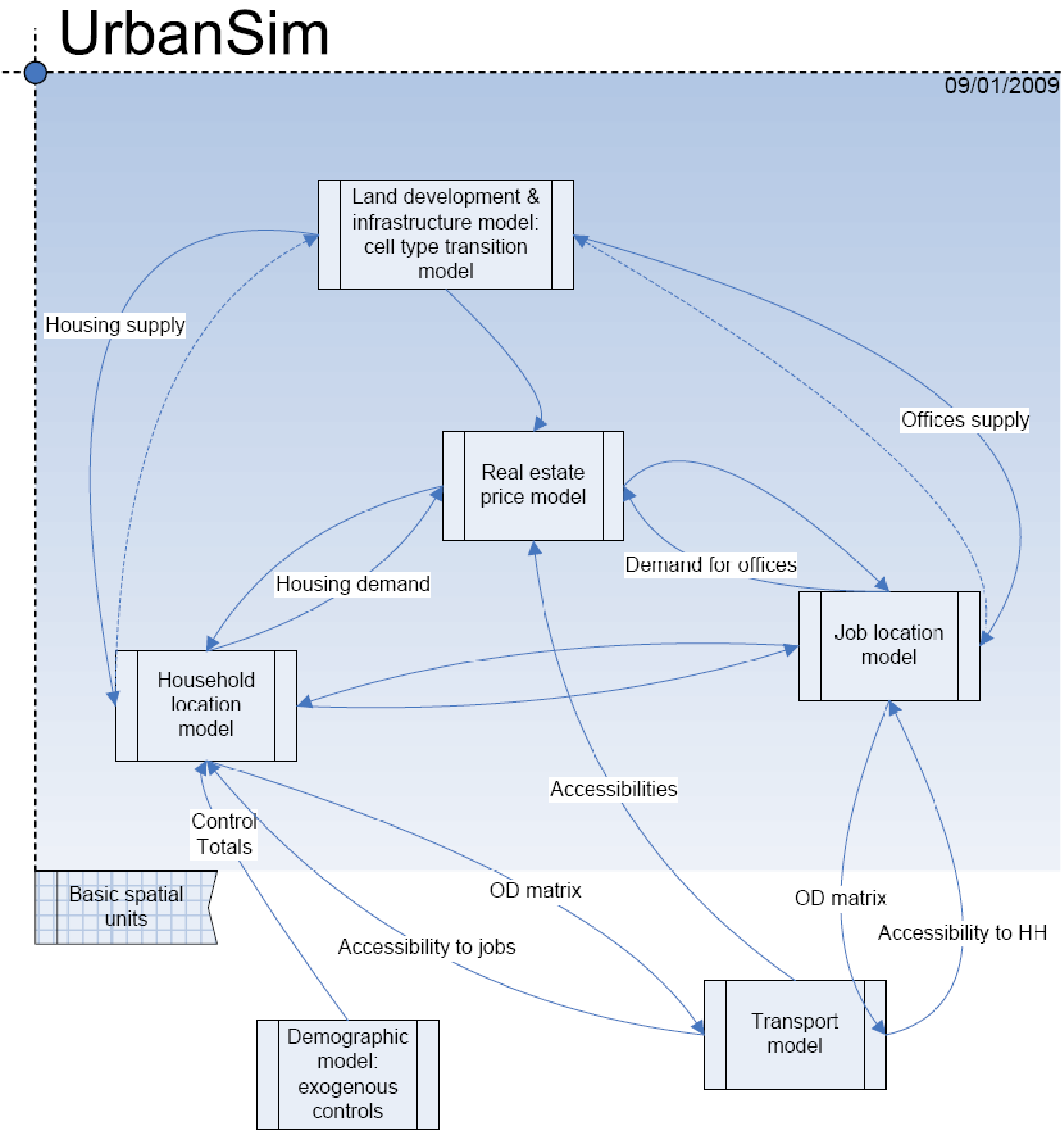
While UrbanSim represents a major advance over urban models developed previously, allowing for examination of feedbacks among land use, transportation investments and air quality, the level of integration with the modeling of travel behaviour is limited by the constraints of existing four-step travel models. The decision to link to existing four-step travel models was an early design choice made in order to move rapidly to add a capacity to Metropolitan Planning Organizations to address the need to incorporate the feedbacks among transportation investments, land use patterns, and air quality that were called for in the passage of the Clean Air Act Amendments of 1991, the Intermodal Surface Transportation Efficiency Act of 1990, and the Transportation Equity Act. However, the loose coupling of a behavioural land use model as represented by UrbanSim with a traditional, four-step, trip-based travel model imposes several significant constraints, including:

1. the loss of individual detail provided by the micro-simulation in UrbanSim, since most implementations of the four-step travel models use aggregate formulations for some of the steps (for example, destination choice);
2. home-based work destination choices and auto-ownership are predicted within the trip-based modeling framework, even though these are clearly not short-term decisions that are of the same temporal scale as route choice or destination choice for shopping;
3. interactions between short term and long-term choices made by households are not represented in this approach, leading to potential bias in evaluation of effects of transportation system changes.

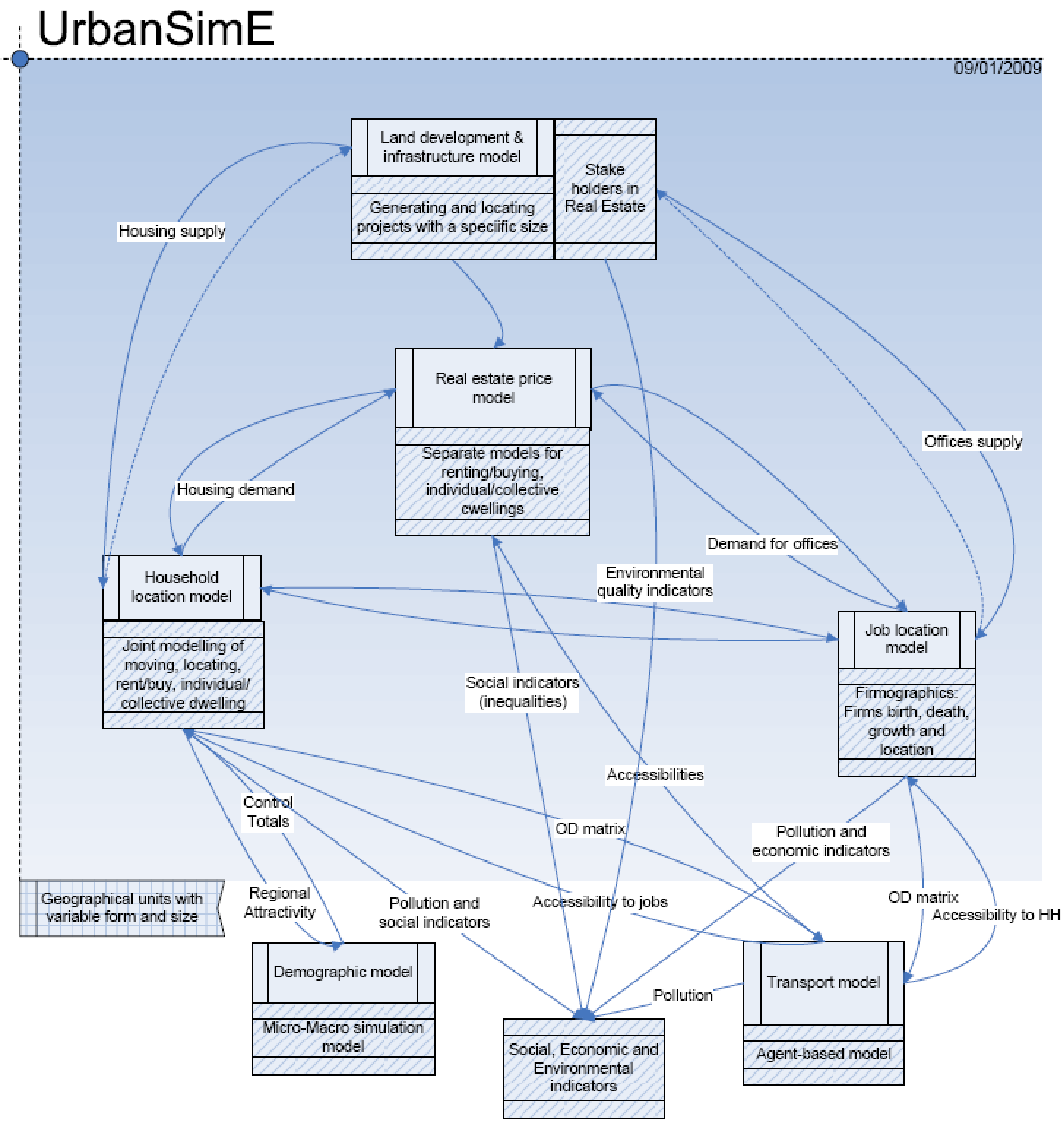
The overall process modelled by UrbanSim in these previous applications, is summarised in the diagram below.

Paul Waddell and his team have developed newer versions of UrbanSim in which some of methodological constraints such as the restriction of Basic Spatial Units to grid cells have been relaxed. But these newer features have not yet been used in European applications. We will study these aspects thoroughly and develop new guide-lines to make the model more adapted to European cities.

Intuitively and very briefly, UrbanSim can be seen to function in the following way over the course of a simulation year. Exogenous household and employment data are used as an input for the demographic and economic transition models. These models either remove jobs and households or create new jobs and households to be located later by the location models. Based on land-use and accessibility data, households and jobs are assigned locations. Based on the vacancy rate, the Development Project Transition Model creates a list of development projects to be placed. The location for these developments is then chosen by the Real Estate Development Model. Finally, the Land Price Model updates land-values that will be used in subsequent simulation years.



The next diagram shows the **UrbanSimE** version of the framework. The improvements involve all elements of the system, but keeps its basic philosophy intact.



B1.2.5 Patent search results

The Open Platform for Urban Simulation (OPUS), and the UrbanSim model system implemented within it, is available to all members of this project, as they are licensed as Open Source software using the General Public License (GPL).

MATSim is available for the project, as it licensed as Open Source software using the General Public Licence (GPL).

METROPOLIS model will be made available for this project. A license agreement will be signed by the partners using it. METROPOLIS once integrated with UrbanSimE will be free of charge for the project.

Standard commercial software such as SAS or STATA, as well as open source equivalents such as R or BIOGEME will be used for this project, for estimating the different models in their stand-alone versions. No further software will be necessary for running the model once the coefficients are estimated. Each partner will be responsible for managing the corresponding licenses. Some of the econometric models used for establishing city-specific *UrbanSimE* implementations are programmed in Python (a free software/language used in UrbanSim), and are built into the OPUS platform.

B1.3 S/T methodology and associated work plan

B1.3.1 Overall strategy and general description

We address here how the different scientific and technological challenges and goals are divided into tasks among the different partners depending on the relevant methodologies that will be explored or advanced.

Our first goal concerns the identification of differences between European and US cities. Our past experience in applying UrbanSim in Paris, Brussels and Zurich among others has taught us that uniform grid-cells do not provide the appropriate geographical units. Although it was convenient from a technical standpoint, it has important drawbacks. First, most European metropolitan areas have distinctive features such as an old dense city centre, usually developed around the historical medieval market, the religious centre or the original settlement where the city arose. Second, several countries have strict regulations concerning development that can be fine-grained and require appropriate geographies. For instance, high-rise buildings are forbidden in some protected (usually historic) areas. Roads are generally available in the US wherever development is undertaken. The same does not apply to public transport, which plays an important role in European urban transport structure. Therefore, an appropriate modelling of the "last-mile" accessibility is required although it cannot be done with standard transport models, which rely on the concept of traffic zones.

Recent advances in UrbanSim have allowed for more fine-grained geographical units such as parcels and even buildings. The careful spatial analysis conducted within this project will aim at clarifying what the optimal spatial unit should be, including considerations of data availability, privacy issues concerning data, usability and computational burden. While building information might be available for instance, population parameters such as income may need to be aggregated to be compatible with data protection law. Finally, geographers and urban economists will elaborate a consistent development model for the European test cases. The system is different from the US where land developers are part of a less regulated market.

Our second goal is to integrate more realistic decision processes with regard to intra-household decisions and to describe the multiple dimensions linking residential choice, mobility tool ownership and professional choices. Since we favour an agent-based approach over other methods from the beginning, an obvious start is to conduct a literature review of relevant approaches which will be the part of the relevant work package. Important advances are needed to understand how households come to the key decisions during their life: investment into real estate and major relocations at the individual level are long-term decisions that affect the travel patterns, the energy consumption and the land-use at the macroscopic level. The choices in much of *UrbanSimE* are presented as Random Utility Models (RUM) (Train, 2003), an approach which has been mainly applied to single-individual decisions. A first (non trivial) advance we will undertake is to extend the methodology of these statistical models to include decisions which are made jointly by households. Households are not atomic units with a unique decision maker: they are made up of individuals who have vested interests in a complex decision process which includes many dimensions (e.g. own wealth, time horizon, presence of children, career opportunities, etc.). Moreover, we will extend UrbanSim by the addition of a more sophisticated demographic model: instead of having households which simply appear and disappear from the area, their ageing progress will be modelled, thereby embedding the history of their past decisions. Firms will be treated analogously based on recent modelling of their life cycle and their related location choices.

The ultimate aim of our research is to provide indicators concerning the sustainability of policy options. Therefore we need to focus also on the production of meaningful indicators based on the outputs of our models. The relevant list of environmental and social indicators will be developed so that it can be produced from our simulations. We will largely borrow from the existing literature and will also provide consumer surplus indicators compatible with the RUM formalism and welfare economics. We will also explore how concepts such as social capital, which could be included within the UrbanSimE framework, based on such recent work as Hackney and Marchal, 2009 or Arentze and Timmermans (available on line). These tasks will require the contribution from our partners who are mostly specialized in econometrics and spatial planning.

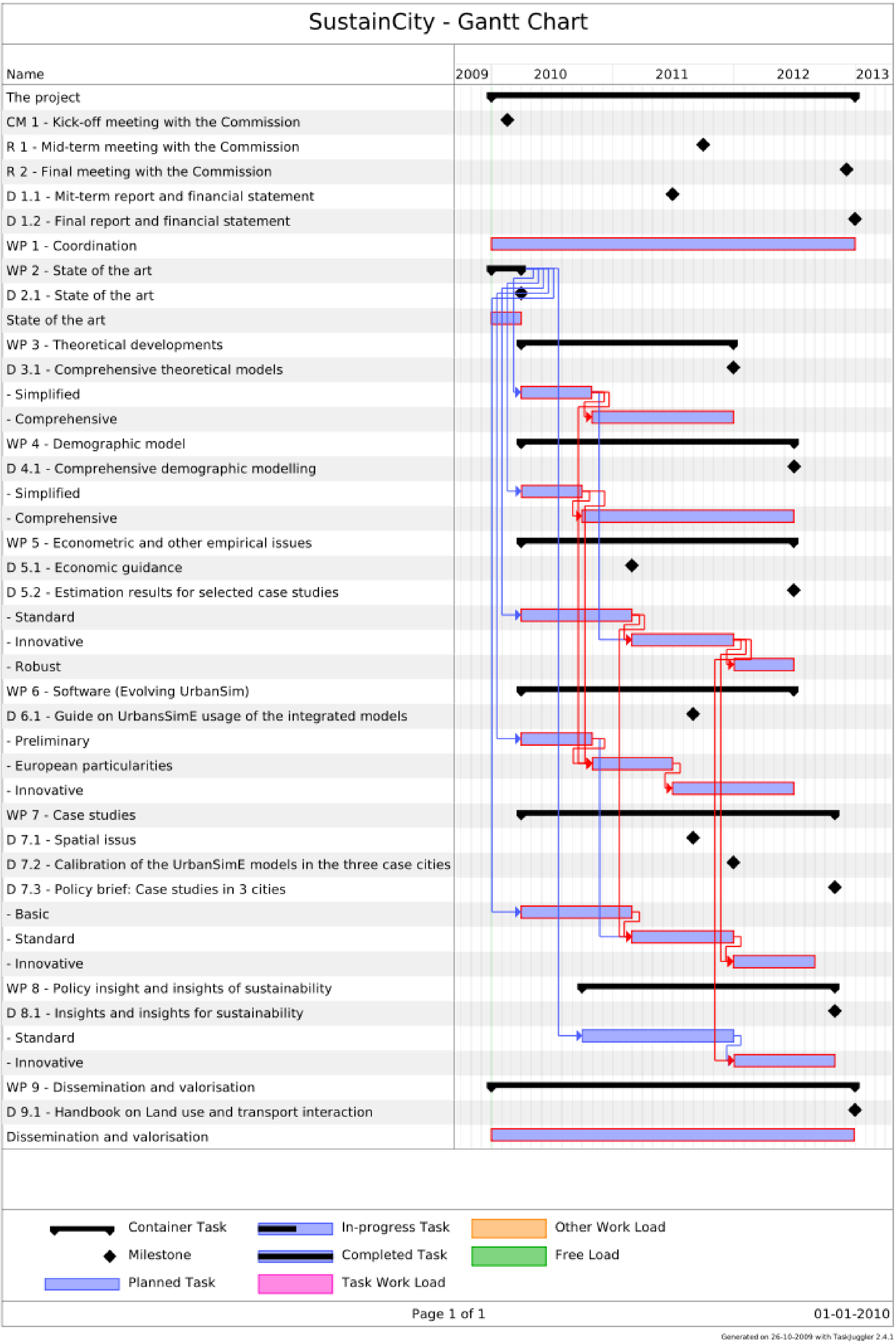
Our third goal is to improve the accuracy of the estimation and calibration procedures of transport and urban models. In particular we will advance the articulation between the transport and land use modelling. A common configuration in the

UrbanSim framework is that data are gathered for a given year (e.g. 1990) for which the model parameters are estimated. The parameters are then kept constant over the simulated years (e.g. 1991 to 2020) and the most recently available data (e.g. 2000) are used to compare the model outputs with the reality and to assess the validity of the predictions. We need to explore how to consistently improve these simulations which depend on huge numbers of parameters, in particular some which are external and largely arbitrary (e.g. population growth or global economy trends). Another setting concerns spatial decisions: the RUM framework was mainly designed for limited choice sets such as brands. However, in the spatial context there is a virtually infinite continuum of possible outcomes when decisions are made about where to relocate, where to invest. Technically speaking, this implies that so-called “non-chosen” alternatives cannot be reasonably enumerated and in any case have to be described as well. In many cases, practical applications simply select a random set of alternatives. Non-chosen alternatives are crucial to RUM, therefore we will advance the techniques of large choice set creation. A potential track which will be explored consists in simulating and estimating location or investment choices in an iterative process.

B1.3.2 Timing of work packages and their components

The project is planned for three years and structured with milestones and deliverables. The regular reports and project meetings will ensure, that the intricate interplay between theory development, econometric estimation, data collection, software implementation and testing, and finally calibration and policy assessment will be kept on course.

The project has been outlined in its subject matter above and will be detailed in the work package structure below.


SustainCity - Gantt Chart
Name
2009
2010
2011
2012
2013
The project
CM 1 - Kick-off meeting with the Commission
R 1 - Mid-term meeting with the Commission
R 2 - Final meeting with the Commission
D 1.1 - Mit-term report and financial statement
D 1.2 - Final report and financial statement
WP 1 - Coordination
WP 2 - State of the art
D 2.1 - State of the art
State of the art
WP 3 - Theoretical developments
D 3.1 - Comprehensive theoretical models
- Simplified
- Comprehensive
WP 4 - Demographic model
D 4.1 - Comprehensive demographic modelling
- Simplified
- Comprehensive
WP 5 - Econometric and other empirical issues
D 5.1 - Economic guidance
D 5.2 - Estimation results for selected case studies
- Standard
- Innovative
- Robust
WP 6 - Software (Evolving UrbanSim)
D 6.1 - Guide on UrbansSimE usage of the integrated models
- Preliminary
- European particularities
- Innovative
WP 7 - Case studies
D 7.1 - Spatial issus
D 7.2 - Calibration of the UrbanSimE models in the three case cities
D 7.3 - Policy brief: Case studies in 3 cities
- Basic
- Standard
- Innovative
WP 8 - Policy insight and insights of sustainability
D 8.1 - Insights and insights for sustainability
- Standard
- Innovative
WP 9 - Dissemination and valorisation
D 9.1 - Handbook on Land use and transport interaction
Dissemination and valorisation
Container Task
Milestone
Planned Task
In-progress Task
Completed Task
Task Work Load
Other Work Load
Free Load
Page 1 of 1
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B1.3.3 Work package list/overview

Work package No[4]	Work package title	Type of activity[5]	Lead beneficiary No[6]	Person-months[7]	Start month[8]	End month[9]
WP 1	Coordination	MGT	1	32	1	36
WP 2	State of the art	RTD	9	30	1	3
WP 3	Theoretical developments	RTD	2	54.5	4	24
WP 4	Demographic model	RTD	3	25	4	30
WP 5	Econometric and other empirical issues	RTD	11	33.5	4	30
WP 6	Software *(Evolving UrbanSim)*	RTD	8	33.5	4	30
WP 7	Case studies	RTD	6	155.5	4	32
WP 8	Policy insights and insights for sustainability	RTD	5	27	10	34
WP 9	Dissemination and valorisation	DEM	7	20	1	36
	TOTAL			411		

B1.3.4 Deliverables list

In addition to the formal deliverables listed below, each partner will provide a synthetic and brief **quarterly progress** report highlighting both the advances made, as well as any difficulty which has arisen in the course of the

4 Workpackage number: WP 1 – WP n.

5 Insert one of the following 'types of activities' per WP (only if applicable for the chosen funding scheme – must correspond to the GPF Forms):

RTD = Research and technological development including scientific coordination applicable for collaborative projects and NoEs

DEM = Demonstration - applicable for collaborative projects

OTHER = Other activities (including management) applicable for collaborative projects, NoEs, and CSA

MGT = Management of the consortium - applicable for all funding schemes

COORD = Coordination activities – applicable only for CAs

SUPP = Support activities – applicable only for SAs

6 Number of the beneficiary leading the work in this work package.

7 The total number of person-months allocated to each work package.

8 Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

9 Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

work. In appendix, it will include any draft deliverables or working papers, which report the on-going work. The project will provide the required progress reports to the CEC.

Del. no. [10]	Deliverable name	WP no.	Lead bene-ficiary	*Estimated indicative person-months*	Nature[11]	Dissemi-nation level [12]	Delivery date[13] (proj. month)
D 2.1	Policy brief: State of the art	WP 2	EPFL	30	R	PU	4
D 5.1	Econometric guidance	WP 5	UCP	17.5	R	PU	14
D 1.1	Mid-term report and financial statement	WP 1	ETHZ	13	R	PU	18
D 6.1	Policy brief: Using land use models for sustainable policy making	WP 6	STR	33.5	R	PU	20
D 7.1	Spatial issues	WP 7	UCL	64.5	R	PU	20
D 3.1	Comprehensive theoretical models	WP 3	ENS	54.5	R	PU	24
D 7.2	Calibration of the UrbanSimE models in the three case cities	WP 7	STR	50.5	R	PU	24
D 4.1	Comprehensive demographic model	WP 4	INED	25	P	PU	30
D 5.2	Policy brief: New behavioural insights; Estimation results for selected case studies	WP 5	UCP	16	R	PU	30
D 7.3	Policy brief: Case Studies in 3 cities	WP 7	ETH	40.5	R	PU	32
D 8.1	Policy brief: Insights for sustainability	WP 8	KUL	27	R	PU	34

10 Deliverable numbers in order of delivery dates: D1 – Dn

11 Please indicate the nature of the deliverable using one of the following codes:
R = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

12 Please indicate the dissemination level using one of the following codes:
PU = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

13 Month in which the deliverables will be available. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

Del. no.	**Deliverable name**	**WP no.**	**Lead bene-ficiary**	***Estimated indicative person-months***	**Nature**	**Dissemi-nation level**	**Delivery date (proj. month)**
D 9.1	Handbook and website on Land use and transport interaction	WP 9	EPFL	20	R	PU	36
D 1.2	Final report	WP 1	ETHZ	19	R	PU	36
			TOTAL	411			

B1.3.5 Work package descriptions

Work package no.	1	**Starting date or event**	1									
Work package title	Coordination											
Activity type	MGT											
Partic. No.	**1**	2	3	4	5	6	7	8	9	10	11	12
Partic. Short name	**ETHZ**	ENS	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	**11**	6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

Objectives

1. On-going management of the project in line with the administrative regulations of the Framework programme;
2. Co-ordination of the work packages;
3. Publication and reporting of the results with i.a. a project website and a software and data repository.

Description of work

The WP will provide the man power to co-ordinate the project and its results on an on-going basis with regards to substantive results, as well as with respect to the administrative matters. Special emphasis will be given to the preparation of the project meetings, their minutes and their follow-up. The co-ordination of the various parallel and sequential activities will require great care. A central element of this consistency will be the joint software and data repository, which will provide access to the case study data and to test scenarios which will allow all partners to check and implement the necessary consistency between the different work packages and their software contributions.

The second element is the publication of the results and reports on the project website (www.sustaincity.org, www.sustaincity.eu). The work package will collate the results and will support the partners in their publication on the web and beyond. The website will provide comprehensive links to the on-going research on land use and transport software and models around Europe and the world. The website will provide the services expected today (RSS feeds, commenting on the reports, mailing list, links to the software and test data).

Deliverables and month of delivery

M 1.1 Project website (month 3 and then on-going) to publish its results and to link it to on-going research around world;

D 1.1 Mid-term report (month 18) on the scientific results already achieved and mid-term report on costs.

D 1.2 Final report (month 36) summarising the results and highlighting the policy insights gained from the case studies and the underlying modelling work. The final financial report is delivered too.

Work package no.	2		**Starting date or event**			1						
Work package title	State of the art											
Activity type	RTD											
Partic. No.	1	2	3	4	5	6	7	8	**9**	10	11	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	STR	NTUA	TUB	**EPFL**	BU	UCP	UCB
Person-months per partic.	2	6	4	1	1	1	2	2	**5**	2	3	1

Objectives
1. Critically review the relevant state of the art 2. Outline the modelling approaches to be taken in the project
Description of work and role of partners
The work is broken down in seven tasks, which will address the issues raised by the programme of work envisaged (see below).
Deliverables and month of delivery
D 2.1 State of the art (Month 4)

Work package no.	2.1		**Starting date or event**			1						
Work package title	Demographic and micro-simulation models											
Activity type	RTD											
Partic. No.	1	2	**3**	4	5	6	7	8	9	10	11	12
Partic. Short name	ETHZ	ENS	**INED**	UCL	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	0	0	**4**	0	0	0	0	0	0	1	0	0

Objectives

1. Understand and describe the state of the art in demographic models, focusing specially in the following issues:

a) dynamics of birth and death;

b) household formation and dissolution;

c) effect of macroeconomic variables in demographics;

d) changes in the composition and characteristics of households.

2. Understand and describe the state of the art in microsimulation models, focusing in the following topics:

a) land use microsimulation models;

b) activity based travel demand models;

c) multi-agent models

d) dynamic traffic assignment models and equilibrium.

Work package no.	2.1	**Starting date or event**	1

Description of work and role of partners

The first step will consist in an overview of existing demographic evolution models used in Europe and outside Europe, focusing on the interactions with urban development models. The aim of this task is to evaluate the existing demographic micro-simulation models. This includes a first group of models developed primarily by demographers and statisticians, such as MicMac[14], SocSim[15] and ModGen[16]. These models are dynamic micro-simulation models, based on transition probabilities by sex, age, and other characteristics. Some of these models include relations between individuals, allowing producing outputs at different levels: individuals, households, kinship.

A second group of models have been developed within transport modelling. This includes Demos (Sundararajan, 2003), and the Population Evolution Model System by Eluru *et al.* 2008). The review of the state of the art will include agent-based demographic models (Billari and Prskawetz, 2003, Billari et al. 2006).

The second step will consist in a literature review, identifying advances in micro-simulation models that have largely occurred in three (somewhat) independent streams of research. In the first stream, land use researchers have developed micro-simulation models of land use development (Waddell, 2000). These models are intended to represent the behaviours of households and businesses as they make location choices (Waddell *et al.*, 2007).

[14] www.nidi.knaw.nl/en/micmac

[15] www.demog.berkeley.edu/~socsim

[16] www.statcan.gc.ca/spsd/Modgen.htm

Work package no.	2.1	**Starting date or event**	1

Multi-agent modelling can be seen as a merge of methods from Artificial Intelligence (AI) and from Complex Adaptive Systems (CAS), where the former concentrated originally on models of single-entity decision making, while the latter originally focussed on the interactions between entities. In a microscopic approach to land-use and transport issues, the decision-making entities are, at least in part, the individual persons, and consequently, interaction is clearly important. In fact, given the size of the problems (typically several million persons), the computing times allowed per agent are often rather short. Therefore, the challenge is to find a good balance between conceptually valid single-agent models and computational feasibility.

An important difference between transport and land-use models is that in the former, some kind of steady state solution, where agents eventually do the same thing from one period (e.g. day) to the next, is a useful starting point. In contrast, for land-use simulations it seems more plausible to assume that the system is never in a steady-state. This has important consequences in terms of the economic/game theoretic interpretation with respect to economic "equilibrium", but it also has important consequences with respect to the level of realism that needs to be embedded into the agent models in order to obtain a useful model.

The literature review will trace the lineage of the models from AI and CAS, discuss different trade-off's between agent model detail and computing speed, and investigate the different necessities of "converging" vs. "transient" models.

The second stream of model development correspond to a new generation of (micro-simulation) activity-based travel demand models (Miller, 2002). At the heart of the activity-based model paradigm is the micro-simulation of daily activity-travel patterns of households and individuals within households (Kitamura and Fujii, 1998). Activity-based models are relevant for this project, since they usually interact with land use models, using land use information to determine trip generation and providing transport demand forecasts that should affect the dynamics of household and firms location in the long term.

The third stream of research relevant to this literature review is that of dynamic traffic assignment (DTA). Dynamic traffic assignment models constitute a class of mesoscopic models wherein the route choices of individual trips/vehicles are modelled in order to simulate traffic flows along links in the network. The dynamic traffic assignment models are related to activity-based travel demand models and land use micro-simulation models in important ways. The dynamic traffic assignment model depends on the activity-travel model for time-dependent flows. In turn, the dynamic traffic assignment model delivers time-dependent network conditions (level of service and accessibility measures) that influence activity-travel choices (mode and destination choices, for example) and longer term location choices in the land use model (residential and workplace location choices, for example).

The DTA equilibrium has been expanded to a scheduling equilibrium in activity-based models and will need to be expanded further to include the steady state of the land-use system. The review will highlight the different formulations available, but especially the problem of how to account for partial equilibria, e.g. traffic assignments within larger non-equilibrium situations and development paths.

Deliverables and month of delivery

Synthesis report on state of the art on demographic and micro-simulation models (included in D 2.1, Month 4)

Work package no.	2.2	**Starting date or event**	1									
Work package title	Behaviour of agents											
Activity type	RTD											
Partic. No.	1	**2**	3	4	5	6	7	8	9	10	11	12
Partic. Short name	ETHZ	**ENS**	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	0	**3**	0	0	1	0	0	0	0	0	0	0

Objectives

Understand and describe the state of agent behaviour modelling, focusing in the following topics:

1. individual and household;
2. stake holders in real estate.

Description of work and role of partners

A literature review of the state of the art in agent behaviour modelling will be conducted. Each of the topics to review are described next.

Individual and household decision making is extremely relevant for land use modelling, since location and mobility choices depend on it. However there must be decisions both at an individual and at a collective level, which may generate conflicts of interest. These conflicts should be better understood in order to model household decisions. The literature review will focus on individual and collective decision making within the household and the dynamic and endogenous structure of households since couple's decisions are fundamental for housing (and other long-term) decisions, such as car-ownership or employment.

Stake holders in real estate (developers and other agents) play a significant role in the evolution of the cities and their characteristics since the generation of supply (dwellings and buildings in general) is a product of their decision processes. UrbanSim and all other commercial and academic land use models do not differentiate between types of developers, but it is obvious that these exists and have different incentive and regulatory structures, which will result in different outcomes. A non-profit cooperative, very common for example in Switzerland and in the Netherlands, can take very different risks from an institutional investor (e.g. life insurance or REIT) with regards to design or operation of their building stock. The most important dimensions are the degree to which the capital needs to be paid for (for profit/ non-profit), the presence of social objectives, access to the capital market and the extend to which long-term risks can be taken.

Deliverables and month of delivery

Synthesis report on state of the art of agent behaviour modelling (included in D 2.1, Month 4)

Work package no.	2.3	**Starting date or event**	1
Work package title	Firmographics		
Activity type	RTD		

Partic. No.	**1**	2	3	4	5	6	7	8	9	10	11	12
Partic. Short name	**ETHZ**	ENS	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	**2**	0	0	0	0	0	0	0	0	0	1	0

Objectives

1. Understand and describe the state of the art in firmographics (life cycle of firms);
2. make a synthesis of the various strands of literature which are developed in various disciplines (regional science, economic geography, economic theory and econometrics).

Work package no.	2.3	**Starting date or event**	1

Description of work and role of partners

The study of the life cycle of firms (firmographics) and of their associated moving and growing behaviour has been comparatively rare in regional science, although it had received some attention in economic geography (gravity model) and in special economics (models of competing firms located on a line, a circle or in the space; positive /negative attraction between firms in complementary/substitutable sectors). See for example Fujita and Thisse, 1996, Zenou, 2000, Gaigné and Goffette-Nagot, 2003; Gaigné *et al.*, 2002, Jennequin, 2001; and Ricci, 1999.

One prominent reason was the lack of suitable geo-coded panel data. Recently this has changed and new empirical work has revealed the interactions between the dynamics of firm growth and the associated locations by industry type (See for example Bodenmann and Axhausen, 2008; Almus and Nerlinger (1999); Brouwer (2004); Brüderl, Preisendörfer and Rolf (1996); Buenstorf and Guenther (2007); van Dijk and Pellenbarg (2000); Fritsch, Brixy and O. Falk (2006); Maoh and Kanaroglou (2005, 2007); Maoh, Kanaroglou and Buliung (2005); Moeckel (2006); Pellenbarg (2005); Wagner (1994); van Wissen and Schutjens (2005)). These interactions suggest an agent-based approach to model firms and their location decisions, as their history strongly influences their choices. It is not appropriate to treat their choices in each time-interval as independent. The new information technologies can be used to improve the estimates of birth and survival rates of firm by size class and industry type.

Birth and survival of firms are not the only sources of evolution in local employment. The other sources are firms' growth or decline, and moves (relocation). Relocation of large firms is a highly sensitive topic since it has very important indirect effects on local employment and on other firms in linked sectors. This is why it generates an intensive fiscal competition between countries and between cities. Local fiscal arrangements are common practice for attracting firms, and have received a large attention by economists.

After analysing in detail the above-mentioned literature, this task will aim at linking the conclusions reached by literature in the various disciplines to empirical results found concerning the decomposition of local employment variations.

The EC contribution claimed by the three French partners do not correspond to the maximum EC contribution. ENS is claiming 70 % of the total budget, INED 50 % and UCP 65%. This ensures that the time declared under the project by permanent or additional researchers remains close to the reality while the total budget of the project remains within the limits given in the work programme. The three French Institutes are committed to cover the remaining of the costs and to support financially the project. An internal agreement between the research teams and their administration has already been found.

Deliverables and month of delivery

Synthesis report on state of the art on firmographics (included in D 2.1, Month 4)

Work package no.	2.4			**Starting date or event**				1				
Work package title	Econometric models											
Activity type	RTD											
Partic. No.	1	2	3	4	5	6	7	8	9	10	**11**	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	**UCP**	UCB
Person-months per partic.	0	2	0	0	0	0	2	0	0	0	**2**	0

Objectives

Understand and describe the state of the art on econometric models used in UrbanSim and other similar software. Highlight their strengths and flaws, and select a list of econometric models which could be efficiently used in the project.

Description of work and role of partners

Evaluate the econometric models used in each case study up to now.

Select the econometric models best suited for estimating each model based on available or obtainable data.

Propose a systematic check on potential endogeneity problems, especially in relation with the interactions between the modules, and to the economic theories underlying the different models.

Deliverables and month of delivery

Synthesis report on state of the art on econometric models (included in D 2.1, Month 4)

Work package no.	2.5	**Starting date or event**	1									
Work package title	Software (UrbanSim and other tools)											
Activity type	RTD											
Partic. No.	1	2	3	4	5	6	7	**8**	9	10	11	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	STR	NTUA	**TUB**	EPFL	BU	UCP	UCB
Person-months per partic.	0	1	0	0	0	1	0	**2**	0		0	1

Objectives

Understand and describe the state of the art on land-use and integrated modelling software

Description of work and role of partners

A literature review will be conducted focusing in the operational and academic land-use model available today. Some of these agent-based models are ILUTE (Canada: Salvini and Miller 2005), ILUMASS (Germany: Moeckel et al. 2002) and UrbanSim (USA: Waddell et al. 2003). Since this project will be based on the UrbanSim platform the review will be focused on this model and its corresponding software structure. However, the review of other existing software should be useful to identify elements that can be introduced in the platform to develop in this project, especially for those conceived originally to deal with European cities.

The review will address both the theoretical framework and the software architecture behind each model, concentrating on database management and the computational algorithms used.

Deliverables and month of delivery

Synthesis report on existing land use modelling software (included in D 2.1, Month 4)

Work package no.	2.6	**Starting date or event**			1						
Work package title	Descriptive and geographical data										
Activity type	RTD										
Partic. No.	1	2	3	**4**	5	6	7	8	9	10	11	12
Partic. Short name	ETHZ	ENS	INED	**UCL**	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	0	0	0	**1**	0	0	0	0	2	0	0	0

Objectives

Identify the differences between the descriptive and geographical data required (and available) to properly model US and European cities

Description of work and role of partners

In the context of our preceding studies on Brussels, Lausanne, Zurich and the Paris region, we have observed many distinctive features of European cities that make them significantly different from US cities. For example, the uniform geographical units (grid cells) are irrelevant for the European cities characterized by a more complex structure. The shape of the relevant geographical units in European cities resulting from a long history is very irregular and should be modelled by polygons of various sizes and patterns. Such geographical units should be consistent with the available data, and their introduction deserves significant changes to the model. The new geographical unit imposes the question of neighborhoods and the computation of its characteristics.

Descriptive data of cities and their agents (households, firms, real-estate developers) usually comes from census data and geographical databases that are generally available in each country/city statistical office. This task will focus on identifying the required and available data to model European cities (through the three case studies) and the feasibility to use this data on the new platform to develop, given the characteristics and requirements of UrbanSim.

Deliverables and month of delivery

Synthesis report on descriptive and geographical data for European cities (included in D 2.1, Month 4)

Work package no.	2.7		**Starting date or event**			1					
Work package title	Social and Economic attributes										
Activity type	RTD										
Partic. No.	1	2	3	4	5	6	7	8	**9**	10	11	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	STR	NTUA	TUB	**EPFL**	BU	UCP	UCB
Person-months per partic.	0	0	0	0	0	0	0	0	**3**	1	0	0

Objectives

Identify market and other economical characteristics of European cities, as well as characteristics of European households that should be considered when developing the new modelling platform.

Description of work and role of partners

Economic aspects

Distinctive features are observed in the real-estate markets in European cities, where the access and conditions of credit for housing and land-use regulations are very different from the ones observed in the US. The behaviour of the different agents that participate in the real-estate market also differs between Europe and the US, specially for developers, that face very specific governmental constraints and regulations and households, where consumption preferences might be different These details should be identified, collected and coordinated to facilitate the implementation of the required changes in the model.

One important aspect to be studied concerns the governments' implications in local markets such as subsidies for education, fiscal advantages or local regulations. These policies obey different logics in European cities than US cities. They should be taken into account by addition of new variables that needs proper reflection.

Social attributes

Location choice models depend on the social characteristics of the decision maker (in this case household). Since UrbanSim was originally designed to model US cities is important to recognise the distinctive characteristics of European households, especially the structure of their social networks that should be acknowledged when developing the new platform. Since there might also exist differences between households within different European cities, such differences should be identified to define the level of flexibility that the new model will require in this aspect.

Mobility tools

European households consider the (annual) public transport pass as the equivalent to the second and often to the first car. We need to identify the variables and characteristics of the households and urban environment which favour the take up of this medium to long-term commitment to public transport.

Work package no.	2.7	**Starting date or event**	1
Deliverables and month of delivery Synthesis report on Economic attributes of European cities (included in D 2.1, Month 4)			

Work package no.	3	**Starting date or event**	4								
Work package title	Theoretical developments											
Activity type	RTD											
Partic. No.	1	**2**	3	4	5	6	7	8	9	10	11	12
Partic. Short name	ETHZ	**ENS**	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	16	**17**	0	0	5	0	0	0	0	0	10	6.5

Objectives

Work package no.	3	**Starting date or event**	4

The work package focuses on a number of improvements we will add to the existing modules on which UrbanSim is based. In particular, we consider the following directions for developing economic models that relax restrictive assumptions in the current versions of UrbanSim:

3.1. real estate investments;

3.2. location and real estate decisions within couples;

3.3. equilibrium;

3.4. stake holders in real estate;

3.5. firmographics.

The existing version of UrbanSim is based on a micro-simulation methodology using the individual households and businesses or jobs as the relevant agents. The evolution of households, jobs and activity densities is captured by different types of adjustment processes characterized by specific relaxation time. These processes will be studied in task 3.3. The industrial structure of the housing market, which is the outcome of the decisions of stake holders characterized by different structure and sizes will be examined in task 3.4. In WP 4, we discuss the demography of households; similarly, in task 3.5, we will analyse the death, birth, location, growth and down-sizing of firms. The optimization process of individuals and of households with respect to their residential location, joint with purchase/renting decision will be analysed in tasks 3.1 and 3.2.

Description of work and role of partners

Economic modelling

The theoretical part relies on the literature review and the state of the art in the case of micro-simulation models scanned in the previous WP. A discussion and development of the appropriate models is undertaken. The econometric analysis selects the most appropriate models (in the sense of statistical significance). The required code implementation and data required for the simulation will emerge at the end of this stage.

At the same time, the Environmental as well as the Social module will be formulated at this stage.

An important milestone is programmed at month 10. It will provide provisional theoretical models, which will be used in WP 5 and 6.

The theoretical models will then be fine-tuned based on the experience in WP 5 and 6, and on the computational issues raised when implementing them in WP 5 and 6. The result will then be comprehensive theoretical models, which will have proven their potential for real case studies.

Deliverables and month of delivery

D 3.1 Comprehensive theoretical models (Month 24)

Work package no.	3.1	**Starting date or event**				4						
Work package title	Real estate investments											
Activity type	RTD											
Partic. No.	1	**2**	3	4	5	6	7	8	9	10	11	12
Partic. Short name	ETHZ	**ENS**	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	0	**3**	0	0	0	0	0	0	0	0	1	0

Objectives

Real Estate investment is a key question in household budget. Households have to decide whether and when they wish to invest in real estate. The decision process follows a mix of a purely financial logic and logic based on actual usage value of the dwelling. Such model will be estimated (WP 5) and integrated (WP6) in UrbanSim and run for at least one of the case study.

Description of work and role of partners

We will incorporate real estate investment in portfolio optimization models. Indeed, for a majority of households, the housing investment is the most important asset in their portfolio. Housing stock is a specific asset for two reasons. First, the housing investment is indivisible. Second, usually, the household occupies the housing unit that was purchased. We also will add the location dimension in the choice of the household. Moreover, residential locations depend on a variety of factors, including job location.

The basic results will be included in a provisional theoretical model at month 10, in order to be used in WP 5 and 6. It will focus on the implications of those issues in the conception of UrbanSim

Deliverables and month of delivery

Individual location and portfolio optimization model for household for a single member in two-period model (included in D 3.1, month 24).

Work package no.	3.2	**Starting date or event**	4								
Work package title	Location and real estate decisions within couples										
Activity type	RTD										
Partic. No.	1	**2**	3	4	5	6	7	8	9	10	11	12
Partic. Short name	ETHZ	**ENS**	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	0	**7**	0	0	0	0	0	0	0	0	4	0

Objectives

We will develop a collective decision model including couple's residential location choice and spouses' job choices. The common decision has to take into account individual as well as common interests. The long-term static and dynamics of these decisions will be studied. A model of real estate household management will be designed, incorporating financial as well as actual usage values, and taking into account choices related to (partially) exogenous shocks (new job, divorce, etc). This model, developed for descriptive and normative use, will allow empirical investigation (experimental economics studies, or internet-based surveys), and should lead us to build a more faithful description of real estate choices made by households.

Description of work and role of partners

Current version of UrbanSim and WP 3.1 is either restricted to the case of singles, or does not distinguish between individuals and households. Here, we will consider the case of households with more than one member, especially husband and wife.

The location issue, when the household is limited to one member is rather simple. Based on the importance of commuting time and cost in large European cities, accessibility to current job and to potential jobs is a major factor for dwelling location. Real estate price is also a major determinant of location choice. Since local renting and buying prices are not perfectly correlated, location decision cannot be separated from the renting/buying decision. Here, we add job location to the dynamic model of dwelling location and renting/buying decision studied in WP 3.1. The model should provide indications on the way one can build individual-specific variables measuring accessibility to (potential) jobs, which should be consistent with the dynamics of job locations.

When there are two active members in the household, their current and potential work places are usually different, so that the choice of an optimal dwelling location is not straightforward. The model of location and real estate decisions of couples will provide indications on how to build wife-specific and husband-specific accessibility variables and other elements reflecting decision process within the couple. Indeed, spouses usually have different levels of risk aversion, and also possibly different time horizons. Moreover, depending on the respective bargaining powers of spouses, the household location may favour more the wife of the husband. We will extend the collective decision models developed by Chiappori (1992, 1996) to the case of household location and real estate investments.

Work package no.	3.2	**Starting date or event**	4

Chiappori (1992, 1996) to the case of household location and real estate investments.

In most standard cases, couples maximize a weighted sum of expected discounted utilities. Another criterion can be based on monetary compensations: each member of a couple bares a cost for not having access to the portfolio/real estate asset which best fits his/her preferences. de Palma and Prigent, 2008 have introduced the idea of compensation in the portfolio optimization framework. The aim of this task will be to compare the actual solutions chosen by a couple with our theoretical predictions. This will also allow a better understanding of the aggregation of couples' preferences in risky situations. We will also discuss the implications of those issues in the conception of UrbanSimE.

Deliverables and month of delivery

1. Household location, spouses' job location and portfolio optimization model for couples in a two-period model (included in D 3.1, Month 24);
2. Implications of those issues in the conception of UrbanSimE (included in D 6.1, Month 18).

Work package no.	3.3	**Starting date or event**	4								
Work package title	Equilibrium										
Activity type	RTD										
Partic. No.	1	2	3	4	**5**	6	7	8	9	10	11	12
Partic. Short name	ETHZ	ENS	INED	UCL	**KUL**	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	0	4	0	0	**5**	0	0	0	0	0	0	0

Objectives

1. Identify the alternative equilibrium mechanisms for the land, housing, job, school, amenities and transport markets;

2. determine criteria for the selection of a set of equilibrium mechanisms (empirical validity, computability);

3. propose alternative sets of equilibrium mechanisms to be tested and implemented.

Description of work and role of partners

Work package no.	3.3	**Starting date or event**	4

1. In urban economics one can distinguish 5 types of markets that are each indexed over time and over space: land market, housing, job, school & amenities, and more generally, transport options.

In each of these markets different equilibrium mechanisms are at work. It is not always clear what mechanism dominates on each of these markets. We distinguish between the following equilibrating mechanisms that can play both at the demand and the supply side (examples):

a. equilibration by price (free housing market where households and land developers determine the equilibrium land rent and housing rent for a given location);
b. equilibration by price + time and other costs (transport markets where congestion costs and schedule delay costs are part of the equilibrating mechanism);
c. rationing (social housing is supplied and allocated at random or using certain eligibility criteria).

In addition one can discuss the availability of future markets and the structure of price and rationing anticipations. There can be a full set of future markets (I can buy a house now but also a house that will be built at a certain spot when I will retire in 15 years) but often there is only a short to medium market (buying houses or signing rental contracts for houses that are available now or will be constructed soon). Anticipations can be forward looking, rational or myopic and within the same category of agents, several anticipation mechanisms can be at work.

A final element of importance is the transaction costs that can be particularly high due to i.e. high property transaction taxes (close to 20% in Belgium).

2. In principle location decisions drive all transport decisions and the accessibility drives location decisions. As most transport (demand) decisions have a short term nature, it is logical to assume full adaptation of transport decisions (mode choice and trip choice) in the short term. The way location decisions anticipate accessibility conditions requires further research as the anticipation mechanism are crucial in this decision process.

3. The equilibrium mechanism is requiring most attention. As houses are an asset with a long lifetime (more so in EU than in the US), decisions are strongly driven by anticipation and attitudes to risk in private wealth management. Inconsistent anticipations exist and this can be the origin of hysteresis phenomena.

Deliverables and month of delivery

Overview of alternative equilibrium mechanisms and selection criteria (D 3.1 Month 24);

Proposal for equilibrating mechanisms (D 3.1 Month 24)

Work package no.	3.4	**Starting date or event**	4
Work package title	Heterogeneous real estate developers		
Activity type	RTD		

Partic. No.	**1**	2	3	4	5	6	7	8	9	10	11	12
Partic. Short name	**ETHZ**	ENS	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	**12**	2	0	0	0	0	0	0	0	0	0	3.5

Objectives

The urban development depends on the decisions of land owners interacting with real estate developers. In this stage of real estate development different types of developers may be distinguished. They differ in various aspects, for example, resources, organizational form, purpose or portfolio managed. Accordingly, they behave differently and have different impacts on the urban development. If a lot of small owner/developers are active the urbanisation process, the resulting settlement patterns will be quite different from the ones created by large real estate companies. A third pattern arises when a settlement is mainly constructed by co-operatives. The settlement structure is not the only thing being affected. Depending on the developer type different usages, densities, building types, standards or even social compositions of inhabitants are more likely than others (Buckley & Mathema 2008, Checkoway 2002, Friedrich 2004, Van Wezemael 2005, p. 8).

Therefore it is important to consider different types of real estate developers to simulate the future development of an urban system. To our knowledge these aspects of real estate developers and their impacts on urban development have not been covered in micro-simulation systems. The objective is therefore to analyse to what extent different types of real estate developers foster a sustainable development in urban areas.

This objective also deserves our attention because a lot of built real estate objects – according to a life cycle model (Zeitner 2006, p. 75) – face redevelopment (Schwaiger 2003). This is a big chance to adapt existing urban structures to the needs of a modern society and this provides an opportunity to achieve an inner development that is more sustainable (Lee and Chan 2008, Hauri and Steiner 2006. p. 40). Here the objective is to be able of testing different policies for different developer types and to find incentives to guide the developers to a sustainable development.

Description of work and role of partners

Work package no.	3.4	**Starting date or event**	4

For the development of a real estate developer model the following steps are necessary:

1. description of the market of real estate developers:
   a) Identify the real estate developers participating in the area of interest. In this work step an overview of the relevant local real estate market will be achieved. The first part is conducting a literature review. A second element is the analysis of building applications from the relevant local authority. This process will be followed by investigating the identified developers. A problem arising might be that urban centres are also an attractive field for international developers which then should be considered.
   b) Gathering of data on real estate development events (Actors, buildings and surroundings) the first priority is to get the data about the evolution of the real estate stock and the permission to work with it. After locating the development events of the last ten (or hopefully more) years an important task will be to gather useful context data that describes the situation in which the decision for development has been made. A good basis in available for the Zürich case study as a result of previous research (Loechl 2006). It is also intended to make extensive use of public authority's geo-databases;
2. develop a theoretically consistent model of the different behavioural patterns of real estate developer types:
   a) Analyse the behaviour patterns of the real estate developers (co-operation with WP 3.2 concerning collective decision-making):
      I. conduct a sample of in-depth personal interviews with decision makers of each identified type of real estate developers
      Out of the total real estate developers a representative sample will be drawn. An interview guideline will be designed to conduct comparable interviews. The respondents will be sent a copy of the outline in advance to give them the chance to prepare which should result in more detailed information;
      II. analyse empirical data of real estate developments.
      The methods of analysis will generally be regression models. When data on the surroundings has become available methods of spatial statistics such as spatial regression analysis will be used. Analysis on developer attributes will be treated by multiple regression approach;
   b) categorise the real estate developers in a suitable way.
   The definition of developer types will be done according to the result of the analysis of the preceding work. The developers will be categorized in such a way that inside the category the variance will be minimized;
   c) derive different discrete choice models for each type of developer.
   According to the identified characteristics of the decision process discrete choice models is formulated. A crucial issue will be the determination of the set of alternatives available to the agents. The incorporation of the incentives and constraints inherent in the local land use regulations will be given special attention;
3. implementation of the model into UrbanSimE.

Deliverables and month of delivery

Work package no.	3.4	**Starting date or event**	4

Data of real estate developments and real estate developers (included in D 3.1, Month 24);
Qualitative data on behaviour patterns of real estate developers (included in D 3.1, Month 24);
Models of different behaviour patterns of real estate developers in Europe (included in D 3.1, Month 24);
Discrete choice model for each identified type of real estate developer (included in D 3.1, Month 24);
UrbanSimE-Module considering heterogeneous real estate developers (included in D 3.1, Month 24).

Work package no.	3.5	**Starting date or event**	4								
Work package title	Firmographics										
Activity type	RTD										
Partic. No.	1	2	3	4	5	6	7	8	9	10	**11**	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	**UCP**	UCB
Person-months per partic.	4	1	0	0	0	0	0	0	0	0	**5**	3

Objectives

1. develop theoretical model for firm death or move, growth or decline and location choice decisions, based on the different strands of literature highlighted in the previous WP, and on the availability of data for the different case studies;
2. provide suggestions for the choice of variables to use in WP 5, 6 and 7, and for relations to estimate and econometric aspects to analyse in WP 5, such as the potential endogeneity of key variables and possibilities for correcting potential endogeneity bias.
3. Implement an initial firmographic model in UrbanSimE

Description of work and role of partners

New models should be developed in different directions, depending on the data available for each case study. When geocoded panel data are available for firms, it will be possible to estimate rich models measuring the dynamics of firms, especially their lifetimes. These models may rely on an agent-based approach or on theoretical economic/geographic models analysing firms' competition.

When geocoded panel data are not available, the models will be more focused on the determinants and decomposition of local employment between two dates, based on literature on regional science, economic geography, and economic theory. These models will aim at estimating jointly, for each sector:

1. firm deaths;
2. firm births;
3. firm location;
4. evolution of the number of employees in each firm.

These models should be developed under the constraints that they can be estimated with available data on at least one case study, and that they can be implemented in UrbanSim. A provisional internal guideline for implementation in UrbanSim and for estimation will be provided to WP 5 and 6 at month 10. It will be fine-tuned in D 3.1, month 24.

The implementation and test of firmography models in urban microsimulation will be part of WP 7 (Case studies).

Work package no.	3.5	**Starting date or event**	4
Deliverables and month of delivery Guideline for implementation in UrbanSim and for estimation (included in D 3.1, Month 24). Initial module for UrbanSimE (included in D 3.1, month 24)			

Work package no.	4		**Starting date or event**			4						
Work package title	Demographic Model											
Activity type	RTD											
Partic. No.	1	2	**3**	4	5	6	7	8	9	10	11	12
Partic. Short name	ETHZ	ENS	**INED**	UCL	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	0	0	**18.5**	0	0	0	0	0	0	6.5	0	0

Objectives

The current implementation of UrbanSim uses a micro-simulation database containing individual households and persons. However, the system lacks models to simulate annual changes in the composition and characteristics of households that reflects dynamics of birth, death, household formation, household dissolution, etc. Instead, households are synthesized to meet aggregate control totals by sampling and duplicating existing households. This is not adequate, however, for modelling the spatial-temporal dynamics in the housing market and labour market arising from ongoing demographic change. Demographic micro-simulation models are used for a variety of policy and other research purposes. These models will be instrumental to inform the development of a demographic module within the UrbanSim system, with specific adaptation to the European context. One component that has been recently added to the Open Platform for Urban Simulation is a household synthesizer, which creates an initial base-year population representing individual households and persons. This module will be adapted to deal with data available in European cities.

The demographic module should provide accurate predictions of the evolution of the total number of households of each type at the regional level for each year. These predictions are based on a micro-simulation model that can explain births, deaths, marriages and other unions, divorce and other union disruptions, children leaving their parents' home, as well as immigration, emigration.

This module will interact with the other modules in the sense that the above-mentioned demographic events may be influenced by labour supply, local or regional economic conditions such as labour market or real estate market.

The demographic model may also improve the modelling of the influence of the regional demographic evolution on the other modules in UrbanSim.

Description of work and role of partners

Drawing on the work carried within WP2, the first step will consist in an overview of the issues concerning the integration between demographic modelling of individual and household behaviour, and urban development models.

The second step will sketch a provisional demographic evolution model which can be both actually estimated in the case studies based on existing data (WP7), and integrated to the UrbanSimE platform.

Work package no.	4	**Starting date or event**	4

Available data which can be used as a basis for estimating the parameters of demographic models will be explored.

It will then work on the programming and integration of this provisional demographic evolution model, and will interact with WP4 for solving the problems raised by the integration of the demographic evolution model (step 3). This initial module will guide the estimation in the three case studies.

The fourth step will then consist in reviewing the case study results and developing a final demographic evolution model ready for re-estimation in the three case studies, if necessary, and ready for future integration in the UrbanSimE platform.

Deliverables and month of delivery

M 4.1 Provisional demographic outline (Month 10) will provide to WP6 guidelines for programming the interaction of the demographic model with other modules, and to WP7 guidelines for estimating the relevant models;

M 4.2 Initial demographic module for UrbanSimE (month 18)

D 4.1 Comprehensive demographic model (Month 30) ready to integrate in UrbanSimE in order to update the integrated software.

Work package no.	5			**Starting date or event**			4					
Work package title	Econometric and other empirical issues											
Activity type	RTD											
Partic. No.	1	2	3	4	5	6	7	8	9	10	**11**	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	**UCP**	UCB
Person-months per partic.	0	9	0	0	0	0	6	0	0	0	**18.5**	0

Objectives

The task focuses on a number of econometric improvements to made in respect to the existing estimation or calibration of models on which UrbanSim is based:

1. household location model should be consistent with variable size of potential locations, husband's and wife's respective preferences and constraints (current and potential labour place); the location decision should be modelled simultaneously with the decisions to live in a house/a regular flat/a low-price (social) housing (e.g. HLM in France), and to buy or rent the dwelling;
2. consider firms rather than jobs as the decision unit for jobs location; decompose the evolution of the number of jobs at a given place in : variation in the number of jobs in each existing firm; firms relocation; births and deaths of firms;
3. for the land use model, instead of estimating transitions probabilities from one usage to another, develop and estimate a model of generation of projects of a given type and size, and estimate a location model for these projects given the constraints imposed by their type and size.

WP 5 will also investigate the possibility to estimate interrelated decisions entering different work packages (For example, life cycle effects in the car ownership and location decision process). However, difficulty to access the needed panel data will add to the difficulties raised by the theory of dynamic decisions.

Description of work and role of partners

1. provide guidance for econometric modelling (data collection, econometric model), as a milestone (month 14) needed in WP 7;
2. estimate each model in at least one case study

Deliverables and month of delivery

Work package no.	5	**Starting date or event**	4
D 5.1 Econometric guidance (Month 14) D 5.2 Estimation results for selected case studies: Estimate each model in at least one case study (Month 30)			

Work package no.	6	**Starting date or event**			4							
Work package title	Integration of advanced agent-based transport models											
Activity type	RTD											
Partic. No.	1	2	3	4	5	6	7	**8**	9	10	11	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	STR	NTUA	**TUB**	EPFL	BU	UCP	UCB
Person-months per partic.	3	0	0	1	0	3	0	24.5	1	1	0	0

Objectives

It seems difficult if not impossible to make an urban simulation model such as UrbanSim more behaviour-oriented without having a microscopic model of how people (and ultimately goods) move in the city. In order to leverage existing work, including computational performance capabilities, we will use existing behaviour-oriented microscopic traffic models and integrate them with UrbanSimE. These models will not only provide a microscopic description of the traffic system, including (ultimately) pedestrian movement, bicycle traffic, and detailed public transit modelling, but also the behavioural modelling that is tightly coupled to the traffic system, such as the scheduling of activities in time and space, task allocation within households, or the consequences of the selection of certain mobility tools (e.g. car vs. "flat rate" public transport season ticket). That is, the long-term choices of residence, workplace, and education will be fed from UrbanSimE to the microscopic transport model, which will use them to construct daily plans adjusted to those long-term choices. The performance of those daily plans will then be fed back to UrbanSimE, which will use these results as a basis for its next round.

More specifically, the objectives are:

1. integrate two existing simulation packages MATSim (behavioural agents) and METROPOLIS (time-dependent car-traffic) into UrbanSimE:
   a) design of travel demand generators from UrbanSimE data targeted toward MATSIM and METROPOLIS;
   b) design of feedback accessibility indicators relevant to MATSIM and METROPOLIS including time-of-day performance of the transportation systems and compatible with micro-economic theory (logsum's);
2. leverage capability to individually identify travellers both in MATSim and in UrbanSimE to provide "warm start" capability for runs of the transport model, dramatically reducing computing times (currently several hours per run of transport model);
3. leverage microscopic analysis capability inside MATSim to provide better accessibility feedback to UrbanSimE.
4. test the integration using the case study data

Description of work and role of partners

Work package no.	6	**Starting date or event**	4

Software:

1. elaborate the required software and implement the corresponding UrbanSimE/MATSim codes. In particular, devise a robust approach to the software integration;
2. write meaningful test cases both on the UrbanSimE and on the MATSim side (both projects use daily regression testing in their software repositories); also use these test cases to illustrate effects of the integration (See also WP9);
3. design, implement, test, and “stabilize” (with test cases) the warm start capability. Document improvements in computing time;
4. use existing interface between UrbanSim and VISUM software to integrate METROPOLIS (de Palma and Marchal, 2002; de Palma *et al.*, 1997) within a classical four-step approach as well as an activity-based approach;
5. implement benchmark tests with METROPOLIS (e.g. no-congestion scenario).

Conceptual/Software:

1. develop accessibility indicators that use the specific capabilities of behaviour-based microscopic transport models, in particular the possibility to consider performance of complete “daily plans” rather than just commute trips;
2. implement these indicators and illustrate/verify them with corresponding test cases;
3. perform sensibility analysis on Ile de France/Paris scenario with UrbanSim/METROPOLIS with regard to the overall model features (e.g. comparison of classical four-step vs. activity-based demand, static vs. dynamic accessibilities).

Other:

1. interact with WP 3 especially concerning issues that lie at the interface between UrbanSimE and the travel behaviour model, such as collective decision-making within households or mobility tool selection;
2. interact with WP 4 concerning a demographic model inside UrbanSimE, especially with respect to a travel behaviour simulation that “remembers” its state from one call to the next;
3. interact with WP 6 concerning the interaction between activity opportunities and location choice modelling of UrbanSimE actors.

Deliverables and month of delivery

M 6.2 UrbanSim upgrading modules (Month 18);

D.6.1 Guide on UrbanSim usage of the integrated models (Month 20);

D 6.6 Report on travel behaviour modelling for Zurich case study (Month 32);

D 6.7 Report on travel behaviour modelling for IDF case study (Month 32).

Work package no.	7	**Starting date or event**				4						
Work package title	Case studies											
Activity type	MGT											
Partic. No.	1	2	3	4	5	**6**	7	8	9	10	11	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	**STR**	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	24	35	4	32.5	3	**15.5**	0	0	24.5	0	17	0

Objectives
The centrepiece of the work package is to take advantage of the achievements of the other tasks in order to undertake an empirical analysis on three European agglomerations (IDF, Brussels and Zurich), and possibly to prepare a 4th application (depending on co-funding). The objective of WP7 is to test the new simulation tool UrbanSimE in at least three case studies.

Description of work

For each of these three case studies there is an existing UrbanSim model.

Preliminary case studies will start at an early date with the current version of UrbanSimE. They will be undertaken in order to help the working teams to identify the main practical limitations and difficulties.

The main case studies will then be undertaken after the upgrade of UrbanSimE.

In each case city, the following tasks will be successively carried out:

1. WP7.1: data collection and analysis;
2. WP7.2: work on spatial issues;
3. WP7.3: calibration: this includes calibration of the transport model, calibration of the urban model, integration of the transport and urban models;
4. WP7.4: simulations of scenarios, evaluation of the tool and of the policies: this includes running the environmental and socio-economic modules (see WP8) to get indicators and evaluate the scenarios.

It is worth noting, that the current implementations for the 3 case studies are at different stages of calibration, ranging from prototype model (Brussels) to fully developed and operational model (Ile-de-France, Zürich). It is therefore likely that the 3 models will also reach 3 different levels of development by the end of the project.

In particular, the new modules which will be developed in the project will not necessarily be tested in all three case cities. For example, the demographic module will probably be applied in the three case studies, but on the contrary, the agent-based transport model will be applied only in Zurich and Paris.

The case of Brussels can take advantage of lessons learnt during two other applications and be seen as a test bed for model application procedure which will be suggested for every other applications of urban

Work package no.	7	**Starting date or event**	4
model. Specific features of the case cities (the current state of the three existing models and the specific issues faced by each city, which should inspire the policies to test) are described below after the work description.			

Deliverables and month of delivery

M 7.1 Database on the three cities (IDF, Brussels, Zurich) (Month 14);

D 7.1 Spatial issues (Month 20)

D 7.2 Calibration of the UrbanSimE models in the three case cities (month 24)

D 7.3 Case Studies in the three cities (Month 32)

Work package no.	7.1	**Starting date or event**	4									
Work package title	Case studies – Data collection and analysis											
Activity type	RTD											
Partic. No.	1	2	3	4	5	**6**	7	8	9	10	11	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	**STR**	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	6	9	2	8	0	**2**	0	0	0	0	2	0

Objectives

The objective of WP7.1 is to collect and analyse the data required by the several sub-models making up the UrbanSimE model in the three case cities.

Description of work

Work package no.	7.1	Starting date or event	4

***UrbanSim data requirements**:* UrbanSim requires a large, but reasonable amount of data: data on the households, jobs, buildings, basic spatial units contained in the city (including transport network and usage data and land use data), data on the development history and the development constraints, at a very disaggregate level.

The characteristics of the basic spatial units include administrative characteristics (zoning, county, city, etc.), land use characteristics (e.g. number of residential units, surface area of non-residential activities, etc.), traffic data (provided by the transport model), and geographical characteristics (distance to transportation infrastructure, gridcell slope, etc.).

The households are characterized by socio-economic attributes such as number of persons, number of vehicles, number of children, age of household's head, household income and data on their location (identification of the basic spatial units in which they locate).

Concerning the employments, two types of data can be used. In the previous version of UrbanSim, the number of jobs was given by industrial sector, building type and location, and jobs were not grouped by firms. To use the firmography approach, we will need information about the firms at least at two time points. Panel data will be an important source to improve the quality of estimates and predictions, and to take into account important elements such as the age of a firm. For each firm, we will need to know at least the workforce, activity sector and location.

The buildings are characterized by the construction year, building type, number of residential units in the building, non residential surface area, etc., and their location.

The development history data contain information on previous real-estate development and its characteristics. The development constraints are the constraints placed on different types of basic spatial units, such as zoning constraints, physical constraints, etc.

***Data elaboration work to be performed in the project**:* In all three case cities, at least a part of the above mentioned data have been already collected, at least at an aggregate spatial level, to calibrate the existing models. The efforts in this project will thus concentrate on the following aspects :

1. collect or elaborate data on the same variables but with a different spatial zoning (more appropriate to European urban patterns, as opposed to American grid-patterns) and possibly at a more disaggregate level, than in the current version of the model;
2. collect data specifically needed for the new modules to be developed in the project, i.e. the demographic module, the household collective decision (location choice) module, the developer type module and the multi-agent travel module, and data needed for the improvements that will be brought to existing models such as firmography.

Data requirements for the demographic module: the demographic module will be a dynamic module, i.e., it will be based on estimates of transformation of households, from one year to the next, by birth of a child, union formation or dissolution, children leaving the parental home, other adults joining or leaving the household. The demographic behaviour of individuals will be simulated in the module, the individuals being linked into households in a consistent way.

Census data are needed to define the starting point of the household structure. Survey data, like the EU-SILC data, or data from larger samples if available on the city area, will be used to estimate transition probabilities, from one state to the other. Covariates imported from other UrbanSim modules will be used to take into account the heterogeneity of the population demographic behaviour.

The models will be calibrated in order to accurately describe the trends in household structures from one census to the next, as well as the structure observed in the last census, and the estimated rates will be projected for the future. The starting hypothesis will always be the one of proportional hazards, where each transition is described by an age profile and the covariates (place of residence, income, professional occupation, etc.) inflate or deflate rates similarly at all ages. Depending on data availability, more specific models will be tested and used.

Work package no.	7.1	**Starting date or event**	4

Data requirements for the household collective location-choice module: this module requires data on the household location, spouse's jobs location, accessibility (in time and cost) from the household location to the potential jobs for husband and wife, real estate prices.

Data requirement for the multi-agent travel module: disaggregate (individual) transport data, both on road traffic and public transport.

Data requirements for the developer type module: the number of active developers in the study area, their classification, and their level of activity and the spatial range of their activity. For the major institutional investors, the detailed interviews used before will be complemented by further information of their investments and investment strategy.

The data collection will be based on existing official and private data sets. No new data collection as such is planned in this WP

In the phase of data preparation as well as in the calibration phase, some spatial issues are of crucial importance, both for the relevance of the outputs and the comparability of results between the 3 case studies. This is developed in the following section.

Deliverables and month of delivery

M 7.1 Database on each case city (Month 14)

Work package no.	7.2		**Starting date or event**			4						
Work package title	Case studies – Spatial issues											
Activity type	RTD											
Partic. No.	1	2	3	**4**	5	6	7	8	9	10	11	12
Partic. Short name	ETHZ	ENS	INED	**UCL**	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	0	4	0	**18.5**	0	1	0	0	6	0	6	0

Objectives

In UrbanSim, a massive amount of geographic data is collected from various sources, and often at different spatial scales. Before these data can be integrated for problem solving, fundamental issues must be addressed. These issues are known to influence and bias the spatial econometric analyses. The objective of WP7.2 is to address these spatial issues.

We will control or at least limit those biases with adequate statistical tools and will conduct sensitivity analyses. This will help the comparison of the results on each city and increase the robustness of the results. It concerns not only data preparation, model definition but also calibration stages. Particular attention will be put on issues such as: spatial scales, relevant definition(s) of the urban agglomeration, relevant basic spatial units (BSU), aggregation issues, "neighbourhood effects", spatial auto-correlation and endogeneity.

Description of work

Let us start here with some examples.

Limits of the agglomerations: it is crucial that the three studied agglomerations are defined with the same (international) criteria (see Dujardin *et al*. for a review). Several definitions will be suggested (including administrative and functional definitions) and modelling results compared. Indeed, in the periurban areas, the friction of distance is different leading to different spatial behaviours.

Interurban structures: moreover, within these well-defined and controlled limits, morphological/functional subzones (e.g. the "centre", the "agglomeration", the "suburban area", etc…) should be defined on common criteria selected in all 3 case studies. This enables one to control the modelling results and understand the functioning of these 3 cities, to compute indicators on households and jobs (re)location (migration from the urban centre to the a first, second, … rings; emergence of edge-cities; …) and to compare these indicators across the case cities, to understand commuting directions, housing rents, etc.

*Definition of the Basic Spatial Unit*s (BSU): data are available in all 3 case studies from different statistical authorities, with different definitions and for spatial units of different definitions across the case cities. The question will then be to assess the influence of that definition on the results, and/or to find a common denominator for all 3 cities. BSUs often vary in shape and size leading to aggregation biases that should be controlled.

To analyse the implications of the definition and size of the Basic Spatial Units on the results obtained requires collecting as much data as possible on a very precise spatial scale, and test different

Work package no.	7.2	**Starting date or event**	4

aggregation levels. In the latest version of UrbanSim, different spatial levels can be used for different modules in the same case study. Unfortunately, this possibility has never been exploited up to now in the case studies of this project. During the course of this project, we will also work on nesting different spatial scales for the same module. This requires developments in WP 3 (theory), 5 (econometric models), 6 (evolving UrbanSim) and 7 (case studies).

Scale: scale is not a new issue in spatial analysis. The spatial scaling problem presents one of the major impediments, both conceptually and methodologically, to advancing all sciences that use geographic information. Changing the scale of data without first understanding the effects of such action can result in the representation of processes or patterns that are different from those intended. The objective is to better understanding how scales influence human perception and behaviour and to mitigate this effect in the modelling processes. Individual's choices for activities (residence, travel, work, leisure) will have to be considered in a multi-level space. Scales are not only social (individual – household) but also spatial (household, ward); scales are not only "natural" but also constrained by data availability (some data are only available at communal level).

Spatial-autocorrelation, Contextual effects, Endogeneity : UCLouvain has accumulated experience in analyzing these aspects in spatial econometric models. It wants to share it and apply it in the SustainCity project. If autocorrelation is well know (but not straightforward to avoid/solve), it is also important to identify neighbourhood effects (i.e. contextual and endogenous effects taken together) and disentangling these from correlated effects (i.e. similarities in behaviours and outcomes arising because of unobserved characteristics shared by individuals in the neighbourhood). Correlated effects arise because individuals are not randomly distributed inside the urban space. On the contrary, individuals sort themselves into neighbourhoods on the basis of their personal and family background characteristics (for example, income) and some of these characteristics also influence the outcome of interest. These background characteristics are either observed by the researcher, and might be controlled for, or unobserved. Because of these *unobserved* characteristics, purging neighbourhood effect estimates from any correlated effects is difficult. If correlated effects are ignored, estimated neighbourhood effects will be biased. This problem is referred to as the endogeneity issue or the self-selection issue in the literature, as it arises from the fact that individuals choose their neighbourhood of residence (i.e. "self-select" into neighbourhoods).

Hence, to summarize, for all 3 cities, a careful spatial analysis is necessary at all stages of the modelling process but especially for the exploratory spatial data analysis (ESDA).

In practice, WP7.2 will address the points mentioned above in the three case cities and provide a report on these issues.

Deliverables and month of delivery
D. 7.1 Spatial issues (Month 20)

Work package no.	7.3		**Starting date or event**			4						
Work package title	Case studies – Model calibration											
Activity type	RTD											
Partic. No.	1	2	3	4	5	**6**	7	8	9	10	11	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	**STR**	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	12	14	2	0	0	**1**	0	0	15.5	0	6	0

Objectives

The objective of WP7.3 is to calibrate the UrbanSimE model for the three case cities.

Work package no.	7.3	**Starting date or event**	4

Description of work

Basically, in UrbanSimE, the calibration work is subdivided into the calibration of the various sub-models and modules:

1. calibration of the transport sub-model
2. calibration of the demographic model
3. calibration of the land-use sub-model, which in turn implies the estimation of the various modules, mainly:
    a) the household and job location models;
    b) the real-estate price models.

Although UrbanSim has an integrated calibration sub-program, the actual calibration and fine-tuning of the model is a complex task which requires a large amount of human resources. Beyond the mathematical estimation of the parameters, the actual calibration is performed by carrying out simulations, comparing the modelled evolutions with observed evolutions and adapting the module specifications and parameter values in consequence.

The calibration of the transport sub-model will be based on the following criteria (to be compared in the observed and modelled situations):

- travel flows by mode
- flows crossing screen-lines or cordon-lines
- travel times on typical origin-destination relationships, particularly by car
- length and location of the traffic queues.

The calibration of the land-use sub-model will be based on the following criteria (again to be compared in the observed/modelled situations):

- location of the households, by household category, and evolution with time
- location of the jobs, by activity sector, and evolution with time
- real-estate prices, by category, and their evolution with time.

Deliverables and month of delivery

D 7.2 Calibration of the UrbanSimE models in the three case cities (month 24)

Work package no.	7.4		**Starting date or event**			4						
Work package title	Case studies – Simulations, tool evaluation and policy evaluation											
Activity type	RTD											
Partic. No.	1	2	3	4	5	**6**	7	8	9	10	11	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	**STR**	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	6	8	0	6	3	**11.5**	0	0	3	0	3	0

Objectives

The objective of WP7.4 is to simulate policy scenarios with UrbanSimE in the three case cities, and to evaluate the tool and the policies, on the basis of the model outcomes.

Description of work

In all the three case cities, the following simulations will be carried out:

1. simulation of a business-as-usual scenario (at a given horizon, common to all 3 case cities (e.g. 2020);
2. simulation of policy scenarios:
    1. city specific policies: one or more individual measures or packages of measures,specifically designed for each case city, aiming to tackle the particular problems it is facing;
    2. common policy package: one package of measures, which will be defined jointly by all partners on the basis of Work package 8 (Task 8.3). That common package will globally aim to socio-economic and environmental sustainability and will be built as an integrated land–use and transport strategy. For example, it will include:
        a) on the transport side:
            i. congestion pricing
            ii. reinforcement of public transport services in the urban agglomeration
        b) on the land use side:
            i. policy of location of new offices in central areas (well served by public transport) rather than in peripheral areas
            ii. fiscal policy aiming to internalise the external costs of new suburban settlements (compared to new settlements in the urban agglomeration), in an attempt to control urban sprawl
            iii. urban growth boundaries with increased gross floor area limits.

Work package no.	7.4	**Starting date or event**	4

As the existing starting models are at different stages of calibration, the final models will probably reach 3 different levels of development and hence, the simulation of the common policy package may be carried out with more or less detail in the three case cities.

The outputs of the calibration and simulation phases, and more generally the outputs of the WP7, will be twofold:

1. firstly, an evaluation of the tool UrbanSimE;
2. secondly, an evaluation of the simulated policies.

Evaluation of the tool: The UrbanSimE new tool developed will be assessed, quantitatively as much as possible, notably on the following aspects:

1. difficulty of the overall calibration;
2. quality of the reconstitution of the evolution (comparison modelled/observed evolutions) for the main variables: population, employment, real estate price, accessibilities, for example:
   a) for Zürich: comparison with the outcomes between 1996 (start year) and 2006, for which we have observed the on-going changes;
   b) for Brussels: comparison with the observed 1991-2001 evolution;
1. sensitivity of the model (direction and magnitude of the effects, elasticity);
2. identification of the remaining limits and weaknesses of the UrbanSimE model.

The assessment will be performed notably by comparing the outcomes of the new UrbanSimE models with those of other models:

1. in the case of Ile-de-France and Zurich: comparison with the outcomes of the previous UrbanSim models;
2. in the case of Brussels: comparison with the outcomes of the available TRANUS model.

Evaluation of the policies: The policy evaluation, i.e. the assessment of the policy impacts in the view of the policy-makers objectives, will be carried out using a common framework of evaluation, which will be defined in WP8.

WP8 will define a set of socio-economic and environmental indicators, which will be computed in the 3 case studies, for the business-as-usual scenario, the common policy package scenario and the city-specific policy scenario(s).

Deliverables and month of delivery

D 7.3 Simulation results, evaluation of the tool, evaluation of the policies (Month 32)

Appendix to the description of workpackage 7

This section describes some features specific to each of the three case studies:

1. firstly, the current state of the models;
2. secondly, the problems currently faced by the urban areas, that should be addressed by the simulations.

Current state: Ile-de-France urban area

The existing model[17] for Paris area was run essentially at the gridcell level. In parallel, we have estimated some stand alone econometric models at the commune level (the smallest administrative geographical unit). Data is also available at a smaller and more homogeneous level (îlots), which seems a priori more relevant for modelling households' location. Further interdisciplinary research is needed for analyzing this question. The residential location choice model was estimated in relation with real-estate price models to address the question of the endogeneity of prices. We also realized that many real estate prices (single houses/flats, renting/selling) are relevant and not totally correlated with each other. This raises the question of estimating the choice between renting and buying, and between the choice of a flat and of a house jointly with the location decision.

A job-based employment location model was estimated and implemented in UrbanSim. In parallel, we collected the data necessary for estimating firmography-oriented models, which still remains to be implemented in UrbanSim. Preliminary encouraging results were obtained on stand-alone econometric models.

The real estate price model is decomposed by real estate property types as dwelling (apartments and houses) and offices.

The urban development model uses the transition approach and the results have not been completely satisfying. The model is calibrated over a period of 9 years and run for a period of 28 years. We have obtained relatively satisfying global results at the "department" (county) level. The interaction between UrbanSim and METROPOLIS (Transportation model) has been implemented in an offline manner. It means that the two models are not run automatically one after other. These models are run and the data is exchanged manually and separately

Current state: Zurich urban area

The UrbanSim implementation for the greater Zürich area was established in a prior project. All the relevant choice models were estimated, at least in an initial version[18]. It was based on official data and a dedicated survey of home owners and tenants. An aggregate transport model of the canton Zürich provided the necessary accessibilities. The initial calibration runs of the model revealed systematic problems in certain parts of the canton, which need to be addressed. They also showed that the initial hedonic model of rents captured accessibility gains in a biased way, which requires a reformulation, which has since been undertaken but not yet tested. They also showed that the commercial sector needs more attention, but an on-going dissertation will provide the necessary information about commercial rents and the interaction with the business cycle and the rental contract.

A calibrated version of the agent.-based micro-simulation model MATSim is available.

Current state: Brussels urban area

[17] See A. de Palma, K. Motamedi, D. Nguyen-Luong, H. Ouaras, and N. Picard, 2008, SIMAURIF (SIMulation of the interAction between land Use and transport in the Region Paris Ile-de-France) : the whole calibration and the application to the "North Tangential" railway project, European Regional Science Association (ERSA) Congress, Liverpool, UK, A. de Palma, K. Motamedi, N. Picard, and P. Waddell, 2005, A model of residential location choice with endogenous housing prices and traffic for the Paris region. European Transport 31 67-82, A. de Palma, K. Motamedi, N. Picard, and P. Waddell, 2007a, Accessibility and environmental quality: inequality in the Paris housing market. European Transport 36 47-74, A. de Palma, D. Nguyen-Luong, K. Motamedi, N. Picard, H. Ouaras, and M. Fernandes, 2007b, SIMAURIF, Modèle dynamique de simulation de l'interaction Urbanisation-transports de Région Ile-de-France, Application à la Tangentielle nord; Rapport intermédiaire de la 2ème phase, Institut d'aménagement et d'urbanisme de la région d'Ile-de-France (IAU-IdF), Paris.

[18] Löchl, M., M. Bürgle und K.W. Axhausen (2007) Implementierung des integrierten Flächennutzungsmodells UrbanSim für den Grossraum Zürich – ein Erfahrungsbericht, *DISP*, **168**, 13-25.

The existing UrbanSim model of the Brussels urban area is a prototype model. This model was developed by using available data aggregate at the level of townships (“communes”), with limited human resources, the main purpose being to understand how difficult it was to develop an UrbanSim model. All the submodels have been calibrated and the model runs, however the simulation results show discrepancies between the modelled and observed evolutions, which indicate that the model requires more disaggregate data and a re-calibration work based on these new data.

In fact, Stratec has previously developed and tested an integrated land-use/transport model of the Brussels urban area with software, TRANUS, which belongs to another family of models based on other principles (more aggregate level, equilibrium, etc). This model was calibrated, updated and tested in previous European research projects (ESTEEM, PROPOLIS, and SCATTER). The population, employment, land use and land value data which were used for the Tranus model were thus re-used for the calibration of the UrbanSim model. On the other hand, the development of the UrbanSim model had also as objective in a longer term to compare the calibration requirements and difficulties and the results quality of the two models.

In the current version of the UrbanSim model, the study area extends roughly on 4000 km² centred around the city of Brussels and includes about 135 townships (“communes”) belonging to the Brussels-Capital, Flemish and Walloon Regions. However this definition of the study area may be adapted, in view of the spatial issues mentioned above and of the data requirements. The model was developed using official statistics, at the “commune” level, on population, employment and land use, in 1991 and 2001, and available data on land value. The interzonal travel times and generalised costs were provided by the Tranus model. The UrbanSim application was developed with a standard 150 meters x 150 meters grid zoning which contains approximately 193 000 gridcells for the region as a whole.

The data required by UrbanSim at the gridcell level were created by disaggregating the data available at the township level, using sensible hypotheses.

As examples of results, in spite of the limitations in the data and dedicated human resources, the population simulation results compare surprisingly well with the actual population growth by township, but on the other hand, the real estate development model provides poor quality results and clearly requires more data for calibration.

Current problems: Ile-de-France urban area

Ile-de-France is a region with about 11 million inhabitants and a surface of 12000 km² (about 46% of surface is habited). 1300 communes constitute the smallest administrative geographical units. They are grouped in 8departments and three rings. The region has an important public transit network and facility with 20% market share of all daily trips (44% for private cars). The share of public transit has been decreasing during the last years. 5 new cities have been constructed from 60’s around the region on absorb the Paris population spill over. These new cities constitute important urban poles in the region. The transportation network has a radial structure and several tangential infrastructures are recently developed and other ones are in project. The environmental and congestion aspects become an important concern for the region’s centre and the city of Paris. Several policies are studied or applied that deserve a more comprehensive study taking into account the relocation phenomenon.

During recent years the real estate prices have increased and also the transportation cost has been modified with further changes in perspective. These evolutions have a considerable effect on social structure of urban population that deserves to be studied in detail using the UrbanSim model, too.

From implementation point of view, we consider following improvements to be applied in the existing area’s application to achieve expected operational model. The first aspect was the choice of the Basic Spatial Units. The data have been produced at different levels, but the most common is commune. The population data in particular have been available at a more detailed level.

We had to develop different price models for different real estate property type because only one model for land price was not sufficient to explain the market situation.

For household location model, UCP observe the importance of the previous residential location in the choice of new one. This aspect is not taken into account in the current version of UrbanSim because of the memory loss for households when they move. A multi-agent approach for modelling will solve this problem. Other directions of improvements can be suggested by the demographic model.

The firmographic approach was tested successfully for Paris area. It should be improved and implemented in UrbanSim to be used as a better approach to employment location choice.

UCP has access to the land use/coverage data. That let us to estimate accurate enough urban development project location model. But we don't have access to cadastre data to know the available floor space at each geographical unit and take into account the capacity of each location to receive employments and firms.

Finally, the automatic and full interaction between UrbanSim and METROPOLIS and necessary intermediate procedures should be implemented in OPUS framework to obtain a fully operational version of UrbanSimE for Ile-de-France area.

Zurich urban area

The greater Zurich area has successfully attracted new residents, both Swiss and foreign, with the resulting pressure on housing and social infrastructure. The shift to a service sector led growth is displacing older local commerce, as well as industrial firms, resulting in social displacement as well. The success of out-of-town firms has created two new cities outside the city of Zurich proper, in the Glatttal[19] and the Limmattal, which are lacking urban focus and intensity. The official rate of empty flats at any one point in time hovers around 0.01%. This level of competition displaces the less wealthy residents and requires a policy response, and that is what makes the role of the different types of developers so crucial in the Zürich case. The specific issues we will address are:

1. development induced by infrastructure investment currently being realised or planned (new motorway to the south-west – Zug/Lucerne; North-South regional rail tunnel; expanded services of the airport; capacity expansion on the circumferential motorway around Zürich and the by-pass of Winterthur to the north-east; improved speeds and service frequencies of the long-distance commuting services of the national railway system);
2. impact of new charging systems for rail and road (road pricing, car ownership taxes, pricing systems for public transport);
3. policies to provide housing of all price ranges inside the urban cores through the different types of developers;
4. policies to induce the development of true urban cores in the Glatttal and the Limmattal (each about 120'000 inhabitants north and north-east of Zürich).

Brussels urban area

The area covered by the current UrbanSim model has about 2, 9 million inhabitants (135 communes). Its central part corresponds to the Brussels-Capital Region, i.e. an administrative entity and one of the three regions making up the federal state. The Brussels-Capital Region groups about 1 million inhabitants. The actual (morphological and functional) urban agglomeration, instead, spreads beyond the limits of the administrative entity, over a part of the Flemish Region and Walloon Region.

19 Campi, M. (2001) *Annähernd perfekte Peripherie: Glattalstadt/Greater Zurich Area*, Birkhäuser, Basel.

In the Brussels city itself, an old industrial axis along a canal surrounded by poor neighbourhoods with different ethnic communities makes its way through the whole city, cutting it in two parts. Since a few years, this area is in a process of renovation (notably of the brown lands), with important residential and office developments. Another feature of Brussels is the continuous out-migration of middle class families to the suburban areas, yet for several decades, which causes urbanization of previously open spaces, commuting by car and traffic congestion. In reply to this, the Brussels-Capital regional authorities implement policies to improve the residential attractiveness of the Region. On the other hand, Brussels also has to manage important administrative functions (including the European and other international institutions) and to elaborate strategies to integrate these functions in the city in a way both harmonious and efficient. Besides, one of the main future projects is the Regional Express railway Network (REN), to be implemented in 2016, which will significantly improve the accessibility between the centre and the suburban areas, and is expected to have effects on household and economic activity location. Eventually, the three Regions committed themselves to drastic reductions in their greenhouse gas emissions. The Brussels-Capital Region in particular committed itself to reduce its emissions by 20 % compared to the 1999 level, by the year 2015. This will require a strong modal shift from car to public transport in the Region, which will have as consequence an increase by 50 % of the public transport demand. This objective appears to be reachable only if it is supported by strong land use planning policies.

Particular issues which will inspire the scenarios to be simulated with UrbanSim, are the following ones:

1. the densification of office districts and namely of the European institutions district: impacts of various policies (regulation, fiscal policies, etc) aiming to make these districts more densely occupied;
2. the pricing of the future Regional Express railway Network: consequences of different pricing strategies in terms of modal shift from car to the REN and in terms of household and firm relocation;
3. the implementation of a congestion pricing: charge level, type of pricing (cordon pricing or area charging), definition of the concerned area, etc.

Work package no.	8		**Starting date or event**			10						
Work package title	Policy insights and insights for sustainability											
Activity type	RTD											
Partic. No.	1	2	3	4	**5**	6	7	8	9	10	11	12
Partic. Short name	ETHZ	ENS	INED	UCL	**KUL**	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Person-months per partic.	2	1	0	1	**12.5**	1	6.5	0	0	0	0	3

Objectives

This WP has 3 objectives:

a) define objectives (sustainability and others) of policy makers: what are the components (economic, environmental, social, etc.), what is the horizon (5 years or 50 years), valuation of each component (monetary and or categorical) as well as the level of aggregation;

b) translate the model outputs into objectives for policy makers: this includes developing output reports for the model and suggesting feedbacks of some elements for the model development (local environmental quality has a clear feedback on housing demand and prices);

c) define alternative sustainability policy packages, translate them into model inputs and discuss expected outcomes.

Description of work and role of partners

Work package no.	8	**Starting date or event**	10

The development of urban areas is holistic and therefore difficult to grasp. The policy makers are expected to improve the economic, environmental, transport and social performance of their city. This is difficult for two reasons. First, these indicators interact in a complex way and there is often a trade-off between them. Second, the policy maker has to decide between alternative developments that differ in many dimensions: some parts of the city may do better (say within a toll cordon), others worse (say outside the toll cordon), some income groups do better than others when city centre is revitalised, there may be a short term gain (by making an area greener and safer) but a long term loss (this may cause a loss of social integration in the city).

The SustainCity model helps to understand the complex relations between the different policy dimensions and helps to translate the effects of policy actions into outcomes. What is lacking is the operationalisation of the complex SustainCity model into policy inputs and policy outcomes. This is the objective of this work package.

The policy objectives need to be defined by type, level of aggregation and level of quantification. We need to think about each of the cells of the following table:

TYPE	Level of aggregation					quantification		
	household	City area	Socio-economic group	Metropolitan area	Region, country	monetized	categorical	other
Economic (income, price levels, wealth)								
Equity								
Local environment (noise, air pollution, green area, water)								
Global environment (climate, soil quality)								
Social (crime, integration,)								

The impacts of standard policies have been studied in various projects. For example, much attention has been devoted to the impact of road pricing, (zone pricing, cordon pricing, etc.: see the European projects McICAM, TIPP, REVENUE, and GRACE, for example). Road pricing has a positive aggregate impact, but implementation costs are not trivial, and acceptability is an issue since some agents gain, while other loose. The transfers needed to improve acceptability and preserve equity are well understood, but the land use impacts and the implementation are still not clear. Parking policies, traffic restrain, pedestrian areas in city centres, lanes restricted to bicycles, etc. provide other types of “soft” policies, which short run and long run impacts are likely to be non-negligible.

We will analyse here policies, which are more drastically changing the role of the different transport modes in the City. We do not argue that such or such policy should be implemented, but we will analyse, at the academic level, the order of magnitude of potential impact of innovative policies.

Work package no.	8	**Starting date or event**	10

This calls for the following steps:

Step 1 Definition of objectives for policy makers: In this task the above matrix is defined. First one needs to define the relevant indicators for each type of objective. This is a scientific challenge in some cases. For the income objective one needs to define in a precise way the long term indirect utility function in order to include correctly changes in wealth components (city debt, value of properties) and in amenities (say transport accessibility). For the equity dimension, one needs to define spatial equity and horizontal equity (income groups, what is relevant population over time). For the local environment, major issues are definition of noise and local pollution. For social environment, the physical and subjective safety (crime) as well as social integration indices need further investigation.

Step 2 Develop policy output reports for SustainCity The model variables are not defined into relevant policy outcomes. This requires choosing the most appropriate variables and translating them into the policy outcomes defined above (This will be performed by Paul Waddell and his team in Berkeley).

Step 3 Define alternative sustainability policy packages:

This task requires first to develop taxonomy of sustainability policies (environmental transport, green areas, housing refurbishment subsidies, etc.). Sources of inspiration are the different sustainable transport and urban development networks that have developed over time in the EU (Civitas, Polis,).

The second component is the precise definition of policy packages that may be of interest and can be tested in SustainCity models. This requires concrete definition of policies like green cars, pedestrian areas, energy saving programs, road pricing schemes etc. and to translate them into model inputs.

One of the challenges is to develop scenarios that are somewhat comparable over the 3 (4) case studies. This requires close coordination with WP7 as they know the precise situation and problems in those particular cities. One could depart from the following 4 ideas:

a) “economists’ scenario: a scenario based on the pricing signals of the Monocentric model: this is the simplest analytical model of the urban economy that is analytically tractable- the monocentric model has been calibrated to the Paris region and can, with a minimum of parameters also be implemented for Zurich and Brussels. This allows to start the simulations with a long term equilibrium price signal for housing, transport etc. that has the same theoretical background for 3 (4) cities with a very different background.

b) A”green belt” scenario trying to restrict the area of the city focussing on land use restrictions as instrument and so indirectly limiting transport flows, floor space and energy use

c) An “integration” scenario where the focus is on favouring the integration of the different social groups using bussing, generalised social housing etc

d) A “transport” scenario where the use of the car is maximally discouraged via high parking charges, bus lanes etc.

Deliverables and month of delivery

M 8.1 UrbanSImE indicator module (month 12)

D 8.1 Report on policy insights and insights for environmental and socio-economic sustainability (Month 34).

Work package no.	9		**Starting date or event**		1						
Work package title	Dissemination and valorisation											
Activity type	DEM											
Partic. No.	1	2	3	4	5	6	7	8	**9**	10	11	12
Partic. Short name	ETHZ	ENS	INED	UCL	KUL	STR	NTUA	TUB	**EPFL**	BU	UCP	UCB
Person-months per partic.	2	1	1	1	1	1	1	2	**6**	1	1	2

Objectives

The urban models are not yet well formulated and easy to use for the professionals as well as for academics. In this project, we will bring it to use of modelling community. To do so, at first, we propose necessary tools and modelling guidelines for our modelling platform. At last, we organise the training sessions and scientific meetings with two different target publics: the academics and the local collectivities. The developed platform is designed to be usable by local authorities as a decision making tool and it seems necessary to interact with the potential users community.

Description of work and role of partners

Work package no.	9	**Starting date or event**	1

The work package will take the broadest possible view of its task of reaching out to the fractioned community in land use transport modelling, which needs to be reached if UrbanSimE is to support sustainable urban development and policy making.

The first and foremost element is a user friendly and accessible documentation of UrbanSimE and its constituent elements. While the documentation can be printed, it primary format is web-based to allow continuous updating and extension. The documentation website will be linked from the project website, while being freestanding. The software environment will be tested early after candidates have been identified. The documentation will include test cases (land use, network, population, and firm data) and software tests to allow the user to gain experience with an artificial environment. The first version is scheduled for Month 12, but the final deliverable is due at the end of the project (month 36). In its later version it will include the meta-data of the actual case studies, or where legally possible their actual data.

To build the user base of UrbanSim, but also to test the documentation, the project will organise a series of training courses for UrbanSimE (month 18) and their partner transport models (MATSim and METROPOLIS) (Month 12). These five day courses will be held at an easily accessible location in a suitable low-cost environment. The project will cover the travel and subsistence costs of some of the participants, especially of younger experts, to jump start the diffusion process. Later expected repeats of the courses will be self-funding (Months 24 and 26; 36).

To match the training courses and to show case the academic and policy results to project will organise two conferences. The first academically focussed conference will be held jointly with a suitable well established larger event, such European Regional Science Association conference, the European Transport Conference or the Transport Research Arena (between month 20 and 24), to increase attendance and to lower the costs for all participants. The second event is intended as a two day workshop for high level policy makers (month 36), which will discuss the policy implication of the test cases and of the research undertaken in general. Again, the project will make stipends available for a part of the attendees to ensure a broad representation across countries and policy interests.

Deliverables and month of delivery

M 9.2 First training course on METROPOLIS and MATSim (Month 15);

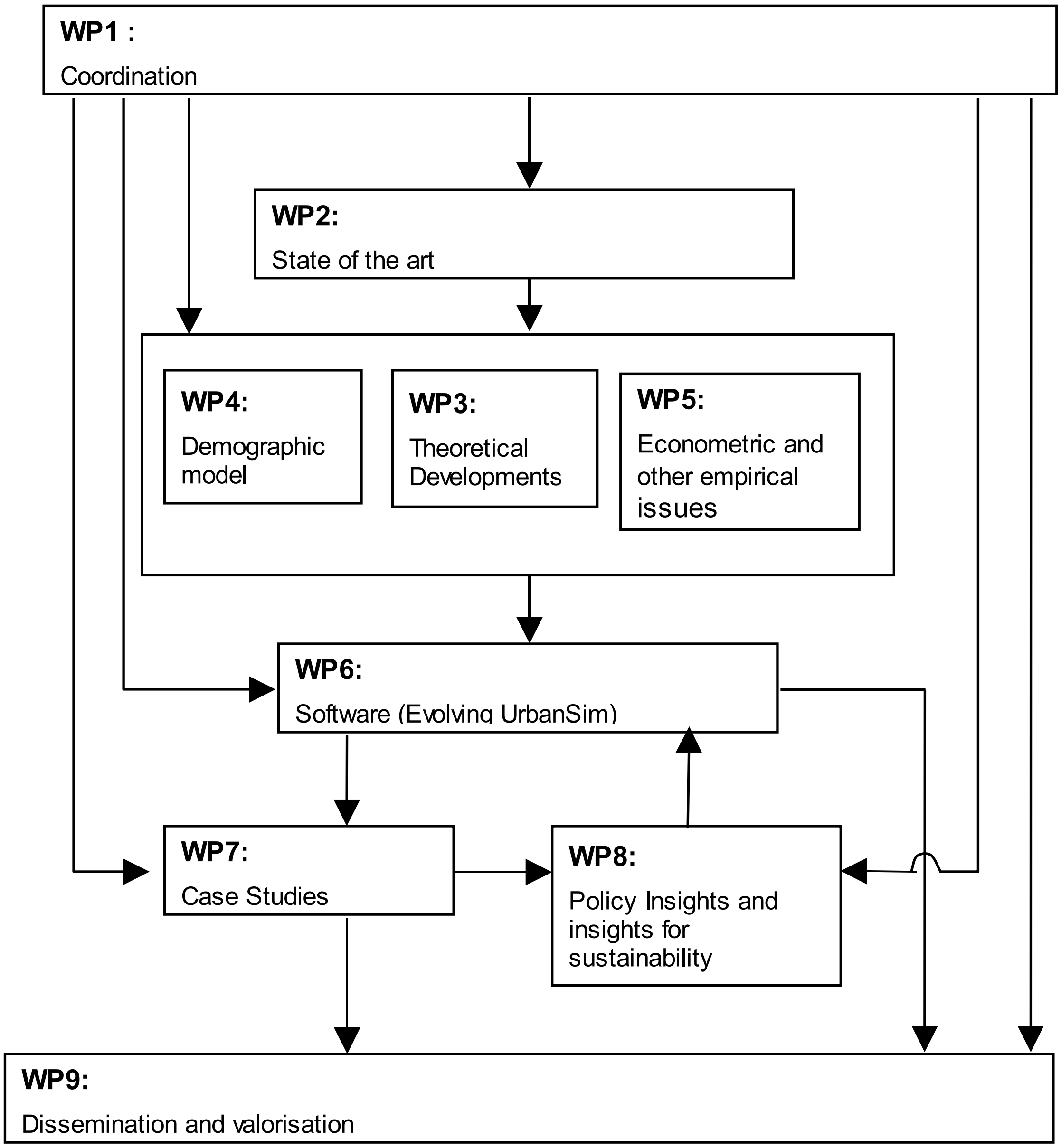
M 9.3 First training course on UrbanSimE (Month 18);

M 9.4 Academic conference on land use and transport (Month 20 to 24);

M 9.5 Final policy oriented conference (Month 36);

D 9.1 Handbook and website on land use and transport interaction (Month 36).

Graphical representation of the project components and their interdependencies



B1.3.6 Efforts for the full duration of the project

Project Effort Form 1 – Indicative efforts per beneficiary per WP

Partic. No.	Partic. short name	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	Total person months
1	ETHZ	11	2	16	0	0	3	24	2	2	60
2	ENS	6	6	17	0	9	0	35	1	1	75
3	INED	1.5	4	0	18.5	0	0	4	0	1	29
4	UCL	1.5	1	0	0	0	1	32.5	1	1	38
5	KUL	1.5	1	5	0	0	0	3	12.5	1	24
6	STR	1.5	1	0	0	0	3	15.5	1	1	23
7	NTUA	1.5	2	0	0	6	0	0	6.5	1	17
8	TUB	1.5	2	0	0	0	24.5	0	0	2	30
9	EPFL	1.5	5	0	0	0	1	24.5	0	6	38
10	UB	1.5	2	0	6.5	0	1	0	0	1	12
11	UCP	1.5	3	10	0	18.5	0	17	0	1	51
12	UCB	1.5	1	6.5	0	0	0	0	3	2	12
Total		32	30	56	25	33.5	33.5	155.5	27	20	411

Project Effort Form 2 – Indicative efforts per activity type per beneficiary

Activity Type	ETHZ	ENSC	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB	TOTAL ACTIVITIES
RTD/Innovation activities													
State of the art	2	6	4	1	1	1	2	2	5	2	3	1	30
Theoretical developments	16	17	0	0	5	0	0	0	0	0	10	6.5	54.5
Demographic model	0	0	18.5	0	0	0	0	0	0	6.5	0	0	25
Econometric and other empirical issues	0	9	0	0	0	0	6	0	0	0	18.5	0	33.5
Software *(Evolving UrbanSim)*	3	0	0	1	0	3	0	24.5	1	1	0	0	33.5
Case studies	24	35	4	32.5	3	15.5	0	0	24.5	0	17	0	155.5
Policy insights and insights for sustainability	2	1	0	1	12.5	1	6.5	0	0	0	0	3	27
Total 'research'	47	68	26.5	35.5	21.5	20.5	14.5	26.5	30.5	9.5	48.5	10.5	359
Demonstration activities													
Dissemination and valorization	2	1	1	1	1	1	1	1	6	1	1	2	20
Total 'demonstration'	2	1	1	1	1	1	1	1	6	1	1	2	20
Consortium management activities													
Coordination	11	6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	32
Total 'management'	11	6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	32
TOTAL BENEFICIARIES	60	75	29	38	24	23	17	30	38	12	51	14	411

B1.3.7 List of milestones and planning of reviews

List and schedule of milestones					
Mile-stone no.	**Milestone name**	**WPs no's.**	**Lead bene-ficiary**	**Delivery date from Annex I**	***Comments***
M1.1	Project website	1	ETH	3	
M2.1	State of the art	2	EPFL	4	
M3.1	Alternative equilibration mechanisms and selection criteria	3	KUL	10	
M4.1	Provisional demographic outline	4	INED	10	
M3.2	Qualitative data on behavioural patterns of real estate developers	3	ETH	12	
M8.1	UrbanSimE Indicator module	8	KUL	12	
M7.1	Database on the three cities	7	STR	14	
M5.1	Econometric guidance	5	UCP	14	
M9.2	First training course on MATSim and Metropolis	9	TUB	15	
M9.3	First training course on UrbanSimE	9	NTUA	18	
M6.2	UrbanSim upgrading modules	6	TUB	18	
M6.4	Guide on UrbanSim usage of the integrated models	6	STR	20	
M7.2	Spatial issues	7	UCL	20	
M9.4	Academic conference on landuse and transport	9	ETH	22	
M7.3	Calibration of the UrbanSimE models	7	STR	24	
M3.5	Comprehensive theoretical models	3	ENS	24	
M3.6	UrbanSimE module of heterogenous real estate developers	3	ETH	24	
M4.3	Comprehensive demographic model	4	INED	30	
M5.2	Estimation results for selected case studies	5	UCP	30	
M6.6	Report on travel behaviour modelling for IDF case study	6	ENS	32	
M6.7	Travel behaviour modellig for Zurich case study	6	ETH	32	
M8.3	Policy insights and insights for sustainability	8	KUL	34	
M1.2	Data archive	1	ETH	36	
M9.5	Final policy oriented conference	9	ETH	36	
M1.4	Final report	1	ETH	36	
M9.6	Handbook and website on land use and transport interaction	9	EPFL	36	

List and schedule of Consortium Meetings			
Meeting no.	**Tentative timing, i.e. after** month X	***planned venue of meetnig***	***Comments , if any***
CM1	After project month: 2.5	**Paris**	**Consortium Meeting 1 – Kick-off meeting with the Commission**
CM2	After project month: 9	**Brussels**	**Consortium Meeting 2**
CM3	After project month: 14	**Zurich**	**Consortium Meeting 3**
CM4	After project month: 22	**Glasgow**	**Consortium Meeting 4 – Mid-term assessment with the Commission**
CM5	After project month: 26	**Paris**	**Consortium Meeting 5**
CM6	After project month: 33	**Brussels**	**Consortium Meeting 6**
CM7	Project month: 36	**Zurich**	**Consortium Meeting 7 – Final meeting with the Commission**

B2 Implementation

B2.1 Management structure and procedures

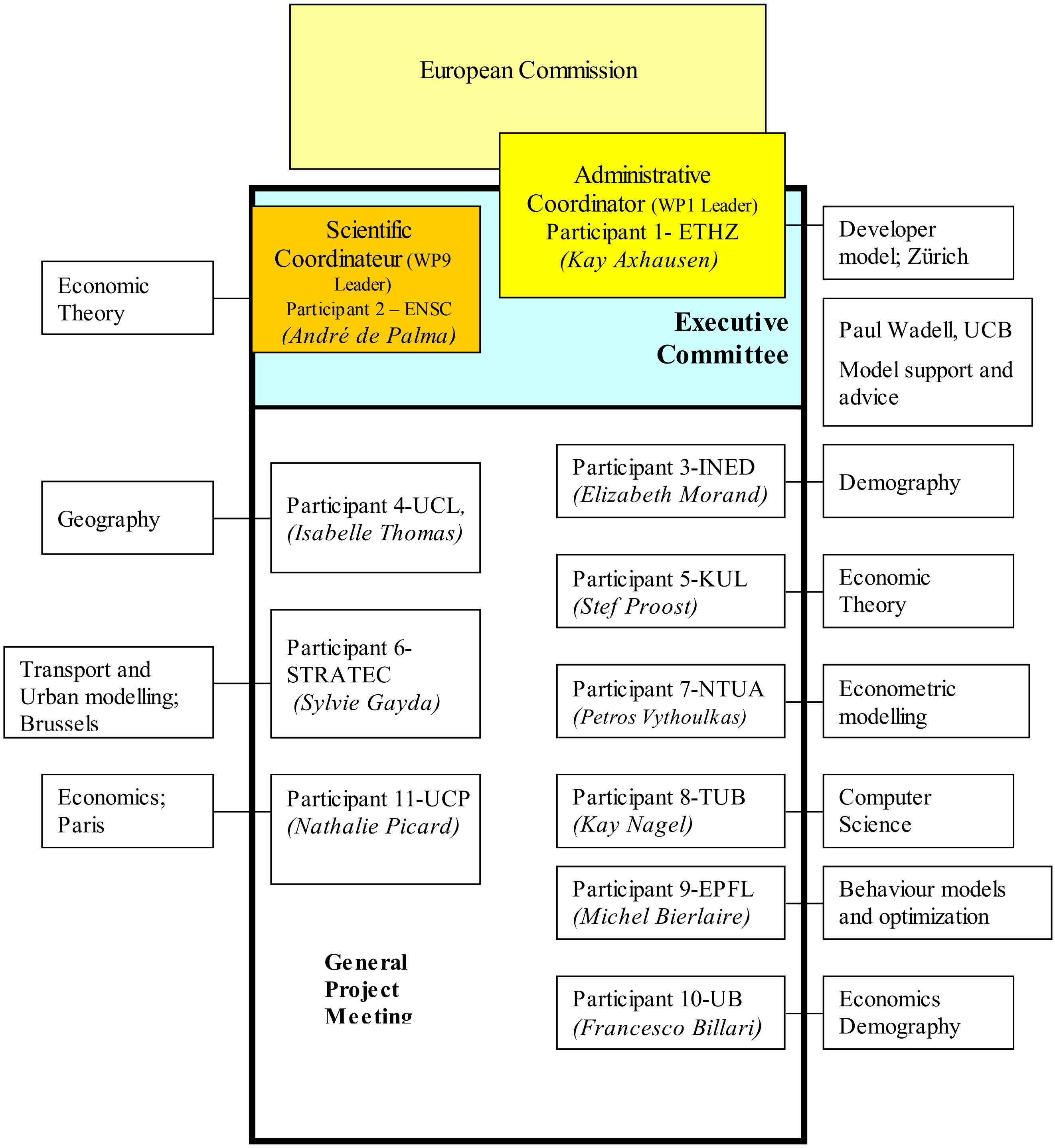
B2.1.1 Management capability of the co-ordinator

Prof. Axhausen has extensive experience with large scale projects and European framework projects. He co-ordinated two successful 5th Framework projects (MEST; TEST) which resulted in a major EU funded survey of long distance travel behaviour (See Axhausen, Madre, Toint and Polak, 2003). His research team at ETHZ consists of about 15 researchers on average. The largest on-going project is the MATSim development jointly with Kai Nagel (TU Berlin), which currently involves 12 researchers at two locations.

ETH Zürich will handle the project administration. It has a specialised contact point office for the European projects. It has extensive experience with the project administration for the EU and other sponsers and has successfully managed many national and international projects.

B2.1.2 Management structure and decision-making structure

While the administrative coordination of the project is allocated to ETHZ under the supervision of Prof. Axhausen, the scientific co-ordination of the project will be shared with the ENSC, André de Palma acting as a scientific co-ordinator besides the general co-ordinator. This sharing of competence has several advantages: on the first hand it leaves the management of the project to a professional team with the adequate experience to manage large scale international research projects, and on the other hand, it ensures that the scientific decisions of the project will be taken in close cooperation.


European Commission
Administrative Coordinator (WP1 Leader) Participant 1- ETHZ (Kay Axhausen)
Scientific Coordinateur (WP9 Leader) Participant 2 – ENSC (André de Palma)
Executive Committee
Economic Theory
Developer model; Zürich
Paul Wadell, UCB
Model support and advice
Participant 3-INED (Elizabeth Morand)
Demography
Geography
Participant 4-UCL, (Isabelle Thomas)
Participant 5-KUL (Stef Proost)
Economic Theory
Transport and Urban modelling; Brussels
Participant 6-STRATEC (Sylvie Gayda)
Participant 7-NTUA (Petros Vythoulkas)
Econometric modelling
Economics; Paris
Participant 11-UCP (Nathalie Picard)
Participant 8-TUB (Kay Nagel)
Computer Science
Participant 9-EPFL (Michel Bierlaire)
Behaviour models and optimization
General Project Meeting
Participant 10-UB (Francesco Billari)
Economics Demography

The Administrative Coordinator is the legal entity acting as the ultimate intermediary between the Partners of the project and the European Commission.

In particular, the Administrative Coordinator will be responsible for:

1. monitoring compliance by the Partners with their obligations;
2. keeping the address list of members and other contact persons updated and available;
3. collecting, assembling, reviewing the scientific reporting information, verifying consistency and submitting reports and other deliverables (including financial statements and related certifications) to the European Commission;
4. transmitting documents and information connected with the project;
5. administering the Community financial contribution;
6. preparing the minutes of all general project meetings;
7. maintaining the archive of all minutes, reports and deliverables of the project;
8. prepare and maintain the calendar of general project meetings and of major work package meetings;
9. ensuring the diffusion of the information between all partners and to the interested public (e.g. project website and publication list; data archive);
10. representing the project with the Commission with respect to the financial and administrative matters.

The financial contribution of the European Commission to the Project shall be distributed by the Administrative Coordinator. The Administrative Coordinator (Kay Axhausen) for this project is ETH Zürich.

Project Management Assistant (PMA) assists the Administrative Coordinator.

The PMA will ensure that all budgetary actions are performed correctly and within the rules and regulations established by the European Commission and Consortium Agreement. This includes operating a good operating practice for financial management adapted for the financial system for each participating country, to ensure that the received funds are correctly distributed among the partners of the consortium and accounted for, costs statements are received, including external auditing. Additionally with the whole of consortium, the PMA will be responsible for ensuring agreement with and constant update of legal issues pertaining to the project, such as the consortium agreement.

The Scientific Coordinator coordinates the scientific part of the project. He is responsible for:

1. monitoring the status of work on the basis of regular quarterly progress reports;
2. reviewing deliverables before their final submission to the CEC;
3. commenting on the scientific quality of the reporting information;
4. representing the project with the Commission with respect to the scientific matters.

The Scientific Coordinator for this project is Prof. André de Palma from ENS-Cachan. He will be supported by a scientific committee, including Nathalie Picard (UCP), Stef Proost (KUL), and Kay Axhausen (ETHZ).

Executive Committee

The Executive Committee consists of the scientific and administrative co-ordinator. The executive Committee will co-ordinate at least monthly and meet quarterly. It prepares and executes:

1. the agendas for the meeting of the general project meetings (10 working days in advance);
2. the minutes of the general project meetings (within 5 working days);
3. chairs the meeting of the general assembly in turn.

General project meeting

General project meeting is the ultimate decision-making body of the consortium. It decides on the strategy of the consortium and approves the public deliverables for transmission to the CEC. It decides on the reallocation of tasks and their associated budgets.

The general project meeting consists of at least one representative of each partner institution. Each partner has one vote. A quorum of two-thirds (2/3) of the partners is required for financial and mayor strategic decisions. Decisions will be taken by a majority of two-thirds (2/3) of the partners present.

Paul Waddell, University of California, Berkeley, is a permanent guest of the meeting. The meeting will take place at least every six months.

The minutes of the meeting will be considered as accepted if, within 15 working days from sending, no partner has objected in writing to the chairperson with respect to the accuracy of the draft of the minutes. The accepted minutes shall be sent to all the members of the Consortium.

Work Package Leader (WPL) will define, coordinate and supervise the research activities of their WPs. WPLs will monitor the achievement of the deliverables and milestones in their WPs. They will report to the Scientific Coordinator on the progress of their WPs and signal in advance any problem or delay. They will organise the necessary meetings or telephone conferences. They will invite the partners involved and inform the executive committee of the meetings 10 working days in advance. They will prepare the minutes of such meetings and will circulate them within five working days for the partners involved and the members of the executive committee.

B2.1.3 Communication strategy

The communicating strategy has been described in WP 9. It will be heavily based on the project websites and the related project publications, courses and conferences. Special emphasis will be placed on publications which reach policy makers to alert them to the new capabilities available to their discussions.

Within the network, the involvement of an experienced project management assistant will facilitate the visibility of the project to the partners and will facilitate the communication within the project. She will be responsible for setting the necessary internal communication tools between the partners, such as mailing lists, collaborative webplatform and website.

B2.1.4 Monitoring, reporting progress and documenting results

As mentioned above, the partners will provide regular progress reports, which will allow the co-ordinators to track the progress and to initiate appropriate responses quickly and efficiently.

The project website and software depository will be the central points of documentation. The reports will be stored in an open-access compatible database, which will make sure, that the results will indexed and cross-referenced quickly and fully.

B2.2 Beneficiaries

Partner 1:	Eidgenössische Technische Hochschule Zurich (ETHZ)
Key personnel:	Kay W. Axhausen
Business type:	University
Role in project:	Coordinator and participant in WP's: 2.3, 3.4, 3.5, 6, 7.1, 7.3, 7.4, 8, 9
Relevant project experience:	Prof Axhausen has co-ordinated two major European Union projects (MEST and TEST) and various nationally funded projects. His group of fifteen researchers is active in agent-based micro-simulation, land use modelling, data collection (revealed and stated preferences), choice modelling and aggregate transport modelling. 25 years experience in the field. The development and/or maintenance of the aggregate national and regional transport model for Switzerland/Zürich, of the agent-based models for Switzerland/Zürich and of the UrbanSim model for Zürich has given the chair a unique level of experience and data access for the tasks of this project.
Additional information: Further will collaborate in the project: Balz Bodenmann Christof Zöllig Patrick Schirmer Kirill Müller Basil Vitins Andreas Horni	

Partner 2:	Ecole Normale Supérieure de Cachan (ENSC)
Key personnel:	André de Palma
Business type:	University
Role in project:	Scientific Coordination of the project Participation in WP 3: theoretical developments
Relevant project experience:	The Ecole Normale Supérieure de Cachan (the ENS Cachan), a prestigious public institution of higher education and research founded in 1912, is one of the major French Grandes Écoles, which are considered the pinnacle of French higher education. With its multidisciplinary departments and their associated research laboratories, the ENS Cachan provides its students with a high-level cultural and scientific training. ENSC has 12 laboratories and 2 interdisciplinary research institutes; 665 research staff: 80 CNRS researchers, 200 researchers/professors; 85 technical and

	administrative staff; 250 Ph.D students and 50 post-doctoral students. The Economics and Management Department works closely with the Center for Economics of Sorbonne (Joint Research Unit Paris 1 / CNRS) and with Dauphine Research in Management (Dauphine UMR / CNRS). These two labs each receive antenna on the campus of the Ecole Normale Superieure de Cachan. ENSC has signed 21 European contracts between 2001 and 2005; today the university manages 5 European contracts under the FP7.

Additional information:

André de Palma is Full Professor (exceptional class) at ENS Cachan, Ecole Polytechnique and senior Member of the "Institut Universitaire de France". His research interests are in the fields of: Industrial Organization, Transport economics, and the Economy of Risk & Uncertainty. He has written more than 180 papers in scientic Journals including in American Economic Review, Econometrica, Review of Economic Studies, Journal of Urban Economy, International Economic Review, Journal of Regional Science, Transportation Sceince,. He has been scientific director and and participated in several European and national projects concerning transport and urban economics and modelling large-scale systems, such as SimAURIF (PREDIT, FR), MC-ICAM, REVENUE, TIPP, and FUNDING (EU).

Hugo Harari-Kermadec is statistician at ENS-Cachan. He develops statistical methodologies for arising applied problems, in econometrics among other fields. He has proposed estimation procedures based on Empirical Likelihood and Method of Moments for studies on data collected by INSEE (health economics) and INRA (food risk).

Nicolas Drouhin is an economist at ENS Cachan. His fields of research are: Intertemporal Choice Theory and Applications, Economy of the Uncertain Duration of Life, Economic analysis of Pension Systems, Economic impact of the AIDS epidemic, Labour economics.

Further will collaborate in the project:

Nicolas Coulombel

Navid Khademi

Moez Kilani

Fabrice Marchal

Seghir Zirguini

Jean-Yves Merindol

Jean-Francois Roch

Partner 3:	**Institut National des Etudes Démographiques (INED)**
Key personnel:	Elizabeth Morand
Business type:	Research centre
Role in project:	Participation in WP4: demographic model development Participation in WP9: training on demographic model
Relevant project experience:	The French National Institute for Demographic Research (INED) is a public multidisciplinary institute that offers a broad range of knowledge and skills (e.g. in demography, sociology, geography, history, economics, statistics) and covers

	virtually the whole spectrum of demographic fields (migration, family studies, fertility, mortality, genetics, gender studies, urban studies). INED will coordinate WP4. In this project, in cooperation with the University of Bocconi, the team of INED will participate in the adaptation of a pre-existing projection model on individual living arrangements to the general UrbanSim model. Two researchers from the unit on “Fertility, family and sexuality” research unit and two informaticians/statisticians of the statistical methods department will be involved. A post-doc will be recruited to work on the adaptation of the demographic model and to perform the application of the model to the Parisian region (WP7). A second post-doc will be recruited for a shorter time to support the team in the evaluation of the demographic model. At INED, the statistical department aims at supporting researchers in their acquisition of statistical methods skills to perform data analysis. The department has already developed an interest for micro-simulation methods which will be reinforced by its participation in this project. From 2005 to 2009, Laurent Toulemon and Eva Beaujouan participated in the MicMac FP6 project which consisted in developing a demographic projection model, under the form of user-friendly software. The aim of the project can be summarized as: 1) the development of a multistate cohort-component model "Mac"; 2) the development of a microsimulation model of individual biographies "Mic". It includes procedures for using views on future trends of demographic variables. It was notably developed to understand the incidence of prevalent individual characteristics on fertility and living arrangements. The team also discovered recently Modgen, another general purpose package used for microsimulation modelling, which has been developed by Statistique Canada. This later model has additional features that allow users to create links between individuals, for example within households. MicMac and Modgen will be evaluated, among other demographic microsimulation softwares, to be integrated in the UrbanSim platform. WP2 on the state of the art will allow identifying other demographic models that could be suite for the project. The model that fits best UrbanSim will be selected, and it will be adapted as an additional module to the global model.

Additional information:

Work Package and team leader: Elizabeth Morand

Elizabeth Morand, statistician (MSc Mathematics, PhD in applied statistics 2006). Elizabeth Morand is a research engineer at the Statistical methods department of INED since 2007. She is specialised in statistical methods such as migrant migration models, multilevel models, longitudinal analysis, and optimal matching techniques. She has developed particular skills in R or SAS software.

Laurent Toulemon, demographer - *Directeur de recherches* at INED since 1984, member of the unit “Fertility, Family and Sexuality”. From 1998 to 2000, L. Toulemon headed the division of Demographic Investigations and Studies at INSEE (French Statistical office). His main research interest is in fertility and its determinants and on family structures. Together with Viviana Egidi, he is responsible for the core course on “Data” at the European Doctoral School of Demography.

Arnaud Bringé, statistician –Arnaud Bringé is the head of the Statistical and Methods department since 2007. Specialised in multilevel and biography methods, he will be involved in the work on the development of the demographic simulation model in WP4, and to formations in WP9.

The work of the team can be supported by two researchers whose involvement in the project is not accounted:

Sophie Pennec, demographer-statistician, is specialised in micro-simulation models applied to demography and economic demography (multi generation families, pensions, family policies, professional population projections and end of life projections).

Further will collaborate in the project:

Catherine Daurèle

Partner 4:	Université Catholique de Louvain (UCL), Belgium
Key personnel:	Isabelle Thomas; Jacques F. Thisse; Dominique Peeters
Business type:	University
Role in project:	Participation in WP 1: Coordination Participation in WP 2.6: Descriptive and geographical data Participation in WP 3: Theoretical developments Participation in WP 6: Integration of advanced agent-based transport models Participation in WP 7: Case studies Participation in WP 8: Policy insights and insights for sustainability
Relevant project experience:	The Center for Operations Research and Econometrics (CORE) is a research center of the Université catholique de Louvain (UCL), located in Louvain-la-Neuve (Belgium). It was founded in 1966 and is nowadays recognized as a leading interdisciplinary research institute in the fields of economic theory, economic geography, game theory, operations research and econometrics. It has developed expertise in several domains such as economic geography, general equilibrium, public economics, political economics, industrial organization, economic geography, economics of information, financial econometrics, integer programming as well as convex and large scale optimization. CORE houses about 30 professors and 120 pre- and postdoctoral researchers. It collaborates with a large number of well-known universities and research centres in economics and operations research around the world. This is attested to by the large number of short- and long-term visitors that come to CORE, as well as by CORE members that spend short- and long periods abroad in internationally recognized research institutions.

Additional information:

Isabelle Thomas is a geographer (PhD 1984) and currently Research Director at the National fund for Scientific Research and professor in the Department of Geography of U.C.L. She is speciaized in: (1) location of human activities and more particularly the sensitivity of the location-allocation models to their inputs; understanding the spatial structure of human activities and transportation fluxes, and (2) applied quantitative analysis for spatial data. Topics such as scale, m.a.u.p., spatial autocorrelation, mapping, multivariate modelling, measurement indices, fractals, etc. are of particular interest. Application domains are: housing, peri-urbanisation, accessibility and socio-economic data. She is and was involved in different research projects, and is nowadays working with colleagues on urban/peri-urban models as well as on fractal measurement methodologies.

Jacques Thisse, a Fellow of the Econometric Society and of the Regional Science Association International, is professor of economics and regional science at the Université catholique de Louvain (Belgium) and a member of CORE. His main fields of interest are in economic geography, industrial organization and public economics. He has published more than 200 papers in various scientific journals, including American Economic Review, Econometrica, Journal of Political Economy, International Economic Review, Management Science, Geographical Analysis and Journal of Economic Geography. He has held a full professorship at the Sorbonne (France) and has been visiting professor at University of Pennsylvania and Virginia Polytechnic Institute (USA). He is the co-author of Discrete Choice Theory of Product Differentiation (MIT Press), Economics of Agglomeration (Cambridge University Press) and Economic Geography (Princeton University Press). He was the program chairman of the European meeting of the Econometric Society held in 1992 in Brussels and has served on the board off several journals and scientific committees. He is member of the Paris School of Economics and a Fellow of CEPR.

Dominique Peeters holds a degree of Engineer in Applied Mathematics and a Ph.D. in Applied Sciences from the Université catholique de Louvain (UCL), where he is presently professor in the Department of Geography and member of the Center for Operations Research and Econometrics (CORE). His main research interests are in economic geography, location theory, spatial statistics and mathematical programming. He has published over 80 papers in journals such as *Environment and Planning A* and *B*, *Regional Science and Urban Economics*, *Journal of the European Economic Association*, *Operations Research*, *Management Science*, *Transportation Science* and *Journal of Regional Science*. At UCL, he lectures economic geography, spatial statistics and project evaluation.

Further will collaborate in the project:

Alain Pholo-Bala

Catherine Rouyer

Bruno Delvaux

Camille Focant

Partner 5:	**Katholieke Universiteit Leuven (KUL)**
Key personnel:	Prof. Stef Proost
Business type:	University
Role in project:	Participation in WP 8: Policy insights and insights for sustainability Participation in WP 3.3 : Multi-agent models
Relevant project experience:	TRENEN-I, TRENEN-II Stran, CAPRI, TREMOVE, UNITE, MC-ICAM, PREMTECH-II, SPECTRUM, TIPP, REVENUE, GRACE, FUNDING and GEM-E3 projects Various Belgian national and regional transport research programmes The Center for Economic Studies (CES – KULeuven) is the research division of the Department of Economics at the Catholic University of Leuven which is the largest and oldest University of Belgium (28000 students). The research staff of the CES counts approximately 80 people. The ETE division (10 people) of the CES focuses on Energy, Transport and Environmental problems. This division is specialised in the use of modelling tools (general equilibrium, partial equilibrium) to address pricing and investment problems in the transport, energy and environment domain. The group aims at academic excellence in this field via publication in the best economic journals. The ETE division has participated in many European research projects. More particularly in the transport field it has participated in TRENEN-I (coordinator), TRENEN-II Stran (coordinator), CAPRI, TREMOVE, UNITE and MC-ICAM. It is currently involved in PREMTECH-II, SPECTRUM, TIPP and REVENUE. In the transport and environment field it coordinated the TREMOVE II consortium for DG-ENV that has become the reference in air pollution policy for transport sector and in the energy and environment field it has been coordinating several of the European GEM-E3 projects, the GEM-E3 model that has become the reference for a general equilibrium analysis of energy and environment questions in the EU It is also active in the most important national and regional research programmes in these fields. There is a close cooperation with the Engineering Faculty of the Catholic University of Leuven via the joint spin-off company “Transport & Mobility Leuven” and via the Energy

	Institute.

Additional information:

Stef Proost is full professor at the Catholic University of Leuven. At the KULeuven he teaches transport economics, environmental economics and energy economics to economists and engineers. He is chairman of the department of economics and director of a group of 10 researchers at the Center for Economic Studies that deals with environment, energy and transport topics

For this project, prof. Bruno De Borger (University of Antwerp) will be associated to the research group.

We will recruit en economist for this project.

Further will collaborate in the project:

Paul Van Dun

Elke Lammertyn

Partner 6:	STRATEC(STR)
Key personnel:	Hugues Duchâteau ; Sylvie Gayda
Business type:	Small and medium-size enterprise
Role in project:	Coordinator of the WP7 : case studies Responsible of the Brussels case studies within WP7 Participation in WP9 : dissemination and valorization activities
Relevant project experience:	STRATEC conducted a large number of projects in urban transport planning and modelling at Belgian and European levels. More specifically, STRATEC has developed a thorough expertise in the field of land-use/transport modelling, notably within European research projects. In the ESTEEM project, a land-use/transport model of the Brussels metropolitan area was calibrated and policy scenarios were tested. In the TRACE project, the Brussels model was used to compute short term and long term elasticities of travel demand in relation with travel cost and time. In the PROPOLIS project, the model was updated and used to assess a new set of land-use and transport policies. In the SCATTER project (whose Stratec was co-ordinator), a model was used to simulate and assess policies aiming to tackle urban sprawl. Within the SCATTER project, Stratec also gained experience by comparing different modelling approaches (Tranus, Meplan, master equation model). Using the Brussels model, Stratec also carried out a study on behalf of the Belgian federal Ministry of Transport aiming to assess the effects of the future Regional Express railway Network (*Réseau Express Régional* - RER) in terms of household and employment relocation and the effects of accompanying measures to the RER.

Additional information:

STRATEC was formed in 1984 by a group of transportation experts who were previously active in renowned consultancies and university research. The group owns all of the company assets, thus ensuring total independence of action. The ambition of STRATEC is to provide private and public decision-makers with state of the art advice in the field of transportation and regional development.

STRATEC has some twenty experts on its permanent staff offering a range of profiles (civil engineers, economists, geographers, architect, computer scientists, etc.)

In 25 years, the company turnover has grown to more than 2.5 millions €.

Since its inception, STRATEC has served a highly diversified clientele, comprising large and small businesses, local, regional, national and international authorities in Belgium and abroad.

STRATEC takes part in European research programmes particularly in transport, energy and environment sectors. These programmes are designed to develop working methods, models and softwares keeping STRATEC ahead of field when it comes to research techniques.

Key personnel

Workpackage and team leader: Sylvie Gayda

Sylvie Gayda, Civil engineer, Senior Consultant, has more than 15 years experience in the field of travel demand modelling and management with a variety of tools such as land-use/transport modelling and stated preference surveys.

She has been a key partner in studies on behalf of the European Commission, connected with land use/transport/environment planning (FP4 projects ESTEEM and TRACE, FP5 projects PROPOLIS and SCATTER). She has developed a thorough expertise in the field of integrated land-use/transport modelling and integrated land-use/transport planning. She directed the calibration and validation of the TRANUS land-use/transport model of Brussels.

She has also developed a thorough expertise in the field of stated preference surveys through participation to research and the conduit of numerous practical surveys using this method, such as surveys on price elasticity for several high speed rail services in Belgium and in France and surveys on mode choice in passenger and freight transport in Belgium and in France.

As regards her capabilities in managing large projects, she has co-ordinated the SCATTER project in FP5 (DG Research), which was dedicated to urban sprawl and was based on land-use/transport modelling.

Hugues Duchâteau Chief Executive Officer of STRATEC, Hugues Duchâteau is Civil Engineer

graduated from the Faculté Polytechnique de Mons with almost 30 years of experience in leading

transportation planning, travel behaviour studies, land use and regional planning, environmental assessment of projects in Belgium as well as abroad. In addition to his current consultancy work, he has developed research activities within national programmes, and has also participated to a number of European research projects Programme, notably ESTEEM, REFORM, EUROSIL, ERGO, TRACE, UNITE, PROTRANS, EXPEDITE, CITY FREIGHT, ISHTAR, STEPS, PROPOLIS and SCATTER. In SustainCity, he will contribute to the project as an expert in transport demand modelling and planning of integrated land use/transport strategies.

Partner 7:	**National Technical University of Athens (NTUA)**
Key personnel:	Constantinos Antoniou
Business type:	University
Role in project:	Econometric modelling of transport and land use choices
Relevant project experience:	The National Technical University of Athens is the oldest and most prestigious educational institution of Greece in the field of technology. The education and research programme of the School of Rural and Surveying Engineering (SRSE) of NTUA, covers a wide range of disciplines including Topography and Geomatics, Urban and Regional Planning, Environmental Analysis, Infrastructure design and Transport Engineering and Planning. Within SRSE, the Laboratory of Transportation Engineering was enacted officially in 1998, in order to cover the areas of highway and traffic engineering, transport economics, transportation planning, travel demand analysis, and transport telematics. The laboratory has strong links with other departments within SRSE and other Schools of NTUA, and its research focuses on the interdisciplinary aspects of transport covering the

	wide areas of planning, economics, engineering and operations, and their interrelationships.

Additional information:

Key persons involved:

Constantinos Antoniou is an Assistant Professor in Transport Safety at SRSE, NTUA.. He holds an M.Sc in Transport and a Ph.D in Transportation Systems from Massachusetts Institute of Technology. He held research positions at M.I.T. and has participated in more than 20 research projects. His research interests focus on the areas of transportation modelling, network analysis and simulation, discrete choice analysis and road safety.

Basil Psarianos is a Professor of Highway Engineering and the Head of the Laboratory of Transportation Engineering at SRSE, NTUA. His research focuses on context sensitive design and operational characteristics of transport systems.

The NTUA team will also include other senior researchers with expertise in the areas of transportation, planning, economics and environmental sciences.

Further will collaborate in the project:

Emmanouela Siwra

Eva Kazagli

Georgia Papadaki

Alexandra Kondyli

Ioanna Spyropoulou

Despina I. Alatopoulou

Yannis Polyzos

Partner 8:	**Technical University Berlin (TUB)**
Key personnel:	Kai Nagel
Business type:	University
Role in project:	Coordinator and main contributor of WP6
Relevant project experience:	The VSP group, part of the Institute for Land and Sea Transport Systems at TU Berlin, counts approximately 10 scientists (mostly Ph.D. students) and about the same number of student research and teaching assistants. It works on a number of projects, including large-scale evacuation, using advanced mathematical methods for dynamic traffic assignment, transport-related aspects of social-networks, and mathematical calibration methods for agent-based simulation. All of these projects use MATSim as a joint platform. MATSim (Multi-Agent Transport Simulation) is a simulation project that combines travel behaviour simulations with microscopic dynamic assignments. By doing this, the model has the full daily dynamics of people in a region at its disposal, and uses this as input to the behavioural models. Relevant examples of projects are: 4. "ADVEST" (adaptive traffic control) – using advanced mathematical methods to improve traffic modelling and traffic control. Together with several

	mathematics groups; funded by the German Ministry for Research 5. "Detailed evaluation of transport measures using microsimulation" – looking in particular at external effects. Together with Prof. R. Gerike (Transport Ecology); funded by the German National Science Foundation 6. Modelling and simulation of public transit within MATSim – Project together with the Berlin public transit company Kai Nagel has also worked on integrating UrbanSim and MATSim during a recent sabbatical stay with UrbanSim in Seattle.

Additional information:

Kai Nagel – Kai Nagel's original background is in physics and computer science; he is now in transport engineering. He has more than 10 years experience in designing, implementing, and using large-scale microscopic ("agent-based") traffic flow and travel behaviour models. He is a creator of MATSim, which will be used on the transport side. As mentioned above, he already has experience with integrating UrbanSim and MATSim, which was obtained during sabbatical work at UrbanSim in Seattle.

Dominik Grether – Dominik Grether has a Diploma in Computer Science (with a minor in economics) from the University of Ulm (Germany) and has been at TUB/VSP since 2008. He is second-in-command in MATSim software design.

Additional input in particular on the transport engineering side will be contributed by Andreas Neumann and Yu Chen, who have Diplomas in transport engineering.

Further will collaborate in the project:

Thomas Nicolai

Benjamin Kickhöfer

Michael Zilske

Manuel Moyo

Johannes Illenberger

Simone Ludwig

Silke Hönert

Anette Schade

Lothar Bauch

Partner 9:	**EPFL Ecole Polytechnique Fédérale de Lausanne (EPFL)**
Key personnel:	Michel Bierlaire
Business type:	University
Role in project:	Participation in WP 2.7: Social and Economic attributes Participation in WP 9: Dissemination and valorisation
Relevant project experience:	EPFL is one of the two Ecoles Polytechniques fédérales in Switzerland. Like its sister institution, ETHZ, it has three missions: education, research and technology transfer at the highest international level. Associated with several specialised research institutes, the two EPFs form the EPF domain, which is directly dependent on the Federal Department of Home Affairs. Directed by Michel Bierlaire, the Transport and Mobility Laboratory at EPFL is active in modeling, optimization and simulation of transportation systems, with a specific emphasis

	on the mobility of individuals. The main research activities are oriented toward three main complementary directions. Transportation research: We identify new solutions to transportation problems, on the ground, in the air, or on the sea, transport of people or goods, whatever the mode. We focus on technical solutions, but also on their impact on the system as a whole. We are also interested in the interactions of the transportation systems with the land use, the economy, the environment, etc. Operations Research: We design, implement and test new mathematical models and algorithms. We are involved in various aspects of operations research, such as optimization (continuous and discrete), queueing theory, graphs and simulation. Discrete choice models: We are specialized in the design, the specification, the estimation and the analysis of discrete choice models. Largely used in transportation demand analysis, we apply them in other contexts as well, such as marketing and image analysis. Other: We are regularly involved in multi-disciplinary research in collaboration with other researchers, in particular in the domain of computer vision, image analysis, hospital management and marketing. See additional detail on transp-or.epfl.ch

Additional information:

Michel Bierlaire combines three types of relevant expertise.

(i) Mathematical modelling of choice behaviour: He made significant contributions in the theoretical development of discrete choice models, their estimation, testing and validation and applications for mobility choices.

(ii) Application of operations research to transport and mobility applications: He made significant contributions in queuing theory, nonlinear optimization, and combinatorial optimization.

(iii) Dynamic traffic assignment. He made contributions in the context of the design and implementation of real-time DTA systems, developed advanced algorithms to solve fixed-point problems arising in these systems. and estimate OD matrices.

He has directed several national and international projects involving the areas of transport, operations research and discrete choice models.

Further will collaborate in the project:

Ricardo Daniel Hurtubia Gonzalez

Gunnar Flötteröd

Olivier Gallay

Gérald Parisod

Partner 10:	**Carlo F. Dondena Centre for Research on Social Dynamics, Bocconi University (BU)**
Key personnel:	Francesco Billari, Alessandra Michelangeli
Business type:	University
Role in project:	Participation in WP4: demographic model development

Relevant project experience:	The Università Commerciale "Luigi Bocconi" was established in 1902 as a private not for profit university, the first Italian university to grant a degree in economics. Nowadays, Bocconi has about 14,000 students enrolled at all levels from undergraduate to PhD, 700 faculty members and 500 administrative staff. Bocconi's strong commitment to research can be demonstrated by its active involvement in 38 ongoing projects funded by the European Union and other international donors. The Carlo F. Dondena Centre, established at Bocconi in 2006, promotes, coordinates and conducts interdisciplinary research on social dynamics, with emphasis on medium- and long-term processes and on comparative analysis. The main areas of interest of the Centre are: demography and the life course including fertility and family dynamics; development and social cohesion; welfare state and public policies; data collection and harmonisation. Dondena is involved in Flumodcont, a public health FP7 project where it contributes to the demographic component for a model for the diffusion of pandemics, and to the development of demographic agent-based models. It is also involved in Multilinks, an FP7 project on links between generations. Like INED, it is involved in MicMac, an FP6 project, where the core group of experts in demography used their expertise in micro-level analyses during the process of model building, and provided the essential inputs on this core topic to forecasting models. The Bocconi team will be involved in the development of a demographic model adapted to UrbanSim (WP4).

Additional information:

Francesco C. Billari is Director, Carlo F. Dondena Centre for Research on Social Dynamics and Professor of Demography, Department of Decision Sciences, Bocconi University. Professor Billari is also Fellow of the Innocenzo Gasparini Institute for Economic Research (IGIER). He holds a Ph.D. in Demography from the University of Padua (1998). He has worked on household and family dynamics, statistical demography and life course analysis, agent-based computational modelling. He has been head of research group at the Max Planck Institute for Demographic Research (Rostock, Germany), and carried research or taught at the Pompeu Fabra University, Barcelona, the Vienna Institute of Demography. Since 2003, he has been Secretary-General of the European Association for Population Studies (EAPS). He is chair of the Evaluation Committee of INED and member of the Social Science Committee, Austrian Academy of Sciences. He is a 2008-09 Distinguished Research Scholar at the Population Studies Center, University of Pennsylvania, USA.

Alessandra Michelangeli is researcher at Econpubblica (Centre for Research on the Public Sector) at the Università Commerciale Luigi Bocconi. Her main research area deals with urban and regional economics (empirical analysis of crime, of urban segregation and social exclusion), with microeonomics applied to real estate, the evaluation of public policies and of environmental resources. Her field of research also cover health economics.

Further will collaborate in the project:

Rodolfo Baggio

Bruno Pavesi

Luigi Pellegrino

Partner 11:	**Université de Cergy Pontoise (UCP)**
Key personnel:	Nathalie Picard
Business type:	University
Role in project:	Participation in WP 2.3: State of the art: Firmographics (Nathalie Picard) Participation in WP 2.4 State of the art: Econometric models (Nathalie Picard)

	Participation in WP 3.1 Theoretical development: Real estate investments (Jean-Luc Prigent) Participation in WP 3.2 Theoretical development: Location and real estate decisions within couples (Olivier Donni) Participation in WP 3.5 Theoretical development: Firmographics (Nathalie Picard) Participation in WP 5 Econometric and other empirical issues (Natalie Picard) Collaborator in tasks: WP 7 Case studies (Ile-de-France region) WP 9 Dissemination
Relevant project experience:	The University of Cergy-Pontoise has a long history of research in transportation and urban economics as well as Finance, Real estate economics and Household decision making theory. Several projects financed by French authorities are conducted in these domains and in particular, a four years project (SIMAURIF) that concerns the application of UrbanSim on Ile-de-France area. The University of Cergy-Pontoise has 20 research units that cover multiple fields of research (Mathematics, Physics, Biology, Environmental Sciences, Chemistry, Social Sciences, Information and Communication Science and Technology, ...); of these 9 are endorsed as UMR (Mixed Research Unites) by the CNRS (National Centre for Scientific Research); UCP has about 500 researchers, 350 PhD students spread between 3 doctoral programmes; 5 Teaching Departments (Units of training and research); 7 European contracts including 4 under the FP7.

Additional information:

Nathalie Picard is Maître de Conférence at University of Cergy-Pontoise and associate researcher at INED. Her specialty is econometrics. She has conducted several researches in Demography and Transportation and Urban Econometrics as well as microsimulation modelling. She has participated in SimAURIF (PREDIT, FR) or Residential Choice and migrations (INED, FR).

Fabrice Barthelemy is Maître de Conférence at University of Cergy-Pontoise. He is specialized in econometrics and has conducted several researches in Real estate economics and finance.

Kiarash Motamedi is a Post Doctoral fellow who has recently obtained his PhD. His dissertation was focused on application and adaptation of UrbanSim on Ile-de-France region and application of METROPOLIS as a dynamic transportation model on that region.

Jean-Luc Prigent is professor at University of Cergy-Pontoise in Finance and mathematical finance. He has conducted researches in Real estate economics and finance as well as portfolio optimization and risk behaviour of investors.

Olivier Donni, professor at University of Cergy-Pontoise, who has conducted a thorough research in intra household decision making and household labour supply economics.

Further will collaborate in the project:

Catherine Bonvalet

Emmanuel Poirault

Francoise Moulin-Civil

Other PhD or graduate students in Economics will contribute partially in the project.

Partner 12:	University of California, Berkeley (UCB)
Key personnel:	Paul Waddell
Business type:	University
Role in project:	Participation across tasks in aspects related to adapting the UrbanSim model system to the European context, providing limited training and technical support on the adaptation of the software platform as needed for the project.
Relevant project experience:	The University of California, Berkeley has extensive expertise to provide support to this project. Paul Waddell is a Professor in the Department of City and Regional Planning. Professor Waddell designed and has led the development of the UrbanSim model system, and coordinated its application in numerous metropolitan regions in North America. He has also provided technical support to UrbanSim applications in Europe.
Additional information: Paul Waddell is a Professor of City and Regional Planning at UC Berkeley. He has extensive expertise in urban economics, land use and transportation planning, and urban simulation. Further will collaborate in the project: Hana Sevcikova Jyl Baldwin Patricia Gates	

B2.3 Consortium as a whole

B2.3.1 Consortium overview and role of the participants

The consortium primarily consists of scholars who are experts in either transport and land-use modelling or computer science/simulation. The consortium gathers eight well-known research labs which have contributed over a long period to economics, land-use and transport models in general. The consortium gathers an important number of high level women researchers and we consider it as an opportunity that deserves to be highlighted.

Only the joint strength will allow the consortium to undertake and co-ordinate the tasks we set ourselves to do.

Meeting the objectives of the projects requires abilities to work in an international and multi-cultural team. The partners have strong records and experience in international activities. Moreover, sub-groups of the partners have been members in one and the same team. As an example, the collaboration between Paul Wadell, ENS, UCP and KUL has been going on for several years now. INED and University Bocconi have now been collaborating in 4 European projects (RTN DEMOG, FP5; MicMac, FP6 ; REPRO, FP7; GGP, FP7). Nathalie Picard, leading the UCP team, is also associate researcher at INED. The experience of the participants across Europe ensures the awareness of the different planning traditions and cultures and of the different trajectories and challenges faced by the different countries.

B2.3.2 Complementarity of participants

The consortium brings together various profiles needed for a project to advance land-use transport modelling:

1. urban economists;

2. spatial planners;
3. geographers;
4. transport economists;
5. transport planners and engineers;
6. computer scientists.

In addition, the necessary expertise in demography requested for the creation of the demographic model has been sought to two of the most reknown European Institutes. These two teams have competence in statistics, demography and sociology.

Geographical complementarities

The geographic complementarities of the consortium is a very important feature of the project. While the consortium builds on a strong partnership between the teams from France, Switzerland, Belgium and the US, a specific attention has been developed to integrate new collaborations to the project. Partners from Italy, Greece and Germany will integrate the consortium. The choice of partners also reflects the limited expertise available on UrbanSim in Europe. Therefore, a special attention will be dedicated to countries where little contacts exist yet within the dissemination and training WP.

B2.3.3 Industrial involvement and exploitation of the results

Commercial land-use transport models have a proud history, but one which is characterised by small number of non-developer users and projects undertaken by the software developers themselves. The activity was too small to advance the usability so far, that urban authorities or large number of consultants would adopt the (expensive) software. This is in sharp contrast to transport planning software, where commercial packages have sold thousands of licences and have matched user/consultant communities. Land-use transport modelling can only escape this situation, if the interested community can develop joint tools through the open source approach, which we have adopted here. The commercial exploitation will arise through the wide spread adoption of the enhanced and Europeanised UrbanSimE for consulting projects.

B2.3.4 Subcontracting

The project SustainCity will undertake substantial revisions and additions to the software code of UrbanSim and the related software: MATSim, the new Demographic Model and Metropolis will be interfaced and integrated with the core program UrbanSim (which also needs further developments to be upgraded to UrbanSimE).

In the initial proposal, Fabrice Marchal was supposed to work on one of these technical tasks (see the Main innovations Section 1.2.3 as well as Section 1.2.4: How UrbanSim works and will be improved), attached to the partner ENS. Fabrice Marchal is the person who developed the code of METROPOLIS, and we have counted on his high-level skill to undertake this technical/programming task (the architecture will be developed by ENS as a scientific activity of the project). At the time we submitted the proposal, Fabrice Marchal was a CNRS (Centre National de la Recherche Scientifique with which the ENS has Joint Research Unit)) researcher. However and against all odds, he left the CNRS on July 09 to join a private Swiss company, and is no more available to work on this project. We therefore need to replace him since this technical competence is now missing from a scientific point of view. No senior researcher could spend time on the technical tasks Fabrice Marchal was initially supposed to perform, and the chances, that we find the required technical programming skill and competence among doctoral or post-doctoral students are very slim. On top of that, the other researchers involved in the project have very different areas of expertise. It would be wasteful to ask them to undertake this technical (computing) task of integrating the modules and developing the interface.

We therefore looked for a private company to perform this task. Such a company should provide the computing knowledge and skills necessary for integrating software and building the interfaces. This could be found in various companies. However, the project also requires the knowledge and experience of working with both UrbanSim and METROPOLIS. Such knowledge, skills and experience are so specialized that only one private company has developed all of them up to now (through previous contracts with several partners of the consortium). Asking another company to develop them would require at least three person months to get familiar with the software packages and modules to interface before it could be productive for the project. Clearly, the consortium cannot afford such a cost.

As mentioned above, a productive working relationship has already been established between some partners of the consortium and Belecotec (a Belgian company based in Brussels specialized in developing software programs), making this company familiar both with UrbanSim and METROPOLIS. Therefore, the number of person months involved will be fairly limited: 2 person months will be enough. José Moyano, the director of the firm, who already worked for KUL and UCP, will personally undertake this task for Belecotec. Jose Moyano is a highly skilled computer specialist, who already integrated previously developed modules and built interfaces for previous versions of UrbanSim and METROPOLIS. Both institutions were totally satisfied with his work and will be happy to work again with him.

The involvement of Belecotec as a subcontractor will require 30,000 € (monthly rate: 15,000€).

B2.4 Resources to be committed

B2.4.1 Equipment resources

The partners, especially those running the case studies, are committing:

1. Extensive and expensive computer equipment (e.g. shared memory computers and hard-disks)
2. Large data sets worth hundreds of thousands of Euros, collected or bought in previous or on-going projects
3. Software, such as commercial transport planning software, PTV Vision or EMME/2
4. Geographic databases

The valuation of these resources is difficult, but the replacement costs today are in sum in the millions of Euros (Equiment: € 50-100’000 per partner; Software: €40’000 per partner; data bases for the case study cities: € 120’000 land use, points of interest and geographies for each region and the last twenty years; € 250’000 land prices, rental values, developments, relocation, mobility tool ownership, commuter matrices and travel behaviour for each region and the required history; € 75’000 for road and public transport networks and timetables for each region and each time step.

B2.4.2 Detailed budget

	ETHZ	ENS	INED	UCL	KUL	STR	NTUA	TUB	EPFL	BU	UCP	UCB
Research related costs												
Personnel	248'630	329'460	128'840	167'735	100'835	163'070	67'280	137'800	144'110	43'605	229'405	80'013
Other direct costs	7'830	11'330	14'000	8'875	5'375	5'125	5'435	6'625	7'625	1'565	8'000	25'801
Subcontracting		29'909										
Overheads over research costs	153'876	204'474	85'704	105'966	63'726	174'923	43'629	86'655	91'041	27'102	142'443	24'497
Total research costs	410'336	575'173	228'544	282'576	169'936	343'118	116'344	231'080	242'776	72'272	379'848	130'311
Demonstration costs												
Personnel	116'125											
Other direct costs												
Overheads over demonstration costs	69'675											
Total demonstration costs	185'800											
Management costs												
Personnel	58'190	29'070	7'293	7'085	7'035	11'932	6'960	7'800	7'085	6'885	7'095	11'430
Other direct costs	1'815	1'000	247	375	375	375	560	375	375	245	245	3'686
Overheads over management costs	36'003	18'042	4'524	4'476	4'446	12'799	4'512	4'905	4'476	4'278	4'404	3'500
Total management costs	96'008	48'112	12'064	11'936	11'856	25'106	12'032	13'080	11'936	11'408	11'744	18'616
Dissemination costs												
Personnel	10'580	4'845	4'862	4'725	4'690	7'955	4'640	10'400	28'350	4'590	4'730	15'240
Other direct costs	330	165	163	250	250	250	375	500	1'500	165	165	4'915
Overheads over dissemination costs	6'546	3'006	3'015	2'985	2'964	8'533	3'009	6'540	17'910	2'853	2'937	4'666
Total dissemination costs	17'456	8'016	8'040	7'960	7'904	16'738	8'024	17'440	47'760	7'608	7'832	24'821
EC contribution	509'729	457'813	124'000	229'829	145'226	205'034	105'308	199'457	229'829	71'320	283'107	135'000
Total EC contribution	**2'695'652**											

B3 Impact

B3.1 Strategic impact

The objective of the SustainCity project is to provide a scientifically sound tool to help land and urban planers professionals to identify new challenges and to prepare adequate policy responses. The project has a strong potential impact on the further advancement of methodological and substantive issues in the scientific study of local sustainable development, as well as on the scientific background of relevant local policy formulation.

The originality of the project is to propose an improved model which will be totally adapted to the European context, and that is comprehensive enough to explore the interactions between economic, social, environmental and demographic factors at the local level. The project will advance the knowledge base that underpins the formulation and implementation of economic, social and environmental policies for European cities and urban areas. Through the different WPs, the project will explore the concepts to be used and organised into a model in order to provide relevant insights and indicators on land planning issues on the middle and long-term perspectives.

B3.1.1 Impact on the competitiveness of the beneficiaries

Direct applications and market prospects

The project will advance methodology of land use transport modelling at the theoretical level as well as make its application easier through the testing and additional functionalities generally, but especially to the existing open-source software systems UrbanSim and MATSim. The training activities planned will lower the threshold to the adoption of such advanced tools generally, but obviously for the two tools further here.

SustainCity is targeting an audience of real-world city and regional planners outside of the academic field. Planning practise of local and regional authorities will benefit substantially, as these tools become more familiar and easier to implement. The output of the project will be therefore immediately usable by the community. Public agencies and consultants across Europe will benefit from an improved framework which allows them to continuously improve their set of prospective tools.

It will also benefit private companies which are selling software or services in transport and land-use by providing interfaces between their own software and UrbanSim (e.g. it was done by PTV America) and MATSim. Their open source nature is and will be a powerful multiplicator as other groups and firms can easily adopt, integrate, tailor and employ the powerful functionalities available.

Next to direct benefits to consulting and software firms, the much more important benefits arise from better planned investment and policy decisions of the local and regional authorities, especially through a better informed and less biased decision process as the models summarize the latest data of the relevant region and combine it with the latest and best theoretical insights into urban and demographic development and everyday travel and land use.

Potentially patentable ideas

Both UrbanSim (OPUS) and MATSim are provided under GNU public licence. No patents are envisaged.

Benefits and competitive advantages

UrbanSim (OPUS) (www.urbansim.org) is the most mature state-of-the-art platform which is open, extensible and actively maintained. There exist academic and commercial alternatives, such MEPlan (UK), Tranus (Venezuela), Delta (UK), MUSSA (Chile), ILUTE (Canada) or ILUMASS (D), but all are characterised by small development teams, lack of on-going investment (e.g. ILUMASS) and their non-existent interfaces to public domain data and software standards. UrbanSim has several key advantages over its competitors:

1. it is (free) open-source using an open-source language (Python);
2. it is very general and was build with that concern;

3. it is actively maintained by a substantial team at University of Washington, Seattle;
4. it has a growing user and developer base.

MATSim (www.matsim.org) is currently the computationally most robust (in terms of scale and speed and integration of relaxation (search for Nash-equilibrium)) of the new generation of activity-based agent-based micro-simulations of activity scheduling, i.e. travel demand, and traffic flow. Recent TRB-sponsored conferences Innovations in Travel Modelling (2008 and 2006)[20] showcased it among its alternatives, which are throughout not open-source, have not yet attracted non-core group users and developers and are designed for computationally less demand scenarios. The advantages of MATSim are as follows:

1. it is (free) open-source using a platform independent and very popular language (Java), which is easily available and follows a public open standard;
2. It is designed for extension through new modules;
3. It is actively maintained by a co-ordinated set of teams at TU Berlin, ETH Zürich and CNRS (Lyon);
4. It has a growing user and developer base.

The combination of the two systems brings together strong teams and conceptually sound state-of-the-art software systems.

METROPOLIS, when used with UrbanSim (or UrbanSimE) and MATSim, will be offered free of charge by adpC. A specific contract will be signed by the partners, who will use METROPOLIS.

Economic justification

The benefits of long term planning for land use and transport system development do not need to be rehearsed here at length. Keywords will suffice: firm long range frameworks for private commercial and private decisions; proper sequencing of investment; reduced over- or underinvestment; better co-ordination of environment, social services, education, land use and transport services; better protection of natural resources and assets.

Metropolitan areas and large municipalities have therefore an increasing need for quantitative tools to assess the impacts of public policies in term of air quality, environmental and social indicators, land use and infrastructure network costs and operations. The existing commercial tools are generally too inflexible, expensive and often too opaque for modern planning processes which require transparency of data, software, models and results. Powerful open-source software fills a need, which UrbanSim/MATSim are ideally suited to fill. They are flexible and open, which allow their integration in planning processes involving public participation and should therefore speed up the process, reduce conflicts over results and therefore the chance of long-running suits and political conflicts. These time gains will translate in substantial social welfare gains.

In addition, the project will help to maintain or build the European lead in software and services for land-use transport modelling.

B3.1.2 Strategy for impact achievement

The training activities within the project, but also the general activities of the teams (open user group meetings) are crucial to build up the general level of experience in the wider community. This will be supported by the on-going publication of the project and further results through all relevant channels: internet (system web-sites), television shows, conference presentations and journal publications for general public, policy makers, planning praxis and academic audiences. Equally, the tools will be employed in the teaching and research of the various partners adding further experienced engineers and planners. It is the interaction of all of these activities which will support the wide-spread adoption of these tools.

[20] http://www.trb-forecasting.org/innovationsConference2008presentations.html

B3.1.3 European dimension

European problem to be solved

The urban cores of Europe provide the economic and social drive of its economy and social cohesion, but they are encumbered with a wide range of problems, which need to be addressed urgently, for example:

1. Urban sprawl and loss of population, but also gentrification of selected urban areas;
2. Congestion and financing of their transport systems;
3. Environmental quality;
4. Energy consumption of travel and buildings in an environment of foreseeable price increases and limited availability;
5. Kyoto objectives which need to be translated in detailed policy and action programmes;
6. Viability of public transport, especially in the suburban and exurban parts of the urbanised areas;
7. Social cohesion through segregation and various other social exclusion mechanisms.

Urban land-use and transport planning is involved in all of these questions, either directly or indirectly through their ability to create the urban space for their solution. In the absence of cohesive land-use transport models the policies will be not co-ordinated and will therefore lack the maximum impact, they might otherwise have, even worse they might be contradictory. The project wants to provide a tool to improve this necessary joint planning process.

Effects on transnational co-operation

The project can be thought of as the core of the future European user community of land-use transport modelling, especially those employing UrbanSim and the associated transport models MATSim and METROPOLIS. Their open-source status will encourage a growing number of developers and critical users from around Europe to collaborate. This exchange of information and experience, maybe further encouraged through the relevant Commission programmes and community institutions, e.g. the Council of Regions, will be a dynamic force in addressing the urban problems of Europe.

Implementation and evolution of EU policies

The various EU transport policies need the support at the urban scale to be successful, as this is where the bulk of the movements take place. The capabilities made available by *SustainCity* will help cities in their planning and budgeting and will allow them to act to match the relevant directives and to respond to the policy initiatives.

The SustainCity Consortium will support the work of the European Commission Expert Group on “The world and Europe in 2030” within the limits of available resources.

Improvement of European social and economic cohesion

The contribution of any planning tool to these issues is indirect, but as sketched above, the capabilities developed here might turn out to be crucial, if they give Europe’s cities and urban regions more confidence in their choices. Reducing the uncertainty, or better characterising their inherent risks, will allow policy makers to make the bolder choices, which are often required. In addition, the Europeanised version of UrbanSim will put special emphasis on tracing population groups, especially those at risk of social exclusion. On the other hand, improved planning will help Europe’s cities to remain the cultural and economic centres need for the economic cohesion of the Union.

B3.1.4 Contribution to Community societal objectives

Land-use and transport planning enable local and regional communities to achieve and balance their objectives across a wide range of specific and sometimes conflicting goals. Planning tools, such as the enhanced and expanded land use transport model (UrbanSim plus MATSim/METROPOLIS), support this process through allowing all stakeholders to formulate their assumptions about the functional dependencies in the dynamics of the urban environment and its use. The reformulation of these lay person models into the language of the formal model encourages joint thinking and testing their validity against past system behaviour and forecast changes to the dynamics of the city or region. The model generated results for the impacts of policy changes, service innovations and physical interventions supports the process by allowing both informal and formal comparison using the relevant decision support approaches, for example at the most formal end of the spectrum cost-benefit analysis.

Examples of policy goals and policies which can be expressed in the model system are:

1. social policy objectives, especially social exclusion and gender equity, through the assessment of the differential impacts of the modelled policies on the different classes of the population, which can be easily traced in the agent-based approach, which carries the information about the agents (persons) throughout all modelling steps and therefore results;
2. quality of life issues, such as changes to the noise landscape, access to green space or cultural institutions;
3. health and safety issue, such as air quality impacts of transport, but also of the localisation of industries and firms;
4. economic competiveness questions, such as improved accessibilities with efficient and sustainable transport systems or improved labour market access;
5. environmental issues, such the impact of land use regulations on the form and size of urban areas, or the flow of air and of heat transfers through built up areas and finally on the dynamics of the mass flows (building materials, food and drink, other urban equipment, wastes, recycling materials).

In addition to the policy analysis and policy process gains available from a formal model system, the SustainCity project will deliver new insights into particular issues. For example, the modelling work planned on household decision making will elucidate the gendered differences in power within households; the analysis of the behavioural differences between developer types will show how equitable the development outcomes are for different tenant groups or categories of home owners.

B3.1.5 Other relevant European or National funded research

The most relevant on-going European project, we are aware of, is www.plurel.net , which is focussing on the urban-rural regions and brings together mostly research groups with an interest in landscape and environmental issues. It wants to develop a new set of tools from scratch. SustainCity with its clear urban focus and its incremental approach of expanding existing and tested tools is complementary to Plurel. Other on-going European projects that might be of interest are PACT (Pathways for carbon transitions) and GILDED (Governance, infrastructure, lifestyle dynamics and energy demand: european post-carbon communities). A finished relevant project we will look at is SENSOR, which investigated the needed capacities to bring Europe back on a sustainable development path.

The SASI and the Propolis model[21], which were developed within European Union research projects, have a larger spatial scale or follow an aggregate approach, whereas this project will follow an agent/parcel based model structure to take advantage of the recent gains in spatial databases and computational power to achieve a new level of realism of the processes modelled.

Various member states support on-going research on land-use modelling, for example at CASA (UCL, London), Wageningen or many other institutions, but these projects tend to be small scale and do not bring a critical mass of researchers together. The open source approach has the potential to overcome the scaling issues typical for university based research, which are limited because the frequent discontinuities in staffing and funding. The definition of XML standards for the data and the modular nature allows other easy access to the data structures and to the modelling capabilities.

It is this need for European scale which requires SustainCity to be formulated as a European research project. It is not so much the funding, but the range of skills available within Europe as well as the range of contexts, which are needed to reach the targeted level of realism and process depth.

B3.2 Plan for the use and dissemination of foreground

The following means of communication will be used to reach a wide range of dissemination:

[21] Wegener, M. (2008): SASI Model Description. Working Paper 08/01. Dortmund: Spiekermann & Wegener Urban and Regional Research.

1. The web site of the project;
2. Reports to the commission: the deliverables that inform about the scientific accomplishments in the work packages, a mid-term report and a final project report. The reports will be placed on the web site after the relevant approval;
3. One publicly available land use transport agent-based micro simulation tool;
4. Training courses and their public materials.

The project will be disseminated among two main target groups of users:

(i) To the scientific community.

The purpose of this type of dissemination is science-based: to distribute the newly acquired knowledge among scientists and scientific institutions. This task can be achieved by the basic means exploited in scientific work.

Scientific publication. As the project develops, research results and the most important findings will be published in refereed scientific journals and as working papers and other scientific reports. Researchers within the project have strong publication records. Given the wide range of research questions covered and the proven productivity of the key scientists involved, numerous publications can be expected to emerge from the scientific activities of the project, especially of a comparative nature. In addition, the findings presented at the final conference will give rise to a scientific book and/or a special issue of the Vienna Yearbook of Population Research.

Conference participation. International conferences will be used to disseminate the on-going work on the project.. Towards the end of the project the Consortium will organize a large conference where project results will be presented and external academic participation will be invited.

(ii) To policy makers and other stakeholders.

The project aims to provide extended background information to policy makers throughout Europe (urban planners, local planning agencies, ministries). Training courses will be organised with key planning agencies staff and researchers in order to disseminate the use of the model to professionals and to the general public. The final project conference will be targeted at the professional public.

B3.2.1 Exploitation and dissemination plan for use of project results

Industrial and commercial routes for exploitation

Direct exploitation is not intended, but the open-source nature allows other players to offer services to cities and regions using the tools. Other business models, such as those pursued by those packaging Linux, are a possibility as well. The consortium will consider this during the project.

Validation of the technology

The case studies will involve detailed validation of the software and the local specific models; see these work package descriptions for details.

Dissemination of results and technology transfer

The consortium is planning to major conference presenting its results, which is the start of an on-going process of dissemination. Consortium members have already organised a first European UrbanSim user meeting and are now putting together a special issue on its results. We envisage continuing this activity, as part of an engaged user community of land-user transport modellers and consultants.

We will contribute through the thorough documentation (manual, examples, utility scripts etc), which will be hosted at the project website, or if dedicated to transport at the MATSim website or METROPOLIS website.

We also will run tutorial workshops which will provide basic and later advanced training in land-use transport modelling (See WP9).

B3.2.2 Management of knowledge and intellectual property

The systems are open-source to have the maximum impact on the policy problems discussed above.

B4 Ethical Issues

ETHICAL ISSUES TABLE

	YES	PAGE
Informed Consent		
• Does the project involve children?	No	
• Does the project involve patients or persons not able to give consent?	No	
• Does the project involve adult healthy volunteers?	No	
• Does the project involve Human Genetic Material?	No	
• Does the project involve Human biological samples?	No	
• Does the project involve Human data collection	No	
Research on Human embryo/foetus		
• Does the project involve Human Embryos?	No	
• Does the project involve Human Foetal Tissue / Cells?	No	
• Does the project involve Human Embryonic Stem Cells?	No	
Privacy		
• Does the project involve processing of genetic information or personal data (e.g. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	Yes	See below
• Does the project involve tracking the location or observation of people?	No	
Research on Animals		
• Does the project involve research on animals?	No	
• Are those animals transgenic small laboratory animals?	No	
• Are those animals transgenic farm animals?	No	
• Are those animals cloned farm animals?	No	
• Are those animals nonhuman primates?	No	
Research Involving Developing Countries		
• Use of local resources (genetic, animal, plant etc)	No	

	YES	PAGE
• Benefit to local community (capacity building i.e. access to healthcare, education etc)	No	
Dual Use		
• Research having direct military application	No	
• Research having the potential for terrorist abuse	No	
I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROJECT		

The project involves both original data collections and their analyses and the secondary analysis of existing data sets. All data sets were/will be obtained from volunteers, or from official sources (e.g. statistical offices). The partners strictly maintain the confidentiality to which they are bound to their volunteers or to the official sources.

The behaviours of interest in SustainCity are strictly limited to their housing and daily activity choices.

The artificial agent populations and household populations have no link to the real population other than replicating the correlation structures and marginal distributions obtained. The simulated behaviour is based on the structural models derived from the observed behaviour of the underlying samples in either real (revealed preference) or hypothetical markets (stated preference). None of the original respondents can be re-identified or associated to their reported behaviours

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