Urban Regions in the Delta (URD) - AESUS project description

Description of the project

a) Rationale and background

Urban development is a complex dynamic process that is characterised by substantial spatiotemporal variation. Growth and decline coexist within neighbouring regions at short distances from each other. Population and employment are expected to grow in the so-called main-, brain- and greenports of the Netherlands, whereas a decline is expected between these regions and, especially, in more peripheral parts of the country (PBL, 2011). This makes steering urban expansion and intensification important policy issues in many regions, while preparing for decline and urban restructuring have become hot topics in others. These processes are driven by various interacting and sometimes even conflicting societal and economic forces that may impact regions differently. Globalisation, for example, is a dominant socioeconomic force that is associated with changes in the production and employment structure of countries and regions. It brings business opportunities and foreign investment to, for example, the Zuid-as in Amsterdam and the Brainport region of Eindhoven. But at the same time, globalisation is partially responsible for rapid reductions in employment and outflows of high-skilled people in other regions. Both developments lead to increased differences between regions and give rise to the societal and political desire for regionalisation that emphasises 'own' identity and local interests and tries to limit globalisation. Also on the governing side, we witness opposing forces: societal concerns such as safety, accessibility and economic development call for active and preferably centralised government control, but at the same time central government is increasingly delegating its responsibilities to lower tiers of government. In fact, attention is shifting from government to governance and societal organisations (including businesses and non-governmental organisations) and individual citizens become more important in decision-making processes. This process of change is especially apparent in the renowned Dutch spatial planning system that is currently being stripped from its most prominent features: top-down restrictive zoning polices and urban concentration polices are being abolished. Also the underlying principles of distributive justice and solidarity between regions are being removed from spatial planning and the related allocation of funds. This is directly relevant for the management of regional population decline as it implies that classical, costly interventionist urban restructuring policies will not be feasible and calls for the development of other, more innovative strategies. The outcome of the ongoing and partially conflicting societal and economic processes is uncertain and can differ per region. Which processes dominate and prevail in a certain region and how governmental interventions of different governmental levels can help steer these developments is unclear.

This research focuses on the hinterland-corridor surrounding the A2 motorway that connects Amsterdam with the cities Utrecht, 's-Hertogenbosch, Eindhoven, Maastricht and from thereon with Belgium and destinations further south. It aims to understand the relative success of some parts (such as the Amsterdam/Utrecht region, Brainport Eindhoven and Greenport Venlo) and the lagging behind of others. Why, for example, has population in the southern extremity of the corridor (Zuid-Limburg), situated in the heart of Western Europe between urban centres as Liege and Aachen, been shrinking in the past 10 years? Is the negative impact of language barriers more important than the expected positive contribution of international accessibility? Which other regions benefit most from the interaction potential offered by hinterland-corridors such as the A2? Apart from understanding these processes this research also aims to support policy making in this context by answering questions such as: which policy options do local and regional policy makers have to steer economic and demographic developments? Can the growth of Brainport Eindhoven, for example, be attributed to local policy? And can policymakers in regions with (projected) population decline learn from these experiences? Or should they try to find the opportunities offered by decline? Can we learn from differentiated developments in other regions in Western Europe? For example, from population decline in East Germany and current economic success of Southern Germany?

b) Research plan (approach & methods)

This project develops an integrated framework for: 1) understanding the complex relation between urban dynamics and sustainability; 2) exploring potential future developments; and 3) assessing likely impacts of intervention strategies. The following three elements are central to our approach:

- gathering knowledge on spatial developments (in particular regional differences in economic and demographic development) and potential intervention strategies fitted to the changing spatial processes and decision making context;
- improving and combining spatial decision support tools to make them adequate for current and upcoming national and regional spatial development issues, changing mind sets and new governance strategies;
- elaborating and assessing potentially successful intervention strategies fitting within the new policy context that are aimed at actual spatial development issues within two case study areas in the A2 corridor.

More specifically we distinguish between four subprojects that focus on:

1. analysis of driving forces behind urban development;
2. development of solution strategies fitting within the changing policy context;
3. spatial exploration of future scenarios of urban development;
4. visualisation and evaluation of those future scenarios.

The subprojects apply a range of different approaches and methods drawing from their different disciplinary backgrounds. Subproject 1 applies spatial analysis techniques common to geography (geographical information systems) and spatial economics (spatial statistics) to better understand spatiotemporal changes in demographic and economic indicators (numbers of residents, residences and employees, gross domestic product, land use) and their links with driving forces such as multimodal accessibility, proximity to borders and economies of agglomeration. This subproject will compare such developments along the A2 corridor with comparable regions in Northwestern Europe. Subproject 2 starts with an analysis of prevailing spatial planning documents produced by planning agencies. The analysis focuses on the evolving underlying spatial (design) concepts and planning principles pertaining to both imagery and text. The inventory delivers a list of spatial (design) concepts and planning principles that can be selected, tested and improved by the participants (researchers and stakeholders) in design studios that are related to the two case studies of the project. The subproject aims in particular to evaluate the applicability of three-dimensional representations of urban landscapes in spatial development processes. Central to subproject 3 is the GIS-based land-use model Land Use Scanner that has successfully been applied to support decision making in the Netherlands and other European regions. The model follows an economic rationale to allocate land use at the local (100 metre grid-cell) level. This subproject aims to improve that allocation process by incorporating information on land-use density, thus allowing a better assessment of, for example, urban densification and extensification strategies. Subproject 4 focuses on visualisation and evaluation using the Urban Strategy framework. This GIS-based decision support system can link results from other modelling frameworks, novel visualisation techniques and interactive geo-ICT tools to assess the impact of urbanisation strategies on sustainability values. This subproject aims to strengthen the evaluation of impacts and visualisation of outcomes in the Urban Strategy framework by: creating a more direct link with input information from, amongst others, Land Use Scanner and Tigris XL; developing new indicators that assess economic impacts; and applying new ways to visualise output such as the Microsoft Surface table. This integrated framework will be tested in the actual planning context of two case studies.

These subprojects are closely related: the spatially-explicit land-use model that will be improved in subproject 3 and the visualisation and evaluation framework that will be expanded in subproject 4 will be applied to evaluate scenarios of urban development in two case studies based on an analysis of driving forces (subproject 1) and suggested solution strategies and visualisation approaches (subproject 2). Figure 1 illustrates the relationships between the subprojects.

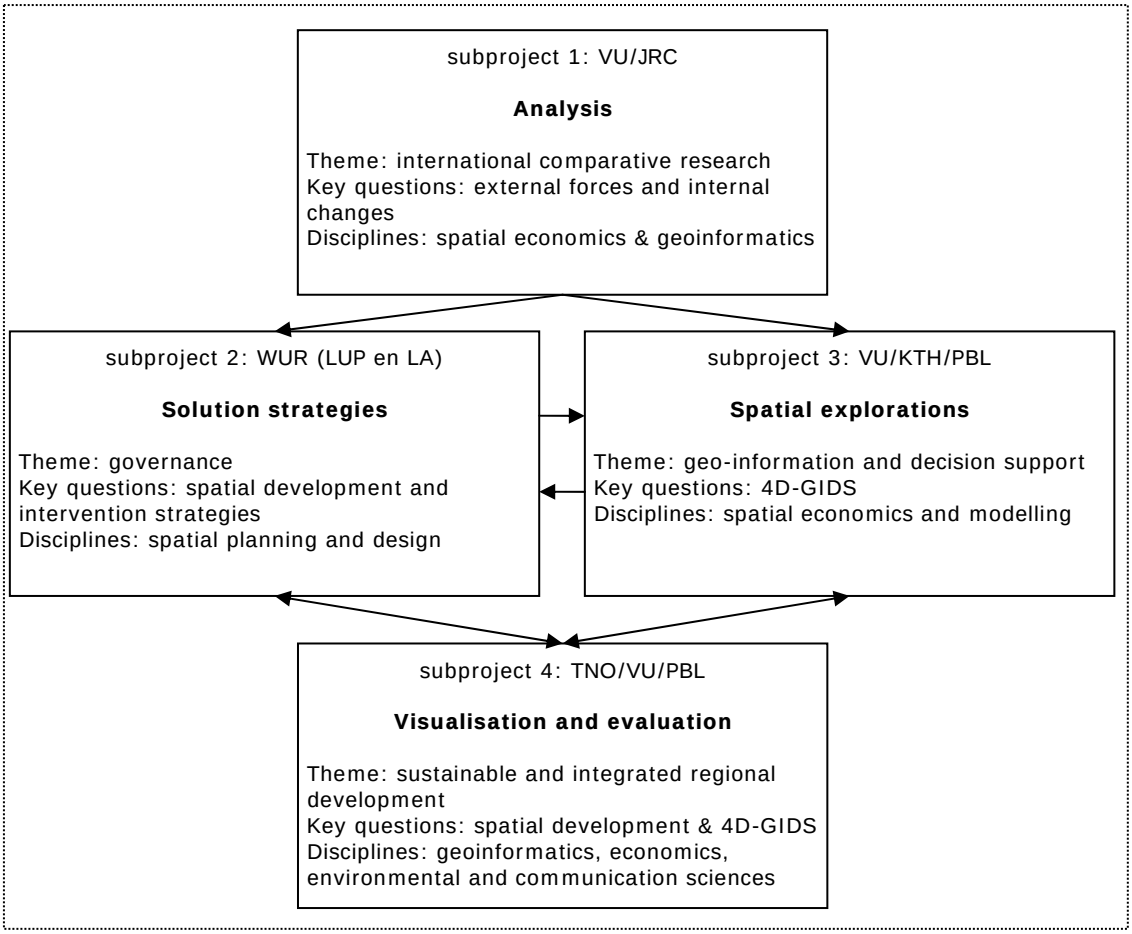

Figure 1 Schematic overview of the project with reference to the most important themes and key questions in the Urban Regions in the Delta programme (programme brochure in Dutch pages 6-8).

Figure 1 also indicates how the subprojects relate to the main themes and research questions of the Urban Regions in the Delta research programme that are specified in the Dutch programme brochure. The entire project focuses on urban regions within the Dutch Delta, the two main themes of the research programmes. In particular, we analyse the dynamics in these regions and the importance of (international) accessibility for urban development (subproject 1). The other subprojects focus on proposing solutions (subproject 2), exploring potential spatial developments (subproject 3) and assessing the impacts (subproject 4) related to ongoing processes of urban change in the Dutch Delta. The four subprojects each have their own specific focus in combining the main research themes with specific research questions of the Urban Regions in the Delta research programme. Subproject 1 performs international comparative research, analysing the external forces and internal changes that cause regional differences in urban development. This subproject aims to learn lessons from developments in other European regions. Subproject 2 looks at governance and, more specifically, strives to come up with innovations in spatial development and related intervention strategies that are expected to be effective in the changing spatial and policy context. The effective use of geo-information to support decision making is the main theme of subproject 3, while subproject 4 focuses on the Urban Regions in the Delta research theme sustainable and integrated development. Both subprojects link to the key question of developing 4D-geographical information and decision support systems (4D-GIDS). Models of land-use change have established themselves as particularly successful examples of geographical information and decision support systems as is documented in a wealth of literature (Koomen et al., 2007; 2008). Such models are able to integrate geographical information on biophysical terrain conditions, infrastructure networks and occupation patterns with socioeconomic scenarios to project future

urbanisation patterns. Generally these models offer two-dimensional results with a time dimension. By incorporating temporal changes in the distribution and density of urban land use in a much-applied land-use model (subproject 3) and linking the outcomes of this model to three-dimensional visualisations (subproject 4) truly 4Dimensional GIDS are established that can be used to assess scenarios of urban development. In addition, subproject 4 also visualises and evaluates impacts of spatial developments in order to better support local and regional spatial development processes.

c) Multi-disciplinary and integrative approach

To analyse and explore sustainable urban strategies in a truly integrated manner, the consortium consists of scholars that represent a wide range of disciplines. The analysis of subproject 1 is performed by researchers specialised in urban and regional dynamics of the Department of Spatial Economics of VU University Amsterdam in cooperation with geographers of EC-Joint Research Centre. Their quantitative results related to, for example, the importance of international accessibility and (language) barriers in influencing urban development are used to provide the context for the development of strategies and spatial explorations in subprojects 2 and 3. In subproject 2 spatial planners and urban landscape designers of the Land Use Planning Group and the Landscape architecture Group at Wageningen University cooperate to first make an inventory of recent planning innovations and then design specific solutions using novel visualisation techniques aimed at the selected case-studies. The model development in subproject 3 will be performed by the Spatial information laboratory of the Department of Spatial Economics of VU University Amsterdam and the School of Architecture and the Built Environment of KTH-Royal Institute of Technology in Stockholm in cooperation with PBL Netherlands Environmental Assessment Agency and involves spatial modelling scientists from both research groups together with geographers and spatial economists that will add realism and rationale to model development. The development of the visualisation and evaluation framework that will be used to assess sustainability impacts of urbanisation strategies is led by TNO Urban Development. This subproject involves specialists in environmental and economic impact assessment to help define sustainability indicators and geo-information scientists for the technical development of these indicators and the application of geo-ICT tools and communication scientists to align development with end user interest and capabilities. The project is organised in such a way that methods and results from individual subprojects are used to feed others (see also the preceding Section 7b). Moreover, cooperation is established in the joint case studies and other joint activities. The involved research groups have proven to be able to cooperate efficiently in past project and publications (see Section 11 for further details).

The project thus has a clear interdisciplinary character as it focuses on collaboration between various unrelated academic fields for the express purpose of crossing disciplinary boundaries with the goal of creating new knowledge and achieve a common scientific goal. In addition, the project aims to be transdisciplinary in the sense that we include scholars from assorted disciplines as well as non-academics in order to achieve common practical objectives and develop new knowledge. Transdisciplinary knowledge may be negotiated knowledge, identification of problems and development of devices and strategies. The proposed transdisciplinary research strategy aims to build on recent experiences with research by design and collaborative planning in the Netherlands. It is a crucial component of subproject 2 and will be central to the case studies.

d) Relevance to Society and Policy

The framework that will be developed in this project and the knowledge and results it will generate are of great interest to society as is demonstrated by the willingness of many societal partners to cooperate and contribute. The knowledge generated on more fundamental model development issues (incorporating land-use density in a land-use model, linking a land-use model with a visualization and evaluation framework) is of particular interest to EC-Joint Research Centre and PBL Netherlands Environmental Assessment Agency that operate similar models. EC-JRC is also interested in the results of the international comparative study performed in subproject 1 as these can be used to further calibrate the land-use model they use to assess land-use impacts of

European policies. The development of suggested solution strategies and their assessment in case studies is relevant to the Ministry of Infrastructure and the Environment and the Province of Noord-Brabant, while the more general experiences obtained in applying the model framework are interesting to BBSR that wants to build a land-use model based on Land Use Scanner to be applied in German national planning processes. The geo-ICT consultancy firm Geodan participates in the project and provides geo-ICT tools to be able to test newly developed functionality of geo-ICT tools and share in the knowledge obtained on their applicability. The association of Dutch provinces (IPO) and the National Spatial Data Infrastructure executive committee (Geonovum) are interested in linking the application of spatial models to the knowledge infrastructure the Dutch provinces and the Dutch National Spatial Data Infrastructure respectively. Moreover, Geonovum is curious to learn to which extent current efforts towards open and standardised information (e.g. PROgideon, INSPIRE, pdok) are helpful in supporting model development and new applications.

To test the proposed framework and to contribute to current policy issues we will perform two case studies in which results and models developed in all subprojects will be integrated and applied in a regional planning context. The case studies are defined in such a way that they each have a different spatial scale and deal with different urban dynamics. They will evaluate scenarios of urban development that are based on the analysis of driving forces (subproject 1) and proposed solution strategies and their visual representations (subproject 2) using spatial explorations (subproject 3) and a dedicated visualisation and evaluation framework (subproject 4). Based on this assessment and the feedback from the societal partners in the case studies the strategies and modelling framework may be adjusted.

One case study will be performed in close cooperation with the Province of Noord-Brabant and will focus on different strategies to accommodate urban growth in the Brainport Eindhoven region. This joint case study will encompass the development of scenarios for growth, initial two-dimensional explorations with Land Use Scanner and concrete (three-)dimensional visualisations of specific (elements of) solution strategies and related impacts. WUR will lead the preparation of this case study and coordinate the integration of research efforts with the involved societal and research partners.

A second case study will focus on the spatial implications of population decline along the southern part of the A2 corridor. This study has a more regional orientation and will be led by VU and coordinated with PBL Netherlands Environmental Assessment Agency, the Ministry of Infrastructure and the Environment and the other research partners. The case study will explore potential changes in population distribution, associated spatial patterns, potential solution strategies and related impacts. The development of spatial planning and design concepts in this case will focus on accommodating population decline, while paying attention to the relation between population and facility levels.

e) International link and collaboration

The project is thoroughly embedded in the international scientific and practitioners' community by involving relevant foreign partners in the research of the subprojects. In addition, several renowned international experts have agreed to participate in our advisory board.

International collaboration within the subprojects

Our foreign scientific partner in the consortium (KTH) is Sweden's leading technological university and will apply her research experience in spatial optimisation and land allocation to the development and implementation of a residential density model in Land Use Scanner (subproject 3). Our international societal partner EC-Joint Research Centre will contribute to subproject 1 by providing relevant spatial data. The results of this subproject will also be linked to the international research group initiated by Prof. Daniel Czamanski of Technion (Haifa, Israel) that studies peri-urban dynamics as part of the Cities and Nature books series of Springer publishers. The study related to new planning and design challenges (subproject 2) will draw on the experience of the

international working group related to comparative studies of the Association of European Schools of Planning. This subproject will, furthermore, be carried out in cooperation with the partnership of academic planning and design schools (Thematic Network Landscape Architecture and Spatial Planning of the Euroleague for Life Sciences) led by Wageningen UR. The development of the spatial model and the evaluation and visualisation framework (subprojects 3 and 4) will be carried out in cooperation with the European association of technical research institutes (Joint Institute for Innovation Policy) and a group of international experts that will advise on various aspects of urban modelling in relation to spatial planning.

International participation in advisory board

The following international experts have agreed to participate in the advisory board of the project:

- Prof. dr. Michael Batty (Centre for Advanced Spatial Analysis, University College London) for technical aspects of modelling urbanization in relation to spatial planning;
- Prof. dr. Michael Wegener (Spiekermann & Wegener, Urban and Regional Research, Dortmund, Germany) for modelling the relation between urbanisation and accessibility;
- Dr. Jana Hoymann (Federal Institute for Research on Building, Urban Affairs and Spatial Development, Bonn, Germany) for general application issues related to using spatial models in planning context;
- Dr. Carlo Lavalle (Institute for Environment and Sustainability, EC-Joint Research Centre, Ispra, Italy) for advising on the international comparative study on urban development and the assessment of land-use related impacts of spatial development.

The advisory board will meet twice a year with consortium researchers and representatives of Dutch public and private organisations (PBL Netherlands Environmental Assessment Agency, Ministry of Infrastructure and the Environment, Province of Noord-Brabant, association of Dutch provinces, National Spatial Data Infrastructure executive committee). The advisory board will discuss scientific, technical, organisational and application issues related to research progress in the subprojects. The letters of cooperation and commitment of all international scientific experts and societal partners are included in the annex to this proposal.

f) Data to be used

This project will make use of many different spatial datasets and spatial models that help describe urban development and related driving forces. For the analysis of driving forces in the Netherlands and selected regions in Europe (subproject 1) spatial data will be used that captures past changes in household numbers and key economic indicators (e.g. GDP, employment) as well as relevant driving forces. This analysis applies commonly available pan-European datasets (e.g. derived from Cambridge Econometrics, Eurostat) as well as specific data provided by EC-JRC. For specific regions (at least within the Netherlands) time-series of more detailed (micro) data will be used that describe the spatio-temporal distribution of residences and employment in the past decades(s) at very refined spatial levels. This data will become available through cooperation with national data providers and research institutes (such as PBL Netherlands Environmental Assessment Agency for the Netherlands and Statistics Netherlands). Subproject 3 will use the same Dutch data to analyse past changes in residential density. Following its longstanding cooperation with PBL, VU University Amsterdam is also able to make use of the most recent configuration of the model Land Use Scanner for this subproject. This model contains a wealth of spatial datasets describing: current land-use patterns, biophysical terrain conditions, infrastructure networks, accessibility and spatial planning policies. Through its links with underlying models (such as Tigris XL) this model also contains information on projected demographic changes and infrastructure development. Subproject 2 will base the development of novel planning and design concepts on spatial data and other information provided by subprojects 1 and 3 and the stakeholders involved in the case studies. The visualisation and evaluation of urbanisation strategies (subproject 4) will make use of the underlying information and results collected and created in subprojects 2 and 3. In addition spatial datasets describing, for example, local topography, building contours and terrain or building heights will be used that are available through existing TNO research activities and the Dutch spatial data infrastructure.