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Guest editorial

Coping with uncertainties in integrative spatial planning

As a consequence of economic, technological, and sociocultural megatrends, Western countries are increasingly being confronted with large spatial problems. Households and businesses need more space for residential, recreational, and economic activities. An increasing demand for mobility of persons and goods enlarges the action radius and the demand for new transport and communication infrastructure. This demand on space is at the cost of vulnerable ecological functions. Conflicts arise from incompatibility in land use in and between the different socioeconomic and environmental systems, leading to undesirable social, economic, and environmental impacts. Examples of these are the loss of life and property through river flooding following deforestation, the drainage of wetlands and floodplain embankments, conflicts between housing and economic land use, the loss of biodiversity following the fragmentation of ecological habitats by urbanisation and transport infrastructure, and, ultimately, deterioration in the quality of life.

Figure 1 illustrates these interactions between land-use functions and use of space. Here, a distinction is made between the socioeconomic system (which comprises households, businesses, and other organisations) and the environmental system (with abiotic and biotic subsystems). The functional systems of both socioeconomic and environmental systems place demands on the land-use system. The task of the planning system is to regulate and to manage the demand for land by developing policies and strategies.

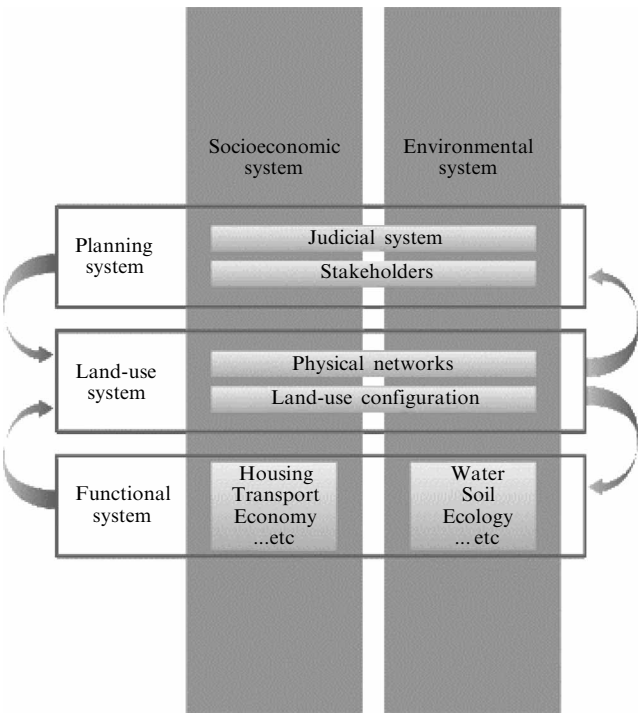

Figure 1. A systems approach to integrative spatial planning (source: Dijst et al, 2003).

The land-use planning system is insufficiently equipped to stimulate sustainable development (see Diamond, 1995). This has led to two forms of uncertainty for spatial planners. First, there are the growing demands on space in terms of size, diversity, and dynamics displayed by residential and economic activities, which leads to uncertainty among those who have to manage and control these processes in order to improve the performance of the land-use systems in economic, social, and ecological respects (Dijst and Schenkel, 2002). This is because the interrelations between economic, technological, and sociocultural megatrends on the one hand, and environmental quality and ecological integrity on the other hand, are poorly understood or are dominated by simplifications (Lambin et al, 2001). Knowledge of these interactions is essential (Sheppard et al, 1999). Second, the last twenty years have shown a growing emphasis on the private sector and a rather nonhierarchical role for local authorities. Participatory planning models came into being in which an important role has been created for various stakeholders to put forward their views, wishes, and knowledge. Top-down, centralised, and hierarchical management of such policies has been transformed into a more decentralised, reticular, and interactive process. This planning model is based on the perspective of social constructivism (Piaget, 1926; Vygotsky, 1978) in which communication processes, such as bargaining, negotiation, and arguing, are seen as essential elements determining the outcome in a policy process (Slezak, 1999). This introduces a type of uncertainty for planners, which is fed by lack of knowledge of the behaviour of the different actors such as decisionmakers in industry and politics. Besides, policy measures can also lead to unintended, unwelcome, and unanticipated changes (Niles and Nelson, 2001).

The problems of increasing diversity, complexity, and dynamics in society have stimulated planners to adopt methods of integrated assessment (IA) in the planning system. In general, IA is a set of techniques focused on combining, interpreting, and communicating knowledge from diverse scientific disciplines, which result in useful information for decisionmakers (Rotmans and Dowlatabadi, 1998). We can make a distinction between two approaches to IA (Hisschemöller et al, 1999):

(1) A *participatory integrated assessment* could be based on multidisciplinary panels of scientists (for example, the Intergovernmental Panel on Climate Change) or on focus groups in which public and private decisionmakers or citizens participate. These interactive institutions have been created with the aim of discussing conflicting perspectives and of making decision processes more transparent. In order to strengthen the planning debate, Diamond (1995) advises an increase in access to information for all actors involved in the decisionmaking process. Different sectoral and integrated models could be used in this approach.

(2) *Integrated assessment modelling* is applied to the analysis of problems in one or more of the systems mentioned in figure 1. Models provide the ability to condense a vast amount of knowledge so that it can be applied in scenario simulation. Couclelis in her contribution to this theme issue argues that models can also be used for visioning and storytelling. Modern graphical and computer-animation techniques provide opportunities to get the messages from these three types of model application across in a readily understandable way to the different types of stakeholders in the participatory planning process. Still, human behaviour is often missing from these models. The interactions between individuals and the locations they use need to be modelled more explicitly to address contemporary planning issues, as shown in Batty's contribution to this theme issue.

Ideally, in the planning process both approaches should complement each other.

As noted above, increasing diversity, complexity, and dynamics in society are accompanied by increasing *uncertainty* among those involved in spatial planning issues.

Planners and modellers seem to differ in their reactions to this uncertainty. In her contribution Couclelis states that planners limit their work to short-term activities instead of devising strategic planning issues. To achieve acceptable sustainable outcomes for a dynamic society in a highly differentiated political arena, Diamond (1995) sees a need to strengthen the strategic discussion on different alternatives for the future. Ideas on using models for these strategic decisions as part of the participatory planning process are presented by Couclelis.

In contrast, modellers try to tackle the uncertainties by developing more sophisticated models in which they seek to incorporate all variables and interactions. However, Hisschemöller et al (1999) believe that uncertainties can only be properly analysed through a selection of key variables and relations (see also Mitchell in this special issue). In order to increase the use of models in the planning processes, modellers should take into account Lee's guidelines for model building. Although written in the early 1970s, these guidelines are still highly relevant. On the basis of an evaluation of large-scale models developed in the 1960s, Lee (1973) stated first that models must be balanced in terms of theory and intuition for policy problems. This implies that models such as decision support systems need to combine theoretically based knowledge and lay knowledge. Lee also demanded that a model should start with a description of the problem that needs solving and not with a methodology that is searching for an application. Finally, Lee recommended the avoidance of overcomplicated models which function as 'black boxes', hardly understood by their users. Instead he favoured rather simple models. Although uncertainty can never be eliminated, Edwards (1996) states that models in policymaking should be used heuristically and not predictively.

Inspired by these developments, in April 2003 the Faculty of Geosciences of Utrecht University in the Netherlands organised an international conference "Framing Land Use Dynamics". The aim of this conference was to identify the driving forces behind (potential) land-use changes in Western urbanised countries, and the conflicts that may arise from these changes, through considering such questions as:

(a) How can 'smart' spatial configurations of socioeconomic and environmental systems reduce spatial conflicts and enhance sustainable development?

(b) What improvements are necessary in integrated modelling to analyse, simulate, and assess spatial land-use dynamics?

(c) How can we improve the application of scientific knowledge from different disciplines to gain a better understanding of land-use dynamics in spatial planning processes?

Information on this conference can be found on http://networks.geog.uu.nl/conference or in the book of abstracts (Dijst et al, 2003).

The keynote papers delivered at this conference that were selected for this theme issue explore different ways of providing new approaches to strengthening the links between science and spatial planning in order to deal with the uncertainties faced in a dynamic and institutionally highly differentiated society.

In his contribution, Bruce Mitchell discusses some general issues of a holistic approach to water management, which are also relevant for other management fields in spatial planning. First, he clarifies the difference between two interpretations of a holistic or system approach in planning and management: comprehensive and integrative interpretation. Then, he presents a framework to facilitate the management of boundary problems of systems caused by institutional fragmentation. Finally, he discusses the connections between integrated watershed management and land-use planning.

Helen Couclelis starts her contribution with the statement that, even after four decades, the place of land-use models in planning remains problematical. Convinced that land-use models could be much more useful than is currently perceived, she sets herself the task of rethinking the role of integrated land-use models in spatial planning.

She notices that, thanks to increasing complexity, diversity, and uncertainty in society, spatial planning is less focused on long-term, strategic, future-oriented planning and more on short-term operational and managerial activities. This development could be changed by developing and using models to fulfil three roles in strategic planning: scenario writing (what may be), visioning (what should be), and storytelling (what could be).

Michael Batty sees that traditional aggregated spatial interaction models are no longer suitable to address contemporary planning and policy analysis, such as regeneration, segregation, polarisation, economic development, and environmental quality. There is a strong need for disaggregated, dynamic urban models in which the interactions between individual agents in different locations are explicitly modelled. Based on these ideas, a generic model for urban simulation is given. Further, the main characteristics of cellular automata and agents-based models together with three applications at different spatial scales are presented.

These keynote contributions present us with valuable views on how to tackle different aspects of uncertainty in spatial planning, ranging from the strategic, institutional and methodological setting, through the function of models in the spatial planning process, to the technological description of human behaviour, leading to insight in how we use space.

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