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### Making planning support systems matter : improving the use of planning support systems for integrated land use and transport strategy-making

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# Chapter 3

From PSS to MPS: A Structured  
Dialogue to Overcome the  
Implementation Gap



Planning Support Systems (PSS) are intended to facilitate relevant steps in planning processes; however, the academic evaluation of PSS reveals many bottlenecks precluding a widespread use of these systems. A central weakness is the lack of communication between PSS developers (focussing on technical issues) and potential PSS users.

Other academic fields like knowledge management and technological innovation have recognised similar bottlenecks years ago. Based on methods proposed in these fields, a new process architecture for the development of a PSS is proposed. Based on a dialogue in which PSS developers and potential users discuss and use the PSS, existing tools, instruments and models are refined and improved to be more useful for their potential users. The focus shifts away from the development of a technically more sophisticated support system, towards a process of PSS development which is intertwined with the planning process itself. This process architecture is called Mediated Planning Support (MPS).

The chapter explores what can be learned from other academic domains and enquires about the applicability of these findings to PSS development. The case of Amsterdam, where the Department of Transport wanted to transform their transportation model into a land use and transport PSS, illustrates how such a process architecture can link PSS developers and users in planning practice. This chapter discusses the concepts behind MPS and uses the case of Amsterdam to visualise its workings, lastly offering hypotheses on the method and suggestions for further research.

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### 3.1 INTRODUCTION

“Most learning takes place in the process of building the model, rather than after the model is finished”  
(Vennix et al., 1997)

Urban and regional planning is becoming an increasingly complex task. First of all, growing numbers of stakeholders and participants are closely involved in the process. Secondly (and deriving from this increase) varying and conflicting goals and agendas have to be addressed during the planning process. Thirdly, planning challenges are growing in scale (e.g. from local problems to regional challenges). As Couclelis summarises: “[land use planning] involves actions taken by some to affect the use of land controlled by others, following decisions taken by third parties based on values not shared by all concerned, regarding issues no one fully comprehends, in an attempt to guide events and processes that very likely will not unfold in the time, place, and manner anticipated” (Couclelis, 2005, p. 1355).

As Couclelis concludes, planners should embrace all available help and there is a wide variety of academic fields which can offer help in the form of theories and guidelines. Faludi (1973, chapter 1), distinguishes a *procedural* dimension (i.e. insights from political or management sciences which define and justify methods of decision making and planning) and a *substantive* dimension (i.e. theories from geography, economics or natural sciences which provide knowledge about the planning object).

One way of offering substantive support is to provide planners with information technologies to model certain phenomena, applying theories from other academic fields. Applying gravity theory to model competition between cities and using market theories to model land use changes are two well known examples.

Since the 1950s, the field of Computer Aided Planning has been developing such technologies, resulting in many families of instruments, such as Large Scale Urban Models (LSUM) and Spatial Decision Support Systems. The most recent of these technologies is known as Planning Support Systems (PSS). There are many different definitions of PSS, ranging from very broad (any computer-aided technique that can be used for planning tasks) to very narrow definitions. Here, we define PSS as *an infrastructure that systematically introduces relevant (spatial) information to a specific process of related planning actions* (based on Klosterman, 1997). As the origins and development of PSS are already concisely covered elsewhere (Geertman, 2006; Klosterman, 2001), here it is important to highlight that PSSs differ from (group) Decision Support Systems, optimisation techniques and computer models in that they are not highly structured. Instead, they are loosely coupled assemblages of (often computer-based) techniques, which aid planning actors to manage and overcome their planning problems (Batty, 2003, p. v). For specific planning actions a planning department can utilise: a transportation model, cost benefit analyses software, qualitative tools and a GIS. A PSS can offer all these types of techniques and can be linked to specific planning actions in specific planning domains. A PSS typically has a process component (related to the planning actions) and an

information component. Under the flag of PSS several packages have been developed which offer such an assemblage of techniques for a specific range of planning actions (What If?™ for collaborative planning actions (Klosterman, 1999), LEAM for spatial modelling (Deal, 2001), UrbanSim for transport and land use integration (Waddell, 2002), for more see (Brail, 2005; Brail, 2008; Geertman and Stillwell, 2003, 2009)).

Numerous studies show that the implementation of these families of instruments in daily planning practice has been lagging and continues to lag behind expectations, especially in actions unique to early phases of planning (such as visioning, storytelling, sketching and developing strategies). These planning actions are increasingly gaining importance in planning and managing cities and regions (see e.g. Healey, 2007). They can be characterised as highly complex both in terms of the planning process (many actors with different goals, means and understanding) and in terms of content. Especially in this phase the sorely needed PPS support (see Couclelis above) is often lacking (see e.g. Couclelis, 2005; Klosterman, 1997; Klosterman, 2007; Vonk et al., 2005). Studies show that planners find serious drawbacks in using PSS; deeming these tools as: too generic, too complex, inflexible, incompatible with the 'wicked' nature of most planning tasks, oriented towards technology rather than problems, incompatible with less formal and unstructured information needs, and too focused on strict technical rationality (see Bishop, 1998; Couclelis, 2005; Geertman, 2006; Klosterman, 2001; Ottens, 1990; Scholten and Stillwell, 1990; Vonk, 2006).

This apparent mismatch between supply and demand is often referred to as the 'implementation gap' of PSS (Vonk, 2006). The consistency of this gap over time and over different planning domains poses serious questions regarding the possibility for applying PSS effectively. Are there more fundamental problems between the realms of PSS development and the realm of planning (the Janus relationship of planners looking forward in time with modellers looking backward as suggested by Couclelis (2005, pp. 1355-1360)? Could solutions from related domains, such as (Group) Decision Support Systems or software development, provide answers and how could they be applied to the field of PSS?

Our core argument is that, in order to bridge the gap between PSS and the early phases of planning, PSS developers should focus away from solving technical challenges and towards improving *the social process* of developing their tools (within the complexity of real planning practice) staying firmly centred on the end user. This does not imply that a separate PSS has to be developed for each unique user. PSS should be sufficiently flexible/adaptable and developed in dialogue with the end user in the context of real planning problems. In this chapter, we will present how such a *dialogue* could be structured and how this could support the refinement, improvement and application of PSS. First, we will explore suggestions for improvements found in existing PSS literature, to further connect them to innovations found in knowledge management literature. Then, we will introduce concepts from academic literature in two related fields which specifically deal with establishing the link between explicit knowledge and tacit knowledge. These concepts are used as starting points for a PSS development framework (found in

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section 6), which is illustrated with a recent application in Amsterdam. In the final portions, the proposed hypotheses are reviewed and followed by some closing remarks.

### **3.2 PSS: SUGGESTED DIRECTIONS FOR IMPROVEMENT**

From its conception in the 1950s the field of Computer Aided Planning can be characterised as a continuous tidal movement (for extensive overviews see: Geertman, 2006; Guhathakurta, 1999; Klosterman, 1997). Periods dominated by high confidence in the potential of applying IT technology in urban planning processes, (partly related to increases in IT capacities) were followed by periods of deep criticism, primarily as it did not fulfil the envisioned goal of changing or supporting planning practices. During these periods of criticism, authors suggested several improvements for connecting IT tools and planning practice, with some fundamental directions repeatedly gaining attention.

The seven sins of modelling, recognised by Douglas Lee in his 1973 seminal paper on the failure of Large Scale Urban Models (LSUM) to support planning practice, are still regularly used by PSS developers (often to state that these sins have been overcome). However, in the often overlooked remainder of his paper, Lee suggested four more fundamental (behavioural) changes, necessary for making LSUM more relevant for planning practice. Namely, modellers should: improve the transparency of their assumptions, improve the contact with the policy (or planning) problem, focus less on theory and objectivity, and retreat from using too complex and unnecessarily comprehensive tools (Lee, 1973, p. 178). In 1994, Lee repeated most of his argument, recognising that (despite the vast changes in computer hardware and software) the attitudes of the model developers have largely remained the same during the 20 years in between. The new tools were still not widely used in daily planning practice (Lee, 1994, pp. 38-40).

Recognizing instrumental, diffusion and acceptance bottlenecks, more recently Vonk (2006) suggested that system developers and specialists should improve communication with practitioners, in order to actively analyse the tasks which a PSS could support. He recommends enhancing the instrumental quality, acceptance and diffusion of PSS through an interactive learning process among the relevant actors of the innovation network. Another key recommendation is for developers to increase their communication with planning practitioners, government research agencies and consultants (Vonk, 2006, p. 96). Klosterman emphasised similar directions. He argued that the search for the appropriate role of technology in planning should not begin from a particular technology, but with a conceptualisation of a particular planning problem (Klosterman, 1997, p. 46).

Focussing on the fundamental characteristics of model developers, Meadows and Robinson (2002) concluded that the modelling community is aware of most of these avenues of improvement and often pays lip service to simplicity, transparency and user orientation. Yet, practice doesn't show major improvements. They concluded that bottlenecks underlying the implementation gap are embedded firmly in the habits and culture of the modellers, who are rewarded for increasing academic

robustness (e.g. R-square focus) with publications, invitations for key notes speeches and status from their peers. Applying their tools in practice often is often only a secondary goal: “they really prefer to have technical conversations with each other” (Meadows and Robinsons, 2002, p. 289).

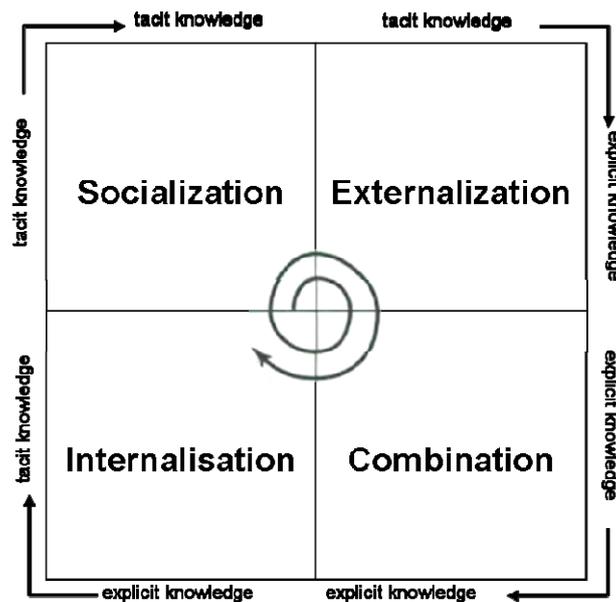
### 3.3 SIMILAR INSIGHTS IN KNOWLEDGE MANAGEMENT

The above mentioned bottlenecks and ways of addressing them mirror insights found in knowledge management literature. PSSs can be understood as tools, feeding planning processes with (often) hard and scientific knowledge (e.g. algorithms, general rules, rules of thumb, etc). As such, they have to be linked to the softer experience based knowledge of the planning actors (e.g. experience of earlier similar projects, education, etc). In recent decades, key discussions in knowledge management have explored the possible avenues for connecting these two kinds of knowledge (respectively called explicit and tacit knowledge (Friedmann, 1973; Polanyi, 1967))

Explicit types of knowledge are formal (such as data, formulae and general/universal theories), making them easy to codify and allegedly giving them a broad validity. Tacit knowledge is more difficult to codify, because it is context-specific, informal and acquired through experience. As Nonaka and Konno state: “tacit knowledge is deeply rooted in an individual’s actions and experience as well as in the ideas, values, or emotions he or she embraces” (1998, p. 42). It is this connection and continuous interaction between both types of knowledge that generates learning and new knowledge. Nonaka and Takeuchi distinguish four modes of interaction in this social process (figure 3.1):

- *Socialisation* (tacit with tacit): to share experiences and to create new tacit knowledge, to observe other participants, to brainstorm without criticism;
- *Externalisation* (tacit with explicit): to articulate tacit knowledge explicitly by writing it down and by creating metaphors, indicators and models;
- *Combination* (explicit with explicit): to manipulate explicit knowledge by sorting, adding, combining and looking to best practices;
- *Internalisation* (explicit with tacit): to learn by doing, to develop shared mental models, goal based training (Nonaka and Takeuchi, 1995).

Each of these types of knowledge creation has a value in the process of creating new knowledge. Ideally they have to be executed in continuous iteration.



**Figure 3.1** The SECI model of knowledge creation (adopted from Nonaka and Takeuchi, 1995)

Following these insights, a PSS which also aims to generate new knowledge has to be able to effectively interact with the tacit knowledge of the planning actors. That interaction will enable it to connect with the subjective insights, intuitions, values and experiences of the potential users, thus increasing the chances of being accepted and successfully implemented. Moreover, if this interaction occurs during the development of the PSS, it will also improve its substantive quality, as the planners will be able to introduce context or area specific knowledge early on in the process.

### 3.4 LEARNING PROCESSES AND STRATEGIES

Recent insights in cognitive psychology illustrate the ways of cultivating learning processes. Learning theories have shifted decidedly away from the behaviourist perspective towards a constructivist perspective. Where behaviourism views knowledge as an entity external to the learner (Gredler, 2001), constructivism sees the learner not as an empty vessel to be filled with knowledge, but rather as an individual with specific personal experiences which he/she brings into interactions with others. Learners create (construct) their own knowledge in their attempts to understand their experiences (Driscoll, 2000; Gergen, 1985). According to this view, the subjective experience of each individual has to be the point of departure for learning ((see Donovan et al., 2000; Simons et al., 2000; Stepich and Newby, 1988). This approach emphasises the importance of linking tacit knowledge and PSS. Most of the recognised bottlenecks of PSS implementation can be related to PSS developers following a behaviourist perspective: offering objective knowledge to the planner. Constructivism argues that without taking the specific personal experiences into account, this is an ineffective strategy.

Constructivism stresses that learners need forms of metacognition, i.e. knowledge regarding the mechanism of organising ones' own thinking and memory. Such knowledge allows them to acknowledge their individual values and perceptions.

Accepting this subjectivity, constructivists also presume the existence of a multitude of truths and realities. The outcomes of learning processes are therefore essentially open.

Recently, constructivist learning theories extended their focus from the individual to the wider context. Social constructivist theory assumes that the behaviour and the learning processes of individuals are dependent of the context which gives meaning to their lives and work (Siemens, 2006). This insight stimulates new learning strategies which combine the individual learning process with the learning process of their team or community. Some examples include: situational learning or communities of practice (Lave and Wenger, 1991; Stein et al., 1998), action learning or learning-on-the-job (Ramírez, 1983), organisational learning (Argyris and Schön, 1978) and double-loop learning (Argyris, 2005). Another line is the development of specific learning strategies emphasising a specific context, e.g. the integration of spatial planning and transport engineering (Schrijnen, 2005).

There is no set format for structuring learning; however, as a general guideline, Kolb (1984) found that a complete learning process combines four stages of perceiving and processing information: (1) concrete experience, (2) reflective observation, (3) abstract conceptualisation, and (4) active experimentation.

Most people have a personal preference for one style; however, a group seeking to acknowledge the various possible learning types in the team should follow the entire cycle. Traditionally PSS developers (especially the larger LSUM) tended to start with abstract conceptualisations, whereas most potential PSS users start with concrete experiences. According to Kolb's learning theory, developing a meaningful or useful PSS requires the combination of these learning styles, ideally including all four. In this way the potential users, which have different preferred styles of learning, can all learn what the PSS can and cannot do. Such learning-by-doing combines explicit and tacit knowledge in different ways, creating the conditions for fruitful learning.

### **3.5 METHODS FOR INTERACTIVE KNOWLEDGE CREATION**

Before translating the insights from knowledge management and cognitive psychology to PSS development, this section identifies methods in related domains that have used such insights to improve development of software and models, with specific focus on the link between explicit knowledge and tacit knowledge. These development methods and their underlying principles served as inspiration for the PSS development approach presented in section 3.6.

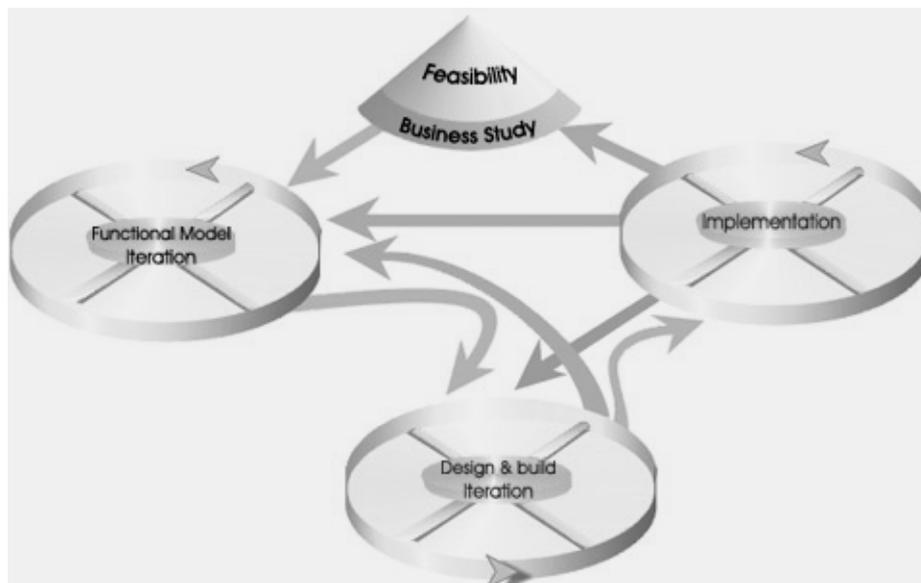
#### **3.5.1 DSDM**

Dynamic System Development Method (DSDM) is developed in interaction between information technology (IT) professionals, consultants and project managers. Their goal was to improve IT implementation through the study of best practices. The philosophy behind DSDM is that development must iteratively combine the users' knowledge of the requirements with the technical skills of professionals (figure 3.2). This is translated into a set of main principles: close user involvement, an

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empowered project team able to make decisions, frequent delivery of products and a focused effort on critical functionality (Stapleton and Constable, 1997).

Building on the learning cycle of Kolb (especially learning by experimenting), DSDM offered a more flexible approach than conventional approaches (Hansen, 2006; Stapleton and Constable, 1997). This flexibility is based on the techniques of Rapid Application Development (Martin, 1991), distinguished by several characteristics: application development should be iterative and incremental; changes made during development should be reversible; the scope and requirements should be base-lined before the project starts; and testing is experiential and carried out throughout the project life-cycle (Stapleton and Constable, 1997). This approach offers strategic benefits: users are more likely to take ownership of the developed product; the risks of developing inappropriate instruments are reduced; it is more likely that the products meets businesses' requirements; users are better trained in using the product; and system implementation runs more smoothly (Stapleton, 2003, pp. XXIV-XXV).



**Figure 3.2** DSDM iterative lifecycle (adopted from Stapleton and Constable, 1997)

### 3.5.2 Group model building

In system dynamics, an approach developed in the 1950s to study the behaviour of complex systems with dynamic visual models as a central product, client involvement is a central and recurring theme (Forrester, 1961; Roberts, 1978; Vennix and Rouwette, 2000) which generated several new techniques over the years. The term Group Model Building (GMB) can be seen as the overarching umbrella for these techniques (Vennix et al., 1997). GMB includes system dynamics insights as well as theories and findings of other academic fields. GMB focuses on group learning, seeking in turn to: integrate explicit and tacit knowledge, engage participants as active subjects, and utilise simple and transparent information (Ackermann et al., 2005; Rosenhead and Mingers, 2001). Stakeholders collaboratively develop a dynamic model of the identified problem or challenge. Through this process they learn about each others' perspectives on the system and collectively identify possible

interventions to improve it. By increasing the stakeholders' ability to process information and arguments, GMB attempts to change the participants' beliefs, mental models, intentions and behaviour (Rouwette et al., 2007).

This method also uses insights from experiential learning; using system dynamic tools results in short feedback loops during the modelling phases. Ultimately, GMB attempts to tap into the situated knowledge of practitioners.

### 3.5.3 *Mediated modelling*

Mediated modelling uses the process of building computer models as a vehicle to support complex environmental policy and problem-solving management (van den Belt, 2004). It builds on theoretical insights from organisational learning (Senge, 1990; Vennix, 1996), system dynamics (Forester, 1961), and social psychology (Hare et al., 1994). Rather than having outside experts dispensing "answers" to stakeholders, mediated modelling brings together diverse interests to jointly construct a simulation model. As a result, it elevates the level of shared understanding of the problem and fosters a broad and deep consensus. Mediation refers both to the role of a mediator (one person or a team) and to the functioning of the link between the system dynamics tools and the participants. It is much more than simple facilitation, i.e. managing the process during meetings (see Phillips and Phillips, 1993). It involves proactive interventions during negotiations, and key contributions to the content and participation in shaping the process in-between meetings (van den Belt, 2004, p. 51).

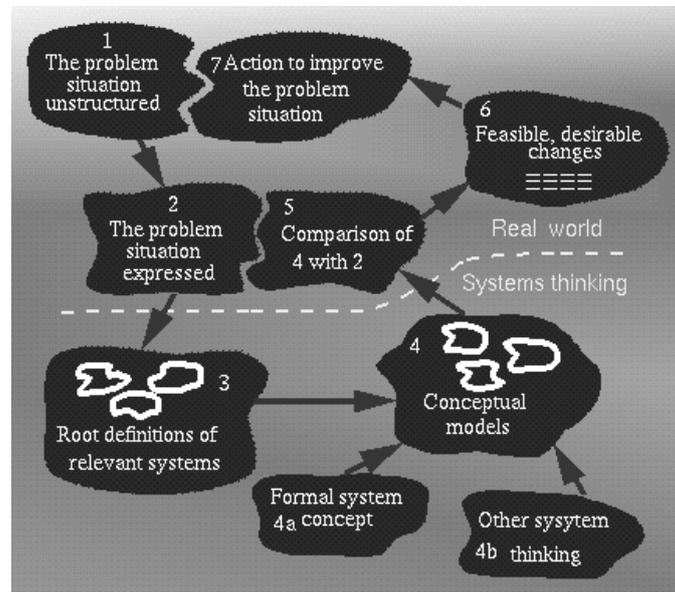
Mediated modelling is linked to GMB, but differs in two aspects. Firstly, the level of client participation is higher and the clients have complete control over the type of modelling and the content of the model. Secondly, as one of the goals is to relate and integrate existing information, participation occurs from the very beginning of the modelling (van den Belt, 2004, pp. 15-16). It does not rely on pre-existing models; instead, it provides building blocks and assistance for constructing models. The manner of arranging these blocks is decided together with the users. This process can be a first step towards a full-blown system model.

The open character of this approach challenges both the users (to make their tacit knowledge explicit) and the developers (to develop model that fit the users' needs). It combines Kolb's learning cycle and (implicitly) Nonaka's SECI model.

### 3.5.4 *SSM*

Soft System Methodology (SSM) (Checkland and Scholes, 1990) is a method of dealing with ill-defined problem situations with significant social and political components (Checkland, 2001; Wilson and Morren, 1990). It originates from the understanding that thinking in "hard" systems is inadequate for large, ambiguous and complex issues. It also builds on the idea of experiential learning (Kolb, 1984). In an iterative process both developers and users engage in active learning and debate, from the starting point of defining the problem up to the final stages of taking action to improve the situation (figure 3.3). Some of these stages address the "real" world, while others address a conceptual world. The key notion is that it provides a

structure aiding the participants in their thought and deliberation process operating in messy situations. SSM stimulates both the developers and the users to reflect on, and experiment with, their (mental) models. Unlike the other methods, *specific* attention is focused on linking tacit and explicit knowledge.



**Figure 3.3** Soft Systems Methodology (adopted from Checkland and Scholes, 1990)

### 3.5.5 Lessons for PSS development

These development methods stem from specific research domains, often supporting different goals than the PSS. Most of these methods build upon insights from knowledge management and/or cognitive psychology. Some methods start from a preconceived notion of the desired way to model a problem (i.e. system dynamics). In (integrative) planning, such a preconception can make it hard to get all planning actors involved in PSS development, because they can hold radically different views of the planning subject or of the process preferred to address the issues (due to differences in culture, paradigm, discourse, education etc.).

SSM specifically addresses the confrontation of tacit and explicit knowledge in creating new knowledge, as proposed by Nonaka & Takeuchi (1994). The other methods only hint to this link.

Some methods actively employ the concept of double loop learning, in which subjects not only learn about consequences of an action strategy to adopt this strategy, but also about their underlying goals, values and frameworks that guide their actions (Argyris, 2005; Argyris and Schön, 1978). Most approaches use both iteration and cyclical development steps. Most methods acknowledge that neither the models, nor the underlying theoretical concepts or the outcomes of the iterations will be definitive.

In contrast to the above mentioned methods, in PSS development a shared understanding or a problem structure should not be the end goal but rather the

means to arrive at the desired planning product - shared visions, strategies and/or planning interventions. A PSS is intended to support the development of strategies, visions and plans; this should be clearly reflected in the PSS development method.

Furthermore, as discussed in the first section, a PSS consists of a process component and an information component. So, both components have to be developed and digested together with the planning actors. In order to bridge the implementation gap, it is essential to introduce the context of the actors in the interpretation or even in the development of the PSS itself.

### **3.6 MEDIATED PLANNING SUPPORT**

Together the insights from knowledge management, cognitive psychology and the development methods described above suggest that a PSS development strategy should include the following:

- An iterative stepwise approach – providing a structure but also taking double-loop learning effects into account (Argyris, 2005; Stapleton and Constable, 1997);
- Experience, reflection, conceptualisation, and experimentation for every (sub)product (Kolb, 1984);
- Socialisation, externalisation, combination and internalisation incorporated in the entire group learning process (Nonaka, 1994; Nonaka and Konno, 1998);
- Emphasising the contextual nature of the method, from problem definition to taking action on existing planning problems, (Checkland and Scholes, 1990; Lee, 1973; Vonk, 2006);
- A close and continuous dialogue between clients and developers (Meadows and Robinsons, 2002; van den Belt, 2004; Vennix et al., 1997);
- A mediator who actively structures the dialogue between PSS developers and planning actors (also in between meetings) (Phillips and Phillips, 1993; van den Belt, 2004);
- To overcome acceptance bottlenecks, existing technologies should be used as much as possible (preferably within the users' organisation) (Vonk et al., 2005);
- Keep it as simple as possible, but not simpler than necessary (Meadows and Robinsons, 2002; van den Belt, 2004).

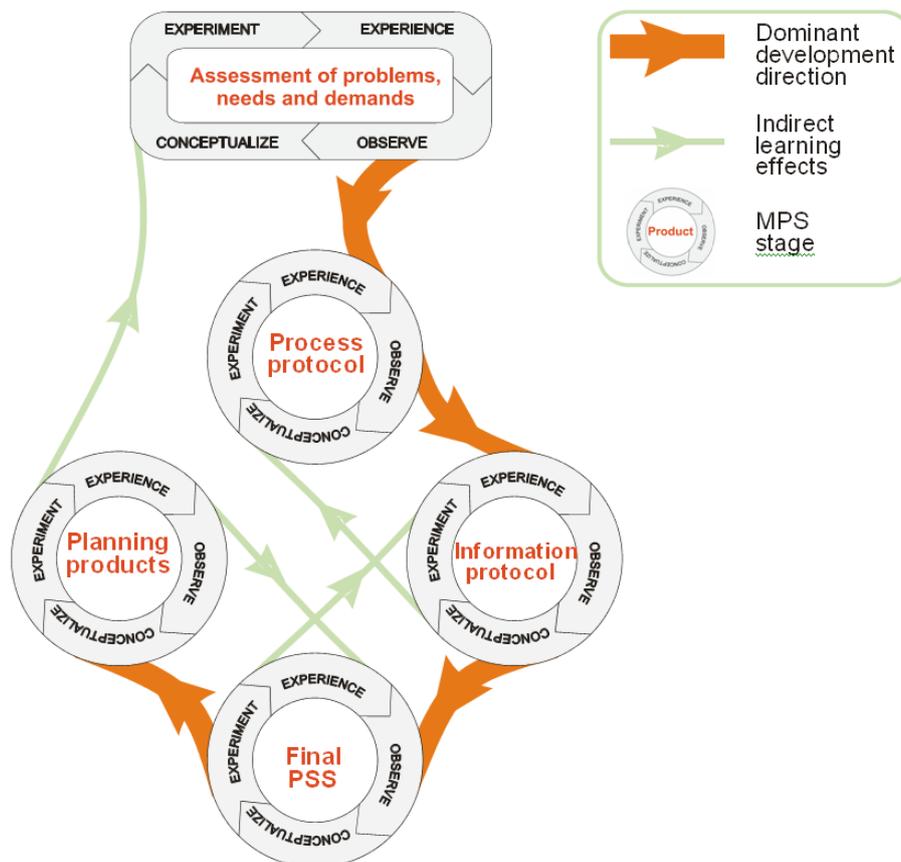
We have called this approach Mediated Planning Support (MPS). Mediated refers to the process of dialogue and learning between PSS developers and planning actors. Planning Support refers to the goal of supporting planning practices. In the next sections, we will describe the core components of MPS and consequently illustrate this mechanism at work in Amsterdam.

### **3.7 THE MEDIATED PLANNING SUPPORT FRAMEWORK**

In order to create more useful and relevant PSSs for early planning phases, the MPS framework aims to structure the dialogue between PSS developers and planning actors. Most often, the starting point is an existing model or PSS with generic features, which have to be applied to a specific planning context. MPS fulfils a supporting function, by providing an iterative learning process, during which both the PSS developers and the planning actors learn together about the specific context and the PSS characteristics. Through this learning process, both adjust to each

other’s needs and perceptions; thus the application of PSS in supporting the planning tasks at hand is greatly enhanced.

A MPS process includes five steps that build upon each other in an iteration (figure 3.4). With the guidance of a process mediator, planning actors and PSS developers go through these steps together and obtain learning effects which may call for the adaptation of earlier (sub)products. For example, by using the developed PSS for the development of planning strategies, planners learn that the proposed process steps are not as functional as originally thought. Each product is developed through the steps of Kolb’s learning cycle. This does not necessarily occur for each product at once; sometimes experiential learning occurs during the development of a later product. Working through the MPS framework delivers two concrete outputs: (1) the final PSS with a process and information component (for the developer) and (2) planning products as strategies and plans (for the planning participants).



**Figure 3.4** A Framework for Mediated Planning Support

The first step in the process (the top square in figure 3.4) focuses on the specific demand for support recognised by the participating planning actors. It aims to answer the questions: why is a desired planning product difficult to develop and where should support be improved? This first step is important as it aligns the participants in the MPS process and mobilises commitment to both products (sense of ownership), as the rest of the product development takes the defined problems and demands as a starting point. Mapping individual feelings can be accomplished on an individual basis; however, it is important to discuss them in plenary in order to

build group consensus. These demands are not fixed and can change during the process.

The second step (figure 3.4: process protocol) is to design a set of planning actions for the desired planning product; answering the questions: what is the planning problem, what is the desired product and how to get there? A starting point can be a standardised framework for developing archetypical planning products (e.g. a two step scenario developing method including a diverging phase in which scenarios are developed and a converging phase of selection). In dialogue between the planning actors, this standard can be adapted to fit the specific context. This step has a strong conceptual character; through experience and testing it will be refined during consecutive meetings. In these first two steps, the PSS developers have to be present in order to learn, to create empathy for the planners' perspectives.

In step three (figure 3.4: information protocol), the PSS developers propose how their PSS can support the process with relevant information. In a dialogue with the planning actors, a selection is made of useful and feasible knowledge sources. Through this discussion, the process protocol can already be adapted (e.g. some information is not feasible, so the process step doesn't make sense).

Steps four and five (figure 3.4: final PSS and planning products) are connected more with iteration than the first three. Their focus lies on experimenting, experiencing and refining the concepts developed before. The process and information protocol are executed to develop the desired planning products. Through one or more iterations (this depends on the complexity of the planning issues and on the available resources) these planning products are developed and the protocols are refined to form the final PSS.

Every step constitutes one or more group meetings, during which planners and PSS developers collaboratively conceptualise, test and use the (sub)products (depending on the complexity, some steps can be combined in one meeting). In between these sessions, the mediator focuses on creating conceptualisations of the discussions in direct contact with some of the planning actors and PSS developers. Meetings start with a discussion of these conceptualisations (problems, process, information) followed by the application of the (adapted) concept and a closing plenary reflection.

### **3.8 ILLUSTRATING MPS IN AMSTERDAM**

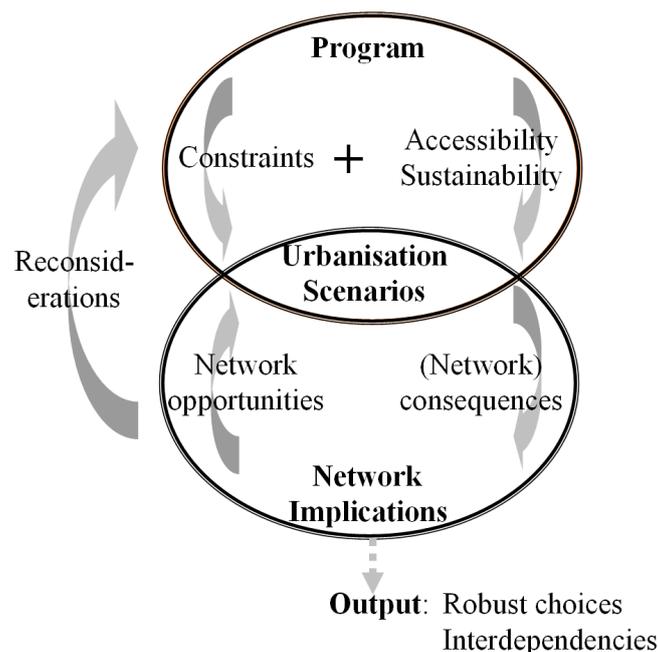
The application of MPS in Amsterdam illustrates the practical application of such a MPS process and its principles. As this is a unique context (in terms of planning actors and in terms of available PSS) it is not used to generalise claims for other contexts.

Early 2006, the University of Amsterdam and the Municipality of Amsterdam started a MPS process, in response to the planners' need for improved support for integrative land use and transport (LUTR) strategy development. They felt that currently available models (notably the city's own transportation model: GENMOD) did not provide sufficient support. Five MPS sessions were set up to develop and use

a PSS for land use and transport strategy development (for more details see Te Brömmelstroet and Bertolini, 2008). The participants from the municipality and the city region included transport planners, land use planners, and model developers (about 10-12 people). Two researchers from the university functioned as mediators. Each session took around 4 to 5 hours and the whole process spanned about five months.

In the first step the participants explored the areas needing improved support in the integrative land use and transport strategy development process. In two groups the existing land use and transport planning practices were conceptualised and missing links were identified. Especially when generating and testing new strategies there should be more knowledgeable integration. It highlighted the need for building a common land use – transport language. Further discussions with the modellers revealed that GENMOD focused too much on detail/objectivity and it was also deemed as slow and insufficiently transparent.

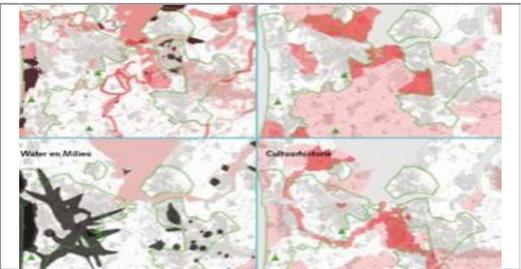
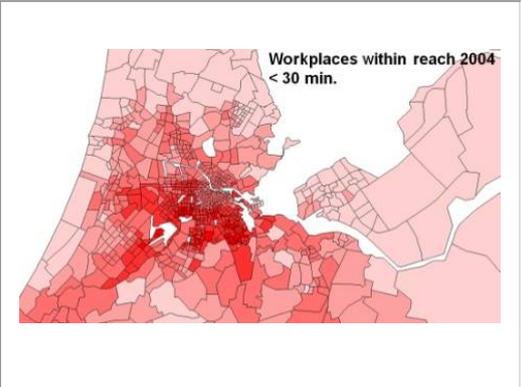
To find out how to provide a common language, in the second step a *process protocol* was discussed. Based on discussions in the plenary meeting and design literature, the mediator team conceptualised a four step scenario design process. The participants shared the need to improve the understanding of crucial land use and transport interdependencies. A four step design process supports such a learning process. The planners wanted to start from an integrated land use and transport program and develop a variety of scenarios based on insights in accessibility and sustainability indicators. Also, spatial constraints had to be considered. Then, the scenarios are evaluated and optimized based on their network effects. This selection step results in an overview of strategies that are interdependent of others or that work in most possible scenarios (robust). This protocol is visualized in figure 3.5.

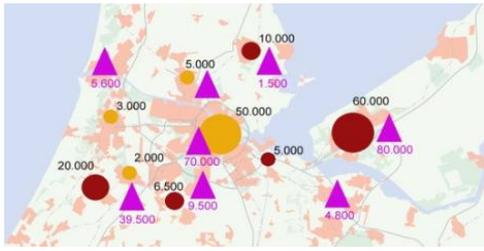
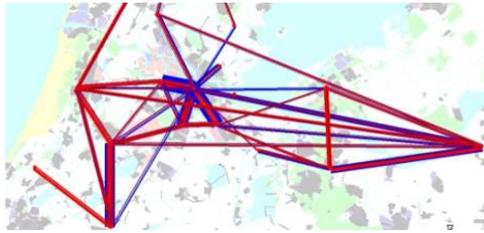
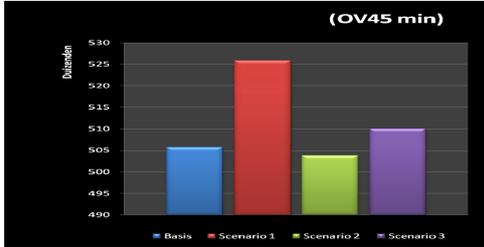


**Figure 3.5** Process protocol for land use and transport strategy development

The starting point was a land use and/or transport program which deals with 150.000 new houses and 150.000 new jobs in the region, in addition to finding solutions to the major congestions of the highway network. Combining spatial constraints and accessibility/sustainability opportunities and threats, different urbanisation scenarios were designed (covering only land use). The third step analyses these scenarios on their car/rail/bike network effects, further refining the scenarios and adding transport interventions. In the final step, the planners discussed and identified important interdependencies based on insights on the interventions and their consequences, in turn distinguishing which interventions seem robust (with stabile positive effects in different scenarios). It is precisely this process of integrated strategy development that has to be supported with explicit knowledge.

In the third step relevant explicit knowledge was identified. The modellers presented several (archetypical) possibilities, based on what GENMOD and other available models can do and what has been done in recent policy documents. Through a selection process, a set of useful, relevant and comprehensible information and analyses was selected and linked to different steps of the process protocol (table 3.1). Also, important characteristics of the best method for presenting this knowledge were recognised. Similarly to the process protocol, this protocol was primarily a conceptualisation; the planners gained new insight by using it in the next steps to develop strategies. During the process, in particular the accessibility opportunity analysis was simplified (excluding congestion effects/competition elements) and made comprehensible for all involved planners.

	<p><b>What: Spatial constraints</b>  <b>When:</b> Second design phase  <b>How:</b> Showing a global overview of spatial constraints from different domains (airport, nature, etc.). Show how stringent the constraints are.</p>
	<p><b>What: Accessibility opportunities</b>  <b>When:</b> Second design phase  <b>How:</b> An analysis of how many jobs /inhabitants can be reached within a given travel time by public transport and car, use high/middle/low categories and show order of magnitude. It is the same for sustainability except that the Euclidean distance is used as proxy.</p>

	<p><b>What: Urban scenarios</b>  <b>When:</b> Second/third design phase  <b>How:</b> Maps with land use scenarios (and in third phase transport interventions). It is important that these maps are transferable as input to the models (use same geographical units)</p>										
	<p><b>What: Network effects</b>  <b>When:</b> Third design phase  <b>How:</b> An analysis of how many jobs/inhabitants can be reached within a given travel time by public transport and car. It shows where bottlenecks occur and where the current situation is improving or getting worse</p>										
	<p><b>What: Network opportunities</b>  <b>When:</b> Third design phase  <b>How:</b> An analysis of opportunities from a network perspective. Where do important relations exist, where is more capacity available?</p>										
 <table border="1"> <caption>Data for Bar Chart: (OV45 min)</caption> <thead> <tr> <th>Scenario</th> <th>Ditanden (approx.)</th> </tr> </thead> <tbody> <tr> <td>Basis</td> <td>505</td> </tr> <tr> <td>Scenario 1</td> <td>525</td> </tr> <tr> <td>Scenario 2</td> <td>500</td> </tr> <tr> <td>Scenario 3</td> <td>510</td> </tr> </tbody> </table>	Scenario	Ditanden (approx.)	Basis	505	Scenario 1	525	Scenario 2	500	Scenario 3	510	<p><b>What: Effects of Interventions</b>  <b>When:</b> Fourth design phase  <b>How:</b> With overviews of several indicators (also ones used in earlier phases) it provides insight in the effects of certain intervention (packages).</p>
Scenario	Ditanden (approx.)										
Basis	505										
Scenario 1	525										
Scenario 2	500										
Scenario 3	510										

**Table 3.1** Information protocol for land use and transport strategy development

In the fourth step, the final PSS for integrated land use and transport strategy development was constructed as a combination of both protocols, applying the lessons learned during its use. Experimenting with the PSS and experiencing how it works, the planners redefined their initial observation-based conceptualisation. This double-loop learning process resulted in simplified analyses and additional information about network effects. On the other hand, information about desired travel behaviour was deleted from the final PSS as its consequences were incomprehensible for most participants. This PSS was documented in a municipal report, which presented the process steps, the information and underpinning analyses. It also contained a special section on the manner of structuring dialogue between planners and modellers for subsequent processes. This report is now used to support a similar exercise to develop strategies for a regional public transit system.

The primary goal of MPS is not the PSS itself, rather supporting the planning process. Developing planning products is the fifth step which spans several meetings, depending on the process protocol. This step is iteratively linked to the fourth step, revising the PSS based on experience. In Amsterdam, the participants were divided in two mixed land use and transport groups, with the task of developing and revising urban strategies. During this process, the modellers were present to explain the output and to understand the input of the PSS. The models supported the creation of a common language, resulting in improved communication and more integrated scenarios between the two planning domains. In an individual questionnaire one planner stated that: “with this [set of information] we can connect goals of the two planning domains”. In the fourth design step, the two groups joined again to interpret the connection between land use and transport interventions; also their accompanying effects were further examined. This resulted in a shared list of robust interventions and important interdependencies, which could be communicated to policy makers or other municipalities in the region. Several land use and transport strategies for the 150.000 houses and jobs were articulated, i.e.: to situate large housing developments in existing corridors in combination with a regional public transit network; to concentrate around satellite public transit stations; and to cancel major urban extensions in Almere if there is no new public transit link.

In questionnaires and interviews, most planning participants stated that this MPS process did support the link between land use and transport strategy development. The strategies were not all new; the positive innovation was to share them between the domains and back them up with explicit knowledge, grounded in a common language. The planners also learned about their own and each others’ manner of working. This shows deeper understanding of the planning process and the potential role of externalisation of tacit knowledge in enhancing it.

The modellers noted that they got more insight in the balance between rigour and relevance of their models in such processes. They also recognised the importance of selecting and discussing the necessary information together with the planners. They acknowledged the benefit of meeting in person to explain their assumptions behind the analyses. MPS provided them with guidelines on how to structure a dialogue with planners. Their land use and transport PSS is formed by the situation and (even though the central elements are more or less stable) this PSS is not fixed and has to be open for dialogue in subsequent planning processes (with different planning actors and a different context).

### **3.9 DISCUSSION AND CONCLUSION**

This chapter seeks to highlight the potential contribution of PSS and to address the fundamental problems which block its successful implementation in daily planning practice. Insights and lessons from the academic fields of knowledge management and cognitive psychology offer useful methods and techniques to overcome some of these problems. Based on those techniques, the Mediated Planning Support (MPS) approach is presented as a potential answer to these challenges. The MPS approach focuses on situations where existing tools, instruments or PSS need modification to be more useful for planners who are willing to use them. The development of

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complete new PSS is a different matter. While this chapter has a theoretical perspective, we used an application in Amsterdam, where a transport model needed refinement to be useful for the support of integrated strategy-making, to illustrate how such an approach might work in planning practice (in this case supporting integrated land use and transport strategy development). Planning actors and modellers in Amsterdam case did appreciate the MPS process. The specific context provided fertile ground to test the approach, as this group of participants often collaborates in other planning projects. Also, the fact that the municipality already had its own fully functional transportation model was a unique advantage. Therefore, it is not appropriate to issue general conclusions based on this one experiment.

Further research is necessary to test the approach in different planning contexts. Such research should radically diverge from existing PSS research routines (a notion further elaborated in Te Brömmelstroet, 2009). It has to be performed *in* planning practice with real modellers and planning actors and (next to) real planning situations. Only then could the potential of the mechanisms and principles of the approach be adequately tested and grounded. And only then could a deeper understanding of the effective ways of bridging the implementation gap evolve (as also asserted by, Schön, 1983; Van Aken, 2005).

The MPS approach addresses some of the fundamental bottlenecks recognised in the PSS literature (section 3.1). The transparency of the output and the assumptions of the (computer) models that are part of the PSS are improved through discussions and continuous explanations by the modellers. The PSS becomes more flexible and attuned to the particular characteristics of specific planning process, increasing their compatibility with the existing planning tasks. Also, planning participants can gain a shared ownership of the process and improved information choices. PSS developers can learn how their model and output is used in 'wicked' planning processes and how this unpredictability can influence the usefulness of their products.

Refining, modifying and using a PSS for a real planning problem results in a user oriented support system, in which the PSS developer and the planning participants together decide on the appropriate complexity and flexibility of the tools and outputs. In dialogue they find the balance between 'as simple as possible, but not simpler than necessary'. The planner becomes more aware that a successful PSS cannot simply be taken 'off the shelf', that he/she has to go through an extended process of learning, modifying and improving the model. The PSS developer becomes more aware that if they want their models to be useful in practice, they should be designed to facilitate an explicit process of modification and learning when they are implemented.

The four steps of the SECI model, designed to create interaction between explicit model results and tacit planning knowledge, are crucial for MPS. Providing planners with the much needed planning support requires internalisation of relevant information. Externalising and socialising the knowledge of the planners themselves is a key component to facilitate this. An important notion is that such steps should not occur only once (at the start of PSS development) but also have to take double-

loop learning into account. Experiential learning supports such a process, as it takes into account Kolb's four learning styles.

Importantly, MPS is a situated method - its core steps need to be reiterated in every new context and for every new planning problem. The method is not a 'one time only' exercise producing a user friendly PSS for all cases. Creating a structured dialogue between planning actors and PSS developers yields many useful lessons. A promising application of this can be seen in the concept of 'modelling in the public eye' as used for the LEAM model (Deal and Pallathucheril, 2008).

The theoretical discussion and the illustrative case show that the MPS method can be a valuable concept for addressing several bottlenecks which block the widespread implementation of PSS. However, more understanding of its workings is needed in order to grasp the exact relationship between the context, mechanism and outcomes. Several key research questions for future efforts emerge. Which context variables are the necessary conditions for a MPS to be successful? What is the role and influence of the initiator of this process? How do power issues play a part in the outcome? How can general lessons from earlier applications be transferred to new initiatives? Currently, MPS is applied in several different contexts to find answers to these questions. Taking the step away from the syntactic program of most PSS research and towards a more pragmatic and design oriented research design seems to be crucial in gaining insight on these points.

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