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 2

Equip the Warrior instead of Manning the Equipment: Land Use and Transport Planning Support in the Netherlands

This chapter assesses the embedding of land use and transport instruments (Planning Support Systems (PSS), models and tools) in Dutch planning practice, in order to shed light on how planning practitioners perceive these instruments and the reasons and manner of their (lack of) utilisation. These insights provide much needed input to improve support instruments for integrated land use and transport planning, in particular during early planning phases and on the regional level. The research adds to the emerging literature on PSS. It builds on general insights in bottlenecks that block the use of PSS in practice, and uses a user oriented approach to gain more insight in 1) how users perceive these bottlenecks and 2) how they relate to the specific land use and transport PSS. Much of the existing research geared at improving these instruments has a technical focus on adjusting the intrinsic workings of the instruments themselves. However, the way in which they are embedded in planning practice has remained largely ignored and poorly understood.

Using a web-based survey, administered among land use and transport practitioners in the spring of 2007, this chapter describes how LUT instruments are embedded in planning practice and how they are perceived by the planning actors in land use and transport planning. The findings suggest that a technical focus is insufficient for improving the implementation of these instruments. The key bottlenecks, identified by the survey, actually are centred on “softer issues”, like lack of transparency and poor connections with the planning process. The closing analysis and discussion offers some potential remedies for these shortcomings.

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2.1 INTEGRATING LAND USE AND TRANSPORT PLANNING

Better integration of transport and land use planning is deemed crucial for achieving more sustainable mobility patterns in urban areas, as strongly supported by academics (e.g. Banister, 2005; Cervero, 1998; Meyer and Miller, 2001), professionals (e.g. TRB, 2004), governments (e.g. ECMT, 2002) and business (e.g. WBCSD, 2001, 2004). In the Netherlands this is mirrored in recent Dutch national policy documents stressing the need for integration, ex. the 'Nota Ruimte' (MinVROM et al., 2004) and the 'Nota Mobiliteit' (MinV&W, 2005).

Nevertheless, effectively integrated land use and transport (LUT) planning processes are often absent in planning practice (Banister, 2005; Stead et al., 2004; TRB, 2004), which in turn produces sub-optimal or even conflicting plans, ideas and concepts. Although there are some positive signs, real LUT integration in the Netherlands is still far away (Expertcommissie Netwerkanalyses, 2006; Heerema and Linssen, 2006). Both reports put emphasis on the importance (and the current lack) of integration in the early phases of the planning process and on addressing issues on the regional level.

Several barriers seem to explain this lack of integration, roughly divided in *institutional/procedural* discrepancies (i.e. separate planning institutions, formal processes, financial arrangements, etc.) and *substantive* differences (i.e. different planning objects, information etc.) (e.g. Curtis and James, 2004; Hull and Tricker, 2006; Lautso et al., 2004; Vleugel, 2000; Webster et al., 1988). As far as substantive barriers are concerned, general insights and suggestions for improvement have produced a host of indicators and instruments which attempt to provide expert LUT knowledge aimed at bridging the divide between the two planning domains (often based on transportation models) (Emberger et al., 2006; Geurs and Van Wee, 2004; Schoemakers and van der Hoorn, 2004; Waddell, 2002; Wegener and Fürst, 1999).

However, not many of these instruments are used to support integral LUT planning in daily planning practice. Some LUT instruments are successfully implemented to identify and extrapolate trends, assess strategies and prioritise land use and/or transport projects; however, they do not address early planning phases, which are more open and 'wicked' (Rittel and Webber, 1984). These phases (ex. visioning, generating strategies and developing strategies) are very dynamic because there is a wide range of options still open for discussion and a wide range of potential participants. The resulting unstructured and diverging information needs greatly complicate the potential role of supporting instruments. Yet, these planning phases are crucial for effective LUT integration; *framing* common problems and solution spaces in a particular way limits the potential options available later in the process (see Schön, 1983).

The lack of effective LUT instruments for these crucial planning phases produces several key questions: why are existing instruments not used/usable in these planning phases; what context specific demands for information support are important and how can the fit of (existing) land use and transport instruments with current planning practices be improved? This chapter will discuss the outcomes of an exploratory research into the embedding of existing LUT instruments in daily planning in the Netherlands.

This research builds upon the existing research which examines the infrequent and week utilisation of Planning Support Systems (PSS) (Batty, 2003; Bishop, 1998; Couclelis, 1989; Geertman and Stillwell, 2003; Harris and Batty, 1993b; Innes and Simpson, 1993; Klosterman and Landis, 1988; Sheppard et al., 1999; Sieber, 2000; Uran and Janssen, 2003; Vonk et al., 2005). It identifies specific bottlenecks for LUT instruments, through a web-based survey of planning practitioners (the end users). The aim is to deepen our understanding of a specific branch of PSS, with a focus on embedding them in planning practice and exploring more directly directions for improvement. Also, this analysis started from a more PSS user oriented perspective than most of the abovementioned publications, with two groups of potential users (land use and transport planners) as starting point. Therefore, this chapter offers more in-depth knowledge than the recent mainstream PSS literature. I will first briefly outline the general academic debate on the 'implementation gap' of PSS, which provided the background for the survey developed for this chapter. After presenting the survey method and the characteristics of the respondents, the outcomes of the survey will be covered in greater detail. Finally, I will close with conclusions and suggested directions for improving PSS support for integrated LUT planning processes.

2.2 THE IMPLEMENTATION GAP OF GENERAL PLANNING SUPPORT INSTRUMENTS

2.2.1 *Computer aided planning: high and low tides*

Since the first serious attempts at using computers to aid planning processes in the 1950s (Harris, 1960), the academic field of computer aided planning has seen several waves alternating between enthusiastic optimism about its potentials and depressive critique (mainly due to the low implementation rates of the instruments).

In the 1960s, there was a growing effort to develop metropolitan land use models and transportation models, applying insights from several adjacent scientific fields (i.e. economics and regional science). Planning was then seen as a technical-rational process; the planning expert started from a set of policy goals and systematically evaluated all policy alternatives on their merits and consequences. It was believed that this process produced the *optimal* plan, which could be subsequently monitored and (if necessary) adapted (Allmendinger, 2002, p. 55). Computers were seen as very useful support tools aiding the planner in their daunting task of assessing all possible alternatives from a wide range of indicators. The computer also offered the opportunity to include more scientific knowledge into the planning process (Batty, 1994; Klosterman, 1997). During this period, some planners even saw computer aided planning as "a revolutionary new potential that may impact or redefine the process of planning" (Harris, 1968, p. 223).

Yet the many large-scale urban models (LSUM) developed at the time (often with significant public funding) failed to be implemented into planning practice, bringing heavy criticism of the instrument developing community (Brewer, 1973; Danziger, 1977; Greenberger et al., 1976; Lee, 1973). In his seminal paper, Lee identified seven sins that seemed to cause the lack of implementation of the LSUMS, mostly concerning (lack of) data and calculation restrictions (Lee, 1973, pp. 163-168). Many see his paper as heralding the start of the 'dark ages' of the computer aided planning field, when most of the funding for instrument developing programs was cancelled (Wegener, 1994).

In the 1980s there was a paradigm shift, due to the recognition that the technical-rational view of planning was no longer feasible in practice. First of all, this approach often resulted in planning disasters (Hall, 1981); while also current planning practice changed and was marked by increased complexity and uncertainty. Thus, planning became more focused on communicative and deliberative activities among all relevant stakeholders. At first sight, this tremendously decreased the potential for computer instruments; however, the advances in computer technology (introduction of the desktop PC) rekindled the interest in the role of computers in planning (Openshaw, 1986). Instead of presenting objective scientific data, it was suggested that computer instruments should primarily support the communication between all the stakeholders and support the process of making collective decisions (Sprague and Carlson, 1982). This view was further strengthened in the 1990s with the introduction of Geographical Information Systems (GIS), a set of instruments geared to support the collection, analysis and visualisation of all kinds of geographical phenomena (Burrough and McDonnel, 1998; Stillwell et al., 1999). Such instruments could enhance the flow of information and knowledge between stakeholders in an open spatial planning process. Some scholars saw this renewed enthusiasm for computer aided planning as a new revolution in planning processes, because now "virtually anything a planner does can be done with a GIS" (Juhl, 1994).

However, "this always imminent revolution has yet to occur" (Klosterman, 1997). Although GIS instruments are used to increase efficiency and facilitate routine planning tasks (i.e. information gathering, processing and visualising), they are hardly used to support the more complex tasks unique to planning (i.e. forecasting, analysis, evaluation and communication) (Couclelis, 2005; Klosterman, 2007; Lee, 1994). Klosterman argues that the "soft side of technology" partially explains this shortcoming; the search for the appropriate role of technology in planning should not begin from a particular technology, but with a conception of a particular planning problem (Klosterman, 1997, p. 46).

The most recent developments in the field of computer aided planning are the so-called Planning Support Systems (PSS). As a relatively new concept, the term PSS has several interpretations in the literature, ranging from very narrow computer centred definitions to much broader concepts related to information and planning. Here I use it broadly to refer to *any kind of infrastructure which systematically introduces relevant (spatial) information to a specific process of related planning actions*. In this view PSS has both a process and a substantive component; the latter is sometimes (but not always) supported by computer technologies. Furthermore, PSS should accomplish several specific tasks: 1) to facilitate interaction among planners; 2) to contain structured and accessible information; 3) to facilitate social interaction, interpersonal communication and debate (to address common concerns); and 4) to support a continuous and interactive process of constantly integrating new information (generated as analytical results) and thus redefining design issues ((Klosterman, 1997). Such PSS would contribute greatly to improving contemporary planning practice.

However, recent research shows that (yet again) these new planning support instruments have difficulties to find their way into daily planning practice (Couclelis, 2005; Geertman, 2006; Uran and Janssen, 2003; Vonk et al., 2005). Some of the reasons for this 'implementation gap' are grounded in the planners' negative perception of current PSS as: inadequate, far too generic, complex, technology oriented (rather than problem oriented), too narrowly focused on strict technical rationality and incompatible with the unpredictable/flexible nature of most planning tasks and information needs (Batty, 2003; Bishop, 1998; Couclelis, 1989; Geertman and Stillwell, 2003; Harris and Batty, 1993a; Innes and Simpson, 1993; Klosterman and Landis, 1988; Sheppard et al., 1999; Sieber, 2000; Uran and Janssen, 2003; Vonk, 2006)In 1994, Douglas Lee argued in retrospect that his 1973 critique of LSUM's was still valid, as model developers had not changed their approach and were still striving for comprehensiveness and fighting to include as much complexity as possible. As a result they failed to respond to the needs of the practitioners, who would rather have "redundant approximations then detailed models" (Lee, 1994).

Recent scientific progress in land use transport interaction models (Waddell, 2002; Wegener and Fürst, 1999), activity based mobility modelling (Ettema and Timmermans, 1997) and the modelling of agents (Macy and Willer, 2002) confirms that there is still vibrant interest in model development. However, the utilisation of these tools in supporting LUT integration in daily planning practice remains rather limited.

2.2.2 *Specific challenges for LUT PSS*

The general lack of use of PSS has been extensively covered in recent studies. We have reasons to believe that supporting LUT integration in the early phases of the planning process presents some *unique* opportunities and threats. First of all, LUT planning is adding complexity: two separate systems (land use and, transport) have to be addressed, each with its own unique input variables, dynamics and uncountable interrelations (not all of which are well understood). Consequently, as LUT PSS have to model all relevant interrelations, it is difficult for planners to interpret modelling outcomes and understand the cause-effect relationships. Also, relationships are sometimes designated as relevant at random and the resulting uncertainties about these relationships increase the complexity of the LUT PSS. Secondly, although there are generic LUT problems, most of the challenges are unique for a specific geographical and temporal context (especially in dynamic urban regions). Finally, the information has to be meaningful for planning actors from both separate planning domains; they come from two very different planning traditions with different education, skills and planning paradigms. LUT PSS and their outputs have to be able to accommodate two highly different mindsets, each with its own set of explicit and tacit knowledge (further elaborated in Straatemeier and Bertolini, 2008; Te Brömmelstroet and Schrijnen, 2010; Willson, 2001).

2.3 EXPLORING LUT PLANNING SUPPORT IN PRACTICE: METHODOLOGY

2.3.1 Data collection

The primary goal was to gain insight in the embedding of PSS in processes of LUT integration in planning practice. With this aim, a web survey was developed based on lessons from the PSS literature, experiences from planning practice and interviews with planners and PSS developers[5]. In March 2007, a large number of Dutch land use and transport planning practitioners were contacted to assess their experience with LUT PSS in integrating land use and transport planning and their willingness to participate. In total, 450 people were approached directly via electronic mailing lists (provided by relevant consultants and knowledge networks) and calls for participation were posted on several appropriate websites and newsletters[6].

Although the survey was anonymous, the respondents had to provide their primary domain of work (transport or land use) and their position (end user or developer). The next part of the survey consisted of eleven general statements, referring to the current state of LUT PSS. For each statement, respondents could distinguish between: 'strongly agree', 'agree', 'neutral', 'disagree' and 'strongly disagree'. The third part of the survey listed twelve possible bottlenecks, selected from existing PSS literature, as possible explanations for the low implementation of existing LUT PSS. For each bottleneck, the respondent had to judge its degree of importance by distinguishing between: 'very big problem', 'big problem', 'neutral', 'no problem' and 'no problem at all'. Also additional bottlenecks could be suggested by the respondent in an open format. The fourth part of the survey consisted of 21 open and closed questions; it focused on harnessing in-depth insight regarding implementation challenges and potential improvements.

2.3.2 Data interpretation methods

For the general statements, the level of agreement was analysed by calculating the average of the responses, where 'strongly agree' was coded as '2', 'agree' coded as '1' and so forth, finally with 'strongly disagree' coded as '-2'. Generating this average level of agreement for each group of respondents (based on their primary domain of work) allowed me to check for varied patterns. Also, the consistency of the outcomes within the groups was assessed by comparing frequency scores.

For each group of respondents, the perceived importance of the bottlenecks was analysed by combining the frequency scores of the categories 'very big problem' and 'big problem'.

[5] The web survey is available at http://www.transport-planning.eu/websurvey.html and http://www.transport-planning.eu/websurvey2.html (both in Dutch).

[6] http://www.verkeerskunde.nl (site for transport planners);
http://www.ruimte-mobiliteit.nl (knowledge network for LUT integration);
IKCRO newsletter (newsletter for land use planners).

The open questions were mainly used to interpret the other results and to provide in-depth justification of problems and possible solutions.

2.3.3 *Exploration of survey participants*

A total of 124 people responded and filled in the first three parts of the survey (a response ratio of 28%): 62 from land use planning, 60 from transport planning and 2 who did not specify their primary work domain. The vast majority (over three-quarters) were LUT PSS users, while the developers made a smaller part (31 respondents). Twenty-four of the respondents (primarily PSS developers) specifically declared that their activities fitted in multiple boxes.

A total of 107 respondents filled in the fourth part (open questions); the twelve which declared to have no prior LUT integration experience were excluded from further analysis. Of the remaining 95, four had LUT experience from a PSS development perspective, 25 had experience from a land use planning perspective and 66 were involved in LUT integration from a transport perspective. The employment of these respondents (mostly civil servants on the sub-national level) is shown in the left-hand pie chart in Figure 2.1. The role they played in LUT integration is visualised in the right hand pie-chart (multiple answers were possible). Project leaders (38 %) form the most prominent group, followed by project members (30%). The respondents represent all (geographical and organisational) layers of land use and transport planning, with different levels of experience in LUT integration processes.

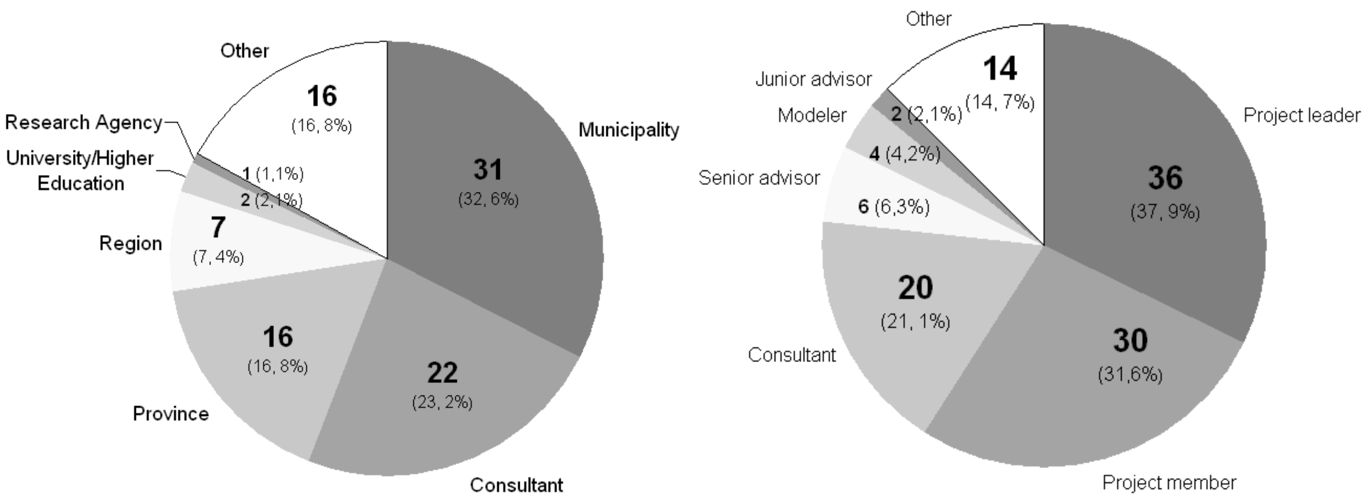

Figure 2.1 Work organization of respondents (N=95) of fourth part of survey (left pie chart) and their role in LUTR integration (right pie-chart**)**

2.3.4 *Validity of outcomes*

Because there is little insight in the embedding of LUT PSS, the main aim of the survey was to *identify* directions and patterns of bottlenecks and solutions, not to scientifically assess the implementation blocking mechanism. Listing the twelve bottlenecks provided a useful format for the respondents to select common problems, and stimulated them in thinking and adding additional ones. Only a very limited number of additional bottlenecks were proposed, leading me to conclude that the original twelve cover the most pertinent barriers.

2.4 HOW ARE LUT PSS PERCEIVED IN PLANNING PRACTICE?

2.4.1 General statements concerning LUT PSS

The three categories of general statements included: 1) implementation of LUT in the planning process; 2) phases of LUT planning that are insufficiently supported with PSS; and 3) general statements. Figure 2.2 illustrates the level of agreement with the statements. In order to verify if there is agreement or conflict of opinion between the two domains, it maps separately the overall average (black), the land use respondents (orange) and the transport respondents (green) outcomes.

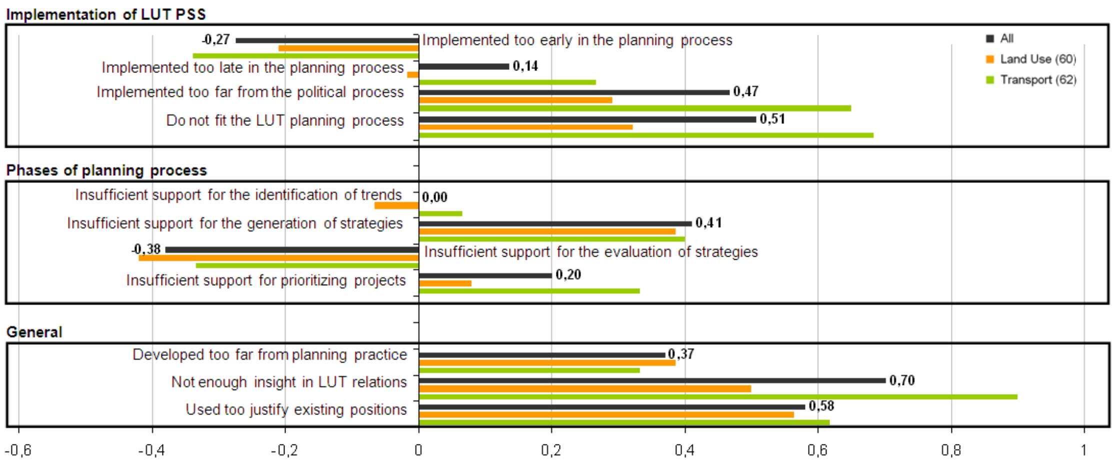

Figure 2.2 Average level of agreement on statements about implementation of LUT PSS, phases of the planning process and general use: from -2 (strongly disagree) to +2 (strongly agree)

As Figure 2.2 shows, the respondents found that LUT PSS are implemented too late rather than too early in the planning process. However, both statements showed a relatively low score (-0,27 and +0,14) indicating a lack of consensus *within* each groups. There was a stronger positive score for the statements that LUT PSS are "implemented too far removed from the political process" and that "they do not fit the LUT planning process". Transport respondents had stronger opinions about both statements.

The responses to the four statements about the support of the different typical phases of the LUT planning process show that LUT PSS do not sufficiently support the generation of new strategies; on the other hand, both planning domains agree that it does adequately support the evaluation of strategies Also, but with a lower level of agreement, the evaluation of LUT projects seems insufficiently supported.
The bottom three general statements show a relatively high level of agreement in both planning domains. This confirms the widely held view of LUT PSS weaknesses, as: developed too far from planning practice, not providing enough insight in crucial LUT relationships and in the words of one respondent being used as "weapons in fact-fighting-battles instead of for joint-fact-finding".
Overall, there are no large discrepancies between land use and transport respondents or PSS users and developers. In general, the results show that the respondents are dissatisfied with the current PSS and how they are used (and

developed). This widely held view is succinctly summarised in the words of one land use respondent who would rather see “a provisional instrument that is simple to use and shows useful images than the current sophisticated black boxes”.

2.4.2 *Bottlenecks blocking implementation*

In order to gauge the importance of each bottleneck, the respondents were asked to select the most pertinent blockages for LUT PSS, as presented in Figure 2.3.

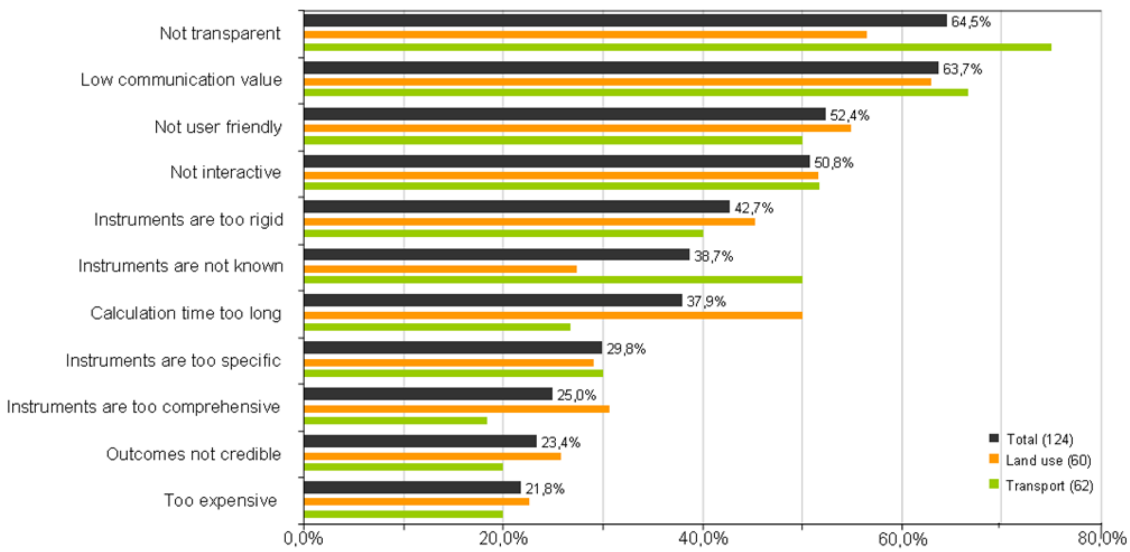

Figure 2.3 Potential bottlenecks for LUTR instruments and their perceived importance (percentage of respondents who consider it a big problem)

Again, a remarkable consensus among professionals from both domains emerged. Four bottlenecks were seen as blocking the use of LUT PSS by over half of the respondents. However, additional analysis showed that PSS developers saw the top four as far less problematic, but graded the bottleneck “instruments are not known” as most important (with 52 percent).

Almost two-thirds of the respondents (and an even higher three-quarter of transport respondents) found the lack of transparency to be a big PSS implementation problem. Apparently, the LUT PSS do not clearly define assumptions and calculation methods, echoing one of the fundamental problems of computer aided planning, already recognised in Douglas Lee’s *Requiem* (Lee, 1973). Land use respondents ranked the low communication value (i.e. LUT PSS which are not understandable for planners, stakeholders and politicians) as the biggest problem, with this bottleneck scoring almost equally to ’lack of transparency’. All four of these key problems can be described as soft problems, clearly indicating that the biggest problem of LUT PSS lies in the fact that they are very difficult to use by non PSS developers.

Apparently, the technical issues are not considered a major hindrance for implementing LUT PSS. The ‘too comprehensive’ and ‘too specific’ bottlenecks scored low, as did the price and the calculation time. However, these problems are not negligible; half of the land use respondents saw them as a bottleneck and the lowest ranking bottleneck was seen as a problem by almost 22 percent of all respondents. As previously identified by Vonk (2006), these findings confirm the importance of the instrument quality category of bottlenecks. However, it is not so much the technological qualities, but rather the adaptation of the tool to the planners' demands (user friendliness, transparency, flexibility) that seems important for LUT PSS. This holds especially true in combination with the lack of PSS support during the phase of generating strategies. In other phases (e.g. evaluating strategies) more technical issues might be considered more important.

2.4.3 Understanding the embedding of LUT PSS in planning practice

The above results support the findings of the academic PSS literature that the planning actors are not satisfied with the current PSS offered. Further in line with the academic literature, the reasons given in this survey highlight the "soft" elements of PSS instead of its technological characteristics. To better understand this perception of LUT PSS and to find concrete directions for improvement, the last part of the survey contained mainly (semi-)open questions.

This last part of the survey was completed by 95 respondents, who had prior experience with PSS in LUT integration projects. Almost half of them (42 percent) consider their integration project a success: "it was the first time that there was genuine interaction between the two domains"; "there was readiness to listen to each other"; "it was possible to dispute sacred cows"; and "it led to more acceptable solutions" than separated planning. Yet, the respondents who consider it unsuccessful (30 percent) often mention the PSS as one of the main reasons: "the assumptions in land use and transport models did not match" and "too rigid [PSS] to easily calculate alternatives".

Conflicting interests between the land use and transport actors are the main barrier to successful LUT integration, with 'lack of a common language' in second place and 'lack of political commitment' as third. Although these findings suggest that there is a severe institutional barrier, they also confirm the potential importance of and need for the development of useful LUT PSS.

The second set of questions concerned the use of PSS outputs. Respondents state that the outputs of LUT PSS often are used as input at the start of LUT workshops, to evaluate existing and new strategies or to provide background information for discussions. Although three-quarters of the respondents state that it created new insights, only 26 percent find that it creates a common language. The weak points deemed responsible for this lack of performance were the one-sided transport orientation and the complexity of the PSS output (which made it is difficult to use for generating strategies).

The respondents were asked how the phases of generating new strategies and developing strategies should be better supported with the output of LUT PSS (Figure 2.4). About 85 percent of the land use respondents suggested that LUT information should be used to 'create new insights' and almost 70 percent that the information should be 'easy to play with'. The most frequent uses of LUT PSS, visualising the current situation and providing background information, were rated at the bottom of the list of important characteristics, especially by transport respondents.

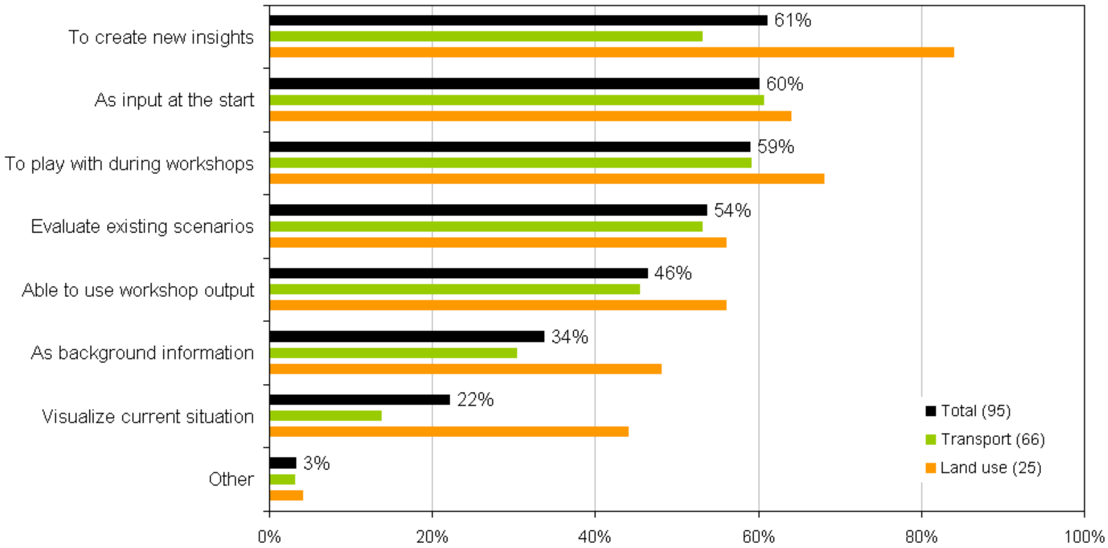

Figure 2.4 How LUTR information should be used to improve support (percentage of respondents)

The last part of the survey addressed the use of LUT PSS. Only 12 percent of the respondents reported that PSS were used *during* workshops and an even lower percentage shared that the participants used them *hands-on*. Mostly, the consultants used the LUT PSS, often as back office applications. Yet, 60 percent confirmed that the PSS did play a supportive role in the project, providing new insights: in each others' choices, in coherent LUT relationships, and in the effects of the strategies selected.

Although both groups agreed on the phases needed to improve PSS usage, land use respondents additionally emphasised the need for improving it in *all phases* of implementation. Figure 2.5 shows the suggestions given by participants for the desired characteristics of a useful LUT PSS.

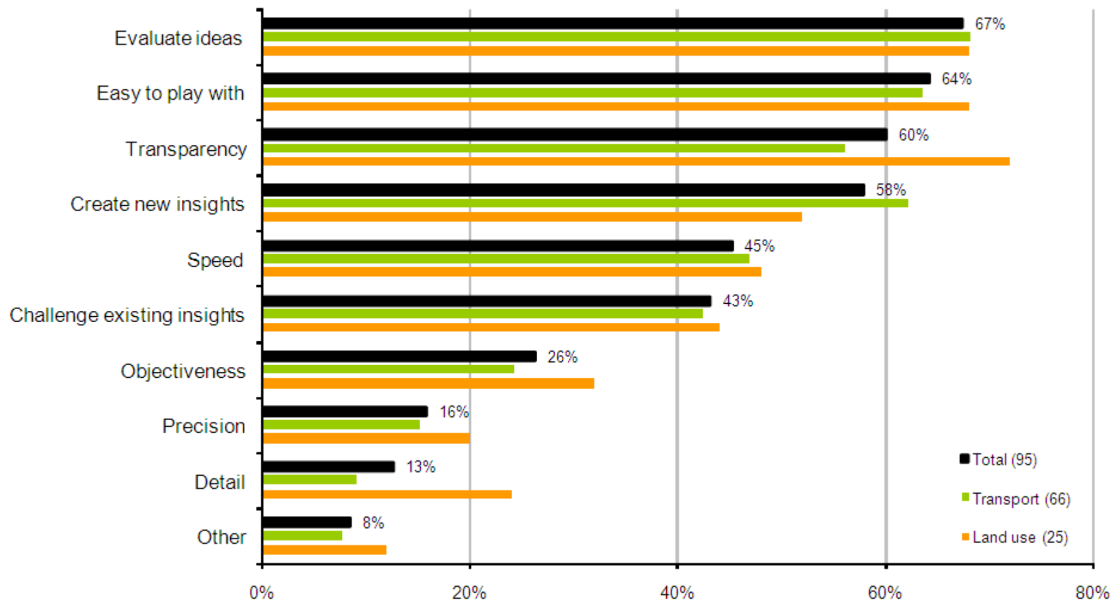

Figure 2.5 Importance of characteristics for LUT PSS in supporting the generation of LUT strategies (percentage of respondents that see it as important)

The PSS should be able to evaluate the participants' existing ideas and to allow the actors to play with strategies and thus learn about their effects. In other words, the LUT PSS should form a theoretical laboratory to experiment and learn-by-doing, which can be effectively achieved only with a transparent LUT PSS. Characteristics such as detail, objectiveness and speed are considered to be less important; therefore, it is apparent that the soft aspects of LUT PSS should be the focus of future improvement efforts.

2.5 CONCLUSIONS AND DISCUSSION

2.5.1 Patterns and directions

This chapter reiterated the widespread consensus on the need to improve the integration of land use and transport planning (especially during early planning phases). However, despite this long apparent need, a common LUT language is still lacking and this forms a substantive barrier. The implementation of recently developed PSS, aimed at overcoming this barrier, is either weak or nonexistent in daily planning. The results of the web-based survey presented in this chapter provide more insight in the challenge of using these specific LUT instruments in planning practice and discern clear patterns of user demands. This research builds upon the existing body of academic literature which deals with the unsatisfactory application of PSS. It seeks to 1) deepen the understanding of specific PSS which successfully supported integrated LUT planning processes; 2) provide more user oriented insights in attitudes towards PSS and 3) explore more directly avenues for improvement.

In conclusion, it can be stated that current LUT PSS seem well suited for some planning tasks, such as calculating the effects of new/existing strategies and providing background information for discussions. However, PSS do have serious shortcomings as they do not provide enough new LUT insights, for example: they are used to justify positions that are already taken (i.e. 'fact-fighting'), do not fit the planning process and are not well linked to planning practice. Land use respondents feel stronger about this sentiment than their transport counterparts. Moreover, the output is often too transport oriented and fails to provide a common LUT language to support the generation of strategies. In one word, the fundamental disconnect between PSS developers and their users is *confirmed* (already addressed in Lee, 1973)

The findings highlight the LUT strategy generating stage (where land use and transport planners are in dire need for good support) as the weakest link, due to: a lack of transparency, low communication value, lack of user friendliness and the incapability to experiment with the PSS. This supports the identified findings of bottlenecks for general PSS and unveils that the PSS developers' recent efforts to address these problems have not yet yielded results. The respondents' minute concerns for the technical challenges flies in the face of current efforts and funding; which remains geared towards improving these technical aspects of LUT PSS (i.e. improving calculation time or credibility of outcomes by introducing new complicated modelling techniques).

LUT PSS seem too complex and too opaque to be useful in early phases of planning. The respondents see a need to support the development of strategies and programs with improved information and LUT PSS support. PSS should function as laboratories where planners can collectively experiment and take part in group learning about LUT relationships. Building on this experience, they can subsequently generate grounded and tested LUT strategies. In order to provide this support, the PSS should be easy 'to play with' and transparent on its assumptions. The researchers' current focus on precision, detail and objectiveness is not very beneficial when planners generate strategies (although probably they are useful in other planning phases).

2.6 DISCUSSION: FROM 'DEVELOPING FOR' TO 'DEVELOPING WITH'

These results seem to necessitate a fundamental shift in thinking for both PSS developers and LUT planners. In order to increase the implementation success of PSS (with the aim of developing a common LUT language) the developers should not only focus on scientific rigor, PSS outcomes, detail and comprehensiveness. Instead, they should try to find a balance between rigor and relevance. When developing their ultimate LUT PSS, the developers still seem to follow a technology and supply focus. They should not (only) develop scientifically state-of-the-art PSS, but (also) PSS which embody context-specific user demands for support (state-of-practice). These demands differ over time, per group of planners, per geographical area and scale (geographical and temporal). Again, Douglas Lee's requiem offers useful guiding principles for such a fundamental shift (Figure 2.6). LUT PSS developers should not aim to follow (only) the dashed line, even though academic incentives support this focus. If PSS aim to support real planning practice, the top of the black line should be the goal, with a rigor-relevance balance to be found somewhere in-between. In my view, this should take place in close cooperation between PSS developer and potential user.

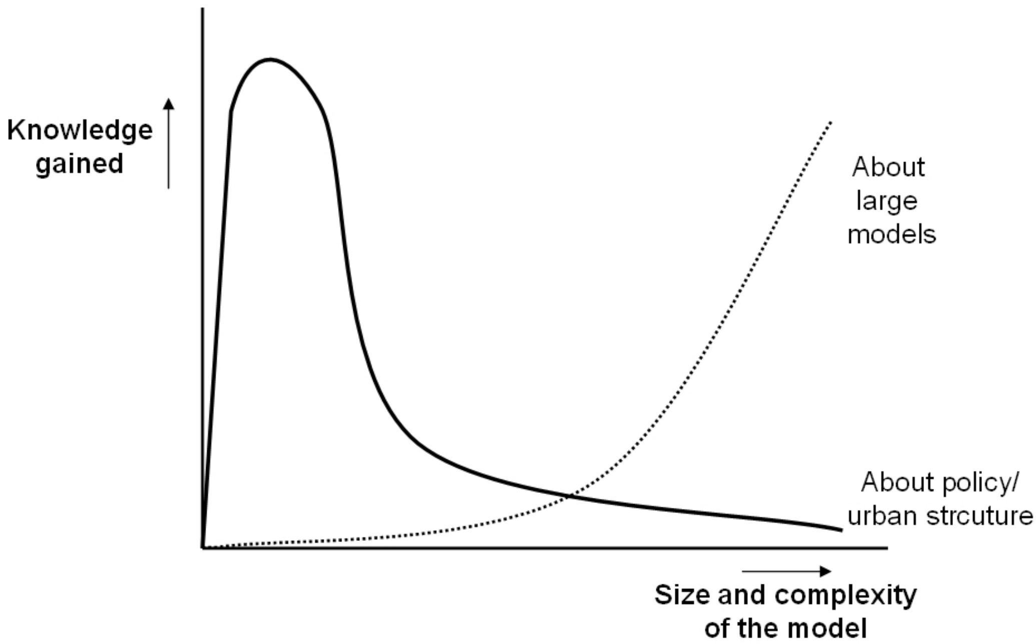

Figure 2.6 The dilemma of different learning curves of PSS developers and users (taken from Lee, 1973)

One promising strategy is to create a structural dialogue between PSS developers and potential users. It would be centred on existing planning problems in daily planning practice and would correspondingly produce a 'learning by doing' dynamic. Around the planning problem, the PSS users and developers can cooperatively construct and use a PSS throughout the entire cycle (not only at the start and the end of a PSS development process), conceptualising and testing it in iterative cycles. Such dialogues would allow PSS developers to understand that a generic PSS does not exist and appreciate the fact that the dialogue with the users should be an integral part of developing and using their PSS. Potential users would understand that these PSS are not always perfectly transparent and flexible to use; however, debate can increase the common understanding and build a useful common language (a notion also supported in Vonk and Geertman, 2008). For LUT PSS such a dialogue is described in (Te Brömmelstroet and Bertolini, 2008).

The shift in approach from a 'developing for' towards 'developing with' will increase mutual understanding between PSS developers and potential users. This shift does not infer a simple 'going through the motions' of a prototype run with the users, upon which the developers would subsequently develop a LUT PSS in isolation based on these identified requirements. It implies a structural, continuous dialogue throughout the relevant steps during the planning process, with the PSS developers participating in all planning projects from the early phases of planning. This seems a promising way to create mutual understanding and thus useful, transparent, flexible and appropriate planning support instruments. Finally this would result in progress from the current situation where they are simply 'manning their equipment' towards a desirable conditions where they 'equip the warriors'.

REFERENCES

Allmendinger P, 2002 *Planning Theory* (Palgrave, Basingstoke)

Banister D, 2005 *Unsustainable transport: City transport in the new century* (Routledge, London)

Batty M, 1994, "A chronicle of Scientific planning; the Anglo-American modeling experience" *Journal of the American Planning Association* **60** 7-16

Batty M, 2003, "Planning Support Systems: techniques that are driving planning", in *Planning Support Systems in practice* Eds S Geertman, J Stillwell (Springer, Heidelberg) pp v-viii

Bishop I D, 1998, "Planning support: hardware, software in search of a system" *Computers, Environment and Urban Systems* **22** 189-202

Brewer G D, 1973 *Politicians, Bureaucrats, and the Consultant: A critique of urban problem solving* (Basic Books, New York)

Burrough P A, McDonnel R A, 1998 *Principles of geographical information systems* (Oxford University Press, Oxford)

Cervero R, 1998 *The transit metropolis: A global inquiry* (Island Press, Washington D.C.)

Couclelis H, 1989, "Geographically informed planning: requirements for planning relevant GIS", in *36th North American Meeting of Regional Science Association*, Santa Barbara

Couclelis H, 2005, "“Where has the future gone?” Rethinking the role of integrated land-use models in spatial planning" *Environment and Planning A* **37** 1353-1371

Curtis C, James B, 2004, "An institutional model for land use and transport integration" *Urban policy and research* **22** 277-297

Danziger J N, 1977, "Computers, local government, and the litany to EDP
" *Public Administration Review* **37** 28-37

ECMT, 2002, "Implementing sustainable urban travel policies. Final report", (European Conference of Ministers of Transport, Paris)

Emberger G, Ibesich N, Pfaffenbichler P, 2006, "Can decision making processes benefit from a user friendly land use and transport interaction model?", in *8th International Conference on Design & Decision Support Systems in Architecture and Urban Planning*, Eindhoven (the Netherlands)

Ettema D, Timmermans H, 1997 *Activity-based approaches to travel analysis* (Pergamon, Oxford)

Expertcommissie Netwerkanalyses, 2006, "Op tijd bewegen: Eindadvies Expertcommissie Netwerkanalyses", (Expertcommissie Netwerkanalyses, Amersfoort)

Geertman S, 2006, "Potentials for Planning Support: A planning-conceptual approach" *Environment and planning B : Planning and Design* **33** 863-880

Geertman S, Stillwell J, 2003 *Planning support systems in practice* (Springer, Berlin)

Geurs K, Van Wee B, 2004, "Accessibility evaluation of land-use and transport strategies: review and research directions" *Journal of Transport Geography* **12** 127-140

Greenberger M, Crenson M A, Crissey B L, 1976 *Models in the policy process: Public decision making in the computer era* (Russel Sage, new york)

Hall P, 1981 *Great planning disasters* (Penguin, Harmondsworth)

Harris B, 1960, "Plan or Projection: An Examination of the Use of Models in Planning" *Journal of the Institute of American Planners* **26** 365-372

Harris B, 1968, "Quantitative models of urban development: Their role in metropolitan policy-making", in *Issues in Urban economics* Eds H S., P Jr., L Wingo (Johns Hopkins Press, Baltimore)

Harris B, Batty M, 1993a, "Location Models, Geographical information and Planning Support Systems" *Journal of Planning Education and Research* **12** 84-98

Harris B, Batty M, 1993b, "Locational models, geographical information, and planning support systems" *Journal of Planning Education and Research* **12** 184-198

Heerema P, Linssen R, 2006, "Op het grensvlak van ruimtelijke ontwikkeling en mobiliteit : balans of spagaat?", (Nirov, Den Haag) p 48

Hull A, Tricker R, 2006, "Findings of the 'Phase 1' Survey on the barriers to the delivery of sustainable transport solutions", (UWE, Bristol)

Innes J E, Simpson D M, 1993, "Implementing Gis for Planning - Lessons from the History of Technological Innovation" *Journal of the American Planning Association* **59** 230-236

Juhl G M, 1994, "getting on the GIS career track" *Planning* **60** 8-11

Klosterman R E, 1997, "Planning Support Systems: a new perspective on Computer-aided planning" *Journal of Planning education and research* **17** 45-54

Klosterman R E, 2007, "Deliberating about the future", in *Engaging the future: Forecasts, scenarios, plans and projects* Eds L D Hopkins, M A Zapata (Lincoln Institute of land policy, Cambridge) pp 199-219

Klosterman R E, Landis J D, 1988, "Microcomputers in United-States Planning - Past, Present, and Future" *Environment and Planning B-Planning & Design* **15** 355-367

Lautso K, Spiekermann K, Wegener M, Sheppard I, Steadman P, Martino A, Domingo R, Gayda S, 2004 *Planning and research of policies for land use and transport for increasing urban sustainability: Final report* (IRPUD, Dortmund)

Lee D B, 1973, "Requiem for large-scale models" *Journal of the American Planning Association* **39** pp. 163-178

Lee D B, 1994, "Retrospective on large-scale urban models" *Journal of the American Planning Association* **60** 35-40

Macy M W, Willer R, 2002, "From factors to actors: Computational Sociology and Agent-Based Modeling" *Annual review of Sociology* **28** 143-166

Meyer M D, Miller E J, 2001 *Urban transportation planning: a decision-oriented approach* (McGraw-Hill, New York)

MinV&W, 2005, "Nota Mobiliteit", (Department of Transport (Verkeer en Waterstaat), Den Haag)

MinVROM, Department of LNV, Department of V&W, Department of EZ, 2004 *Nota Ruimte* (Department of Housing, Spatial Planning and the Environment (VROM), Den Haag)

Openshaw S, 1986, "Towards a new planning system for the 1990s and beyond" *Planning Outlook* **29** 66-69

Rittel H, Webber M, 1984, "Dilemmas in a general theory of planning", in *Developments in design methodology* Ed N Cross (John Wiley and Sons, Chicester) pp 135-144

Schoemakers A, van der Hoorn T, 2004, "LUTI modelling in the Netherlands: Experiences with TIGRIS and a framework for a new LUTI model" *European Journal of Transport and Infrastructure Research* **4** 315-332

Schön D, 1983 *The Reflective Practitioner: How Professionals Think in Action* (Temple Smith, London)

Sheppard E, Couclelis H, Graham S, Harrington J W, Onsrud H, 1999, "Geographies of the information society" *International Journal of Geographical Information Science* **13** 797-823

Sieber R, 2000, "GIS implementation in the grassroots" *URISA journal* **12** 15-29

Sprague R H, Carlson E D, 1982 *Building effective Decision Support Systems* (Prentice-Hall, Inc, Englewoods Cliffs, N.J.)

Stead D, Geerlings H, Meijers E, 2004 *Policy integration in practice. The integration of land use planning, transport and environmental policy-making in Denmark, England and Germany* (Delft University Press, Delft)

Stillwell J, Geertman S, Openshaw S, 1999 *Geographical information and planning* (Springer, Heidelberg)

Straatemeier T, Bertolini L, 2008, "Joint Accessibility Design: a framework developed for and with practitioners to stimulate the integration of regional land-use and transport strategies in the Netherlands." *Transportation research record* **2077** 1-8

Te Brömmelstroet M, Bertolini L, 2008, "Developing Land use and Transport PSS: Meaningful information through a dialogue between modelers and planners" *Transport Policy* **15** 251-259

Te Brömmelstroet M, Schrijnen P M, 2010, "From Planning Support Systems to Mediated Planning Support: A structured dialogue to overcome the implementation gap" *Environment and Planning B: Planning and Design* **37** 3-20

TRB, 2004 *A New Vision for Mobility: Guidance to Foster Collaborative Multimodal Decision Making* (Transportation Research Board, Washington DC)

Uran O, Janssen R, 2003, "Why are spatial decision support systems not used? Some experiences from the Netherlands" *Computers, Environment and Urban Systems* **27** 511-526

Vleugel J M, 2000 *Design of transport and land-use scenario's; principles and applications* Doctoral Thesis, Economic Science and Econometrics, Free University, Amsterdam

Vonk G, 2006 *Improving planning support; The use of planning support systems for spatial planning* (Nederlandse Geografische Studies, Utrecht)

Vonk G, Geertman S, 2008, "Knowledge-Based Planning Using Planning Support Systems: Practice-Oriented Lessons", in *Creative urban regions: harnessing urban technologies to support* *knowledge city initiatives* Eds T Yigitcanlar, K Velibeyoglu, S Baum (Medical Information Science Reference, Queensland) pp 203-216

Vonk G, Geertman S, Schot P, 2005, "Bottlenecks blocking widespread usage of planning support systems" *Environment and Planning A* **37** 909-924

Waddell P, 2002, "UrbanSim: Modeling Urban Development for Land Use, Transportation and Environmental Planning" *Journal of the American Planning Association* **68** 297-314

WBCSD, 2001, "Mobility 2001 - World mobility at the end of the twentieth century and its sustainability.", (World Business Council for Sustainable Development (Prepared by MIT and Charles River Associates), Geneva, Switzerland)

WBCSD, 2004, "Mobility 2030: Meeting the challenges to sustainability", (The sustainable Mobility Project)

Webster F V, Bly P H, Paulley N J, 1988 *Urban land-use and transport interaction: policies and models* (Aldershot, Avebury)

Wegener M, 1994, "Operational urban models; State of the art" *Journal of the American Planning Association* **60** 17-29

Wegener M, Fürst F, 1999 *Land-use transport interaction: State of the Art.* (Institut für Raumplanung, Dortmund)

Willson R, 2001, "Assessing communicative rationality as a transportation planning paradigm" *Transportation* **28** 1-31