The final publication is available in Progress in Planning 2016. 109, 1-32.
http://dx.doi.org/doi:10.1016/j.progress.2015.05.002

How planners' use and non-use of expert knowledge affect the goal achievement potential of plans: Experiences from strategic land-use and transport planning processes in three Scandinavian cities

Abstract

This article addresses the question of how planners' use and non-use of expert knowledge affect the content and goal achievement potential of plans, and discusses how changes in planners' and researchers' practices can contribute to improving goal achievement potential. These are questions that have been given surprisingly little attention in planning research. Although interesting discussions have emerged over recent years, few empirical studies have been presented. This article presents theory-based empirical research on these issues based on analyses of strategic land-use and transport planning processes in three Scandinavian cities where an aim is to limit or reduce traffic volumes and greenhouse gas emissions of transport. This is a highly relevant issue when analysing the effects of planners' use and non-use of expert knowledge. Goal achievement potential refers to whether plans (if implemented) contribute to achieving defined objectives, which in this paper mainly regards curbing or reducing urban traffic volumes. The expert knowledge in question concerns how land-use and transport systems development influence traffic volumes in urban regions.

The article concludes that whether planners use the expert knowledge in question or not, and how they use it, do affect the goal achievement potential of the plans they produce. This knowledge is the main basis for many planners' knowing and acting. Planners use it to understand, explain and argue for how and why coordination is necessary, and for selecting traffic-reducing measures. All examined plans also include strategies and measures that reduce their goal achievement potential, and non-use of the expert knowledge is an important part of the explanation as to how and why this is the case. When competing objectives seem to call for traffic-increasing measures, planners tend not to take account of expert knowledge in explaining that these measures reduce the goal achievement potential of plans, and they do not turn to it for finding innovative ways of solving their planning problems. Instead, they rely on their embedded professional knowledge, which is sometimes outdated or misleading. In other cases, planners disregard the knowledge because it challenges planning agendas or compelling ideas, or they exercise self-censorship when finding that it conflicts with political agendas.

Considerable effort is required in ensuring higher goal achievement potential in future plans. Planners need to be more critical of their own tacit knowledge, and turn more actively to research-based knowledge. Researchers need to produce the knowledge planners need in ways that are useful and usable for them.

Keywords: planning practitioners, expert knowledge, goal achievement potential, land-use and transport planning, sustainable mobility

1. Introduction

In this paper we investigate how planners' use and non-use of expert knowledge in planning processes affect the goal achievement potential of plans. It contributes with theory-based empirical investigations of how planners gain knowledge of the subject matter dealt with in planning; whether and how they use this knowledge when making plans; and whether and how this affects the goal achievement potential of the resulting plans. This also includes analyses of how and why planners include measures and strategies which, according to state-of-the-art knowledge in the field, counteract goal achievement. Here, we combine structural and causal analyses with readings in planning theory when developing theoretical hypotheses or explanations. We critically examine these explanations in empirical case studies of strategic planning processes concerning land-use and transport development in three Scandinavian cities where an aim is to limit or reduce traffic volumes and greenhouse gas emissions. Finally, we discuss how both planning and research practices need to change if the goal achievement potential of plans is to improve. Along with several authors who discuss knowledge in planning, we agree with Rydin (2007: 53), who defines knowledge as differing from information and data "*in that the specification of causal relationship is central to knowledge*". Goal achievement potential refers to whether the plans (if implemented) contribute to achievement of defined goals.

A main hypothesis in this work is that research-based expert knowledge and skilled planners applying this knowledge when making analyses, appraisals and plans, are important prerequisites for plans with high goal achievement potential. Hence, properties of the relevant expert knowledge, the planners, and the practices of the planners could also be part of the might also be part of the explanation why planning processes produce plans with low goal-achievement potential. This is in line with an understanding that the aim of planning is to bring knowledge into decision-making, in order to improve decision-makers' abilities to make decisions about future actions contributing to achieving their objectives (Faludi, 1973; Friedmann, 1987), and that planners are main carriers of knowledge of the subject matter dealt with in many planning processes. This approach may be understood mistakenly as belonging in a positivist epistemology, where presumably neutral and objective scientific knowledge "*translates straightforwardly into the substance of policy*" (Owens et al., 2004). This is often contrasted with communicative or collaborative planning (Healey, 1992), where transparency, inclusiveness and deliberation are main issues. Based on our understanding of how planning processes normally proceed, we find it reasonable to combine these approaches.

Our understanding is that planning processes (to varying degree) are deliberative processes, where a (varying) number of actors contribute in different ways. Professional planners are important actors in these processes, as process leaders and as knowledge carriers, users and producers. A main contribution of planners should (as we understand it) be to bring research-based expert knowledge concerning substantive case matters relevant for the planning problem in hand to the planning discussions. By asking questions such as 'what should we do in order to ….?', and 'what are the consequences of …?', and applying relevant expert knowledge when answering these questions – in dialogue with other actors – planners can contribute to finding ways of solving problems, reaching agreements and achieving defined objectives. In these ways they can also contribute with *ex ante* assessments of positive and negative consequences of proposed projects or strategies. Such assessments are necessary in order to understand what is at stake in conflicts between different interest groups (Næss et al., 2013), and could hence be a contribution to transparent, inclusive and deliberative planning processes. As numerous authors have

discussed (see Owens et al. (2004) for a summary), planners do not necessarily use knowledge and analyses in this way.

Planners' use and non-use of *expert knowledge* in planning processes, and how this affects the content and goal-achievement potential of plans being their outcome, have received surprisingly little attention in planning research and theory, as pointed out by several authors (see, for instance, Davoudi, 2006; Krizek et al., 2009; Mazza, 2002). Interesting discussions concerning these issues have emerged over the past decade (Friedmann, 2003; Krizek et al., 2009; Næss, 2004; Owens et al., 2006), with several authors calling for theory-based empirical studies (Krizek, 2009; Næss, 2004; Owens, 2005; Owens et al., 2004). One aim of this present paper is to respond to such calls; a second is to discuss how both planning and research practice might change in ways that contributed to the higher goal achievement potential of plans.

Hence, the overall research questions in this article are: 1) How do planners' use and non-use of expert knowledge affect the contents of plans and their goal achievement potential? 2) What can be done to improve the goal achievement potential of plans?

In order to answer these broadly formulated main research questions, we defined four interrelated sub-questions which we answer for each case: *i)* Through what mechanisms is the expert knowledge in question introduced in planning processes? *ii)* Through what mechanisms is this knowledge used in ways that increase the goal achievement potential of plans? *iii)* Through what mechanisms are counter-productive measures with respect to defined objectives included in plans? *iv)* How and to what extent have planners' use and non-use of the expert knowledge in question affected the goal achievement potential of the plan?

1.1 Different kinds of knowledge are necessary in planning

As emphasized by a number of authors (Flyvbjerg, 2001; Healey, 1992; 2009; Krizek et al., 2009; Owens et al., 2006; Rydin, 2007), various kinds and forms of knowledge from a number of sources are normally used by planners when making plans. We distinguish between expert knowledge, knowledge of the project and/or objectives, process knowledge, knowledge of context, and other types of knowledge (as illustrated in Figure 1). Planners *apply* all of these when they *produce* knowledge in the form of alternatives, analyses, plans and recommendations meant to be *used* by politicians in their decision-making, together with other kinds of knowledge.

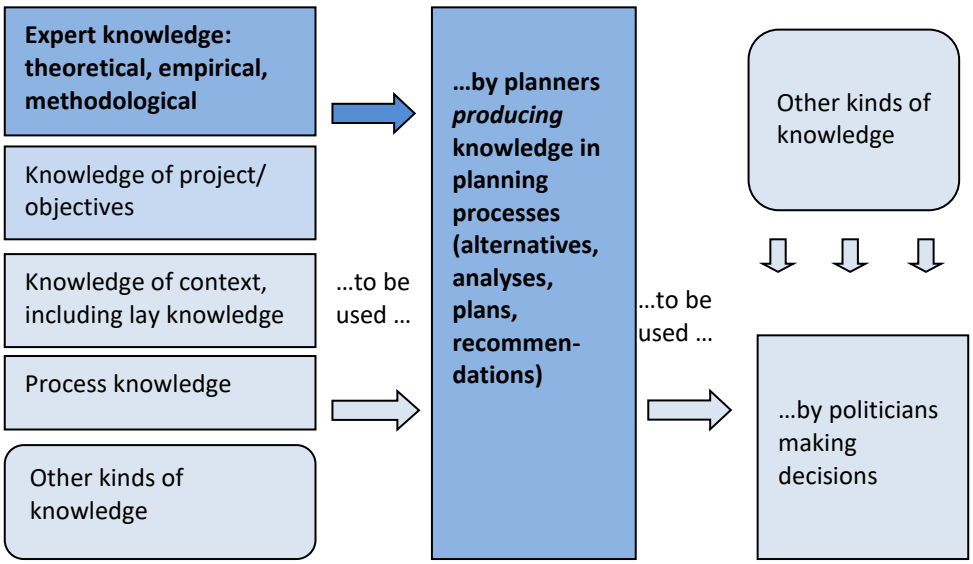

Figure 1: Planners use various kinds of knowledge when producing knowledge in the form of analyses, plans and recommendations. Decision-makers are supposed to use this knowledge, together with other kinds of knowledge, to improve their ability to make decisions contributing to achievement of their objectives. The darker boxes and arrows indicate the focus in this paper (figure based on Tennøy, 2012).

Process knowledge includes knowledge about laws, regulations and procedures of planning and decision-making defined in planning legislation; knowledge about how to carry out planning processes; knowledge about public participation in planning processes, and so on (see, among others, Healey, 1992; 2009). Planners are supposed to be trained in and to possess this kind of knowledge, which includes the necessary professional skills of listening, interpreting, mediating and negotiating (Forester, 1989).

Knowledge regarding the *projects* in, and *the objectives* of, a planning process is also necessary when making plans. Previously, this knowledge was often assumed to be provided by the planners' employers, who were developers or political decision-makers. However, as discussed in current planning theory, it is often produced as part of the planning process in dialogue with a number of actors, often with the strong influence of the professional planners involved (Healey, 2009; Rydin, 2007; Tennøy, 2010).

Knowledge regarding the *specific context of* the planning and the project is an absolute prerequisite. This includes knowledge of several issues – physical, political and cultural contexts, existing plans and policies, current situation and trends, political objectives, and so forth (see also Rydin, 2007) – which is collected from sources such as statistics, existing plans, political signals in various forms, communications with interested and involved parties, businesses and local residents, or the users of areas (Fischer and Forester, 1993; Healey, 1992; 2009).

Expert knowledge here is the theoretical knowledge of cause–effect relations; empirical knowledge on whether, how and with what strength certain actions have caused certain effects in various contexts, as well as methodological knowledge for analysing which effects certain actions can be expected to produce in the specific context and time horizon dealt with in a specific planning process. Planners are assumed to be trained in and to possess such knowledge within their disciplines in order to be recognized as professional planners

(as understood in this work). Still, there will be huge variations in how knowledgeable different planners are within specific topics; for instance, integrated land-use and transport planning. The expert knowledge may be understood as the basis on which planners can approach, understand and deal with the concrete planning problems they face in their practice (Schön, 1983). In order to distinguish between the knowledge planners use when making plans and the knowledge they produce (analyses, plans), the knowledge planners produce is not termed expert knowledge in this work.

The above description illustrates how various types and sources of knowledge are necessary when making plans, including expert knowledge. Furthermore, even if the primary focus of this paper is the role, use and influence of expert knowledge, we recognize other kinds of knowledge as necessary and useful as well.

1.2 Situating our understanding of the role of expert knowledge in planning

Understandings of the role, use and influence of expert knowledge in planning have shifted over time. The different understandings are closely related to changing ideas on the possibilities of planning and governing, democracy and democratic practice, and the perceived problems to hand. Debates have revolved around topics such as the kinds of knowledge that are relevant; which and whose knowledge is valid; who defines which knowledge is valid; whether predictive knowledge is possible; and how predictions could be made and understood.

1.2.1 Lack of focus on expert knowledge

A main impression from readings published over recent decades, however, is that planning theory *does not* deal much with expert knowledge on concrete issues planning deals with, the role of such knowledge in planning processes and how it affects the content of plans. When searching in often referred to readers (Campbell and Fainstein, 2003; Faludi, 1973; Fischer and Forester, 1993) and in much referred to works in planning theory (Flyvbjerg, 1998; Friedmann, 1987; Healey, 1997; Hull, 2005; 2008; Stead and Meijers, 2009), the absence of debate explicitly addressing expert knowledge and planners' use of this knowledge when making plans and analyses is striking. In Allmendinger's (2002) typology, this kind of knowledge seems to be classified as 'exogenous theories'.

Several authors have claimed that the strong focus on process and deliberation in planning theory in previous decades has led to a detachment of planning theory from the subjects with whom planning dealing with (Krizek et al., 2009; Mazza, 2002; Næss, 2001). In the 1980s and 1990s, Davoudi (2006: 22) found, *"[a]ttention moved away from developing the substantive evidence base of planning about how cities function (knowing what) to developing new ideas, such as communicative planning, about the process of planning (knowing how)"*.

Recent planning theory hence seems mainly to be about theory *of* planning and less about theories *in* planning (Faludi, 1973; Friedmann, 2003). Moreover, the literature *of* planning seems to focus very little on the planners and how they act and interact when applying expert knowledge on various substantive matters in planning analyses, or on how this affects the content and goal achievement potential of the resultant plans.

1.2.2 Negative understandings of the role of expert knowledge

Literature actually dealing with expert knowledge in planning is often negative, suggesting that its influence is low or should be reduced, or that such knowledge is not possible. Krizek et al. (2009: 460) came to a similar conclusion, claiming that *"planning theory has been absorbed with critiquing expert and scientific knowledge, celebrating local and community knowledge, or pointing out the political nature of planning".*

One reason may be that authors distance themselves from ideals of 'extreme instrumental rationality' dating back to the 1950s and 1960s. According to Banfield (1959), examples of planning practised this way were hard to find even in the 1950s and have probably never been common practice in public planning. Owens et al. (2004: 1950) did not "*find many theorists or practitioners of conventional forms of appraisal adhering to the technical-rational model in extreme form*". Some researchers argue that economic–rational transport models and optimizing cost–benefit analyses are examples of applied instrumental rationality (see Næss, 2006b or Willson, 2001 for critical discussions).

Another explanation could be the communicative or collaborative turn in planning theory. Here, an ideal is that actors develop objectives and knowledge in collaborative and transparent processes, where "*knowledge is not pre-formulated but is specifically created anew in our communication"* (Healey, 1992: 153*).* There is ongoing debate concerning whether this is a useful approach (see Rydin, 2007). Owens and Cowell (2002: 167) find that "*dialogue may be a good way of dealing with purely local issues, but in the context of sustainability these are probably rare, because many processes shaping economic and environmental change operate at a much broader scale*".

Third, there is the discussion on whether there actually *can* exist general knowledge on how, for instance, developments of land-use and transport systems affect travel behaviour and traffic volumes (Batty, 2006; Flyvbjerg, 1998; 2002, Skjeggedal et al., 2003; Portugali, 2008). This could be related to the understanding that one cannot produce accurate and certain predictions in social science, because what actually happens in a concrete situation in an open system will always be context-dependent (Danermark et al., 2002; Sayer, 1992).

1.2.3 Evolving debates on the necessity of expert knowledge

Other authors argue that expert knowledge, as well as planners applying the expert knowledge in planning, is necessary and useful. Schön (1983: 309) states: "*A most important kind of research has to do with the methods of inquiry and the overarching theories of phenomena, from which practitioners may develop on-the-spot variations.*" Owens et al. (2006: 635) find that "*concerns to facilitate knowledge transfer, so that 'sound science' impacts upon the world of policy, has become almost ubiquitous*". In her discussion and typology of knowledge claims, Rydin (2007: 64) lists *"theoretically framed expert research on the future informed by experiential knowledge where appropriate"* as predictive knowledge. Næss et al. (2013) argue that we may now be seeing the beginnings of an *ontological turn* in planning theory towards a stronger focus on the concrete subjects that planning deals with, without turning the back to the insights brought by process-oriented planning research.

1.2.4 How the role of expert knowledge is understood in this work

Underlying and fundamental assumptions in this work are that changes in the physical environment do affect aggregate-scale human behaviour in relatively predictable ways, and for rational and explainable reasons (Næss, 2015). The appropriate predictions, however, are of a 'soft' nature, since the causal relationships are tendencies, not deterministic regularities. They should be considered as being of a possibilistic and probabilistic nature. There can and indeed does exist theoretical and empirical knowledge about many of these cause–effect relationships. This knowledge is continuously evolving and is fallible, as is all knowledge. In order to take planning and development of the built environment systematically in directions contributing to achieving defined goals, planners need to possess relevant expert knowledge concerning which developments contribute to this (and not), and use it when making plans.

Various forms of knowledge interplay in planning processes. Sager (1994) emphasizes that interactions between professionals and non-professionals, requiring communication as well

as calculation, are needed in planning processes. Fischer and Forester (1993) see planning as an argumentative practice, where analyses produced by experts applying their expert knowledge on concrete and contextual problems may be understood as arguments in a larger debate over planning and policy issues. Rydin (2007) sees planners as co-producers of knowledge when making plans and expert knowledge as one of several types of knowledge necessary. In line with these authors, we understand planning processes as deliberative, and expert knowledge as one kind of knowledge necessary in the processes.

This also means that even if expert knowledge exists and is possessed by planners involved in a planning process, there is no guarantee that it is influential or that plans produced have high goal achievement potential. Planners may not introduce the relevant expert knowledge in the planning processes, and if they do it may be overruled by other kinds of knowledge or ousted.

1.3 Studying processes of strategic land-use and transport planning

In our empirical research, we study planners' use and non-use of expert knowledge in strategic and integrated land-use and transport planning processes in cities whose aim is reduction of traffic volumes and GHG emissions from transport. We find this issue highly interesting and relevant, for several reasons.

One reason is that changing practices to ways that result in planning and plans steering land-use and transport systems developments in directions fostering more sustainable mobility patterns is a major challenge for planning practitioners in many cities and countries. Land-use and transport systems development are, to a large extent, under the control of public authorities and political decision-makers, through planning and decision-making processes under the Planning and Building Act (PBA) or similar, and through public planning and funding of transport infrastructure and public transport services. According to research-based knowledge, the spatial structure of an urban region – together with the absolute and relative qualities of transport systems for cars, public transport, cycling and walking – greatly affects transport demand and modal split (Banister, 2008; 2012; Cairns et al., 1998; Newman and Kenworthy, 1989; Næss, 2006a; 2012). Steering developments of land-use and transport systems in directions contributing to reduce transport demand and traffic volumes is a prominent objective in many planning and policy documents (e.g. European Commission (EC), 2011; Norwegian Ministry of Transport and Communications, 2013; Municipality of Lund, 2009; UN Habitat, 2013). Still, land-use and transport systems are being developed in ways contributing to increased traffic volumes in Norway (Office of the Auditor General of Norway, 2007; Furu, 2010), the rest of Europe (EEA 2001; 2007) as well as in other countries worldwide (Banister, 2011; Owens and Cowell, 2002). In the EU, transport is the least successful sector in reducing GHG emission targets (EEA, 2014; EC, 2011).

Second, developing land-use and transport systems in ways that reduce transport demand and traffic volumes is a complex problem, and cause–effect relations are often not intuitively obvious (we return to this in section 3). Hence, if planners are to develop innovatory and efficient ways of achieving this goal, and to assess whether proposed actions contribute to goal achievement, they need to possess and use research-based expert knowledge when making analyses and plans.

Third, transitions towards more environmentally sustainable land-use and transport planning and plans require fundamental change in framing and practice. New objectives and new knowledge incorporating and giving priority to environmental considerations need to replace or find a place alongside existing and established knowledge and objectives. Moreover, urban land-use and transport planning are multi-disciplinary by nature, with multiple kinds and forms of knowledge, from different sources, being brought into the

process (Hull, 2008; Næss, 2015; Petts, Owens and Bulkeley, 2007). This may result in conflicting objectives and clashes of knowledge in planning processes: between and within policy areas; between and within professions; between older and newer understandings; as well as between the scientific state-of-the-art, applied practices and politics (Flyvbjerg, 1998; Owens, 1995; Tennøy, 2009, 2010, 2012).

A fourth reason is that strategic and integrated land-use and transport planning processes are complex. Actors from different sectors and levels are involved: private and public initiators of plans and projects, planning authorities, public authorities and other stakeholders entitled to comment on plans, political bodies at the national, regional and local level and the wider public. They enter planning processes with different objectives, knowledge and power, and they participate in order to achieve what they see as the most important (Tennøy, 2012). Hence, real and fundamental conflicts are often embedded in processes, the stakes may be high, and some actors will gain and others actors lose from whatever decision is made (Flyvbjerg, 1998). In this perspective, planning and decision-making processes can be understood as arenas for settling conflicts, which does not necessarily mean arriving at consensus. For such reasons, power is an unavoidable topic when analysing how planners' use and non-use of expert knowledge affect the goal achievement potentials of plans. Hajer (1995) finds that discourses frame certain problems by emphasising some aspects of situations rather than others. In Flyvbjerg's (2004: 293) words, *"power produces knowledge and knowledge produces power".* Whether and how actors involved in the planning processes *exert* the power they possess can greatly affect the processes and their outcomes, as demonstrated by, among others, Flyvbjerg (1998), Næss (2011a), Richardson (2005) and Tennøy (2012). In line with this, we assume that whether and how planners use expert knowledge can influence and be influenced by how the actors involved (including the planners) exert the powers they possess. This will depend on how the planners understand their role in the planning process, which in turn will vary with person and context.

The expert knowledge in question includes theoretical understandings of the causal mechanisms through which changes in land-use and transport systems contribute to changes in travel behaviour and traffic volumes; empirical evidence concerning how certain developments have contributed to concrete changes in traffic volumes in concrete contexts, and methods for applying theoretical and empirical knowledge in combination with contextual knowledge when analysing how land-use and transport systems ought to develop if they are to contribute to reduced traffic volumes. Such knowledge is *not* understood as context-independent knowledge that can deliver quantitative, certain and accurate predictions. In particular, it is not to understood as quantitative cost–benefit analyses or the like. A brief overview of the authors' understandings of current state-of-the-art knowledge in this field is presented in section 3.

1.4 Outline of the article

The structure of the article is as follows. In section 2 we describe the research approach, design and methods, and in section we 3 briefly describe our understanding of the state-of-the-art of the expert knowledge in question. Later, we use this as a theoretical framework to assess the goal achievement potential of plans examined in the case study. In section 4, we define mechanisms through which expert knowledge may be introduced in planning processes, how planners' use of expert knowledge may contribute to high goal achievement potential of plans, and how counteracting measures can be included in plans. In section 5, these mechanisms are critically examined in three empirical case studies of land-use and transport planning *processes* in three medium-sized Scandinavian cities. Cross-case analyses are conducted with the aim of arriving at more general explanations as to how the use of

expert knowledge contributes to improving the goal achievement potential of plans or inhibits it. We discuss the findings in section 6 and answer the main research questions by analysing how both planners researchers can change their practices in ways contributing to improving the goal achievement potential of future plans. In section 7, we present our conclusions and final reflections.

2. Research design and methodology

2.1 Research design

The research design is inspired by understandings embedded in the meta-theory of critical realism (Bhaskar, 2008; 1998; Danermark et al., 2002; Sayer, 1992). One is that in every concrete situation a number of objects with their structures[i] and embedded causal powers, working through triggered mechanisms, contribute to the occurrence of a certain event. This means that most events have several causes. They are *multi-causal*. If mechanisms are triggered and causal powers are activated, the resulting *events* depend on the conditions in the specific situation (other mechanisms in operation). In most cases, there are countless combinations of circumstances that may influence whether a specific causal power will manifest itself as a particular event. The produced events are therefore a *"complex compound effect of influences drawn from different mechanisms, where some mechanisms reinforce one another and others frustrate the manifestation of each other"* (Danermark et al., 2002: 56). These contingent conditions affect whether and how the mix of causal powers and mechanisms actually produce a certain event, such as a plan that contributes to the reduction of traffic volumes in an urban region. Depending on the conditions present (the context), one and the same mechanism may produce different events, whereas different mechanisms or combinations of mechanisms can produce one and the same event. The aim of research is to distinguish important structures, causal powers and mechanisms, and to examine them critically in empirical studies.

2.2 Methodology

Our main methods are structural and causal analyses, literature studies and case studies (document studies and interviews). The authors' understanding of state-of-the-art expert knowledge (section 3) is based on literature studies combined with structural and causal analyses in a critical realist perspective with a focus on causal powers and mechanisms. When defining the theoretical framework for structuring, analysing and interpreting studies of plan-making processes (section 4), we combined structural and causal analyses with literature studies (*retroduction*). The aim was to arrive at potential mechanisms through which: expert knowledge may be introduced in plan-making processes; use of expert knowledge may contribute to coordination of land-use and transport planning and to inclusion of traffic-reducing measures in plans; strategies and measures reducing goal achievement potentials may be included in plans. The results were a number of potential explanations to our secondary research questions (listed in section 1). These mechanisms or explanations were critically examined in empirical case studies.

Cases selected for the empirical studies are overall planning processes that may strongly affect land-use and transport developments in three Scandinavian cities: Lund in Sweden, Aarhus in Denmark and Trondheim in Norway. Our choice of cases is partly pragmatic, reflecting practical and project-administrative criteria, including among others that we needed to select one city from each of these three countries. Within these frames, we searched for strategic planning processes in cities focusing on limiting traffic volumes and/or GHG emissions from transport, and where we would expect the expert knowledge in question to be used and influential. Aarhus, Trondheim and Lund all have stated objectives concerning reduced traffic volumes and/or reduced GHG emissions from transport. They are

medium-sized university cities (with populations varying from around 100,000 to 300,000) all currently experiencing considerable population growth. They also belong to a fairly homogeneous socio-economic and cultural context – Scandinavia – with similar planning systems and legislations. We have not analysed whether national context matters in our studies.

In order to develop context-related explanations, we conducted internal analyses for each case. We analysed the goal achievement potential of each plan by comparing suggested strategies and measures with findings and recommendations in the state-of-the-art knowledge described in section 3. Turning our analytical focus to the plan-making processes, we critically examined the mechanisms and explanation developed in the theoretical framework in section 4 in the concrete context of each case. The aim was to answer the secondary research questions *i)* to *iv*) listed in section 1 for each case.

The main sources of data and information in the case studies were planning documents and semi-structured in-depth interviews; the interviewees were 11 planners actively involved in plan-making in the three cities. We developed an interview guide focusing on the particular expert knowledge each planner related to, whether and how the planners use it in the planning process, how measures and strategies in the concrete plan were selected, and whether and how the planners used the expert knowledge in question in this selection. Furthermore, we asked whether there were conflicts regarding the understanding of and the use of the expert knowledge, how they judged its quality, and how they perceived the goal achievement potential of the plan. Planning documents included were the main policy documents, planning analyses, impact assessments, and approved plans in each case.

We used tables when analysing the data. We listed our theoretical explanations in the first columns, and examined whether statements made in documents and interviews were in accordance with these explanations, much in the same way as the summarising tables in section 5.4. We listed the findings in the relevant rows, using this as the basis for critical discussion of whether each of the explanations was relevant in this concrete case, and which were the most relevant. This was our basis for answering the secondary research questions in each case.

We also conducted cross-case analyses aimed at making analytical generalization (Yin, 1994) or explanation-building generalization (*ibid.*; Bergene, 2007). Our aim was to expand the theoretical understandings of the phenomenon, rather than to generalize correlations between outcomes and factors of influence to a larger population of cases. Findings from all three cases were analysed with respect to various theoretical approaches in iterative processes (*abduction*), while aiming at arriving at better explanations of the phenomenon, and in this way developing answers to the main research questions.

3. State-of-the-art expert knowledge for traffic-reducing land-use and transport planning

This work concerns land-use and transport planning processes, and focuses on the goal of 'reducing or curbing urban traffic volumes'. 'Expert knowledge' therefore refers to theoretical and empirical knowledge regarding how changes of land-use and transport systems tend to affect travel behaviour and traffic volumes, as well as the methods for assessing the transport effects of land-use and transport developments in specific contexts. This section presents a brief description of our understanding of state-of-the-art knowledge in this field.

A main understanding is that certain kinds of developments of land-use and transport systems, alone and in combinations, contribute to long travelling distances, facilitate car-use and to growth in traffic volumes. Other kinds of developments contribute to short travelling

distances and facilitate the use of public transport, cycling and walking instead of private car, thereby contributing to a reduction in traffic volumes.

The model in figure 2 illustrates the theoretical understanding used here on how land-use, transport systems, travel behaviour and traffic volumes are causally interrelated, and on how planning and development of land-use and transport systems interact with this system. In this model, traffic volumes are defined by travel behaviour: frequency of travel, length of travel, and car shares (population size is exogenous in the model). Travel behaviour is affected by the spatial layout of the city (density, location of various activities, people's use of activities) and by the absolute and relative qualities of the transport systems, as well as by other factors exogenous to this model. Land-use, transport systems and travel behaviour influence one another reciprocally and are affected by traffic volumes. Changes in one variable of the system may cause changes in several of the others, and several changes often take place simultaneously.

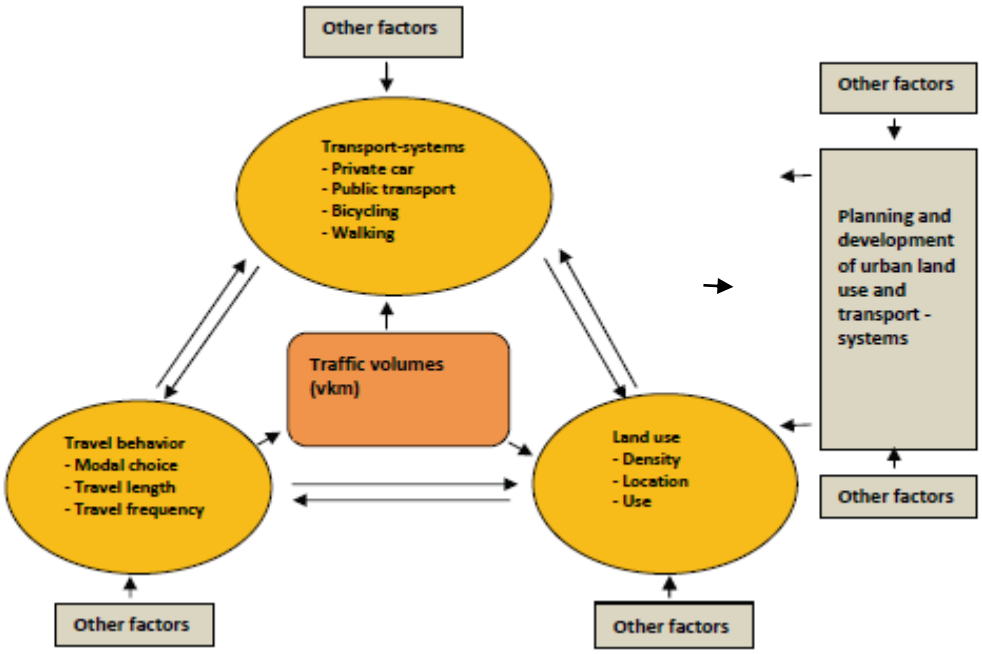

Figure 2: Model of how developments in land-use, transport systems, travel behaviour and traffic volumes are causally interrelated, and how the planning and development of land-use and transport systems interact with this overall system (figure based on Tennøy, 2012).

Changes occurring in this system are both changes in land use and transport systems consciously imposed through physical planning and development, changes occurring as people using the structures react to changes and changes resulting from factors exogenous to the model. This could be changes in economy, workforce participation, individuals' needs and preferences. Land-use and transport planning affect how land-use and transport systems are developed, while the actual functioning of the city and our knowledge of it affect planning and decision-making (or is supposed to). These different forms of changes are interrelated, since they belong in different but intersecting systems. It could therefore be described as a *complex system* (Byrne, 2003). Changes in land-use or transport systems affecting traffic volumes are normally a result of the activation of multiple mechanisms. The main mechanisms have been theoretically explained and empirically examined for decades, and the findings can briefly be described as follows.

3.1 Effects of land-use developments on traffic volumes

Overall density of a city affects traffic volumes, since average travel lengths are shorter in a dense city than in a sprawled city, thus the increasing the possibility that travels will be short enough to be done on foot or by bicycle and that car trips will be short. A dense city provides a population base for a more fine-meshed net of public transport lines with more frequent departures than in a sprawled city, thus reducing walking distances to and from public transport stops, as well as waiting times. The conditions for car use will often be worse in a dense city, with less room for parking and roads, lower speed limits, more pedestrians and cyclists in the streets, etc. The effects of overall density on traffic volumes have been documented in a number of studies. For instance, Newman and Kenworthy (1989; 1999) found strong relations between densities of urban areas and fuel consumption for transport per capita in their comparison of mega-cities worldwide. Næss, Sandberg and Røe (1996) found the same tendency when studying 22 Nordic towns.

Location within the urban structure affects accessibility to various activities by defining proximity and the available choice of modes. Housing, workplace, retail services, etc., are more accessible by modes other than car the closer to the city centre they are located, hence generating less car traffic, as confirmed in numerous empirical studies (Hartoft-Nielsen, 2001a; 2001b; Strømmen, 2001; Næss, 2005; 2006a; 2012). Activities located in city centres are for instance normally more accessible by public transport from all parts of the region, and on foot or by bicycle for a higher proportion of the population, than if located in other parts of the city. Consequently, highly specialized workplaces, retail and services drawing customers and employees from a larger region tend to generate less traffic if located in city centres (Hartoft-Nielsen, 2001b; Næss, Sandberg and Røe, 1996; Strømmen, 2001; Tennøy et al., 2014). Daily services such as grocery stores, kindergartens and hairdressers normally draw employees, users and customers mainly from their local surroundings, and generate less traffic if dispersed to local centres close to their users. When surveying studies carried out in Nordic countries about the influence of urban form on travel behaviour, and discussing the results in view of the international literature, Næss (2012: 21) found that, "*there is quite overwhelming evidence that urban spatial structures matter to travel behaviour*". Hence, the spatial structure of an urban region affects transport demand and traffic volumes in the region. This is also the case when accounting for socio-economic and demographic factors (Bhat and Guo, 2007; Brownstone and Golob, 2009).

Other authors claim that neighbourhood-scale variables such as land-use mix, connectivity and layout of local streets have major effects on travel behaviour and car-use (for overviews showing the commonality of this focus, see Boarnet and Crane, 2001; Cao et al., 2009; Ewing and Cervero, 2010). It could be argued that such variables are strongly related to centrality of the neighbourhoods (for instance, are grid patterns normally found in central parts of a city and cul-de-sac patterns in less central parts of the city), and that measured effects are due to centrality rather than to local variables (Næss, 2011b). This is not an important issue here, however, since this paper deals with the effects of overall land-use and transport systems development.

3.2 Effects of transport systems development on traffic volumes

The absolute and relative qualities of systems for different transport modes affect the possibilities and preferences for modal choices and choices of destinations (travel length), and thus traffic volumes. If travel is fast, comfortable and cheap, one would expect trips to be more frequent and, on average, longer than if expensive, uncomfortable and time-consuming. If travelling on public transport, on bicycle or on foot becomes relatively better (faster, cheaper, more comfortable, safer) than travelling by private car, this would influence the modal choice and contribute to reduced traffic volumes. The opposite effect

would be expected if travel by car became relatively faster, cheaper, and so on (Banister, 2005). Based on a review of numerous studies worldwide, Kenworthy (2003) concluded that qualities of public transport services and facilitation for private car-use (urban freeways, levels of parking) strongly influence travel behaviour and energy use of transport in cities. Several studies have demonstrated that increased urban road capacity in itself contributes to increased car-use and traffic volumes (Downs, 1962; Goodwin, 1996; Mogridge, 1997; Noland and Lem, 2002; SACTRA, 1994). Cairns et al. (1998) found that reduced road capacity resulted in reduced car-use and road traffic on specific roads, as well as in the area as a whole.

How transport systems are developed affects land-use. Transport infrastructure and traffic take up space, and hence contribute to sprawl. New road capacity reduces congestion and the relative travel time by car, at least in the short-term perspective. This allows households, businesses and workplaces to locate in ways contributing to more sprawl and car-dependence, thereby contributing to increased traffic volumes (Cervero, 2003; Johnston and Ceerla, 1996). If land-use developments occur as sprawl, new transport infrastructure and services are needed to serve new areas. If new developments require new public transport lines and the budgets for public transport services are not increased, this implies a weakening of public transport services at other places in the urban structure and contributes to an overall increase in traffic volumes. Finally, increased traffic volumes in inner and central parts of the city may reduce the attractiveness of these areas, sprawling developments and activities outwards in a transport-demanding pattern.

3.3 Multiple mechanisms

Consequently, multiple mechanisms are involved when land-use and transport systems development affect traffic volumes. These mechanisms may reinforce each other, counteract each other or not affect each other. This means that even if traffic-reducing measures and strategies are implemented, such as improving public transport services, increased traffic volumes may still be experienced if other simultaneously working mechanisms (such as urban sprawl) contributing to traffic growth outweigh this effect, so that the observable effect is traffic growth. This does not mean that the improved quality of public transport services did not contribute to reduce traffic volumes, but rather that other simultaneously occurring changes triggered other mechanisms, thus contributing to increases in traffic volumes that were greater.

3.4 Recommendations

Based on the above-mentioned and a number of similar studies, there seems to be relatively widespread agreement in the scientific literature on how land-use and transport systems ought to be developed if urban road traffic volumes are to be reduced (Downs, 1962; Banister, 2011;2012; EEA, 2013; Hull, 2011; Kenworthy, 1990; Newman and Kenworthy, 1989; 1999; Næss, 2006a; 2012; Owens, 1986; Strømmen, 2001; Tennøy, 2012). This can be summarized and simplified as to implement the following strategies, preferably in concert:

- Developing land-use as urban densification close to city centres, as ‘car-independent’ location of new activities, and with daily services within walking distance of residential areas (density, centrality, accessibility)
- Improving public transport services (frequency, coverage, speed, comfort, prices) and conditions for walking and cycling (infrastructure, maintenance, land-use)
- Imposing physical and fiscal restrictions on road traffic (road tolls, road capacity reductions, reduced access to parking or increased parking prices)

Numerous policy and planning documents recommend similar strategies (e.g. Norwegian Ministry of Transport and Communications, 2013; Norwegian Ministry of the Environment, 2012; Municipality of Trondheim, 2008; UN Habitat, 2009; 2013).

3.5 Planning methods

The literature is less than helpful when turning to the *methods* planners use while producing traffic-reducing plans, and when assessing whether a concrete plan will contribute to increased or decreased traffic volumes. Because of the multi-causality and complexity of this system, it is difficult to predict accurately and quantitatively what will happen when certain changes in land-use or transport systems are implemented within a system (Næss, 2004; Næss and Strand, 2012; Tennøy, 2012). What actually happens will be context-dependent (affected by other mechanisms), and the future context cannot fully be known or controlled. This poses challenges for planning practitioners using the knowledge described above when attempting to make plans contributing to reduce traffic volumes. They need to analyse the context and the alternatives for developments in order to arrive at recommendations (plans) for developments contributing to goal achievement. The main task is to analyse which conditions need to be in place in order to trigger certain mechanisms that contribute to the reduction of traffic volumes, while at the same time *not* triggering mechanisms contributing to *increase* traffic volumes. This means that they aim to facilitate for the triggering certain combinations of mechanisms by affecting relevant and impressionable factors of the context. This is often termed *coordinated strategies*. The planners will then (or are supposed to) analyse whether the strategies will actually produce the sought-after effects. This is required by the planning legislation in many countries, as environmental impact assessments (EIA) and strategic impact assessments (SEA).

Describing methods leading to such coordinated strategies is not easy. Tennøy (2012) found that rarely could the planners she interviewed explain which methods they used when making plans and conducting analyses, nor could they refer to any written descriptions of their methods (transport model analyses and the like were not understood as methods for planning analyses). It therefore seems that method knowledge is tacit knowledge learned through education and experience. Furthermore, Tennøy (*ibid.*) found that these methods are barely described in the planning literature, leading her to the conclusion that the planning community has yet to come up with defined and systematic descriptions of methods for analysing the complex problems and contexts described here. This is problematic, among other reasons, because: planners are not provided with good tools; the situation hampers the planning community's ability to examine methods critically; it contributes to less useful methods being used; and it makes the planners' methods and analyses less transparent. Taken together, it reduces the methods' usability, use and validity. Næss and Strand's (2012) discussions of what they term 'soft prediction', and Tennøy's (2012) discussions of what she terms 'professional reasoning', could be understood as ways of describing methods for planning analysis.

We use this brief description of state-of-the-art expert knowledge for land-use and transport planning for reduced traffic volumes when analysing the goal achievement potentials of the plans in the case studies.

4. Theoretical framework – use and influence of expert knowledge in planning

In developing the theoretical framework for structuring, analysing and interpreting the case studies, we combine structural and causal analyses with literature studies. We searched for insights concerning mechanisms through which expert knowledge is introduced in planning processes, how planners use this knowledge when making plans, and how their use of it

affects the contents of plans. This included mechanisms through which counteracting measures are included.

4.1 Mechanisms through which expert knowledge may be introduced in planning processes

The first set of mechanisms concerns how expert knowledge may be introduced to planning processes. Krizek et al. (2009) discuss planners' use of what they term 'research-generated evidence' in planning practice. Their discussions revolve around practitioners' *direct use* of research-generated knowledge, without going into detail on how this could happen. One might reason that it involves planners searching for relevant literature when facing a planning problem and using this knowledge to better understand the problem, finding useful alternatives or assessing the consequences of proposed plans or projects. Another way could be to invite relevant researchers to contribute with their research findings and their research-based knowledge in planning processes. Krizek et al. (*ibid*) conclude that planning practice is minimally affected by research, and they find this to be problematic. This is in line with Tennøy's (2012) findings in interviews, where very few planners could list any references to written sources for the knowledge they used when making plans.

Krizek et al. (2009: 474) find that planners instead *"practice what they learnt at school, what their predecessors practiced, or replicate what are considered to be best practices".* Planners learn through their own experiences, through cooperation and discussions with other planners, through evaluations and best practice descriptions of plans and projects, and from listening to particularly knowledgeable and respected planners. Planners also read good practice guides, planning guidelines and research summaries. This could be understood as planners forming a *community of practice* (Wenger, 1998), where persons within a domain of knowledge form a social fabric of learning through their shared practices.

Owens et al. (2006) argue that rather than limiting the discussions to short term and instrumental use of research-based knowledge or 'direct hits', more nuanced and sophisticated understandings of knowledge-transfer to policy should be developed. They refer to Radaelli's (1995) understanding of knowledge transfer as 'knowledge creep', *"whereby research gradually infiltrates policy",* and to Weiss's (1977; 1979) understanding of 'enlightenment', *"involving slow changes in vocabulary and mindset"* (Owens et al., 2006: 640). This concerns the shaping of ideas about which means can contribute to achieving certain objectives, and – perhaps more importantly – the shaping of what is understood as problems and challenges. Owens et al. (ibid.) find *that, "it is perhaps most helpful to think in terms of a continuum of influence and utility, ranging from clear and immediate impacts to long-term subtle processes in which problem definitions and modes of thinking change"*. They conclude that when studying use of research-based knowledge in policy-making, we need to be conscious of the many mechanisms of knowledge transfer from research to practice, although Owens et al. do not specifically describe them.

This could happen through *knowledge diffusion* (Ibert, 2007; Shipan and Volden, 2008), where knowledge spreads among people in different ways. Based on our own experiences as planners and researchers, relevant mechanisms for knowledge diffusion can be deduced within planning practice. Planners and the planning community could gradually learn from research and knowledge development through the education of planning students, at conferences, in commissioned works acquired from research institutions and specialized consultants, or from readings of popular science or scientific articles. When new knowledge, ideas and framings diffuse to forerunners among practitioners, they may be reflected in overall planning documents such as municipal plans and in government white papers and guidelines. Following from this, the new knowledge may be used in operational plans and concrete projects, and in the evaluations of implemented projects. The wider planning

community may learn from this, contributing to more planners bringing such knowledge into planning discussions and processes. Adopted plans, implemented projects and evaluations often constitute stronger references and arguments than research articles for planning practitioners, and not least for political decision-makers. In this way, the expert knowledge could diffuse to the planning community, and affect how planners *frame* objectives, problems, alternatives and relevant consequences (Schön, 1983; Tennøy, 2010). Eventually, the knowledge becomes *embedded in planners*, who bring it into planning processes through the ways they act, explain and argue. Over time, this can spread to the wider community. Forerunner politicians, NGOs and others may pick up new research and expert knowledge and bring it into planning processes.

Based on these discussions, seven partially overlapping mechanisms through which the expert knowledge in question could be introduced in the planning process are the following. The *first* concerns planners searching for expert knowledge in scientific papers and research syntheses and bringing it to the planning process. The *second* is researchers or consultants bringing the expert knowledge into the planning process. The *third* is planners learning from other planners through discussion, previous plans, what has been done elsewhere, popular science journals, and attending conferences. The *fourth* mechanism is knowledge creep and enlightenment, where the framing of problems, objectives, alternatives, etc., change over time due to the influence of expert knowledge through fine-grained and iterative processes. What planners 'learn at school' could be included here. The *fifth* is planners learning from government white papers, planning guidelines, etc. The *sixth* is the knowledge embedded in knowledgeable planners taking part in the process. The *seventh* is politicians, NGOs and others bringing such knowledge into the planning process. The case studies critically examine whether these and other mechanisms are important in introducing expert knowledge to the examined plan-making processes.

4.2 Mechanisms through which use of the expert knowledge may contribute to coordination and to inclusion of traffic-reducing measures

We now turn to mechanisms through which expert knowledge may be applied in planning processes in ways contributing to coordination of land-use and transport planning, as well as to inclusion of strategies, measures and projects that contribute to a reduction in traffic volumes (discussed in section 3). When searching the literature for descriptions and discussions of how expert knowledge is used or is supposed to be used by practitioners in concrete plan-making in ways influencing the contents of the plans, findings are scarce.

The institutional and organizational settings of a planning process define the rules of the game. This regards which procedures to follow, as well as the roles, powers and duties of the numerous and different actors involved. Within these frames, Tennøy (2012) found that the objectives, knowledge and powers of the planning practitioners involved in a plan-making process (working for various private and public employers) affect how the planners can and do act and interact, and hence how the various tasks in the plan-making process are carried out (as illustrated in Figure 3). These are fine-grained and complex processes in which the different actors pursue their objectives and concerns and use expert knowledge and other kinds of knowledge in a constant power struggle. What become the prominent objectives and what knowledge becomes more influential are shaped in these processes (Flyvbjerg, 2004; Hajer, 1995 and Richardson, 2005). This eventually defines the contents of the resulting plans.

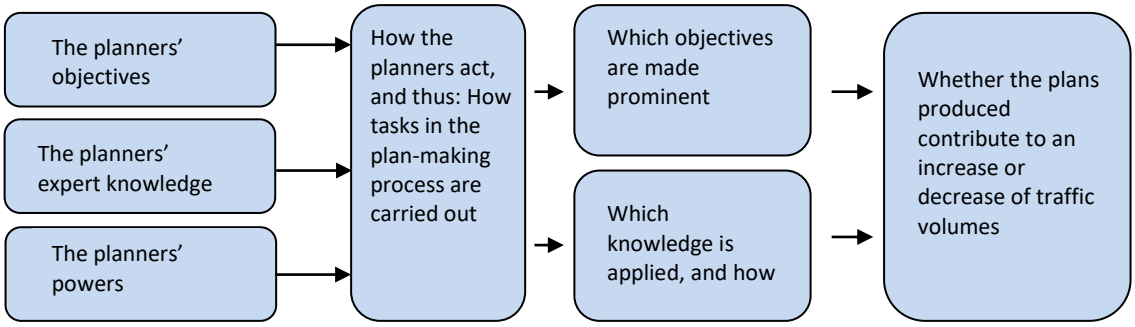

Figure 3: The objectives, knowledge and powers of the actors define how they act and interact in planning processes, and hence which objectives and knowledge become prominent, and eventually the contents of the plans (figure based on Tennøy, 2012).

These struggles take place in the various tasks carried out as parts of a planning process. Through the shifting discussions regarding planning, those that seem to *define* planning and to be unavoidable in a practice defined as planning (Friedmann, 1987; Banfield, 1959) may be listed as:

- Situation analysis and problem definition
- Formulation of goals and objectives
- Identification and design of alternatives
- Identification, prediction and assessment of impacts and consequences of each alternative (impact assessments)
- Comparison of alternatives with respect to consequences in relation to desired objectives and other values
- Making planning proposals and recommendations

Planning processes will not normally follow a direct course of action from situation analysis to recommendations. Rather, they are iterative and deliberative processes, more to be understood as continuous discussions regarding where we want to go, and how to get there.

The question is then how planners can and do use expert knowledge when carrying out these tasks, and how their use of this knowledge can lead to coordination of land-use and transport planning and to selection of traffic-reducing measures and strategies. Rein and Schön (1993) explain how practitioners' professional knowledge is the main basis for their knowing and acting. It provides them with the tools and understandings guiding (translated by us to planning practice): the issues they focus on when describing the situation; how they formulate problems; the alternatives they consider; the measures they include in alternatives; the methods they choose for analysis; how they carry out the analyses; how they interpret and respond to results; how they compare alternatives; and how they select the measures and combinations of measures they include in a planning proposal. This means that the kinds of knowledge planners possess, together with the objectives they give priority to, strongly affects the kind of plans they can and do make. For instance, a traditional transport planner struggling with a congestion problem would probably arrive at increasing road capacity as a measure for solving the problem. A land-use and transport planner possessing the expert knowledge in question would know that this would only solve the problem in the short term. Instead, she would seek ways of reducing traffic loads and hence congestion through improving public transport services, regulating parking access, developing local centres, steering new land-use developments to central areas, etc. An important mechanism through which the expert knowledge in question comes to be used, and contributes to coordination of land-use and transport developments and inclusion of

traffic-reducing strategies, may therefore be as constituting *a basis for knowing and acting* that allows for coordinating land-use and transport planning, and for selecting traffic-reducing measures.

A second mechanism may be that planners turn to research-based sources or to knowledgeable individuals for the knowledge they need to solve specific planning problems, *and use this to understand cause–effect relations better or to find new ways of solving planning problems*. Moreover, they can *use empirical knowledge in their analyses* of effects of a certain measure in a certain type of context, and they can *seek advice about which methods are suitable for certain analyses*. In order to make other planners, politicians and others understand and accept their knowledge claims, planners need to be able to present rational explanations for how and why certain measures and strategies are likely to contribute to the achievement of certain goals, while others are not (see Rydin (2007: 58) for elaborate reflections on rationality). A *third* mechanism could hence be that planners use theoretical explanations from the expert knowledge in question when *presenting rational and trustworthy knowledge claims* concerning why coordination of land-use and transport systems development, as well as selection of certain measures rather than others, are ways towards achieving defined objectives. *Fourth*, planners may use theoretical or empirical expert knowledge as *convincing arguments* in discussions and struggles in planning processes. *Fifth*, planners can also refer to the body of knowledge as *references*, preferably in the form of written documents accepted as trustworthy and valid by decision-makers. This could demonstrate that their understandings, analyses and judgments are anchored in a larger knowledge base and add to the legitimacy of their knowledge claims, thus strengthening the impact of their arguments. These mechanisms, or ways of using expert knowledge in planning, partly overlap. The case studies critically examine whether these are relevant mechanisms through which planners use the expert knowledge in ways contributing to coordination of land-use and transport planning, and to inclusion of traffic-reducing measures.

4.3 Mechanisms through which counteracting measures may be included in plans

It is interesting to investigate how and why counteracting measures and strategies with respect to this objective are included in plans, especially in cases where reduced (growth in) traffic volumes is explicitly stated as an objective. The primary focus in our discussions is whether and how planners use expert knowledge when making plans, and how this affects the contents of plans. However, as previously discussed, planners do not make plans in a vacuum, far from it: property developers and political decision-makers, for example, influence planning and the contents of plans in several ways. When investigating mechanisms through which counteracting measures are included in plans aiming at reducing traffic volumes, the interplay between planning practitioners and other actors needs to be considered. Through theoretical and empirical investigations, Tennøy (2012) identified five overall mechanisms through which planners arrive at traffic-increasing rather than traffic-reducing plans*: i)* objectives concerning reduction of traffic volumes are not introduced in the planning process, or *ii)* they are ousted by other objectives. Furthermore, *iii)* relevant expert knowledge is not introduced to, *iv)* or is ousted from the plan-making process, or *v)* it is applied wrongly. These mechanisms are interrelated in several ways (see also discussions in section 4.2 and Figure 3).

If reducing traffic volumes is *not introduced as a prominent objective* in a planning process, traffic-increasing measures may be included in order to achieve other goals, and without consideration as to whether this contributes to increase traffic volumes. If, as in all three cases studied here, reducing (growth in) traffic volumes is stated as a prominent objective, this *objective could anyhow be ousted by other objectives* understood as more important,

and which require inclusion of traffic-increasing measures. This could happen for instance if political decision-makers signal that implementation or non-implementation of certain measures is politically unacceptable, and planners obey these signals (see, e.g., Flyvbjerg, 1998 or Healey, 2009 for interesting discussions). In such cases, planners could meet political signals by presenting knowledge-based analyses and arguments explaining why these measures are counter-productive in relation to prominent political goals, or they may ask researchers to present research-based knowledge concerning the issue. If *planners or others do not present knowledge, analyses or arguments explaining the counteracting effects*, politicians may not be aware of this. Politicians may be unwilling to listen to such knowledge or arguments (Flyvbjerg, 1998; Sager and Ravlum, 2005). Owens et al. (2006) point to problems related to communication and timeliness. Among other things, this means that policy (and hence sometimes planning practitioners) demands uncomplicated messages, which research often neither would nor could offer. It may also be a problem that research lags behind actual problems, and hence cannot provide good answers to policy problems. Often, research is instead "*uncomfortably ahead of contemporary policy agendas*" (Owens et al., 2006: 637). In such cases, knowledge can be understood as threatening if it calls for strategies and measures that do not support the dominant policy agendas.

Properties of the planners may mean that they are unwilling or unable to explain how and why certain strategies or measures are counter-productive. If planners are to speak up to decisions-makers about counter-productive measures, their understanding of their role must allow them to do so. This is not always the case. As explained by Lukes' (2005) third dimension of power, it could be that planners obey the decision-makers because they understand this as 'their role in the existing order of things'. Furthermore, if they are to speak up, the planners would need to be knowledgeable with respect to the issues in question, which is not necessarily the case. There are variations as to how skilful and experienced planners are within different issues of planning. If it is assumed that specialized, skilful, knowledgeable and experienced planners are better at making plans with high goal achievement potentials than other planners (Dreyfus and Dreyfus, 1986; Flyvbjerg, 2001), a lack of skilfulness or knowledge among the planners involved could be an explanation when measures and strategies counteracting the goal achievement potential are included in the plans.

There has been – at least in part – a paradigm shift in this field over the past few decades (Owens, 1995), and planning is a multi-disciplinary profession. Planners are educated within various disciplines (for instance, land-use planning and transportation planning) and at different times. They may therefore have various degrees of insight and different understandings of how land-use and transport system developments affect travel behaviour and traffic volumes. Tennøy (2012) found in her empirical studies that most planners deeply involved in the planning processes she studied *knew of* the expert knowledge in question. Nonetheless, few knew and understood it well enough to be able to make traffic-reducing plans in complex contexts such as cities, to assess the traffic-generating potential of proposed plans, or to present convincing arguments based on such knowledge in tough discussions. Shortcomings in planners' competencies may also include that they rely on outdated knowledge or undocumented 'planning myths', as discussed by Næss et al. (2013). Here, 'planning myths' refers to undocumented ideas and beliefs concerning cause–effect relations that are not in accordance with state-of-the-art scientific knowledge. Myths and outdated knowledge could be parts of the planners' framing of objectives, alternatives, assessments, etc. Hence, properties of the planners may cause that they are not aware of or disagree that these are counter-productive strategies, measures and projects. For a variety of reasons, planners may also favour traffic-increasing strategies and measures.

Other explanations could be related to *characteristics of the knowledge itself*. Krizek et al. (2009) found that one inhibitor preventing the use of research-based evidence in planning practice is that the evidence is poor within some topics. They also found that planners often lack the resources to seek out and critically read research findings, and to translate and introduce it in the concrete context. Good research summaries could help overcome this problem, but they claim that research summaries are often unavailable. Tennøy (2012) found that expert knowledge needs to represent reality relatively correctly, be scientifically sound and usable if it is to be used in and influence plan-making. She found that the expert knowledge in question mostly meets these criteria, but has certain shortcomings. These are mainly a lack of accessible, usable and referable (for planning practice) descriptions of theoretical understandings of 'how the system works', which is underpinned by relevant empirical knowledge. Furthermore, the effects of some cause–effect relations are not well documented, and the strengths of some effects are barely studied empirically in certain contexts (such as smaller cities), or in combination. Additionally, she found that the planners' main method of analysis, which she termed 'professional reasoning', is described inadequately and hence probably poorly evaluated and developed (as discussed in section 3).

Taken together, this could cause that planners do not possess or understand the expert knowledge in question, and hence that they *do not introduce it in planning processes*. If introduced, *the expert knowledge may anyhow be ousted by other knowledge*. More inclusion of lay knowledge may increase the difficulties of distinguishing what is valid knowledge from less substantiated knowledge claims (Rydin, 2007). Another imaginable explanation could be that planners involved relate to *other research-based knowledge*, concluding that the assumed traffic-increasing measures and strategies (as described in section 3) would not have such an effect. We do not know of any actual examples of such relevant competing and contradicting research-based knowledge. If it were presented, it would call for a rewriting or updating of current state-of-the-art knowledge.

Furthermore, *expert knowledge may be wrongly applied,* consciously or otherwise. Wachs (1989; 1990) and Flyvbjerg et al. (2002) disclosed how planners may be *'lying with numbers'.* Research may be used selectively and strategically, and unwelcome findings may be downplayed or excluded (Krizek et al., 2009; Owens, 2005; Næss, 2011a; Tennøy, 2012), or it may be used symbolically to legitimise and sustain predetermined positions (Amara et al., 2004). Another concern is that issues can be framed in ways that reduce complexity and lead to "*simple, but potentially misleading, policy prescriptions as result*" (Owens et al., 2006: 637).

All the above-listed issues are considered here as mechanisms through which strategies, measures and projects contributing to reducing their goal achievement potential may be included in plans. We have investigated how this acts out in three concrete cases.

5. Analyses of three case studies

In this section, we present and analyse our studies of strategic planning processes in Trondheim (Norway), Lund (Sweden) and Aarhus (Denmark). We critically analyse the mechanisms defined in section 4 in the concrete contexts of the cases, and answer the four sub-questions defined in section 1 for each case. This allows us to develop context-related explanations. We also carry out cross-case analyses to distinguish important structures, causal powers and mechanisms across cases, in this way arriving at more general explanations of the phenomena we study, and use this to expand the theoretical understandings of these phenomena.

5.1 Trondheim Environmental Package for Transport, Norway

5.1.1 Introducing the Trondheim case

The Trondheim case concerns the planning processes leading to the land-use and transport systems development package *Trondheim Environmental Package for Transport*[ii] (referred to below as the Trondheim Package). Trondheim is the third largest municipality in Norway with 180,000 inhabitants (the fourth largest city if defined as an 'urban settlement'), and is experiencing population growth. It is the main city in the region, and the home of the Norwegian University of Science and Technology (22,000 students, 5,000 employees).

The analyses are based on document studies and interviews with eight planners, the majority of whom are highly skilled and have a long and broad experience in urban planning as practitioners and consultants; some as university researchers and lecturers. They had major roles in the Trondheim Package or in planning processes underpinning it. At the time of the interviews, three planners worked for the municipal planning authorities, two for the Norwegian Public Roads Administration (NPRA), one for the County Governor's office, one for the County Administration, and one for the Public Transport Administration.

The main documents examined were: the political document *Trondheim Environmental Package for Transport* (MoT, 2008a); a working paper assessing the expected effects of suggested measures in the package presented by the Chief Municipal Executive to the Municipal Climate Committee (MoT, 2008b); the municipal *Transport Plan for Trondheim 2006–2015* (MoT, 2007a); and the overall *Municipal Land Use Plan 2006–2018* (MoT, 2007b). These are interrelated and refer to each other, and they are to a high degree produced in a cooperation of several of the same planners. They are overall and strategic plans influencing land-use and transport systems developments in Trondheim. We also read a number of other documents as background material.

Trondheim experienced steady traffic growth in the years before the Trondheim Package discussions started, a total of 12 percent between 2002 and 2006 according to Jean-Hansen et al. (2009). Owing to population growth and people changing from other modes to car, traffic growth was expected to continue, causing with increasing CO_2 emissions, local environmental problems and congestions (MoT, 2007a; 2008a). The toll cordon, which had financed transport system developments for 15 years, was closed down at the end of 2005. The National transport plan discussions signalled that Trondheim would be granted virtually no funding for transport infrastructure. Hence, the municipal transport plan presented a future situation characterized by increasing traffic volumes, environmental problems, congestion and inadequate tools by which to improve the situation (MoT, 2007a). Strong governmental signals concerning the need to curb CO_2 emissions from road traffic intensified the local focus on the issue.

In dealing with the situation, the City Council of Trondheim initiated and adopted the Trondheim Package in 2008 (MoT, 2008a). This is a strategic, coordinated land-use and transport plan. The first of its 10 main goals is to reduce CO_2 emissions from transport by at least 20 percent before 2018. The second objective is to reduce travel by private car from 58 percent of all trips in 2008 to 50 percent in 2018. The share of trips made using public transport on foot or bicycle should increase from 42 percent to 50 percent. The 20 percent CO_2 emission reduction target is to be achieved through reduced traffic volumes (reducing CO_2 emission by 12 percent) and a transition to less polluting engines, fuels, etc. (reducing CO_2 emission by 8 percent). The remaining eight objectives concern concrete measures towards achieving the main objectives (such as increasing average speed for public transport) and local environmental objectives (reducing the number of people exposed to noise above certain levels).

The planners explained that the Trondheim Package was a truly political initiative. Several political parties discussed various initiatives, and the Trondheim Labour Party presented a proposal at their 2008 annual meeting. This developed into the Trondheim Package through a political process, and was adopted with the support of six political parties a few months later. The politicians put together the package, but in strong interaction with the planning authorities. All strategies and measures included in the package were already analysed in previous planning processes, most recently in the municipal transport plan (MoT, 2007a). These plans and analyses were produced in collaboration among several planners working for different actors in more or less open planning processes, and adopted by the relevant political bodies. The strong political involvement, and the fact that several political parties supported the package, ensured a stronger political anchoring than for most packages of this type. According to planners interviewed, the measures and strategies selected for inclusion in the Trondheim Package were therefore a result of compromises among different political priorities. What was politically acceptable was an important determinant for what was included in the package, but the more expert-driven plans and analyses made up the menu from which the politicians selected the measures and projects they included.

5.1.2 The goal achievement potential of the Trondheim Package

The Trondheim Package includes several measures that, according to state-of-the-art knowledge (as presented in section 3), will contribute to reducing traffic volumes. This includes: completing a comprehensive bicycle network; reducing parking access; improving frequencies, speed and coverage of the public transport system; traffic regulations and traffic capacity reductions in the city centre; and reintroduction of the toll cordon[iii]. The toll cordon is the main source of income financing other measures. The package includes major road expansion projects, and more than 50 percent of the funding will be used for road construction (MoT, 2008a). Furthermore, there is a densification strategy for land-use development, where 80 percent of new residences are to be located within the existing urban area demarcations and 60 percent of new labour-intensive workplaces in close proximity to the main public transport corridor. This is probably a much stronger densification strategy than in many other cities. However, the strategy allows 20 percent of new housing to be built on new land outside the urban demarcation area, and 40 percent of workplace and visitor-intensive workplaces built in areas not well covered by public transport, and with few people living within walking and cycling distance. This means that substantial parts of new developments may take place in mainly car-based locations, thereby contributing to increasing traffic volumes and reducing the goal achievement potential of the package. This was pointed out by local planners in interviews. Our assessments are summarized in Table 1.

Table 1: Measures included in the Trondheim Package and our assessments of whether they contribute to or counteract the goal achievement potential of the plan (focusing on reducing traffic volumes and GHG emissions from transport).

Element included in the plan	How it affects goal achievement potential
Reintroducing toll cordon	Contributes to *reducing* traffic volumes
Improving bicycle infrastructure and the winter maintenance for cycling	Contributes to *reducing* traffic volumes
Substantially improving public transport services, reducing prices	Contributes to *reducing* traffic volumes
Reducing parking access and increasing parking fees in the city centre	Contributes to *reducing* traffic volumes
Land-use densification strategy, but 20 percent of new dwellings allowed to be located on new land and 40	In total contributes to *increasing* traffic volumes

percent of new workplace-intensive workplaces are allowed to be located with low public transport access	
Substantially increasing urban road capacity	Allows and contributes to *increasing* traffic volumes

Since 2008, public transport services have substantially improved and the bicycle network has been extended. The toll cordon was reintroduced in 2010. According to state-of-the-art knowledge, as discussed in section 3, this should contribute to reducing traffic volumes. From the homepages of the Trondheim Package, we learn that this has indeed occurred. The number of public transport passengers increased by 23 percent from 2010 to 2012, while the number of car trips decreased by an impressive 10 percent (some uncertainties) (MoT et al., 2013). So far, the road projects have not been implemented.

5.1.3 Mechanisms through which the expert knowledge was introduced

Planning documents and interviews with planners clearly demonstrate that several sources of knowledge were used by planners when compiling the Trondheim Package and the underlying plans and analyses. They refer to governmental documents, previous municipal plans and other plans relevant to the issues discussed. They also refer to numerous sources in describing the context as current states, trends and challenges: travel surveys, national statistics and indicators, various registers, mapping of specific issues, as well as other plans and policy documents at governmental, municipal and project levels. Most of the planners interviewed demonstrated comprehensive knowledge regarding their city – its history, planning history, state, developments, physical layout, challenges, etc. – even though they were often unable to pinpoint the sources for this knowledge. Several planners also demonstrated their knowledge of what was politically acceptable in the specific context. The main sources for this knowledge were policy documents, public statements and politicians' actions in previous cases, as well as direct exchanges between planners and politicians.

When asked how the expert knowledge in question was introduced in the planning processes, the planners explained that *people* were knowledge carriers. They referred to the competencies and work of the other named planners involved. When asked, for instance, how public transport knowledge was brought into the Trondheim Package discussions, three local planners were mentioned, while a public transport analysis by external experts in the previous year was not. In order to attain the necessary competence in concrete planning processes, they ensured that persons with complementary knowledge are included. It therefore seems that a main mechanism through which the expert knowledge in question is brought into the planning processes is as *embedded in the planners involved*.

Planning documents, as well as interviewees, make frequent reference to other and previous plans for the Trondheim area. The planners explained that they use experience-based knowledge obtained through working with various projects and individuals over time. This indicates that *learning from other planners* is an important mechanism.

There are clear indications that a *knowledge creep* has taken place in Trondheim. This is confirmed by planners saying that some central politicians also relate to the expert knowledge in question. The planners explained that a road link planned with six lanes 10 to 20 years previously had now actually been built, but with two lanes. The reduced capacity was due to some planners arguing for years as to why this was altogether better, and to a gradual mutual understanding (*enlightenment*) of this among planners and politicians. Our understanding that knowledge creep has taken place is not compromised by the fact that

some planners clearly indicated that they did not possess or relate to the expert knowledge in question.

There are few references to *readings of scientific works* in documents or interviews. One interviewee explained that they rarely turn to academic or scientific literature. Instead, they refer to strategies and objectives in government, county and municipal policy documents, since these are stronger references in dialogue with politicians. Several documents and planners referred to two locally well-known scientific studies with Trondheim as case area (Meland, 2002; Strømmen, 2001). The assessment of the Trondheim Package compiled for the Climate Committee (MoT, 2008b) referred to a few more and less scientific works and research syntheses. Hence, readings of scientific literature seem to be one mechanism by which expert knowledge is brought into the plan-making processes, though not an important one.

5.1.4 Mechanisms through which use of expert knowledge contributed to coordination and inclusion of traffic-reducing measures

The planning documents defining and analysing the Trondheim Package, along with the underlying planning documents and analyses, are steeped in the expert knowledge in question. There are references to land-use developments, developments of different parts of the transport system, city centre development, parking, etc., in all the examined documents, and the necessity of seeing these elements as integrated parts of urban development is highlighted. There are, however, few references to specific sources. The reference practice is generally poor.

When we asked five of the planners about which factors they saw as most important for changes of modal splits and traffic volumes in Trondheim, all mentioned land-use as well as development of various parts of the transport system, and explained how these are interrelated. The political document describing the Trondheim Package lists the strategies and measures included, and states simply that they will have traffic-reducing effects (MoT, 2008a). All other examined documents discuss (to varying degrees) *how* the different elements affect: each other, accessibility, traffic volumes, the environment, living conditions in the city and other relevant outcome categories. These findings clearly indicate that the expert knowledge in question was *the main basis for planners' knowing and acting* when producing the Trondheim Package. This contributed to founding the understanding that coordinated efforts were necessary, as well as which measures had to be included, if the goal achievement potential of the package was to be improved with respect to reduced traffic volumes.

Knowledge claims deriving from the expert knowledge in question are used *for explaining interrelations* between land-use, transport system developments and traffic volumes in plans and analyses. For instance, the introduction to the chapter on public transport in the Municipal Transport Plan states: *"A competitive public transport system is decisive for a denser and less resource demanding urban structure to work"* (MoT, 2007a: 22). A model explains how improved public transport services contribute to reducing car-use through several mechanisms. The analyses are conducted as simplified 'professional reasoning', with the expert knowledge in question used to explain how and why, for instance, parking restrictions and densification are important strategies for keeping traffic volumes down (MoT, 2007a).

In the working document prepared for the municipality's climate committee (MoT, 2008b), which we understand as the impact assessment of the Trondheim Package, the planner writing it quantified the effects of the measures and strategies included in order to arrive at quantitative answers as to whether the package would ensure that the defined goals were

achieved. For this, he explained, he *turned to the expert knowledge for help.* He looked up research summaries concerning, for example, average elasticities,[iv] for changes in price, frequency, speed, etc. of public transport on passenger growth (references to Norheim and Ruud, 2007) and for effects of the toll cordon on road traffic. Based on such data, he made rough estimates of the expected reduction in car driver trips per year. The document emphasizes that these are rough estimates. The calculations showed that the measures and strategies included in the package, implemented with the assumed strength, would not ensure goal achievement, and that stronger measures were indeed necessary. In this case, the planner hence turned to the expert knowledge for empirical data, while he already knew the cause–effect relations between the measures suggested and the expected effects. He expressed the view that he saw these elasticities as rules of thumbs rather than as scientific knowledge, hence demonstrating his ability to question and judge knowledge. Other interviewees also did this when explaining their scepticism to the validity of model-based transport analyses conducted in relation to overall planning analyses as well as for concrete projects.

Planners also used research-based data and knowledge *as arguments.* For instance, restricting parking access in general, it was argued: "*experiences from Norway and other countries show that, on average, a 10 percent reduction of parking capacity in the city centre will result in 1.5 percent fewer car trips and 1.4 percent more public transport trips*", with reference to the Institute of Transport Economics (but with no reference to any specific document or author) (MoT, 2007a: 70). When preparing the municipal transport plan the planners demonstrated, with the help of the expert knowledge in question, the limited room for meeting future problems if politicians were not willing to include restrictive means to keeping traffic volumes down and to reintroducing the toll cordon.

One interviewee said that the County Governor's office had recently filed a formal complaint about a zoning plan allowing workplace developments in a specific area not well supported by public transport, this in order to force the planning authorities to get to grips with development in the area. The County Governor's office used cause–effect relations from the expert knowledge in question in explaining how and why the ongoing development was not in accordance with the overall planning objectives, and as an argument for stopping this development. This spurred the planning authorities into mapping the ongoing development, which they found was less desirable than expected. In the proposal for the new municipal plan, the rules for development in this area are clearer and stricter. This is an example of how planners *using* the expert knowledge in question – by *explaining* and as an *argument* – succeeded in achieving shifts contributing to less traffic-increasing planning and development.

We found no examples in documents or interviews of references to expert knowledge as a 'body of knowledge' in order to strengthen arguments, nor to any document where this knowledge is explained or documented.

5.1.5 Mechanisms through which counter-productive measures were included

We understand particularly two elements in the Trondheim Package as reducing its goal achievement potential (as discussed in section 5.1.2): urban road capacity expansion and the land-use strategy allowing new developments in car-dependent locations.

Most of the planners interviewed agreed that increasing road capacity and otherwise facilitating private car use would cause and allow growth in traffic volumes; this is mentioned in the policy document for the Trondheim Package (MoT, 2008a). In interviews, several planners volunteered the main mechanisms causing increased road capacity to contribute to growth in traffic volumes, but without reference to written professional or

academic knowledge. One planner questioned the sense in expanding road capacity if a main objective was to reduce traffic volumes and thus– causing less need for road capacity in the future. Planners are therefore aware of this mechanism. There were, however, no signs in planning documents or in interviews of *planners meeting proposals for road capacity expansions by knowledge-based arguments or analyses* in order to explain to politicians that road expansions would reduce the goal achievement potential of the Trondheim Package.

Instead, two planners working closely on the Trondheim Package came up with a number of arguments as to why increased road capacity would *not* cause growth in traffic volumes in this particular case. They described the road construction projects as completion of the ring road system in Trondheim, meant to drain road traffic from the city centre, central areas and residential areas. Since there were few or even no delays on the roads at the time, they argued, increased road capacity did not mean actual improvement for road traffic. They also explained that counteracting measures would keep the traffic down. Furthermore, there will be yearly evaluations of goal achievements and, if the results are not satisfactory, road tolls will be increased and access to parking further reduced. A transport planner working for the NPRA saw this differently. He explained that road capacity expansions were necessary to allow changes to the local street network that would reduce current congestion, as well as prevent future congestion on the trunk roads.

In response to a direct question concerning why induced traffic caused by new road capacity was not included in estimations of the effects of the total package (MoT, 2008b), one planner explained this as due to uncertainties related to effects of the combination of measures included in the Trondheim Package. There is no documented knowledge of the probable effects of this combination of measures, he claimed. Hence, it cannot be said with any certainty that increased road capacity would cause growth in road traffic volumes in this particular case. This could be understood as an example of *characteristics of the expert knowledge* in question contributing to measures being introduced that reduce the goal achievement potential of the plan. Effects of measures are context dependent, and empirical evidence is not available for all combinations in all contexts. Planners can therefore claim that the effects of a particular combination of measures in a particular context are uncertain. This is reinforced by the lack of good methods for ex-ante assessments of combinations of measures.

When pushed, planners working on the Trondheim Package explained that local politicians were convinced the planned roads were necessary and desirable if objectives other than reducing traffic volumes were to be achieved, and that there would be no point in trying to persuade them otherwise. Furthermore, income from the toll cordon was a basis for the Trondheim Package; without new roads in the package there could be no political agreement on a toll cordon. The planners aimed at producing the best possible package within these frames, bringing about as much reduction in traffic and GHG emissions as feasible. Two planners explaining that the Trondheim Package developed from discussions on how two large-scale road projects could be implemented felt that the process had led to substantial improvements. In the previous transport package, 75 percent of the income was used for roads, so using 50 percent of this package for roads was an improvement.

Several planners were sceptical about whether the densification strategies were ambitious enough to contribute to reducing traffic volumes. The same planners claimed that the politicians had shown little willingness in ensuring implementation of the densification strategies in concrete zoning plans, mainly because this could hamper growth and development in the city. They hoped that including the densification strategy in the Trondheim Package would help contribute to changing this, but commented that it had not

happened so far. There were no signs that planners had made any effort to *use the expert knowledge in question to explain* to the politicians that a stricter densification strategy would benefit the goal achievement potential of the Trondheim Package. On self-reflection, planners at the planning authorities realized that they could have been more pro-active by, for instance, analysing and demonstrating the densification potential in the public transport corridor.

Almost all planners emphasized that they need to adjust the solutions they propose to politicians and politics. When deciding which strategies and measures to suggest in the Trondheim Package, they based their assessments on a mix of the expert knowledge in question and their knowledge of local politics. One understanding of why traffic-increasing road expansions and land-use developments were included in the Trondheim Package could hence be that the *main goal was partly ousted by other objectives*. The *expert knowledge in question was ousted* when planners exercised self-censorship because they understood that this knowledge did not supported measures and strategies that political decision-makers prioritized. There were no indications of actors explicitly rejecting or disagreeing with the expert knowledge in question.

5.1.6 Whether and how use and non-use of the expert knowledge affected the goal achievement potential of the Trondheim Package

The Trondheim Package states ambitious and clear goals concerning reductions in traffic volumes and GHG emission from transport. A number of measures are included contributing positively to the goal achievement potential of the package as well as strategies and measures contributing negatively.

The expert knowledge was introduced in the plan-making processes mainly as embedded in the planners making the plans. There are clear indications that knowledge creep or an enlightenment process has taken place over decades seems strongly related to the fact that planners learn from each other in various ways. To some degree, knowledge has also been introduced through planners reading scientific and popular scientific literature, and through their readings of government policy documents and planning guidelines.

There are clear indications that planners' use of the expert knowledge in question influenced the plan-making processes in ways contributing to coordination of land-use and transport planning, and to inclusion of traffic-reducing measures. The main mechanism through which this occurred was that this expert knowledge was the main basis for planners' knowing and acting. Moreover, the planners actively used the expert knowledge when explaining cause–effect relations in various documents, and as arguments for restrictive measures being included. On a few occasions, the planners turned to the expert knowledge for help in solving their planning problem, primarily by searching for empirical data.

When counter-productive measures were included in the package, this was due not to the planners not understanding that these would reduce the goal achievement potential of the plan, but rather to their understanding that political decision-makers, for various reasons, were convinced that including these measures was necessary. The planners found it pointless to explain or argue that this would negatively affect the goal achievement potential of the package, and therefore did not meet the proposals with knowledge-based analyses, arguments or explanations. It might therefore be concluded that the expert knowledge in question was ousted when planners understood that the implications were not acceptable in – or threatening to – the local political context. Another way of expressing this is that the objective 'reducing traffic volumes' was ousted by other objectives (completing the ring road system, draining traffic from the city centre). Furthermore,

aspects of the expert knowledge allowed planners to argue that road expansion would not necessarily contribute to increasing traffic volumes, and this weakens their foundations for convincingly explaining the traffic-increasing effects to decision-makers.

5.2 The Master Plan for Lund, Sweden

5.2.1 Introducing the Lund case

This case regards the overall planning processes for the Master Plan in Lund in Sweden. Lund is located in the largest populated region in the Nordic countries, close to Malmö in Sweden and Copenhagen in Denmark. The municipality has a growing population of 110,000 inhabitants and the city is home to Lund University, which is the largest in the Nordic countries (47,000 students and 7,200 employees).

Analyses of the Lund case are based on document analyses, analyses of previous research, and interviews with planners specialised in traffic planning and architectural city planning, two of whom specifically for this paper. We also draw on interviews conducted in relation to other research projects covering similar topics.

Two complementary planning documents have been taken into account in the analyses, the main one being the municipal *Master Plan* (later we use the term "Master Plan" for short) (Municipality of Lund (MoL), 2010). LundaMaTs II (strategy for a sustainable transport system in Lund 2030) is included as background material (termed *Transport Strategy* in the discussions) (Rydèn et al., 2005). It was developed for, and in cooperation with, Lund municipality by a consultancy firm and has had a central role in transport development in Lund, and to a certain degree in land-use development, over a long period of time (Holmberg, 2008).

5.2.2 The goal achievement potential of the Master Plan for Lund

The planners claim that there is consensus among the political parties to strive towards sustainability. This is important, since political colours can shift after elections. Planners believe that politicians, regardless of which parties are in power, have a stated goal that Lund should change in more sustainable directions, and that plans should be designed in ways that contribute to this. According to the planners, these intentions have existed for the past 30 years.

The vision of the Master Plan for Lund is *"sustainable development based on the Brundtland Commission's definition of sustainable development, which is development that meets present needs without compromising the ability of future generations to meet their own needs. The Master Plan will contribute to a sustainable society economically, socially, environmentally and culturally*" (MoL, 2010: 13, our translation). The Master Plan states that development of Lund and its satellites should contribute to reducing CO_2 emissions in the municipality by 85 percent before 2050; however, no quantified goals have been set for reducing traffic volumes. The Master Plan refers to an underlying climate analysis finding that traffic volumes need to be reduced by 50 percent if the 85 percent CO_2 reduction is to be reached. The plan presents 134 statements about what needs to be achieved to contribute to the vision setting the directions for planning and development. Some of the statements could be understood as sub-goals of the Master Plan, others as measures or strategies by which the defined goals can be achieved. Land-use is to be developed preferably as densification in locations well covered by public transport, and with densities high enough to sustain local shopping and service facilities. New workplace and visitor-intensive workplaces should be located at sites with good public transport access, and the municipality will be strict in its attitude to the external and semi-external location of groceries and other shopping facilities. Public transport would be the backbone of new

urban developments. Before construction of new transport infrastructure is considered, traffic-reducing measures or measures improving the efficiency of the existing infrastructure have to be considered. The main bicycle network should be given priority, and a new policy on car parking drawn up.

On examining the Master Plan and planning map, one may question the densification strategy. For instance, when concretising housing development strategies, the figures show that only 200 out of 780 new housing units per year are planned as densification in Lund itself and its larger satellites (the closest satellites are located about 6, 7 and 14 kilometres, respectively, from the periphery of Lund city) (MoL, 2010: 24). This means that almost 75 percent of new housing is planned on undeveloped land as what we would term "sprawl", even though it is emphasized that new developments are to be dense. It is argued that in order to reduce transport demands new workplaces should be developed in a similar pattern. The plan sums up the need for new land for developments at 1,730 hectares over the next 20 years (MoL, 2010: 25).

A light rail link (Lundalänken) is under construction, improving public transport accessibility within the city and eventually to some of the satellites. A new railway line is planned, connecting at least two of the satellites with the main city centre. Several minor and one major road-building project are shown on the planning map, as well as several road improvements.

An impact assessment was conducted as part of the Master Plan (MoL, 2010). Three alternatives were assessed and compared: continue as before (the zero or do-nothing alternative), traffic reduction, and the Master Plan proposal. The impact assessment concluded that the Master Plan proposal contributed least to achievement of the CO_2 reduction goal, this among other reasons because of more car-dependent land-use development. Mitigating measures proposed are introduction of a stricter parking policy and development of the least car-dependent areas first.

As summarized in Table 2, our assessment of the Master Plan is in line with the impact assessment. In total, it cannot be expected that implementation of the plan will contribute to reducing traffic volumes and CO_2 emissions; rather, it is more likely to increase them. It therefore seems that the goal achievement potential of the plan is low if the focus is CO_2 reduction.

Table 2: Measures included in the Master Plan for Lund and our assessments of whether they contribute to or counteract the goal achievement potential of the plan (focusing on reducing GHG emissions from transport).

Elements included in the plan	How this affects the goal achievement potential
75 percent of housing development planned on new land outside the main city's borders; new workplaces are to be located in a similar pattern	Contributes to increasing traffic volumes
Developing local centres and the city centre, strict policies towards external and semi-external locations of new retail development	Contributes to reducing traffic volumes
New public transport infrastructure, improving public transport services	Contributes to reducing traffic volumes
Improving the bicycle network	Contributes to reducing traffic volumes
New roads, increased road capacity	Contributes to increasing traffic volumes

The Transport Strategy includes a number of indicators keeping track of goal achievements. The 2011 report shows good figures with respect to several of the indicators (MoL, 2011) and that road traffic distance *per person* is unchanged (compared to 2004), while there has been a 1 percent increase in the municipal network. Since the population of Lund is growing, the total traffic volumes are increasing as well.

5.2.3 Mechanisms through which the expert knowledge was introduced

The planning processes in Lund are characterized by the use of different kinds of knowledge from a number of sources. In taking account of context, the planners explained that they used various methods and sources such as forecasts, population statistics, surveys and meetings with citizens. They referred to national and international policy documents in the Master Plan, for instance the '2 degree goal' and the 'Brundtland Report'. Furthermore, the Master Plan refers extensively to earlier municipal plans.

The expert knowledge in question is important as well. Interviewees said that planners in Lund had long been taking an integrated sustainability approach and that this had affected politicians' ways of thinking (see also Hrelja and Nyberg, 2012). Knowledge and methods of integrated land-use and transport planning are used right from the very beginning of planning processes. Planners rely on academic knowledge from their university education, and they learn from each other. One central method facilitating knowledge-sharing has been the mixing together of planners with different academic backgrounds and specialties. In this way, land-use planners have learned to consider issues related to transport systems development and traffic when planning land-use, and vice versa. As an efficient way of sharing knowledge, the municipality produces handbooks, such as the *Handbook for Traffic Reducing Societal Planning* (MoL, 2004), and has carried out self-assessments with external evaluators analysing their ongoing work. Hence, an important way in which the expert knowledge in question is brought into planning processes is *through being embedded in planners involved*. They possess this knowledge, it seems, through knowledge-sharing and knowledge creep over the years.

There are few, if any, references in the Master Plan to *written academic literature* on the expert knowledge in question, but there are references to the handbook 'Traffic for Attractive Cities' published by the National Transport Agency (2007). The examined plan has a proper reference list of non-academic literature and data, although not for all knowledge claims, in particular for statistical data regarding context, state and current development.

The planners actively gain new knowledge from *experts from the outside.* One interviewee explained that researchers at Lund University were invited to make specific evaluations in the early stages of plan-making. Furthermore, the municipality hired consultants to assess specific issues where they lacked expertise, or where they wanted external opinions. Planners also gain new knowledge by participating at conferences and workshops, making field trips to other countries and analysing evaluations of similar projects in municipalities worldwide (Rydén et al., 2005). The planners believe that Lund is at the forefront when it comes to integrated land-use and transport planning in Sweden, and therefore find it necessary to look abroad for good examples and new knowledge.

5.2.4 Mechanisms through which use of expert knowledge contributed to coordination and inclusion of traffic-reducing measures

The expert knowledge in question is apparent in various ways in the planning documents examined. Both the Transport Strategy and the Master Plan discuss land-use, development of transport systems, and how these affect each other and developments of traffic volumes and/or GHG emissions from traffic. For instance, the first of 18 indicators listed in the Transport Strategy concerns the location of new residences in the municipality. The

planners readily discuss these issues in interviews, which might indicate that this knowledge is *a main basis for the planners' knowing and acting*.

In the impact assessment of the Master Plan, theoretical knowledge claims as well as empirical knowledge embedded in the expert knowledge in question were used in explaining how and why the proposed plan has negative effects with respect to the CO_2 reduction goal. The main method in the impact assessment is professional reasoning, supplemented by quantitative calculations. There are few, if any, examples of planners *referencing more actively to the expert knowledge* in question. The impact assessment in the Master Plan can be understood as an example of the expert knowledge used as *an argument*. This is because the assessment, based on the expert knowledge in question, argues that the proposed plan counteracts achievement of the stated main objective.

5.2.5 Mechanisms through which counter-productive measures were included
It is clear from the planning documents that the CO_2 emissions reduction target includes reducing traffic volumes. An underlying analysis had suggested that a 50 percent reduction in total traffic volumes would be necessary if the CO_2 emissions target was to be achieved. Hence, when the plan proposes land-use development and urban road capacity expansions clearly contributing to growth in traffic volumes, it is not due to an absence of objectives concerning this issue.

A more obvious explanation is that this *objective was ousted by other objectives*. The preface of the Master Plan states: "*In order to achieve a socially sustainable society, the Master Plan is to facilitate for the construction of 900 housing units per year"* (MoL, 2010: 3). The impact assessment of the Master Plan explains that there is conflict between the CO_2 reduction objective and objectives concerning the conservation of land for food production. It is concluded: *"this goal conflict requires that measures in other sectors are necessary to achieve the CO_2 emission reduction target*" (MoL, 2010: 42). The combination of high demand for new housing, combined with strict conservation regulations, might explain why the plan proposes this land-use development.

The impact assessment could be understood as a way of *using expert knowledge to explain* to politicians how the proposed plan does not contribute to achieving the defined objectives. Nonetheless, the assessment does not refer to empirical studies demonstrating that the proposed land-use development would cause increased transport demand and car-use. Furthermore, the suggestions for mitigating measures do not include alternatives offered by the expert knowledge in question. This could be to intensify the densification strategy and reduce land-take, or to give priority to the location of specialized workplaces in more central locations. However, it did suggest development of the least car-dependent areas first.

It could hardly be argued that lack of empirical evidence in the expert knowledge might help explain the introduction of counter-effective measures with respect to reduced traffic volumes and GHG emissions. Interrelations between spatial urban structures and traffic volumes have been investigated over decades and in numerous locations and contexts, and the evidence is compelling. In this case, the planners may be influenced by planning myths (as discussed in section 4.3). One could claim that one such planning myth is that employees at suburban workplaces have on average shorter commuting distances than employees of centrally located workplaces because people live close to where they work. Even though several authors argue that this is the case (Crane and Chatman, 2003; Gordon and Richardson, 1989; Giuliano and Small, 1993), there is little evidence in the Nordic countries of any such overall tendency. Several Nordic studies have instead found that workplaces and housing located in the periphery of cities, even if located close to public transport stops, generate more traffic than centrally located workplaces (e.g. Hartoft-Nielsen, 2001a, 2001b;

Næss, 2006a, 2012; Strømmen, 2001). It seems that this myth is a basis for knowing and acting in the Lund Master Plan, since new housing and workplaces are planned in all satellites. Furthermore, it could be taken from explanations in the plan that planners believe they can achieve low car shares in suburban areas if they improve public transport and other local services. The planners were surprised when analyses demonstrated that this may not be the case, even in the highly profiled Brunnshög area, which is the development area closest to the city centre. These findings could be interpreted as *the expert knowledge in question was ousted by other knowledge* (myths). Furthermore, there are no discussions in the Master Plan concerning the traffic-inducing effect of road capacity expansions.

The planners argued that the overall strategies of the Master Plan are not counterproductive with respect to the GHG emissions objectives, and that it strives towards sustainability. This could be understood as if *properties of the planners caused that they were not able to understand* that the proposed land-use development was counter-productive to the CO_2 reduction objective. However, the planners also explain that population growth requires development in the outer parts of the municipality, which increases the transport demand and possibly also car usage. The municipality aims at mitigating the traffic increase by strengthening public transport, among others ways by building the new light rail line, and by developing services and workplaces in the satellites. Hence, while planners argue that the strategies contribute to goal achievement, they are at the same time aware of the contradictions in the planning documents. The planners emphasize that plans are not produced by planners alone, but involve political and democratic processes with other stakeholders.

One way of dealing with conflicting goals and counter-productive measures is to develop different alternatives, and three were included in the impact assessment in the Master Plan (as described above). One planner argued that this allows decision-makers to understand the consequences of the plans before they adopt them, to vote for the less traffic-increasing plan if they found this to be an important objective, or to ask the planners to come up with better alternatives if none were acceptable.

5.2.6 Whether and how the use and non-use of the expert knowledge affected the goal achievement potential of the Master Plan for Lund

The Lund Master Plan states clear objectives concerning to reduce GHG emissions from transport, and acknowledges that this includes curbing traffic growth. The plan does, however, present land-use and transport systems developments strategies contributing to increase car-use and traffic volumes and thus the goal achievement potential with respect to the CO_2 emissions reduction goal is low.

When analysing whether and how use and non-use of the expert knowledge in question affected the goal achievement potential of the examined plans, the findings are contradictory. Planners' explanations concerning cause–effect relations in the plan are in many ways in accordance with the expert knowledge, and are a basis for coordinating land-use and transport planning and for including traffic-reducing measures. Still, their explanations for including counteracting measures in the plan are more in accordance with the planning myth that employees at suburban workplaces on average generate less traffic than employees at centrally located workplaces. It seems as if this planning myth has ousted the expert knowledge in question and been used as part of the basis for knowing and acting when making the plan. Furthermore, the Master Plan raises no concerns about the traffic-inducing effects of road capacity expansions.

During interviews the planners explained that planning processes are politically driven and involve actors other than planners. Furthermore, they explained that the Master Plan states

several objectives – some contradictory. However, the planners did not feel that they were overruled by politicians on the matter of the land-use development strategy.

5.3 The Master Plan for Aarhus, Denmark

5.3.1 Introducing the Aarhus case

The Aarhus case is the planning process relating to the 2009 Master Plan. With more than 300,000 inhabitants in the municipality, Aarhus is the second largest city in Denmark and is capital of the Middle Jutland Region. It is a university city with about 40,000 students and 11,000 university employees. The polycentric East Jutland region, where Aarhus is the biggest city, has about 1.2 million inhabitants.

The case description and analyses are based on document studies and interviews with municipal and public transport planners engaged in the planning process. The documents examined as part of the case study are the *Aarhus Municipal Master Plan 2009* (Municipality of Aarhus (MoA), 2009) (hereafter termed Master Plan) and the *Environmental Impact Assessment of the Master Plan 2009* (COWI, 2008) (hereafter termed EIA). In this last document, a consultancy agency was engaged to assess whether the formulated strategies in the Master Plan would minimize road-based traffic and GHG emissions as well as other consequences of the plan.

The 2009 Master Plan process was the first Danish planning process following the 2007 Regional reform in the Danish Government. It resulted in increased spatial planning responsibilities for the municipalities. The 2009 Master Plan is also the first Danish planning process where urban and regional land-use planning were integrated with planning of a public transport project (a light rail infrastructure).

Aarhus has high ambitions regarding CO_2 reductions. The City Council has signed the *Covenant of Mayors*, by which about 500 European cities voluntarily committed to reducing their energy consumption by 20 percent by 2020. In 2009, the City Council signed an EU-founded agreement on a *Sustainable Energy Action Plan* for Aarhus to become a CO_2 neutral city by 2030. The Master Plan refers to this goal several times, stating that spatial development of Aarhus and development of the transport systems should be planned in accordance with this objective (MoA, 2009: 12, 146). It is stated that strategies in the plan would actually contribute to minimizing transport demands. At present, 25 percent of the CO_2 emissions in Aarhus municipality are produced by transport (MoA, 2009: 13).

The process of formulating the Master Plan 2009 was undertaken by a steering group constituted by the heads of departments of Urban Planning and Construction, Nature and Environment and Traffic and Roads. Several public hearings took place during the planning process, and arenas were set up to facilitate the participation of private stakeholders central to financing and to the realization of various projects.

5.3.2 The goal achievement potential of the Master Plan for Aarhus

For the past few decades, the main trends in Aarhus have been growth in the number of workplaces in the city centre, and increasing prices for housing in the proximity of the city centre (MoA, 2009). These trends, together with objectives related to minimizing traffic volumes, have stressed the need for a new planning strategy for coordinating land-use and transport development. In the 2009 Master Plan, this has been translated to high density, mixed-use 'new towns' located 9 to 24 km outside the city centre, and transformation of already urbanized areas to high-density and multi-purpose areas. This is integrated with planning of a new light rail as the new public transport artery reorganizing the future

metropolitan development of the Aarhus city region. The new towns will have excellent access to the main road system, and several road construction projects expanding urban road capacity are included in the plan. The Master Plan argues that this is necessary in order to accommodate the expected growth in traffic volumes. There are no suggestions concerning reduction of parking accessibility, or any other restrictive measures. The Master Plan stresses that the combination of high-density neighbourhoods, mixed-use and accessibility to the future light rail stops will favour non-motorized travel behaviour and public transport, hence limiting road traffic.

The Master Plan states that urban transformation, mainly on brownfield areas (harbour front) and as infill, has potential corresponding to 35 percent of residential developments and 70 percent of business developments in the plan (MoA, 2009). This means that about 65 percent of new residences and 30 percent of new workplaces are planned for development on new land, most of it fairly distant from the city centre. The urbanized areas in the municipality will increase by 20 percent (1,030 hectares) if the Master Plan is realised.

These planning strategies were assessed in the EIA, and compared to a zero-alternative with concentric urban expansion (COWI, 2008). The EIA concluded that the Master Plan could be understood as producing a little less traffic than the zero-alternative, but that this would depend on a number of uncertain factors. The EIA consultants discussed whether the two alternatives would contribute to the CO_2 emissions reduction referred to in the Master Plan. Their analyses, mainly conducted as professional reasoning, concluded that both alternatives would probably contribute to increasing rather than reducing car traffic volumes.

When assessing the goal achievement potential of the Master Plan in light of the expert knowledge described in section 3, we agree with this conclusion. The main strategies concern development of most new residences and a substantial number of workplaces in new towns 9 to 24 km from the city centre, with no restrictions on road traffic suggested. Instead, the road capacity will be expanded to facilitate for an expected growth in traffic. Our assessments are summarized in Table 3.

Table 3: Main measures included in the Aarhus Master Plan 2009 and our assessments of whether they contribute to or counteract the goal achievement potential of the plan (with respect to reducing GHG emissions from transport).

Elements included in the plan	How this affects goal achievement potential
High density, mixed use 'new towns' located 9 – 24 km from the city centre and close to the future light rail stops and the main road system (65 percent of new housing, 30 percent of new workplaces)	Contributes to *increasing* traffic volumes
Inner city densification and transformation	Contributes to *reducing* traffic volumes
The light rail project	Contributes to *reducing* traffic volumes
Improve facilities for bicycling	Contributes to *reducing* traffic volumes
Road capacity increasing projects	Contributes to *increasing* traffic volumes
Parking policies (if not changed)	Contributes to *increasing* traffic volumes

5.3.3 Mechanisms through which the expert knowledge was introduced

Various kinds of knowledge, from different kinds of sources, were used when producing the Aarhus Master Plan. There are references to European political agreements, and to plans and policy documents at international, governmental, municipal and project level. The plan presents figures concerning current states and prognoses with respect to population, dwellings, public transport and GHG emissions, although rarely are there references to specific documents. In interviews, urban planners demonstrated local knowledge about the context and politics surrounding urban planning.

The expert knowledge in question was brought into the planning processes through different mechanisms. One was *learning from other planners* through direct exchanges. In interviews, planners explained that their knowledge developed through the long-term planning process, especially with respect to light rail, since this was the first light rail project in Denmark. The planners actively searched for knowledge concerning other cases of European provincial cities building light rail. They organized study trips and visited other planners and policy actors in German and French cities where light rail had been constructed in the previous decade, citing this as valuable experience. Important to urban planners, public transport planners, consultants, policy actors and politicians was the idea that light rail could become an artery for regional development in the Aarhus area. The understanding that land-use and transport planning needed to be integrated was a main basis for the design of the plan. This understanding, it seems, was brought into the planning process as *embedded in the planners involved*.

It seems that knowledge, particularly concerning how land-use and transport systems development affect travel distances and modal choices (the expert knowledge in question in this case), was introduced to the planning process mainly *by experts from outside*, namely the EIA consultants. The EIA analyses demonstrate that this kind of knowledge is embedded in the EIA consultants, and that this is their field of expertise. The consultants combine the expert knowledge in question with context knowledge extracted from the Master Plan proposal and other sources (COWI, 2008). They refer to previous plans, policy documents and statistics, as well as to research syntheses and a few scientific works – Hartoft-Nielsen's (2001a; 2001b) works in particular concerning how the location of activities in the spatial structure affects traffic volumes and GHG emissions. Aarhus was one of the cities examined in these works. Another example of scientific evidence brought into the planning process is empirical knowledge concerning the effects of car-use in other Danish cities that have carried out similar strategies as proposed in the Master Plan.

It seems that a *knowledge creep* was going on in municipal planning circles in Aarhus at the time the plan was made. Planners were learning from each other, from planners and planning elsewhere, as well as from specialists in various technical and specialized fields.

5.3.4 Mechanisms through which use of expert knowledge contributed to coordination and inclusion of traffic-reducing measures

The Aarhus Master Plan 2009 focuses strongly on integration of land-use and public transport developments, and on minimizing transport demands and use of the private car, while at the same time facilitating mobility demands. The necessity of seeing these elements in relation to each other seems to be part of the planners' basis for knowing and acting. The expert knowledge in question is used for *explaining* cause–effect relations. The Master Plan explains how short distances to shopping and services, as well as improved public transport services and better facilitation for cycling, may increase the modal shares for other modes than the car. This forms strong *arguments* for implementing the light rail as a traffic-reducing measure.

As we read the document, the expert knowledge in question is the primary basis for the knowing and acting of the planners (consultants) producing the EIA. They make use of it to *explain* the main interrelations, as well as how and why some of the proposed strategies and measures will not contribute to minimizing road traffic and achieving the CO_2 emissions reduction goal. Furthermore, the EIA explains the interrelations between restrictive measures for car traffic and traffic volumes. The EIA could be understood as planners *arguing* that the strategies in the Master Plan will not contribute to achieving the defined objectives (even though this is not clearly expressed in the document). It could also be claimed that planners making the EIA used the expert knowledge as a *'body of reference'*, giving their knowledge claims, explanations and arguments extra weight.

5.3.5 Mechanisms through which counter-productive measures were included
Main strategies or measures reducing the goal achievement potential of the Master Plan for Aarhus are the extensive urban expansion on new land far from the city centre and the road capacity expansions included in the plan.

The Master Plan claims that development of new towns between 9 and 24 kilometres from Aarhus city centre would contribute to minimizing local transport demands. The plan mentions that housing and workplaces located this far from the city centre tend to generate more traffic than more central locations, but explains that good access to daily services, combined with light rail, would reduce this effect. These claims are partly anchored in the expert knowledge in question. However, they disregard the theoretical and empirical knowledge concerning that the location of activities this far from the city centre and the main city, as well as increased urban road capacity, contribute to increase transport demands and car-use (as discussed in section 3). The argumentation may be influenced by the planning myth that employees at suburban workplaces have shorter commuting distances than employees at centrally located workplaces because people live close to where they work, as discussed in the Lund case.

It is explained in the EIA how and why the land-use strategies proposed in the Master Plan would be counter-effective with respect to achieving the goals of minimizing traffic and reducing CO_2 emissions (MoA, 2010: 127). Moreover, differences between the assessed zero-alternative with an improved bus system and the proposed light rail are very small. Municipal and public transport planners find that the real benefits of light rail cannot be assessed in this way, but rather on how the combination of land-use and transport development bring long-term achievements such as quality of life and air quality. This cannot be calculated with any degree of certainty in a long-term perspective.

Municipal planners are aware of the understanding that new town developments generates more traffic, among other because of dialogues with Aalborg University and other experts on the case matter. One municipal planner explained during the interview that developments included in the plan facilitated the reduction of car traffic only to a certain degree. The light rail needs to be understood as a first step towards more sustainable mobility patterns in Aarhus. Municipal and public transport planners agree that measures other than those proposed in the 2009 Master Plan should be implemented to actually reduce car traffic in the city.

There seem to be no reflections in the Master Plan, or in the interviews, on the traffic-inducing effects of expanding the road capacity, which could be interpreted as the municipal planners not being aware of this effect. The Master Plan does not introduce stricter regulations regarding parking access, but the planners pointed out in interviews that parking restrictions would probably be necessary if road traffic was to be minimized. They had not made any serious effort to get this included in the 2009 Master Plan, but found that parking restrictions would probably be introduced in future plans.

The combining of light rail with new towns has been a compelling planning idea that has engaged municipal and public transport planners, as well as local politicians, in a common vision for urban development in Aarhus. This may have shaped new knowledge between two diverse planning sectors which over time has formed a new objective around the city-regional development of Aarhus, rather than of minimizing traffic and becoming a CO_2 neutral city by 2030. The expert knowledge in question may have been understood as threatening to the light rail project and may therefore have been disregarded.

Another explanation could be that the political decision-makers were not really concerned about the GHG emissions reduction objective. Decision-makers could have put more weight on other stated goals, and the planners may have been aware of this. If politicians found the proposed Master Plan to be contributing to the fulfilment of competing goals, or that introducing restrictive measures on road traffic would counteract such goals, this could be an explanation as to why the planners introduced traffic-increasing measures in the plan. The planners did not imply this in the interviews.

In this case, it seems more as if the planners have promoted what they understand as good principles for urban development in Aarhus, and have not really focused on traffic minimization or CO_2 reduction as a prominent planning objective. Consequently, the explanations and arguments in the EIA regarding traffic-increasing effects of the plan may not have been regarded as relevant. In that case, a primary mechanism through which counteracting measures have been included in the plan is that the objective of 'minimizing traffic' was ousted by other objectives and ideas.

5.3.6 Whether and how use and non-use of the expert knowledge affected the goal achievement potential of the Master Plan for Aarhus

All the involved parties seemed to agree that the *integration* of land-use and transport planning was obvious and correct in this case, and that this is based on understandings in the expert knowledge in question. There are important elements in the plan that positively contribute to the goal achievement potential of the plan with respect to reducing traffic volumes and GHG emissions, but also strong elements contributing negatively to it (new towns, increased road capacity). The EIA explains these effects, but the municipal planners do not seem to have emphasized this.

One explanation could have been that the planners relied on other kinds of research-based knowledge when claiming that the new towns would generate less traffic. Neither the Master Plan nor the interviewees presented any empirical evidence or documented knowledge underpinning this assumption. Another explanation might be that the planners were influenced instead by planning myths, as discussed in the Lund case, and trusted these. There seems to have been low awareness that road capacity expansion contributes to increased traffic volumes, which leads to another explanation, namely that powerful planners are not specialized in coordinated land-use and transport planning for reducing traffic volumes, and hence are not highly skilled in this respect.

In this case it seems that the strongest mechanism is planners and decision-makers agreeing on the compelling idea of combining the light rail project with developing new towns, and saw this as a promising future for urban development in Aarhus. In this situation, elements of expert knowledge demonstrating that this would not contribute to achieving the overarching goal of reducing GHG emissions and minimizing traffic were unwelcome or understood as not relevant. Hence, it was disregarded. It seems there was low awareness that road capacity expansions contributed to increasing traffic volumes.

5.4 Some reflections on the cities' goal formulations

The goal formulations in two of the three case cities are somewhat vague in terms of traffic volume reductions. Only Trondheim has an explicit goal. Aarhus has a goal of minimizing traffic volumes, but this is a very 'elastic' formulation. When can something be said to have been minimized? Obviously, minimizing does not mean reducing to zero; rather, it means reducing 'as much as possible'. But then, what is possible is a matter of judgment and trade-off. In Lund, there is an ambitious long-term goal of reducing CO_2 emissions by 85 percent over the next four decades, but no adopted goal concerning traffic reduction. As mentioned earlier, there is instead reference to a background document stating that a 50 percent reduction in traffic volumes is necessary if this goal is to be reached. There is, however, no further indication of how much of this is to be achieved through changes in the modal split and/or by reduced mobility levels, or how large a contribution to any changes in mobility levels land-use development is supposed to bring about compared with other possible measures such as road pricing.

According to Sager (1991), goals can have different functions: steering, legitimating and propagandistic. In politics, goals are often not meant to be steering, but instead propagandistic (i.e. functioning mainly to brand the political regime as modern and responsible, environmentally aware, etc.) It should be noted that ambivalence can sometimes be conducive to transition towards sustainability, as it permits and facilitates forms of movement, change, flexibility and reinterpretation that such transitions will undoubtedly require (Walker and Shove, 2007: 223). According to Christensen et al. (2013), so-called "eco-talk" or aspirational talk might be understood as helping channelling practices to more sustainable actions.

Notwithstanding any inconsistency of the stated quantitative objectives with other adopted policies, or the vagueness of formulations like 'minimizing traffic volumes', it is still highly relevant to examine how planners' use and non-use of expert knowledge in plan-making affect the contents and goal achievement potentials of plans.

5.5 Comparative analyses and generalizations

Based on the findings in internal analyses of the three cases, we now conduct analyses across cases in order to distinguish the more important mechanisms and explanations from the less important.

5.5.1 Mechanisms through which expert knowledge is introduced in plans

Analyses of three cases revealed that the main mechanism through which the expert knowledge in question was introduced into planning processes was as embedded in knowledgeable planners involved (see table 4).

The planners had gained their insights in the expert knowledge in several ways (see table 4). In all cases, planners refer to how they learn from other planners in their daily work, and we found examples of deliberate institutional set-ups for knowledge-sharing in all three cases. Planning documents refer to previous plans and other relevant plans, which means that the planners learn from what others have done before them. In some cases, expert knowledge was introduced in the planning process through experts directly contributing to the plan-making, or conducting specific analyses, assessments and evaluations. Planners and planning documents make frequent reference to international, national, regional and local policy documents, especially when explaining how objectives are defined and given priority. A few planners referred to their scholarly education. These findings clearly indicate that planners form a community of practice (Wenger, 1998). Much learning occurs as knowledge diffusion (Shipan and Volden, 2008) internally in municipal planning processes and offices, but also across cities within countries and across borders, as described by planners in Lund and Aarhus.

Planners' stories of how their own and others' knowledge evolves over time indicate that *knowledge creep* (Radaelli, 1995) and *enlightenment* (Weiss, 1979) are important mechanisms diffusing research-based knowledge into planning practice. As far as the expert knowledge in question in this article is concerned, it seems that knowledge creep has evolved to a higher level in Trondheim than in the other cities. In all cases, planners stated that political decision-makers also learn over time and change their framing of problems and relevant solutions accordingly.

We found few references to research literature or to direct exchanges with researchers, and therefore conclude that in our cases this was not an important mechanism bringing the expert knowledge in question into planning processes. This is in line with findings in previous studies (Krizek et al., 2009; Owens, 2005; Tennøy, 2012). None of the planners referred to situations where politicians, NGOs or other non-professionals brought the expert knowledge in question into the processes.

Table 4: Assessment of whether mechanisms defined in section 4 were important for the expert knowledge in question being introduced in the plan-making processes.

Mechanisms	Trondheim	Lund	Aarhus
Brought in as embedded in planners involved	Yes, through highly skilled and experienced planners specialised in land-use and transport planning	Yes, planners claim to be at the forefront in Sweden on this issue	Yes, to a certain extent by municipal planners, to a higher extent by the EIA consultants
Learning from other planners in various ways	Clear indications that planners learn from previous plans, and from working with other planners	Conscious facilitation of knowledge-sharing and learning from planners abroad	Clear indications that planners learn from each other, locally as well as from examples from abroad
Brought in by experts from outside the planning agency	No references to this	Researchers and consultants had been hired to contribute with analyses	Yes, through consultants making the EIA
Knowledge creep affecting basic understandings	Clear indications that knowledge creep has taken place	Clear indication that knowledge creep has taken place	It seems that knowledge creep was going on in municipal planning circles
Readings of scientific works and popular science literature	References to two academic works in interviews and to some research syntheses in documents	Some references to popular science works in documents	No such references in the Master Plan, several references in the EIA
Readings of governmental white papers, guidelines, etc.	Several references to such documents, but not an important mechanism	Several references to such documents, but not an important mechanism	Some references to such documents, but not an important mechanism
Brought in by political decision-makers, NGOs, etc.	No references to this	No references to this	No references to this

5.5.2 Mechanisms through which use of expert knowledge contributes to increasing the goal achievement potential of plans

We turn now to the question of how use of the expert knowledge in question contributes to increasing the goal achievement potentials of plans. This is narrowed down to the questions of how planners use such expert knowledge in ways contributing to coordination of land-use

and transport planning and to the inclusion of traffic-reducing measures and strategies in plans.

We found that the main mechanism through which the expert knowledge in question contributed to coordination and integration of land-use and transport planning in all three cases was by virtue of being the main basis for planners' knowing and acting. The idea that coordinating or integrating land-use and transport planning was necessary seems to be deeply embedded in the planners' professional knowledge, hence forming their *primary basis for knowing and acting* (Schön, 1983). This is a fundamental and stated understanding in the plans and analyses examined, including sectorial documents such as transport strategies and land-use plans. The way most planners discuss various issues in interviews implies that they see land-use and transport developments as indivisible, also when analysing for instance how public transport services need to be developed if they are to achieve defined objectives. For other planners, expert knowledge concerning, for example, transport infrastructure developments is their main basis for knowing and acting. However, these planners also recognize that land-use and transport systems development are intimately related. The planners also used the expert knowledge more explicitly as *arguments* for coordination, in *explaining* how land-use developments and transport systems development are causally interrelated with each other and with transport demands and traffic generation.

Being the *basis for planners' knowing and acting* was also the main mechanism through which planners chose to propose traffic-reducing measures and strategies in the plans. Planners *know,* without much reflection, which measures can contribute to goal achievement. For instance, the measure 'improving conditions for bicycling' is included in all three plans, because planners know that enhancing the conditions for cycling increases the chances that people will cycle instead of using motorised transport.

When making plans and analyses, planners needed to justify why certain strategies and measures be included for certain objectives to be achieved. For this, they used the expert knowledge in question to *explain cause–effects relations*. These explanations formed strong *arguments* in planning processes. We saw for instance how planners in all our cases explained how and why improving public transport services would contribute to reduced car dependency and traffic volumes, and at the same time improve mobility. This was used as an argument for large infrastructure investments in Lund and Aarhus. Empirical research findings were used to some extent as evidence that certain measures would contribute to the desired effects, and hence strengthen explanation-based arguments, as was the case for instance when Trondheim planners argued for stricter parking regulations.

The knowledge was used in assessments of the expected effects of suggested measures and strategies in all three cases. In the impact assessments in Lund and Aarhus, we saw clear examples of planners using the expert knowledge when explaining causal relations, for instance how and why urban development far from the city centre contribute to higher transport demands and car-use than more centrally located developments. In the Aarhus case, consultants also used empirical research findings as evidence that the proposed land-use could contribute to increased car-use. In the Lund case, planners used this as an argument for suggesting mitigating measures.

There were few, if any, examples of planners actively turning to the expert knowledge in question for solving their planning problems. It could be that planners do this more than shows up in planning documents, but the interviews did not indicate that this was the case. There were also few, if any, findings in the case studies of planners using the expert knowledge *per se* as a reference for legitimizing and strengthening their knowledge claims.

One exception was the Aarhus consultants, who referred to 'the body of knowledge' as well as particular documents when making the EIA.

Table 5: Assessment of whether the mechanisms defined in section 4 were important for the expert knowledge in question affecting coordination taking place and traffic-reducing measures included in plans.

Mechanisms	Trondheim	Lund	Aarhus
The expert knowledge in question was the basis for planners' knowing and acting	Clear indication that this was the case	It seems as if this was the case	To a certain degree for the municipal planners, clearly so for the EIA consultants
The expert knowledge was used for explaining cause–effect relations	Yes, in several of the underlying plans and analyses	Yes, in all the examined planning documents	Yes, in the EIA, and to some degree in the Master Plan
The expert knowledge was used as arguments	Yes, for instance as arguments that the toll cordon and parking restrictions were necessary	Yes, for instance as an argument for public transport infrastructure investments. The impact assessment could be seen as an argument opposing the land-use strategies proposed in the Master Plan	Yes, for instance as an argument why light rail is a good investment. The EIA could be seen as an argument opposing the claim that the Master Plan contributes to minimizing transport
Planners turned to the expert knowledge for help in solving their planning problems	Not for finding solutions, but to some degree for assessing suggested measures	Not for finding solutions, but in the impact assessment	Not for finding solutions, but in the EIA
The expert knowledge, as 'a body of knowledge', was used as reference	No, references were not made to either written documents or to any 'body of knowledge'	Not in the Master Plan, neither to documents, nor to any 'body of knowledge'	Yes, the EIA referred to this as a 'body of knowledge', as well as to particular documents

5.5.3 Mechanisms through which counter-productive measures are included in plans

Analysis of the three plans revealed that all include measures and strategies which, according to state-of-the-art knowledge, clearly reduce their goal achievement potential. This was not because the goal 'reducing or curbing traffic volumes' was absent in the processes. Rather, this was a stated and highlighted objective in all plans, and in particular in the Trondheim Package. Traffic-increasing measures and strategies were introduced in planning processes mainly as responses to other objectives or needs, more or less clearly stated in the planning documents. Examples of such objectives are to facilitate for population growth, to drain traffic from the city centre and housing areas, to meet mobility needs and to make the city more attractive. In our cases, the responses were suggestions for traffic-increasing measures and strategies, in particular urban road capacity increases and land-use expansions in non-central locations on new land. Hence, one way of explaining how and why traffic-increasing measures were included in the plans was that the objective 'reducing traffic volumes' was ousted by competing objectives.

As discussed in section 4, planners can meet seemingly competing objectives in ways other than by including traffic-increasing measures. As a minimum, they could ensure that political decision-makers are aware that including certain measures compromises the goal achievement potential of the plans. The impact assessments of the planning proposals in the three cases could be understood as examples of planners using the expert knowledge to

explain how and why inclusion of certain measures and strategies could reduce the goal achievement potential of plans. Assessments of the Trondheim Package demonstrated that the proposed measures, implemented with the assumed strength, would not ensure goal achievement. Impact assessments for the Aarhus and Lund master plans showed that implementing the proposed plans would contribute to increased, rather that reduced, traffic volumes and GHG emissions. Hence, one could argue that planners did warn political decision-makers that certain measures and strategies would reduce the goal-achievement potentials of the plans.

The impact assessments, however, were conducted after the planning processes had got to the planning proposal stage. One can readily understand how this kind of knowledge may be unwelcome at this stage. Responding to it would, at least in the Lund and Aarhus cases, mean developing entirely new strategies and concepts for overall urban development. Surely the plans could have been amended; for instance, by removing road expansion projects, applying stricter parking restrictions, or removing development sites furthest from the city centre. As discussed in section 4.2, proposed plans are normally the results of long-term processes involving negotiations between numerous and different stakeholders with different objectives, knowledge and powers. Including or removing bits and parts after the actors have agreed on a plan can often be hard. Proposing totally new strategies or concepts is normally not an option.

What could contribute to plans with higher goal achievement potential is planners bringing insights from the expert knowledge in question into the deliberation on ongoing plan-making processes. The planners could use the expert knowledge as a basis for explaining why certain measures and strategies are counter-productive with respect to prominent objectives (such as reducing traffic volumes and GHG emissions), for arguing that these should not be included in the planning processes, and for introducing alternative solutions contributing to the achievement of multiple objectives, including traffic reductions. We found few, if any, examples of planners doing so in our cases.

Understanding why this is the case may be a key to understanding how and why measures and strategies counteracting goal achievement are included in plans. As discussed in sections 3 and 4.3, this could be due to properties of the expert knowledge. In the Trondheim case, planners explained that effects of measures were context-dependent, and empirical evidence concerning effects of measures is not available for all combinations in all contexts. Furthermore, good methods for *ex-ante* assessments of combinations of measures are lacking. Hence, the planners could claim that effects of the particular combination of measures in the particular context were uncertain. This allowed planners to disregard the expert knowledge in question when it did not fit the current political agenda. In the Aarhus and Lund cases, planners expressed knowledge claims concerning effects of new town developments located fairly distant from the city centre that were more in line with outdated knowledge or planning myths than with state-of-the-art expert knowledge. There were few, if any, references to the traffic-inducing effects of increased road capacity in the Lund and Aarhus cases.

However, the above examples cannot necessarily be explained by properties of the expert knowledge, since the theoretical and empirical knowledge concerning traffic-increasing effects of expanding road capacity in urban transport systems under pressure, as well as of urban developments at the urban fringes, are among the better documented issues in planning theory (as described in section 3). We found no examples of planners referring to other research-based knowledge demonstrating that the assumed (in section 3) traffic-increasing measures would not in fact have such an effect.

Other explanations could be related to properties of the planners and their practices. Planners may be unable to bring the expert knowledge in question into planning processes because, for various reasons, they do not know it well enough to understand or explain the traffic-increasing effects of suggested measures. This could be part of the explanation in the Lund and Aarhus cases, where the planners seemed to rely on planning myths concerning the effects of spatial structure rather than on research-based knowledge. In Trondheim, on the other hand, several planners expressed that they knew very well that un-central urban developments and increased road capacity counteract the main objectives of the Trondheim Package. As for the land-use strategy, planners at the planning authorities believed they could have achieved more if they had been more pro-active in facilitating the densification strategy they considered necessary to achieve the defined goals. When explaining why they included the road projects, the planners said that the political decision-makers saw these as a necessary part of the package and would not be persuaded to apportion priority differently. Instead they did what they could to reach agreement on the best Trondheim Package possible within the existing frames, and to find ways of mitigating negative effects. Likewise, the planners in Aarhus did not speak up about the parking restrictions they saw as necessary to achieve the defined objectives, since they believed the political decision-makers were not yet ready for car-restrictive measures. These are examples of planners exercising self-censorship. They possess the knowledge that certain measures counteract stated main objectives but, it seems, decide not to use it or to make political decision-makers aware of it. These findings illustrate that the power relations between planners and political decision-makers may be important explanations when planners include traffic-increasing measures in plans.

The Aarhus case illustrates another interesting explanation, namely the power of a compelling project or idea. The origin of the plan was an idea about a rail-based public transport system in the city. This grew into the idea of combining new town developments with a light rail project, which planners and political decision-makers alike agreed on, and which resulted in the 2009 Master Plan. Taking the expert knowledge in question into account would be threatening to this idea. Likewise, questioning the road projects in the Trondheim Package could stop the plan from being implemented, according to the planners. These could be examples of research-based knowledge being threatening to political agendas, and hence disregarded or ousted (Owens et al., 2006).

Our readings of planning documents revealed that planners do not necessarily explain the cause–effect relations on which their knowledge claims are based. Furthermore, we found that they rarely present references to documented knowledge underpinning their knowledge claims or recommendations. We find that this practice is part of the explanation why traffic-increasing land-use and transport system developments are included in plans aiming at reducing traffic volumes and GHG emissions. It opens for confusing un-documented myth, beliefs and wishes with documented knowledge. It also opens for planners selecting which knowledge claims to present. It absolves planners from reading up on documented knowledge concerning the case matters in the plans. It reduces the transparency of plans, analyses and planning debates, and hinders open and knowledge-based planning debates. It paves the way for political decision-makers affecting professional analyses and recommendations in ways not fostering knowledge-based analyses, plans and decisions. If planners in our cases were required to document their knowledge claims and recommendations, they could not have presented these plans as responses to objectives concerning reduction of traffic volumes and GHG emissions.

The reasoning in this section demonstrates that when explaining how and why measures and strategies counteracting goal achievement with respect to reducing traffic volumes are

included in plans, several interrelated mechanisms need to be included. Main explanations are related to ousting of the objective 'reducing traffic volumes', and to planners not knowing (well) or not using the expert knowledge in question.

Table 6: Assessment of whether the mechanisms defined in section 4 were important when non-optimal and counter-productive measures were introduced in and included in plans.

Mechanisms	Trondheim	Lund	Aarhus
The objective of 'reducing traffic volumes' was not introduced	No, this was the main stated objective in the Trondheim Package	No, this was a clearly stated objective	No, the objective was stated
The objective was (partly) ousted by other objectives	Yes, by objectives concerning completing the ring road system in order to reduce local environment problems, and to ensure enough land for construction of housing and businesses	Yes, by objectives concerning facilitation for strong growth in housing combined with a strong focus on soil conservation	Yes, the objective was not made prominent in the plan-making, and was ousted by objectives concerning facilitating growth and making the city more attractive
The expert knowledge was not introduced	No, the expert knowledge is present in all documents and most interviews, but knowledge concerning traffic-inducing effects of urban road expansions was downplayed	Parts of the expert knowledge were introduced in the plan-making process, other parts in the EIA, while knowledge concerning traffic-inducing effects of urban road expansions was not introduced in the Master Plan	Parts of the expert knowledge were introduced in the plan-making process, other parts in the EIA, while knowledge concerning traffic-inducing effects of urban road expansions was not introduced
The expert knowledge was ousted by other knowledge or disregarded	Yes, knowledgeable planners exercised self-censorship when they found that implications of the knowledge were politically unacceptable	Yes, it seems that influential planners were not experts with respect to this knowledge, and that it hence was ousted by 'planning myths'	Yes, it seems that influential planners were not expert with respect to this knowledge, that it was ousted by 'planning myths', and disregarded when it opposed the compelling planning idea
The expert knowledge was wrongly applied	Perhaps in assessments on whether the combination of measures would cause traffic reduction	Perhaps in arguments that improved public transport and improved local services would ensure low car shares and car use to suburban housing and workplaces	Perhaps in arguments that improved public transport and good access to local services alone would ensure low car shares and car use to suburban housing and workplaces

5.5.4 Whether and how the use and non-use of expert knowledge affect the goal achievement potential of the plans

The above analyses show that whether or not planners use the expert knowledge in question in planning processes, and how they use it, indeed affects the goal achievement potential of plans.

This expert knowledge is a main basis for knowing and acting of many planners. It affects their framing of problems as well as which measures they consider in ways fundamental to the coordination of land-use and transport planning and for inclusion of traffic-reducing

measures. The planners use this expert knowledge to explain cause–effect relations and as arguments as to why some measures increase goal achievement potential, while others do not.

We also found that the ways planners use the expert knowledge in question, as well as their non-use of it, are important parts of the explanation as to how and why measures reducing goal achievement potential were included in the plans. When competing objectives, understandings or ideas seemingly call for traffic-increasing measures, the public planners did not use the expert knowledge in question to explain that the proposed measures reduced the goal achievement potential of the plans or for find alternatives that would improve it. This was explained in different ways. Certain characteristics of the expert knowledge could explain why it was disregarded in some situations. The main explanations were, however were related to the planners and their practices. Some planners do not know state-of-the-art knowledge in this field, or they rely on obsolete planning paradigms and planning myths. They are therefore unable to bring this knowledge into the planning processes. Some planners choose to disregard it when it opposes a compelling planning idea. Others knew the knowledge in question well, but exercised self-censorship and chose not to bring the knowledge into planning processes because they did not believe they could convince the political decision-makers to include or exclude certain measures and strategies. An important prerequisite for this is the practice of not clearly substantiating or presenting references to documented knowledge for important knowledge claims in plans and analyses.

Table 7: Assessment of whether and how the use and non-use of the expert knowledge affected the goal achievement potential of the plans in Trondheim, Lund and Aarhus.

Trondheim	Lund	Aarhus
Yes, use of the expert knowledge in question was fundamental for coordinating land-use and transport developments, and for selecting traffic-reducing measures. Planners exercised self-censorship when they found that the expert knowledge contradicted political agendas, and they did not speak up against counter-productive measures (road capacity expansions, land-use development strategies)	Yes, use of the expert knowledge in question was fundamental for coordinating land-use and transport developments, and for selecting traffic-reducing measures. The knowledge was ousted by planning myths concerning land-use developments, and not regarded when considering road capacity expansions	Yes, use of the expert knowledge in question was fundamental for coordinating land-use and transport developments, and for selecting traffic-reducing measures. The knowledge was ousted by planning myths concerning land-use developments, disregarded when it opposed a compelling idea, and not regarded when considering restrictive measures and road capacity expansions

6. Discussion

6.1 Interesting contradictions

When asking whether and how planners' use and non-use of the expert knowledge in question affect the contents of plans and their goal achievement potential, there is an interesting contradiction in the findings in our cases. On the one hand, we found that the idea of coordinating land-use and transport systems development in ways contributing to reducing traffic volumes is prominent in urban planning practice. This is stated as a high priority objective in all examined planning and policy documents. Widespread agreement on how land-use and transport systems ought to be developed in order to contribute to achieving this (listed as three bullet points in section 3) is also found in planning documents and interviews with planning practitioners. Planners use this knowledge for understanding, explaining and arguing how and why coordinating land-use and transport systems

development are necessary, and how and why certain measures and strategies contribute to reducing transport demand and traffic volumes and should be included in the plans. Hence, this could be interpreted as a success story where research-based knowledge has diffused to wide parts of planning practice, and where it is used in plan-making in ways contributing to increasing the goal achievement potential of the plans.

On the other hand, however, we found that planners include counteracting measures in plans, which reduces their goal achievement potential. When competing objectives seem to call for traffic-increasing measures, planners do not use the expert knowledge in explaining how these measures reduce the goal achievement potential of plans, and they do not turn to research-based sources of knowledge for help in solving their planning problems. In this process, planners disregard or oust the expert knowledge in question. We found three main explanations for this in our cases. One was that planners do not know this knowledge well, and/or they rely on previous planning paradigms and planning myths. Another was that planners more or less consciously disregard this knowledge when it does not fit their planning agenda or a compelling idea. The third was that planners exercise self-censorship when they find that this knowledge contradicts political agendas or objectives.

6.2 Exploring potential explanations

In order to answer our second research question about what can be done to improve the goal achievement potential of plans, we need to explore different ways of understanding and explaining the findings in our cases. Our discussions concern mainly how and why strategies and measures reducing goal achievement potential are included in plans. Here are four hypotheses or potential explanations that are interrelated in several ways:

- The ways planners gain knowledge affects how they use or ignore expert knowledge when making plans
- The ways planners use or ignore expert knowledge when making plans – their practice – cause that counter-productive measures are included in plans
- Characteristics of the expert knowledge cause planners either not to use it or to use it wrongly
- The distribution and exertion of power in planning processes prevents planners from using the expert knowledge when making plans

6.2.1 The ways planners gain knowledge

The first potential explanation is that the way planners gain knowledge affects how they use it when making plans, and hence the content of the plans. Analyses of the three cases revealed that the main mechanism through which the expert knowledge in question was introduced in planning processes was as embedded in knowledgeable planners involved. The interviews demonstrated that planners form a community of practice (Wenger, 1998), where learning from experience and from other planning practitioners are important ways of gaining knowledge after their education. This includes reading local, regional, national and sometimes international planning and policy documents. Knowledge diffuses (Shipan and Volden, 2008) between planners working together in the same city, and between planners in different cities and countries. Knowledge creep (Radaelli, 1995) and enlightenment (Weiss, 1979) are important mechanisms through which new knowledge reaches planning practice. There are indications that knowledge transfer also occurs through direct contact between academic milieus and planning practice in planning processes and at seminars and conferences. From our cases, it seems that planners' reading of scientific or popular science literature is not an important mechanism for knowledge

transfer from research to practice. This is in accordance with findings in previous studies (Krizek et al., 2009; Owens et al., 2006; Tennøy, 2012).

Learning through communities of practice is a natural and logical way of transferring knowledge between planners with different competence and between more and less experienced planners. Knowledge diffusion like this could also have disadvantages. For instance, there is little room for contact with research-based knowledge and there are time-lags between production and use of research-based knowledge. It opens for faulty translations, misunderstandings and over-simplifications, as well as vulnerability for confusion of documented and non-documented knowledge. Furthermore, knowledge diffusion offers few opportunities or possibilities for critical discussions and corrections.

An important mechanism through which research-based knowledge transfers to planning practice is through education. This involves a substantial time-lag from the point at which research produces knowledge until the students become influential planners contributing to setting the agenda in planning processes. Furthermore, fresh planners will be (and should be) influenced by the knowledge, understanding and framing of more experienced planners. This opens, however, for outdated knowledge and old planning myths living alongside and being confused with state-of-the-art research-based knowledge. Another entry point for research-based knowledge is researchers contributing in planning processes, or at seminars and conferences aimed at planning practitioners. This allows a more direct transfer of research-based knowledge if researchers contribute with relevant and useful knowledge for planning practice, and present it in ways that are understandable and useable by planning practitioners. If they do, planners still need to interpret this knowledge to fit the physical and political contexts in which they work, and to explain it to other planners and decision-makers; otherwise the knowledge will not become influential in planning processes. If planners do not turn to scientific or popular science written sources for confirmation, the knowledge transfer is vulnerable for misinterpretations, over-simplifications, and confusion of myths and un-documented knowledge with research-based knowledge.

These are explanations of how and why some planners do not know state-of-the-art expert knowledge concerning the case matters in planning processes well, and why they relate to and rely on obsolete knowledge, un-documented knowledge or planning myths rather than on documented research-based knowledge when making plans.

6.2.2 The ways planners use or ignore expert knowledge when making plans

Through the case studies, we learned that the ways planners use or ignore expert knowledge clearly influence the content and goal achievement potential of plans. We also learned that the most important mechanism through which the expert knowledge in question is used and influences the content of plans is as being the basis for knowing and acting of planners involved. This knowledge is an important part of planners' *framing*, described by Schön (1983) as a way of selecting, organizing, interpreting and making sense of a complex reality to provide guideposts for knowing, analysing, persuading and acting. Their framing influences how planners understand problems, which measures and strategies they consider, which analyses and tools they use, etc. (as discussed in section 4.4.2).

This could also mean that planners use this knowledge rather subconsciously for understanding problems and possible solutions. This may work well for experienced planners dealing with familiar problems, solutions and contexts. Problems occur, it may seem from our cases, when planners face new objectives and challenges, such as making plans contributing to reduced traffic volumes, or when they find unfamiliar conflicts of objectives in planning processes. If they do not turn to relevant, documented, research-based knowledge in solving their planning problems in such cases, but rather rely on their

embedded knowledge and what others have done before them, they may not be able to find innovative ways of meeting new challenges contributing to achieving seemingly contradictory objectives. If they instead turn to out-dated knowledge not relevant for the objectives and context in hand, to un-documented planning myths (see Næss et al., 2013) or to old solutions that worked well for other problems and objectives, they are likely to produce plans with low goal achievement potential.

This problem is aggravated by a culture where planning practitioners are not required to clearly state the cause–effect relations on which they build their analyses and plans, where references for important knowledge claims are rarely presented or asked for, and where research-based empirical evidence is seldom displayed. This results in a lack of clarity and transparency in plans and planning analyses which makes critical discussion almost impossible. Others cannot test or verify their knowledge claims, make up their own minds or dispute the validity of the claims in the actual context. This, too, makes distinguishing between well-documented knowledge claims and analyses from planning myths and undocumented knowledge difficult, and may reduce the influence of research-based knowledge. Furthermore, it does not require planners to read up on documented knowledge relevant to the planning task.

In our cases, planners used the expert knowledge in question more actively and consciously when assessing whether the proposed measures and strategies in a plan would contribute to goal achievement. As discussed in section 5.5, impact assessments are normally conducted after the actors have agreed on a plan. Making major changes at this stage will often not be an option. If the knowledge is to have substantial influence on the content and goal achievement of a plan, planners need to bring expert knowledge into the plan-*making* process. They need to use it when describing the problems to hand, their causes and the causal relations between land-use and transport systems development and traffic volumes. Furthermore, they need to address how mechanisms contributing to reducing traffic volumes can be triggered and how mechanisms contributing to increasing traffic volumes can be hampered, how to mitigate problems that may occur if the necessary strategies and measures are implemented, etc. In our cases, we found little evidence that planners did so.

Professional planners are supposed to be the primary knowledge carriers in complex plan-making processes, and the ones that bring relevant, up-to-date, knowledge into planning processes. This is a prerequisite for production of plans with high goal achievement potential. We have already described how planners gain knowledge through communities of practice, with the risk of substantial time-lags, faulty translations, and confusion between documented and non-documented knowledge; also, that planners use this knowledge in subconscious ways, and without stating the bases and references for their knowledge claims. Lastly, it seems that planners tend not to turn to research-based state-of-the-art knowledge to solve complex and unfamiliar planning problems. Together, this could explain why planners include traffic-increasing measures and strategies in plans aiming at reducing traffic volumes. This could severely hamper transitions towards land-use and transport developments fostering more sustainable mobility patterns.

6.2.3 Characteristics of the expert knowledge

Characteristics of the expert knowledge itself were suggested as a possible explanation as to how and why counter-productive measures are included in plans (section 4.3). Our case studies revealed that some planners find that the expert knowledge does not present precise and unquestionable answers to their planning problems. As a response, researchers could point at the overwhelming empirical evidence of the traffic-increasing effects of urban sprawl and urban road capacity expansion. This throws up interesting questions concerning

whether and why researchers and practitioners have different points of view with respect to what it takes for research-based knowledge to be usable in practice.

These findings may also be understood as a demonstration of the asymmetric burden of evidence (Næss, 2011a). The requirements are far stronger when it comes to controversial questions, such as when knowledge challenges current framings or compelling ideas. That said, we agree that theoretical understandings and empirical evidence concerning certain forms of polycentric urban developments (e.g. location of non-specialized jobs in suburban or exurban centres) need to be further developed. This could contribute to better and more knowledge-based planning analyses concerning how spatial urban development affects travel behaviour and traffic volumes. This could also be a valid critique when it comes to other issues and case matters in planning, such as the effects of various improvements in public transport services (frequency, speed, walking distances) on car-use in various contexts.

Another problem that planners face when using research literature when making plans is that it may be hard to judge which research to rely on. Researchers focus on different aspects of for instance the characteristics of spatial structure (such as centrality of housing, density in demarcated residential areas, street layout), and they may disagree on which aspects matter more for traffic volumes generated per capita. This may be part of the explanation why planners in two of our cases saw large, new urban, development fairly distant from the city centre as unproblematic strategies in land-use and transport plans aiming at reducing traffic volumes. It also allows planners to select research findings fitting their agenda or project, and for disputes between planners basing their knowledge claims on different research findings.

In section 4.3 we opened for the possibility of competing scientific knowledge to the state-of-the-art knowledge presented in section 3 as an explanation for non-use of the expert knowledge in question. We have not found references to such competing, documented knowledge in our cases.

A relevant characteristic of the expert knowledge concerns how accessible it is for planning practitioners. Traditionally, much academic knowledge is hidden behind journal paywalls. Planning practitioners may not be familiar with the journal system, or their employers may not want to pay for access to journal articles. This situation may improve as more researchers publish their academic works as open access – free and searchable on the Internet. Planners may still lack the resources to seek out, sort, read and translate research literature in their own context. The interviewees in our cases did not report that they had been prevented from reading up on research literature in any way. Rather, our impression is that they had not considered this as a relevant option.

We agree with Krizek et al. (2009), who suggest that good research summaries could help in the communication of research findings to the planning practitioner, but find that they are often lacking. Two planners in our cases referred to such summaries, while no one referred to journal articles. Our own searches for research summaries concerning various issues revealed that they are often more concerned with planning processes than with effects of physical developments, that they present more normative opinions, assumptions and beliefs, and less documented knowledge concerning effects of certain measures in specific contexts. This was the case, for instance, when we searched for summaries of documented effects of parking regulations on retail in city centres. Litman's (2013) summaries are good examples of research evidence concerning induced traffic.

6.2.4 Distribution and exertion of power in planning processes

As discussed in sections 1.3, 4.2 and 4.3, the distribution of power in planning processes, and how different actors exert the powers they possess, may strongly affect whether and how planners use relevant expert knowledge, which knowledge becomes influential, and hence the contents and goal achievement potential of plans. Our discussions on power in this article focus on these aspects.

Lukes' (2005) three dimensions of power are relevant when analysing planning processes. He orders power as: *direct power,* exercised in order to win in more or less open conflicts; *agenda-setting power,* exercised for affecting which issues are made prominent; and *structural power,* related to latent or not openly expressed conflicts, and which influence and shape perceptions, cognitions and preferences in such a way that actors accept their role in the existing order of things. We also find Bachrach and Baratz's (1962) definitions of five different ways of exerting power useful: *Coercion, influence, authority, force* and *manipulation*.

We did not find evidence of actors exerting direct power in open conflicts in ways affecting whether and how planners use the expert knowledge in question in our cases. Neither did we see examples of planners or others using expert knowledge as tools in order to win in open conflicts. This is partly explained by our cases being strategic planning processes, since they are led by and mainly involve public authorities. If studying zoning plan processes, we would probably have found clearer examples of open conflicts, knowledge battles and power-play between planning authorities and developers, as did Tennøy (2012) for instance when analysing four zoning plan processes. It is also partly explained by our focus on planners and their use of knowledge. We know for instance that the political right and left wings in Trondheim disagreed on re-introduction of the toll cordon. Since the left wing was in power, the right wing respected the authority of the left to make the decision. We assume that there had been some political power-play before the decision was made, but this was outside the scope of our research. On these terms, we did not find open conflicts concerning the planning proposals or which measures should be included in or excluded from the plans. In particular, we did not find planners exerting their powers as knowledge carriers opposing inclusion of traffic-increasing measures, and we did not find conflicts between different planners using knowledge as tools for convincing the other side. Planners and consultants used their influence as professionals and as knowledge carriers to explain in the impact assessments that the plans would not contribute to (Aarhus and Lund) or ensure (Trondheim) goal achievement. Planners presenting professional analyses in these ways can only to a certain degree be understood as actors exerting their power to win in open conflicts.

In strategic planning processes, as studied here, the exertion of agenda-setting power stands out. In planning terms, we can interpret this as exerting power to define main objectives. As discussed throughout the analyses, there are conflicting agendas in all three cases. In all cases, sustainable urban development and the need to curb traffic growth is one agenda, or objective. This is an important explanation as to why planning of land-use and transport systems developments is coordinated, and why traffic-reducing measures are included in the plans. In all cases, there are also other agendas or objectives, seemingly conflicting with the agenda concerning reducing traffic volumes and GHG emissions. This is an important part of the explanation as to how and why traffic-increasing measures are included in the plans.

Planners were important agenda-setters in all cases and in different ways. In Trondheim, they used the municipal transport plan to move traffic and environment higher up on the agenda by describing a grim future without certain decisions and actions (re-introducing the toll cordon, facilitating use of other modes of mobility than car, steering land-use

developments towards densification). Political decision-makers in power strengthened this agenda by making and adopting the Trondheim Package. They made reducing or curbing traffic volumes in order to reduce GHG emissions an important agenda, but in a way where expansion of urban road capacity was a prerequisite. Planners made politicians aware that this could threaten the agenda concerning reducing traffic volumes, and hence paved the way for capacity reductions on other roads.

In Aarhus, one planner worked for several years to get light rail put on the planning agenda in the city, and succeeded (a forthcoming article in the same project presents the planner's own story about this project) partly because his agenda seemed to coincide with an emerging political agenda concerning reduction of GHG emissions from traffic in the growing city. Interestingly, through continuous dialogue with academic milieus, Aarhus planners became more aware of the traffic-increasing effects of new towns. In the revised plan, the most traffic-generating new towns are postponed to an undefined future. This could be understood as academics using their authority as knowledge carriers to affect the planning agenda.

In the Lund case, it seems that planners working for the planning authorities used their agenda-setting power the way it is normally used, that is by interpreting many of the objectives defined by political decision-makers and making a planning proposal. Making the plans (writing, drawing, calculating) could be understood as planners' strongest exertion of agenda-setting power.

Despite these examples of planners and decision-makers exerting power in defining agendas, we did not find examples of open conflicts concerning agenda-setting, or that actors strongly (stronger than one would expect) and openly exerted their power to render one agenda more prominent than another. This could be explained by Lukes' *structural power* being dominant. According to Powell and DiMaggio (1991), institutions influence human behaviour through rules, norms and cognitive structures. Actors take action through a logic of appropriateness based on what is accepted as norms and priorities in their institutional environment (March and Olsen, 1989). In planning processes, the Planning and Building Act defines the rules of the game. The actors involved have pre-defined understandings of the order of things, including who is in power over which decisions. In this system, planners are supposed to advise political decision-makers, but not openly oppose political signals or decisions. This can explain why Trondheim planners exercised self-censorship concerning effects of road capacity expansions, and why Aarhus planners did not suggest stricter parking restrictions.

If planners experience decision-making bodies not really caring much about some of the objectives affected by the planned solutions, they may find it necessary not to align their proposals with these objectives. Planning theorists such as Lindblom (1959) have advised against elucidating solution alternatives and impact categories unlikely to be emphasized by the decision-makers. If the planners adhere to this way of thinking, it might appear rational to direct the search for solutions backed by sufficient power. Controversial solutions that might lead to delays in the decision-making process, or even set implementation of the plan at risk, are then likely to be ousted. This seems to have occurred in all three case cities. Our findings hence illustrate that power relations between planners and political decision-makers may be important explanations when planners include traffic-increasing measures in plans.

This does not mean that planners can blame plans with low goal achievement potential on political decision-makers, or that planners' use and non-use of expert knowledge cannot or do not affect the content and goal achievement potential of plans. Planners are influential and have much room for manoeuvre in planning processes, as our case studies have

demonstrated. There is also much unused space for planners exerting power in ways contributing to plans with higher goal achievement potential. The largest may be that planners use their powers and abilities as knowledge carriers and professionals to develop planning alternatives contributing to reduce traffic volumes, and at the same time to achieve other objectives high on the political agenda (enough housing, attractive cities, reduced local environmental problems, etc.).

6.3 What can be done to improve the goal achievement potential of plans?

What, then, would be necessary to improve the goal achievement potential of plans? When focusing on planners' use and non-use of expert knowledge when making plans, within the framework of existing legislations we develop answers focusing on what planning practitioners and planning researchers can do differently from today. The practitioners are the ones using or not using expert knowledge when making plans with high or low goal achievement potential, while the researchers are the ones produce and disseminating the expert knowledge (as defined here). Our answers are interrelated and partly overlapping.

6.3.1 What planning practitioners and the planning profession can do

As far as planning practitioners are concerned, their producing plans with higher goal achievement potential with respect to reduced urban traffic volumes would require, *first*, that they make this a more prominent objective throughout the plan-making process. The planners need to approach planning processes confident that their plans will contribute to reducing traffic volumes. They also need to get this objective high up on the agenda among the planners involved and among the political decision-makers who may be required to make unpopular decisions. If not, the chances are high that the objective is ousted by other objectives during the planning and decision-making process, and that the process produces a plan with low goal-achievement potential.

Second, planners need to make a real effort towards finding ways of solving challenging planning problems and of meeting seemingly conflicting objectives in ways contributing to reducing transport demands and traffic volumes. Doing so requires that planners meet this task through innovative thinking, curiosity and hard work. Reducing traffic volumes, improving transport quality, facilitating city growth, and developing a more attractive city are not necessarily conflicting objectives. The expert knowledge in question offers ways of meeting all these objectives simultaneously. Rather than relying on undocumented knowledge and previous experience, if planners turn to the expert knowledge in question their chances of finding innovative ways of solving new and challenging planning problems would probably increase substantially, and allow them to develop planning alternatives meeting different objectives without compromising reduced traffic volumes and more sustainable urban mobility. Our cases demonstrated that planners do not necessarily do these things. Our *third* point is therefore that planners need to turn more actively to documented and research-based knowledge when struggling with difficult planning problems and seemingly conflicting objectives.

Fourth, this, too, means that planning practitioners need to be more critical of their own plans and ideas, as well as of their tacit and embedded knowledge. As discussed above, the ways planners gain knowledge through their community of practice can result in misinterpretation, over-simplification, and for confusion between undocumented knowledge and research-based knowledge. This problem can be reduced if planners are aware of it and act to ensure that they lean on well-founded knowledge claims when making plans and analyses.

This takes us to our *fifth* point; namely, that planning practitioners need: to present clearer descriptions of the understandings of cause–effect relations on which they build their

analyses and planning proposals; to give references for their knowledge claims; and to present empirical evidence where available. This would call for clear thinking and allow for critical reflections and discussions, which could then open for innovation leading to plans with higher goal achievement potential. It would also require planners to read up on the relevant literature and be more capable of distinguishing between valid and less valid knowledge.

This calls for a *sixth* change; namely, how planning practitioners understand and exercise their role and power as knowledge carriers and decision-makers' main advisors. We suggested above that planners do not fully use the power they have to set new agendas, that is, in their capacity to develop planning alternatives contributing to reduce traffic volumes, and at the same time achieving other objectives given priority. If they instead exercise self-censorship of the knowledge they possess, disregard vital knowledge opposing compelling ideas or do not seek updated knowledge on unfamiliar case matters, they do not contribute to enlightenment of fellow planners and decision-makers with respect to the consequences of decisions or to alternative ways of solving problems. How they actually can and do act, relates to the properties of the planners themselves. This has to do with how competent, skilled and experienced they are in regard to the challenges and case matters at hand, and how determined and curious they are about finding good ways of solving challenging problems contributing to reducing traffic volumes. It also depends on the context they operate in, such as whether decision-makers are willing to listen to planners' advice, and whether their planning community is open to innovative thinking and new ideas.

Changes in how planning practitioners operate are not just a task for the individual planner, they are also to a high degree a responsibility of the planning profession. The challenges described above call for the planning community seriously to discuss their practice and to reflect on changes that could contribute to making the profession, as well as the individual planner, better able to develop land-use and transport strategies contributing to more sustainable urban development. We do not discuss this at any length here, but just suggest some relevant issues. One is the education of planners. This concerns whether and how they are trained in strategic land-use and transport planning. It is also about whether and how they are trained to seek out research-based knowledge, to state the cause–effect relations underpinning their knowledge claims, planning proposals and recommendations, and to make references to research-based knowledge in plans and analyses. Another issue concerns post-university courses and continuing professional training. The Scandinavian countries have no organisation resembling for instance the UK Royal Town Planning Institute (RTPI), which offers membership to accredited planners and courses qualifying for membership. The situation is the same in Denmark and Sweden. The findings in this study indicate that the Scandinavian countries could benefit from an organisation resembling the UK Royal Town Planning Institute, which organises and trains planners and sets the standards for what is required by someone denoting themselves as planners.

6.3.2 What planning researchers can do

When discussing what can be done to improve the goal achievement potential of plans, focusing on planners' use and non-use of expert knowledge, we also need to discuss how researchers producing this expert knowledge can contribute. Our discussion is based on findings concerning how planners gain knowledge, how it is introduced in planning processes, how and why planners use or ignore such knowledge when making plans, and how it all affects the content and goal achievement potential of plans.

One issue is the kinds of knowledge planning research produces. As discussed in the Introduction, several authors claim that planning research has not given much attention to what we have termed expert knowledge – substantive evidence concerning how cities

function. As a consequence, planners aiming at making their plans and analyses more knowledge-based may not find research-based knowledge valid in the concrete context concerning the case matters they struggle with. Based on our own experience when making planning analyses of various issues for cities of varying size, we know that relevant research-based knowledge can be hard to find. Often, we need to rely on knowledge that may not be valid in the concrete context. One task for planning research is hence to produce evidence concerning the effects of different kinds of development on traffic volumes, attractiveness, transport quality, etc., and thus contribute to strengthening the expert knowledge planners need to make plans with high goal achievement potential.

Another issue is how researchers disseminate and communicate the knowledge they possess and produce to planning practice. We have learned that planners gain knowledge through their community of practice, that knowledge is brought into planning processes mainly as embedded in the planners, and that planners use the expert knowledge subconsciously when making plans. They do not turn to journal articles for help in solving their planning problems. How, then, can researchers communicate knowledge into planning practice? Our case studies point out some suggestions. Researchers can contribute with relevant articles in popular science journals, and in seminars, conferences and courses directed towards practitioners. Researchers can contribute in on-going planning debates, through accepting invitations to workshops and meetings discussing these issues, in public discussions in papers and open meetings, and by involving themselves in concrete planning processes and analyses (this is probably more relevant for researchers working at research institutes taking this on as commissioned work than for university researchers).

How research-based knowledge is presented is crucial for its usability by planning practitioners. Summaries of research-based knowledge concerning specific topics (effects of land-use and transport systems development on traffic volumes in various contexts, measures affecting the vitality and viability of city centres, etc.) could be a way of increasing planning practitioners' knowledge of state-of-the-art expert knowledge in various fields. This requires that researchers take time to producing them while making sure they are useful and usable for to planning practitioners (for instance by involving practitioners in developing, improving and disseminating them). This requires that the summaries are relevant for planning practice, that the scientific quality is good (for instance that there are full references for all knowledge claims), and that the knowledge is presented in ways that are easy to refer to and to translate into concrete contexts by planners. Researchers and public authorities would often need to promote such summaries if they are to be used in planning practice.

This would require planning researchers to be more questioning about what kinds of knowledge planning practice needs, and how planning practitioners assess and use the knowledge produced by academics. Researchers could more actively and empirically seek to figure out how and why planners produce plans with low goal achievement potential, and how useful for plan-making planners find research-based knowledge. This might involve deep studies of the fine-grained processes through which plans are made, as this paper attempts to do, and/or direct dialogue with planning practice concerning their knowledge needs. Such studies and dialogues could affect research agendas by revealing knowledge needs as well as perceived or real shortcomings of the knowledge that research could contribute to improving. It could also contribute with new insights concerning what planning practice requires with respect to the quality of the research-based knowledge if it is to be usable. This might inspire some researchers to change their research and dissemination strategies in ways that provided planning practice with more useful and

usable knowledge. This in turn would be helpful to planners in producing more knowledge-based analyses and plans with higher goal achievement potential.

Owens (2005: 290-291) warns that researchers should not necessarily adjust their research to practice, since *"the research that seems least useful, indeed even threatening, in the short term might contribute most to substantial longer term change"*. We agree, but find that planning research should contribute to knowledge and theories *in*, *of*, as well as *about* planning (Faludi, 1973; Friedmann, 2003), where knowledge *in* planning concerns the substantive objects of planning. For instance, this could be how land-use and transport system development affects traffic volumes.

7. Conclusions

In this paper we have investigated how planners' use and non-use of expert knowledge in plan-making affect the content and goal-achievement potential of the plans. In addition, we have examined what can be done to improve the latter. Our analysis rests on three basic assumptions. One is that changes in the physical environment affect aggregate-scale human behaviour in relatively predictable ways. The second is that there can and does exist research-based expert knowledge concerning these interrelations. The third is that research-based expert knowledge and skilled planners applying this knowledge when making plans are important prerequisites for producing plans with high goal achievement potential.

We developed theoretical hypotheses and explanations concerning how and why planners' use and non-use of expert knowledge when making plans affect the goal-achievement potential of plans, and examined these through empirical case studies of three strategic land-use and transport planning processes. The expert knowledge in question in this work was theoretical and empirical knowledge regarding how changes of land-use and transport systems tend to affect travel behaviour and traffic volumes.

We found that whether or not planners use the expert knowledge in question when making plans – and, if they do, how they use it – indeed affects the goal achievement potential of the plans they produce. This expert knowledge is a main basis for the knowing and acting of many planners. It affects their framing of problems, as well as which measures they consider and give priority to, in ways being fundamental for coordination of land-use and transport planning and for inclusion of traffic-reducing measures. The planners also use this expert knowledge to explain cause–effect relations and as arguments why some strategies and measures increase goal achievement potentials, while others do not. We found that non-use of the expert knowledge in question was an important part of the explanation as to how and why measures reducing goal achievement potential were included in the plans. When competing objectives, understanding or ideas seemingly call for traffic-increasing measures, the planners did not use the expert knowledge in question to explain that this reduced the goal achievement potential of plans nor to find alternatives that would improve it. Some planners did not know state-of-the-art knowledge in this field well, or they relied on obsolete planning paradigms and planning myths. Some planners choose to disregard this knowledge when it opposes a compelling planning idea. Others exercise self-censorship and choose not to bring the knowledge into planning processes because they believe they cannot persuade the political decision-makers to include or exclude certain measures and strategies.

In the discussion section, we explored explanations relating to how planners gain knowledge, how they use it, its characteristics and the distribution and exertion of power in planning processes. We found that the ways planners gain knowledge might explain the confusion of valid with less valid knowledge. Furthermore, the often subconscious ways

planners use knowledge when making plans, together with a culture in which they are not required to clearly state the cause–effect relations on which they build their analyses and plans, or to present references for their knowledge claims, are parts of the explanation why they produce plans with low goal achievement potential. We also found that properties of the knowledge might make it less accessible and usable in planning practice. Lastly, we found in particular that the structural power in planning processes is part of the explanation as to why planners sometimes exercise self-censorship and do not share their expert knowledge with political decision-makers and others in planning processes.

Based on these findings, we discussed what planning practitioners and planning researchers can do to contribute to a higher goal achievement potential of future plans. We argued that planners would need to make reduction of traffic volumes an even more prominent objective, and strive to find ways of solving challenging planning problems that safeguarded this. This requires them to be more critical of their own tacit knowledge, and to turn more actively to research-based knowledge. Planning researchers would need to strive towards producing the kind of expert knowledge planners need in order to make plans with higher goal achievement potential, and to present it in places where practitioners find themselves and in ways that are useful and usable for them.

The case studies in this paper were strategic land-use and transport planning processes aiming at reducing urban traffic volumes and transport-related GHG emissions. For several reasons we find this issue highly relevant and interesting when discussing the effects of planners' use and non-use of expert knowledge. Reducing traffic volumes and GHG emissions from transport come high on the agenda in many cities and countries. Developing land-use and transport systems in directions contributing to this is a complex problem, and planners need to use research-based expert knowledge in order to solve it in ways that contribute to goal-achievement. Achieving this also requires fundamental changes in framing and practice, which sometimes cause clashes of knowledge in the planning processes. Finally, processes concerning strategic and integrated land-use and transport development are fairly complex too, with many actors promoting different objectives and kinds of knowledge. Together, this creates situations where the use and influence of research-based expert knowledge are not necessarily obvious, and therefore are interesting cases when investigating how planners' use and non-use of expert knowledge affect goal achievement potentials of plans.

One may find, however, that many of the mechanisms discussed here are relevant also when studying the use and influence of research-based knowledge in planning processes concerning other complex issues, where other types of expert knowledge are more relevant, and maybe even within other sectors and professions. Hence, we believe the analyses and findings may be relevant beyond strategic land-use and transport planning. Furthermore, we believe that the research and results may be relevant for other countries and cities with similar challenges and planning systems as the three Scandinavian cities studied here.

In empirically investigating the issues in three overall planning processes, this article contributes with new empirical insights on the use and non-use of expert knowledge in planning, and on how it influences the content and goal achievement potential of plans. The research also contributes to our understanding how, exactly, planners use expert knowledge when making plans, and how it is brought into plan-making processes. Furthermore, the research adds to the theoretical and empirical understanding of how counter-productive measures with respect to stated objectives are included in plans. This concerns among other things an enrichment of our understanding of the fine-grained processes through which planning processes arrive at the strategies and measures included in plans, and how expert knowledge is disregarded or ousted when it does not fit current agendas or tempting

projects. Finally, the paper contributes with recommendations concerning what planning practitioners and planning researchers can do to improve the goal achievement potential of plans. Our hope is that this research has produced knowledge that will enable future planning and policy-making to be successful in steering land-use and transport developments towards more sustainable mobility patterns, given here as reduced urban road traffic volumes. We also hope that the research will inspire other researchers to explore the issue further.

Acknowledgments:

The research on which this article is based was funded by the Swedish Innovation Agency VINNOVA, within the project *Innovation for sustainable public transport in Nordic Regions. Integrated planning, political processes, institutional changes*. The authors want to thank project team members Robert Hrejla, Tim Richardson, Frode Longva and Tomas Svensson, as well as anonymous referees of Progress in Planning, for valuable comments on previous versions of the article.

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[i] Here, 'structure' refers to how an object is constructed, and not to social structure in relation to human agency.

[ii] It has recently been decided that the official English name of the package is: *Greener Trondheim – Partnership for sustainable transport.*

[iii]According to Meland et al. (2010), the traffic increase in the year following removal of the toll cordon (operating in rush hours) in Trondheim in 2005 was two percentage points above the average general traffic growth in the county (no other substantial and expected influential changes taking place at the time), which could lead to the understanding that reintroducing the toll cordon would not in itself contribute to a strong reduction or hold on traffic growth.

[iv] Elasticities (E) are often considered as a simple and comprehensible quantitative measure of the responsiveness of one variable on another. In its simplest form it may be defined as *"E = percent change in Y / percent change in X"* (Fearnley and Bekken, 2005: ii), where Y is the effect variable.