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Published online: 03 May 2022.

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From forecasts to scenarios in strategic city-regional land-use and transportation planning

Raine Mäntysalo[a] , Kaisa Granqvist[a] , Oya Duman[a] and Miloš N. Mladenović[a]

ABSTRACT

The article proposes a theoretical framework for the application of four scenario-planning approaches in strategic land-use and transportation (LUT) planning, focusing on city-regions. Each approach has a specific role in the process, with a distinct mode of knowing: *explanation* (knowing what), *narration* (knowing how), *argumentation* (knowing to what end and practical judgment) and *instrumentalization* (doing). The framework is contrasted with reflections from Finnish planning practitioners and applied when reviewing the scenario and impact assessment process of the Helsinki Metropolitan Region strategic LUT plan. The article highlights the key role of explorative scenario planning in strategic city-regional LUT planning.

KEYWORDS

backcasting; Helsinki Metropolitan Region; intuitive logics; normative scenario; theory of truth

INTRODUCTION

The recent years have seen a rise in the development and implementation of various urban foresight techniques (Dixon et al., 2018; Ravetz & Miles, 2016; Tewdwr-Jones & Goddard, 2014). In this article, we discuss such techniques in the context of strategic land-use and transportation (LUT) planning of metropolitan and city-regions. The strategic approach to metropolitan and major city-regions has gained national attention, viewing these spaces as engines of economic growth and global competitiveness, associated with the term 'city regionalism' (Jonas & Moisio, 2016). In turn, the related conceptualization of these spaces as 'functional urban regions' has emphasized the need to manage mobility and commuting patterns in connection to managing urban structure development (e.g., Davoudi, 2018), thus fostering city-regional LUT planning.

A central foresight approach in strategic LUT planning is *scenario planning* (Albrechts, 2005; Zegras & Rayle, 2012). It attempts to go beyond existing views and assumptions of the future and explore possible futures and planning responses to them (Zegras & Rayle, 2012). Accordingly, scenario *planning* is not merely about making scenarios of possible futures, but strategic planning of actions to be taken in anticipating and responding to the materialization of these scenarios (Walton, 2008).

The first applications of scenario planning in transportation planning appeared in the United States in the 1970s (Zegras et al., 2004), with LUT scenarios emerging in the 1980s. While the scenario-planning tools and related simulation software have become more sophisticated towards the 2000s, previous reviews on the applied scenario-planning approaches reveal shortcomings in dealing with multiple futures, engaging diverse stakeholders and publics in scenario work, and in using the scenarios produced (Bartholomew, 2007; Bartholomew & Ewing, 2008; Chakraborty & McMillan, 2015; Sustar et al., 2020; Zapata & Kaza, 2015; Zegras et al., 2004). In addition, studies of alternative scenarios in planning processes are often provided by separately hired consultancies to be used as mere background material for the justification of a certain long-term vision.

Indeed, strategic LUT planning has remained too focused on developing a single preferred scenario, without adequately considering multiple uncertain futures (Chakraborty et al., 2011; Myers & Kitsuse, 2000; Zapata & Kaza, 2015). As Chakraborty and McMillan (2015) note, there has been an overemphasis on 'picking' a preferred future. Such planning projects typically come up with a desired future land-use pattern and a corresponding set of transportation investments, without addressing critical uncertainties, in case the expectations of future growth in population and economy would not be met (Avin & Goodspeed, 2020; Goodspeed, 2020).

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However, more recently there have also been examples of using scenarios in an explorative sense, too, to explore a wider range of uncertain futures (e.g., Avin & Goodspeed, 2020; Banister & Hickman, 2013; Goodspeed, 2020). Such an approach to scenario planning somewhat correlates with a shift in planning thought more generally. During the recent decades, the deterministic blueprint-type approach to planning has given way to an idea of planning that is characterized by dealing with uncertainty. In planning-theoretical terms, this idea of planning is rooted in the concepts of bounded rationality (Simon, 1947), 'muddling through' (Lindblom, 1959), and mixed-scanning (Etzioni, 1967), and further developed in the more recent strategic planning approaches (e.g., Albrechts, 2004; Faludi, 2000; Friedmann, 2004; Healey, 2009).

At the core of the foresight challenge lies the contention between evidence-based and deep uncertainty frames of planning, and their related approaches to understanding and validating knowledge in planning. The evidence-based approach addresses future as a continuation of the existing and known development paths. In contrast, the deep uncertainty frame requires one to imagine development trajectories for which one does not have evidence, but which might emerge in the future, even if with a very low probability. Thus, in addition to the insights from previous research about scenario methodology, there is an underlying need to understand and relate to the plurality of 'modes of knowing' in planning practice (Davoudi, 2015).

In order to respond to this gap, our aim in this article is to develop a framework for the application of different scenario-planning approaches in strategic LUT planning practice. While doing so, we also argue that a more multi-faceted, and at the same time more structured, view is needed on how different modes of knowing are in use in strategic LUT planning that applies scenario planning. As we intend to show, evidence-based knowledge is essential, but not the only mode of knowing to be used in strategic LUT planning. Our approach is mainly theoretical, but we will also relate our theoretical ideas to two types of empirical material from the Finnish LUT planning practice.

The next section presents an outline of a scenario-planning framework for strategic LUT planning in city-regions. Our framework consists of four different approaches to scenario planning, each with a specific role in the different stages of the planning process, in relation to 'what is going on', 'what might lay ahead', 'where we want to go' and 'how to get there'. While having methodological implications, these four approaches do not denote one clear-cut method each, as multiple methods could be used for each approach depending on the planning process organization. The framework builds on critical accounts of scenario work in city-regional LUT planning.

The third section elaborates how each approach to scenario planning corresponds to a specific mode of knowing, leading us to argue that a multifaceted utilization of scenario approaches in strategic city-regional LUT planning requires an equally multifaceted approach to knowledge.

In the fourth section, we relate the scenario-planning framework and its corresponding modes of knowing to the reflections by Finnish LUT planning practitioners, including public officials of all levels of government and private sector experts. These reflections are based on a workshop (32 participants besides the researchers), held in September 2019, and a subsequent online discussion platform (14 participants) that was kept open for three weeks after the workshop. The programme of the three-hour workshop included the researchers' introduction of different scenario-planning approaches and their implications to knowledge production, and then four parallel workshop tasks in small groups (75 minutes) related to each approach. The researchers coordinated the workshop tasks, having two researchers to facilitate each parallel task: one coordinating the discussion and one recording the discussion by taking notes. After the workshop, the notes were immediately collected and transcribed into a memo that was then published on the website of the research project. The workshop programme was concluded with a joint discussion on the results of each task.

In the fifth section, we employ our framework as an analytical tool for reviewing the scenario and impact assessment process of the Helsinki Metropolitan Region (HMR) strategic LUT plan titled MAL 2019. In this review, we use related planning documents and semi-structured interviews of 11 transportation planning professionals who were involved in the impact assessment process of the MAL 2019 plan. The interviews were conducted in September–November 2020, recorded and fully transcribed. The document analysis includes documents related to the MAL 2019 plan preparation (especially on the scenario exercise and impact assessment) and the relevant legislation. The MAL 2019 plan brings together LUT planning, jointly with housing policy measures. As the HMR is by far the largest city-region in Finland and has often been considered as the only metropolitan region of the country, its coordinative intersectoral planning does not only have regional but also national importance, for example, in terms of achieving sustainability goals. Thus, we review the MAL 2019 scenario exercise and impact assessment process against our theoretical framework, and make critical observations on how the scenario and assessment processes contributed to the MAL 2019 plan, and what modes of knowing were at play.

In the final section, we make conclusions on the viability of the theoretical framework and its relevance to planning practice, and end with implications for further research.

SCENARIO-PLANNING FRAMEWORK FOR STRATEGIC LUT PLANNING

Framework of scenario-planning approaches in strategic LUT planning

In this section, we propose a framework of different scenario-planning approaches, to be applied in strategic LUT planning (Figure 1). We acknowledge that evidence-

based forecasts (population, mobility, economy, etc.) have an important role in this framework when developed into broader *trend scenarios* (Figure 1a). The estimated impacts of the trend scenario are useful to explore in parallel with the estimated impacts of *explorative scenarios* (Figure 1b) (Bradfield et al., 2005). Furthermore, based on deliberation between the scenarios and their impacts, a *normative scenario* can be identified, with a vision towards which the strategic LUT plan is targeted at (Figure 1c). The deliberation might concern, for example, the capacity of the scenarios to minimize the vehicle-miles travelled (VMT), to maximize accessibility of services and urban functions, and to provide other support for sustainable urbanization. The *backcasting* approach can then be incorporated for the programming of the development path and the related decisions to be taken from the present towards the vision, such as how to implement certain policies and who is responsible for implementation (Figure 1d). Below, we introduce these different methods and their sequencing in more detail.

Trend scenarios

LUT scenario planning emerged as a counter-reaction to the incapacity of traditional travel demand forecasts in dealing with the dynamics of transportation investments and land-use changes (Bartholomew, 2007; see also Hickman & Banister, 2014; Witzell, 2021). The mainstream travel demand forecasts draw on analytical models that extrapolate historical trends in travel behaviour and modal shares into the future (Lyons & Davidson, 2016; Witzell, 2021). Although sophisticated, at their core, travel demand forecasts still draw on simple gravity models developed in the 1950s, motivated by the need to manage growing flows of car traffic (Lampinen, 2015; Timms, 2008).

Bartholomew (2007) (see also Bartholomew & Ewing, 2008) has reviewed LUT scenario-planning projects conducted in the 1990s and early 2000s in over 50 metropolitan regions in the United States. According to Bartholomew, a key motive for applying scenario planning in these projects was to redirect the ongoing trend of increasing car dependency and dispersion of urban structure towards a more sustainable trajectory. Alongside LUT forecasts also alternative development paths were studied. In these, the prospects of incorporating densification-oriented land-use policies and sustainable mobility-oriented transportation policies were examined, in counteracting the forecasted trends.

In these LUT scenario-planning projects, travel demand forecasts were usually used in identifying 'business as usual'-type LUT *trend scenarios*, against which strategic LUT scenarios were compared. In a trend scenario, the prevailing trend of transportation system and urban structure development is expected to continue in the future in a time span of 20 or more years (Figure 1a). The environmental impacts of this development are then assessed. Next, alternative scenarios are formulated in which LUT arrangements are made to differ from the trend scenario by, for example, land-use densification and mixed land-

use measures, and public transportation and infrastructure investments and charges on private car use (e.g., parking, road tolls). The environmental impacts of these alternative scenarios are assessed accordingly. One key assessment indicator is the impact of a scenario on the VMT. Usually a scenario that indicates less VMT and other societal costs is chosen as a basis for further planning (Bartholomew & Ewing, 2008). This is in sharp contrast to the conventional 'predict and provide' approach that rather serves to foster the growth of (private car) VMT, by combining travel demand forecasting and travel time savings as a societal benefit, and thereby justifying new transportation infrastructure investments (Banister, 2008). In turn, the American LUT scenario-planning projects, reviewed by Bartholomew can rather be likened to a 'predict-and-prevent' approach (Owens, 1995) in which the predicted demand for travel is treated as a phenomenon to be studied and proactively influenced.

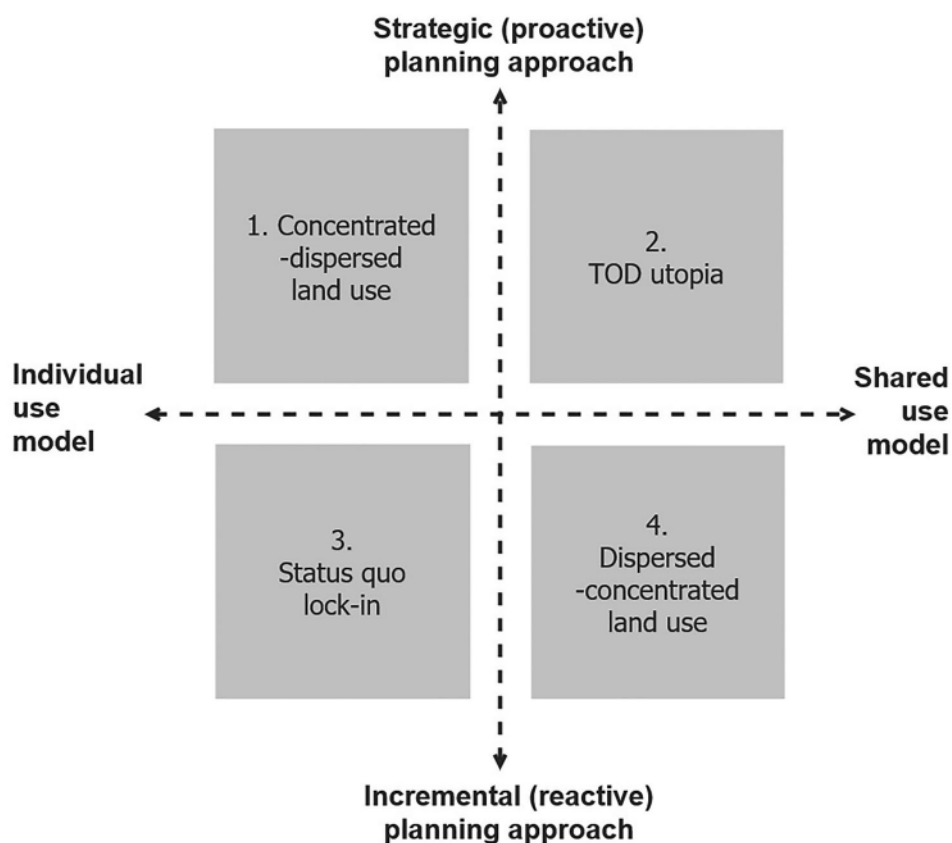## Explorative and normative scenarios

Bartholomew (2007) criticized the LUT scenario planning practices in the US metropolitan regions for their limited focus on *normative scenarios* towards sustainable urban structure and mobility. What are missing are the *explorative scenarios* (cf. Albrechts, 2005). With explorative scenarios, also such imaginable future developments are probed that are less desirable, yet plausible. Being common in strategic business management, they draw especially on the intuitive logics methodology of scenario planning (Chermack et al., 2020; Mäntysalo & Grišakov, 2016) that builds on the so-called shell-style scenario-planning approach (Wack, 1985), and the seminal work of Schwartz (1991) developing it further. The intuitive logics methodology is one of the three main methodologies of scenario work (the other two being the la prospective and probabilistic modified trends) (Amer et al., 2013; Mäntysalo & Grišakov, 2016), and the one applied the most. One of its distinguishing features, critical to scenario planning in the context of strategic LUT planning, is its 'decision focus' in framing the scenarios process at the beginning (Lyons et al., 2021).

Scenario planning according to Schwartz (1991) involves several steps. The first step is to identify the key issue demanding strategic responses – not the given strategic goals of an organization. In relation to this key issue, different driving forces in the operational environment of the organization, from the local to the global level, are then identified. In the identification of the driving forces, the known trends are examined together with imagined unknown factors and developments, weak signals and possibly emerging disruptive forces or 'wild cards', further differentiating them into social, technological, economic, environmental, political, and cultural driving forces.

In the next step, the driving forces identified are arranged and combined into thematic groups across the societal sectors. The aim is to recognize a few overarching themes under which sectorally differentiated driving forces could be grouped. The themes are then further refined vis-
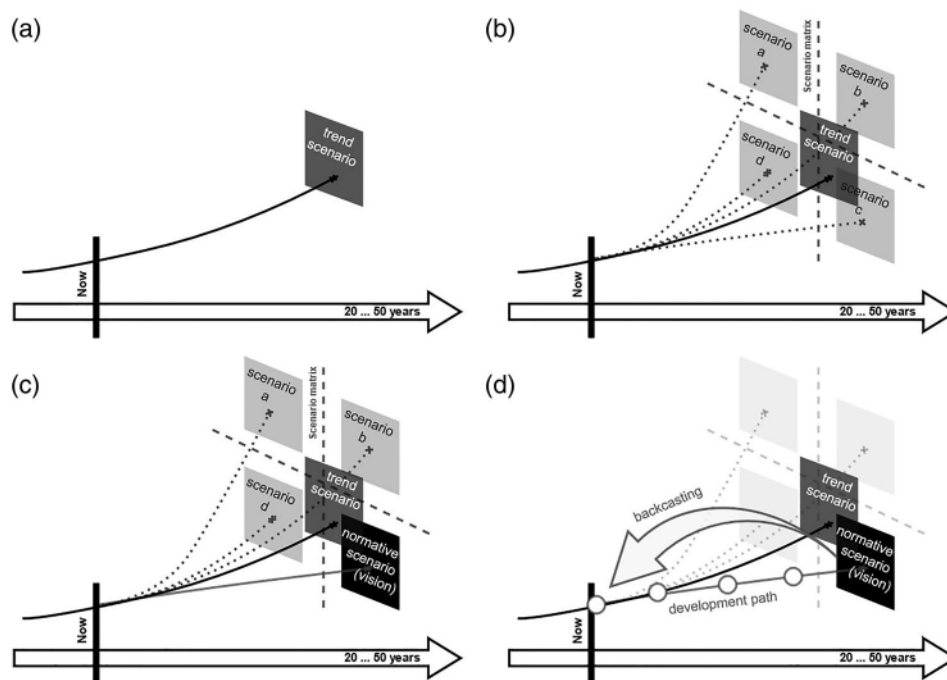
Figure 1. Scenario-planning framework: (a) trend scenario extrapolated from a historical trend into the future; (b) explorative scenario plans formulated on the basis of a scenario matrix, alongside the trend scenario; (c) choice of the scenario plan amongst alternative scenario plans to be taken as the normative scenario plan (vision); and (d) backcasting from a given vision to the present, and programming of the development path towards the vision, gradually diverging from the trend scenario path.

Figure 2. Scenario matrix example, regarding emerging mobility technologies and urban planning responses, showing four scenarios, to be elaborated further in the explorative scenario-planning process.
Source: Mladenović and Stead (2021, p. 10).

à-vis each other, trying to identify axes of polarity or extremity in terms of which the themes could be interrelated. Refining of the themes continues by selecting those from different categories, such as technological, cultural or policy, and positioning them in a matrix that is drawn up by perpendicular combinations of such axes. Van der Heijden et al. (2002) have suggested 'relative importance' and 'level of uncertainty' to be used as the axes of such a two-axis diagram. Figure 2 provides an example of a developed scenario matrix, with an approach to planning as one axis, and technological development as another.

Based on the cells in the matrix, the core idea for each of the four alternative explorative scenarios is then formulated and further elaborated by arranging the driving forces earlier identified according to each core scenario idea (Figure 1b). At this stage, scenario *planning* means that the organization's own purposive actions are accommodated into these scenarios: What strategic choices should the organization make, in order to both adapt to and influence the driving forces of the scenario at hand? The purpose is to come up with explorative scenario plans that indicate bearable futures even in cases when the external forces counter the internal aims of the organization. Hence, even for the least favourable scenario, a dystopia is not a proper plan.

Only after this planning work on alternative explorative scenarios, a normative choice between them is made: Which future pathway is the most desirable for the organization from the possible ones? This *normative scenario plan* then becomes the basis for the vision of the organization's strategic plan (Figure 1c).

Many scholars regard four scenarios as the optimal number of alternative scenario plans, to provide a setting for making such a normative choice: they enable divergent thinking and coherence to the scenario plan storylines, without making the handling of different scenario plans too complicated for the participants (Bartholomew, 2007; but see also Zegras et al., 2004). Moreover, four scenario plans, if divergent enough from each other, could account for a wide range of possible futures. In contrast, having only three explorative scenario plans could easily lead to an overly simplistic setting of two scenario plans representing mutually oppositional extremes, thus suggesting the 'middle' alternative to be chosen as the appropriate normative one.

The explorative scenario plans are not forecasts but narrative accounts of imaginable and plausible futures. In their narrativeness, they are coherent and consistent, and have the quality of being convincing about their worthiness for consideration and foresight. Their relevance is not in the probability of their unfolding but in their capacity to inform present-day planning and decision-making in the face of future uncertainties, and threats and opportunities that these might imply. Such scenario planning 'is not about predicting the future; it is about preparing an organization for a number of plausible futures' (Hussain et al., 2017, p. 161). As in strategic planning in general, its purpose is to offer 'insights into prospective change to encourage and promote public debates about

them' (Friedmann, 2004, p. 56). Contrary to forecasts, the scenarios are not devised in terms of number-driven graphs, for example, on traffic volumes, population and gross domestic product (GDP), but by first trying to grasp the driving forces and related uncertainties behind the development trajectories. The number-driven graphs are useful, too, once you have configured the *story* behind them. The 'Schwartzian' steps of scenario planning, shortly reviewed above, have become familiar in urban policy integration (Zegras & Rayle, 2012), and they have been applied by, for example, Zegras et al. (2004) in strategic regional transportation planning.

Connecting the chosen normative scenario to the present-day context of planning and decision-making is, however, not easy. To make this connection, Robinson et al. (2021) have recently suggested the concept of 'policy lensing'. The approach is aimed to translate scenario 'worlds' into the language of shaping policies, requiring also further elaboration of the given scenario in terms of its policy relevance. This insight is important also in distinguishing between scenarios and scenario plans, the latter not merely describing the unfolding of an imagined future, but also involving planning responses in coping with such a future horizon. Robinson et al. suggest that a major added value of their policy-lensing approach lies 'in the opening-up of policy spaces, of choices and their potential consequences in the different political and societal contexts as defined by the scenarios' (Robinson et al., 2021, p. 8). However, in our framework, to make such a connection between the normative scenario and its implications to the planning and decision alternatives of the political and policy context of today, we suggest the addition of yet another scenario approach: backcasting.

Backcasting

After the choice of the normative scenario, the *backcasting* approach is useful for operationalizing actions towards the target vision of this scenario. Backcasting is a form of scenario planning, outlined by Robinson (1990), that stretches back from the given long-range vision to the present situation, to orient and program actions from the present into a development path towards the vision. 'Backcasting can thus be viewed as a normative scenario, but with an additional and explicit step in the development of the pathway back from an image or a scenario to the present' (Hickman & Banister, 2014, p. 78).

There are basically two kinds of approaches to backcasting: those focusing on mapping and elaborating the development path, and those concentrating on actions and related actors (Neuvonen et al., 2014). The first aims at bridging the present and forthcoming decision choices and the long-term vision, asking: How is the change to be made? How can transformative factors be identified, behind conventional techno-economically framed decision agendas, that might engender transformative action towards the desired development path? Such factors may have to do, for example, with policy and planning measures, economic incentives and inhibitors, and behavioural and value changes (Neuvonen et al., 2014).

In such mapping of the development path, the methodology of roadmapping can further be used. Being formerly used as connected to forecasting (Okada et al., 2022), some scholars have recently suggested using it in combination with scenario work, to make it more robust and responsive to future uncertainties, and thereby more applicable in decision-making (Hussain et al., 2017; Kishita, 2021).

In turn, the second, action-oriented backcasting approach, complements the 'how' questions of development path mapping with questions on 'who': Who could be the key actors with appropriate resources to generate transformative change towards the development path? This approach emphasizes the role of values and ways of life, and related social–cultural agencies – such operators that are hidden from the gaze of rational choice theory – based subjectification (Neuvonen et al., 2014). Target-oriented backcasting scenario work has become increasingly common in assessing transportation system development trajectories, for example, when ordinary forecasting methods indicate undesired long-term development, such as automobility-inclined traffic volume forecasts (Witzell, 2021). It has been used, for example, in the Organisation for Economic Co-operation and Development's (OECD) Environmentally Sustainable Transport (EST) project, in the late 1990s and early 2000s, involving several countries (Geurs & van Wee, 2004), and in the Visioning and Backcasting for Transport (VIBAT) methodology, developed by Hickman and Banister (2014), applied in the UK, Canada, Australia and India.

However, it has been commonplace to apply backcasting in settings similar to those US strategic metropolitan LUT planning projects that Bartholomew studied. There is a forecasted trend scenario against which a normative sustainable urban and mobility development scenario (vision) is set. The backcasting scenario work is then used to identify policy choices and measures in order to depart from the trend scenario path towards the vision (Figure 1d). Here, Bartholomew's above criticism applies: one jumps from a trend scenario to determining the normative scenario plan, without gaining broader insights of plausible futures through shaping explorative scenario plans.

FOUR MODES OF KNOWING RELEVANT FOR PLANNING PRACTICE

Davoudi (2015) has identified four types of knowledge relevant for planning practice, or rather four modes of knowing embedded in planning action: knowing *what*, knowing *how*, knowing *to what end* and *doing*. Used together with practical judgment these four modes of knowing constitute the *wisdom* of planning practice, according to Davoudi. Each of the four methods of scenario planning presented above corresponds with one of Davoudi's four modes of knowing in planning practice. Each of these modes has its own approach to knowledge: how it is to be produced, what are the terms of its validation, and for what purpose it is needed. Davoudi's categorization of modes of knowing in planning practice largely correlates with Huttunen

et al.'s (1999) identification of *theories of truth* that are relevant in action research.

The first theory of truth is *correspondence theory*. This theory considers a claim as valid, if it corresponds with the 'reality' it explains. The sharper the explanation the claim provides, the more valid it is seen to be. In terms of Aristotle's (1926) intellectual virtues, *episteme* represents correspondence-based truth claims. When such knowledge is sought, questions starting with the word 'what', 'where', 'when', 'how many', 'how often' are asked, for example, from the data that are gathered by using statistical methods. The validity of traffic, population and GDP forecasts is assessed by judging the rigor of their statistical correspondence with 'real' trends. The more rigorous they are seen to be, the better they are believed to predict the future. This is Davoudi's 'knowing what'. We call this mode of knowing *explanation*.

The second theory of truth is *coherence theory*. Here, validity of a claim is not assessed in terms of its correspondence with the 'reality' 'out there'; instead, the focus is on the consistency of the claim within itself and in view of one's existing system of beliefs (Walton, 2008). The validity of an intuitive logics-based explorative scenario is assessed this way: Does it provide a plausible, credible and consistent narrative of the possible unfolding of events from the present to the future? Is the plot of the scenario story coherent, in view of its connections to the underlying driving forces, and its characters and their dealings with events in progression towards a certain fate? (Amer et al., 2013; Chermack et al., 2020; Mäntysalo & Grišakov, 2016). In Aristotelian terms, truth claims that draw on their coherence can be likened to *techne* in the sense of productive *skill*: How can explanatory trend knowledge of driving forces be plausibly combined with imaginative explorations of counterintuitive and emergent driving forces – in the form of a scenario story? Schwartz (1991) refers to such a skill in the title of his seminal book, *The Art of the Long View*. This is Davoudi's 'knowing how'. We call this mode of knowing *narration*.

Similarly to forecasts, explorative scenario stories provide answers to the 'what', 'where' and 'when' of the futures they describe. However, as regards forecasts, their validity is assessed in view of the correspondence of these answers with existing trends, whereas the validity of explorative scenarios is assessed in view of *how coherent* their storylines are in answering to these questions.

The third theory of truth is *consensus theory*. It is based on Habermas's (1984, 1987) idea of communicative rationality, influential to communicative planning theory. In communicatively rational action, claims are deemed valid, if they are acknowledged as such in uncoerced argumentation and reasoning processes in the public realm, resonating with the lifeworldly understandings and values of their audiences. In Aristotelian terms, this is *phronesis*, practico-ethical deliberation: How to perform well? Would these decisions and goals support 'good life', and would they be justifiable? This type of questioning takes place when persuasive proposals and claims are being made for the selection and justification of the normative

scenario in the political process. We call this mode of knowing *argumentation*. It has resemblance with Davoudi's 'knowing to what end', but also with her idea of wisdom as practical judgment.

The fourth theory of truth is *pragmatic theory*. Drawing on pragmatist philosophy of science, the validity of a claim is to be assessed in view of its instrumentality in organizing action. Unlike correspondence theory, here the validity of a claim is not assessed from the point of view of its capacity to explain an object, but from the point of view of the consequences that are brought by action guided by this claim. This perspective to validation of knowledge is essential in backcasting: How to formulate a development path that would become instrumental in organizing action and agencies towards the given vision? What to do first and what next? Whose contribution is needed and who is in charge? In Aristotelian terms, pragmatic knowledge is also a form of *techne*. This is Davoudi's 'doing'. We call this mode of knowing *instrumentalization*.

By pulling together these four theories of truth, and their connections to different types of scenario planning, Table 1 can be drawn.

In this section, we have traced the different theories of truth underneath scenario planning's different methodological approaches to knowledge production. Thereby we have identified the fundamental differences between them, as regards to how knowledge is understood, where it is sought for, how it is generated, and then validated. Hence, each scenario-planning approach is to be acknowledged as a mode of knowing in its own terms, while also appreciating the mutual complementarity of the approaches, for gaining *wisdom* in planning work.

REFLECTIONS FROM PRACTICE

Views on scenario-planning approaches

The potentialities of the above scenario-planning approaches in strategic LUT planning were discussed in the workshop and online platform with the planning practitioners, highlighting several aspects. First, the backcasting approach received the most attention, especially amongst the transportation planners. It was seen useful in identifying cause–consequence relationships and in building concrete stepping-stones for the strategic pathway towards the envisioned future. Through this concreteness, backcasting was also seen to enhance communication between planning sectors, decision-makers, stakeholders, and citizens. Indeed, such communicativeness and joint identification of agencies is crucial especially in action-oriented backcasting (Neuvonen et al., 2014; see also Soria-Lara & Banister, 2017). In particular, the practitioners viewed backcasting as a useful approach for demonstrating how abstract and distant visions and goals (such as a certain target level of CO_2 emissions; Ravetz et al., 2021) can be brought into concrete programming of activities and choice-making between development projects and policy measures. Conversely, backcasting was seen useful in the strategic assessment of LUT project initiatives: Would they conform to or divert from the development path towards the vision? Some practitioners noted that there are already some examples of applying backcasting in strategic local and regional planning in Finland, partly also in strategic transportation planning.

Despite these positive comments on backcasting, a common view was that transportation planning in Finland is still strongly reliant on the use of travel demand forecasts. Such a finding is similar to previous studies of planners' mental models, which, despite moving away from the 'predict and provide' paradigm, still have challenges in transitioning away from forecasting-led practices (Pettersson et al., 2021). In the Finnish case, this was seen evident especially on the national level, when state investment decisions are made on bypass roads and other projects to enhance the throughput of the road infrastructure. Similarly, forecasting-based planning was also evident in and around city-regions (see also Lampinen, 2015) – instead of making decisions that would redirect the path of forecasted growth of automobility. Such determinism was seen to be potentially relieved if the backcasting approach were more commonly adopted in transportation planning. Backcasting is thus expected to facilitate the move towards more goal-oriented and strategic planning. As an example, the goal of radical reduction of private car traffic was mentioned, which is difficult to achieve if, at the same time, forecasting-based preparations are made to accommodate for the increase in car traffic.

However, the use of travel demand forecasts was not rejected, either. Similarly to the US metropolitan LUT scenario planning practices discussed above, forecasts were seen as useful when used as points of reference to goal-oriented LUT planning. Hence, forecasting was not seen as contradictory to backcasting. Their parallel use was perceived as especially useful in demonstrating the widening gap between the path of the trend scenario and the one towards the vision (Figure 1d). This juxtaposition was seen especially useful in bringing the strategic perspective to political choices that are made in the present.

Despite these reflections, it was revealing how difficult it was for the practitioners to address and discuss the idea of using explorative scenarios. These difficulties in relating to a multitude of futures are in line with previous findings, highlighting that planning experts have been trained to visualize futures linearly (Hickman & Banister, 2014), which is further exacerbated with projection-based visualizations (Julsrud & Uteng, 2015).

Views on modes of knowing

Regarding their understandings of modes of knowing relevant in scenario planning, the Finnish planning practitioners emphasized reliability of knowledge. Moreover, they also saw a need for a mode of knowing that could be used in justifying radical actions, such as those needed to break out of currently unsustainable path dependencies. A key question, then, is whether only the kind of knowledge that is not bothered with 'black swans' is considered reliable. The practitioners agreed that there is a need for different means of gaining knowledge and comprehending potential impacts of different plans and policy measures.

Table 1. Four approaches to knowledge and truth, and their connections to the four types of scenario planning.

	Making forecasts	Drafting explorative scenarios	Choosing a normative scenario	Backcasting of a development path
Validity of a claim	Correspondence with 'outer reality'	'Inner' coherence	Consent	Instrumentality in practice
Guiding questions	What? Where? When? How many? How often?	How? (giving shape)	Why? Who gains, who loses?	How? (programming action) Who?
Mode of knowing	Explanation	Narration	Argumentation	Instrumentalization
Aristotelian intellectual virtue	Episteme	Techne	Phronesis	Techne
Davoudi (2015)	Knowing what	Knowing how	Knowing to what end, practical judgment	Doing

However, they also admitted that in the present Finnish LUT planning practice such means are few. Similar findings on the difficulties of planning practitioners in accepting deep uncertainty have been highlighted before (Lyons & Marsden, 2019).

In addition to the above points, a common view was that contemporary ways of gaining knowledge may be poorly connected with the needs of comprehending broader systemic phenomena and their repercussions (see also Güell & López, 2016). Moreover, such systemic complexity has been exacerbated with the long-term time span in strategic assessment (Ravetz & Miles, 2016). In strategic assessment, existing and easily attainable data largely determine the perceived scope of impacts, and, in turn, the assessment methods determine what kind of data is held appropriate. In this regard, the structural and path-dependent separation of data management systems, and their underlying rationales, was seen as a major challenge for building joint scenario horizons and strategic insights between the LUT planning sectors. A respondent later commented using the online discussion platform: 'There may well be knowledge but its usability is poorly known. A challenge is that capabilities of recognizing different instances for different uses of knowledge are missing.'

An important point about the relation between knowing and feeling in planning practice (Ferreira, 2013) was also raised in discussion with the practitioners. This adds further depth to the point raised in previous research that policymakers do not seem to grasp the full potential of foresight methods in formulating urban strategies (Güell & López, 2016). The Finnish planning practitioners highlighted that the psychological dimension has a big role in the use of knowledge in political decision-making, as positive information is easier to accept than negative. This concerns especially the mindset that approaches development only narrowly from the economic growth perspective. Unpleasant knowledge is rejected and framed out, thereby possibly justifying the continuation of unsustainable development. The need to explore alternative futures with broad strokes was acknowledged – however, with consideration of limits of political realism and acceptability.

SCENARIO EXERCISE AND IMPACT ASSESSMENT OF THE MAL 2019 PLAN OF THE HELSINKI METROPOLITAN REGION

The MAL 2019 plan of the HMR is a strategic land-use, housing and transportation plan that was prepared in the four-year cycle of 2016–19, to be updated in the following cycle (MAL 2023 plan). It is the first proper LUT plan in the city-region. Formerly, since the 1970s, coordinative intersectoral planning between the four municipalities of the capital region was conducted by a separate commission, however with only moderate results. This arrangement was replaced in the 2000s by a specific Act on cooperation of capital region municipalities on waste management and public transportation (Act 829/2009, 2009). To implement this Act, two city-regional agencies were established: Helsinki Region Environmental Services (HSY) and Helsinki Regional Transport Authority (HSL). The latter was initially comprised of the capital region municipalities and two neighbouring municipalities, but it has since grown with the joining of further three municipalities. The LUT approach in the HMR was fostered by a temporary Act on restructuring local government and services (PARAS Act 2007, 2007–12), which ordered the capital region, together with 16 other Finnish city-regions, to prepare a joint strategic city-regional plan, coordinating land use, housing and transportation. In addition, at the turn of the 2010s, the central government established a specific agreement policy between itself and the municipalities of the four largest city-regions (now seven). The agreement policy focuses especially on sharing transportation infrastructure investment costs and securing the provision of subsidized housing in the city-regions, based on the municipalities' joint city-regional plans on land use, housing, and transportation. Since then, in the HMR, the 14 municipalities comprising it have voluntarily collaborated in preparing joint non-statutory land-use and housing plans, while HSL has continued conducting city-regional transportation planning – until 2016, when the preparation of the integrative MAL 2019 plan started, with HSL receiving the role of coordinator from the 14 municipalities (Duman et al., 2022).

MAL 2019 scenario exercise and impact assessment

A scenario exercise was undertaken at the start of the MAL 2019 planning process, and a private consultancy, MDI, was hired to assist in it. It was more ambitious and elaborated than previous scenario exercises. While previously such an exercise was treated as a separate 'study' in the planning process, this time it was viewed as part of the impact assessment process of the MAL 2019 plan (HSL, 2017a). According to the final scenario report (HSL, 2017b), the exercise was aimed to give insights on which themes the MAL 2019 plan should focus, and which developments it should anticipate and try to influence. The first step of the MAL 2019 scenario exercise was to identify different 'change phenomena' (global trends, weak signals, wild cards), which were then grouped under three headings: society, economy, and environment and technology. This was followed by deducing from these change phenomena different development trajectories, and then assessing them in view of their significance and likelihood. These different trajectories were further studied based on their implications to city-regional land-use, housing, and transportation planning. It was deliberated whether the change phenomena and their development trajectories would strengthen or weaken the possibilities of attaining the planning objectives. Thereby, the scenario exercise provided material for a kind of risk assessment.

Building on these assessments of the change phenomena, the developments most likely to occur by 2030 were recognized. These were used to form a 'baseline scenario', which is a kind of *trend scenario*, although not of a kind that would be based on conventional forecasting, discussed above. To address longer term uncertainties, the scenario work also included drafting three explorative scenarios for the period of 2030–50, with the addition of a fourth scenario that extended the baseline scenario from 2030 to 2050. The aim of the explorative scenarios was to outline possible longer term future developments and provide information on how to acknowledge them in planning.

According to the scenario report (HSL, 2017b), the explorative scenarios used the method of 'elaboration of fixed-scenarios', citing Bishop et al. (2007). With this method, scenarios are developed in terms of '*incasting*' (forecasting within a scenario). Contrary to the intuitive logics approach, the scenarios are here decided upfront and the role of the participants in the scenario exercise is merely to articulate the implications of alternative given futures. For the purposes of the method, the alternative futures are often designed as rather extreme ones, to carve out more clearly the differences between alternative development paths and their impacts (Bishop et al., 2007). This was also the case with the MAL 2019 scenarios. Each explorative scenario was formed around a few main change trajectories recognized in the previous trend scenario 2030 analysis: sustainable development, population growth, urban structure, development of technology, social change dynamics, and development of the economic situation. The resulting four scenarios for 2030–50 were formulated around: (1) fast technological development, servitization and privatization; (2) changes in social structure and ways of life with adaptation to climate change; (3) intensified population growth with climate and refugee problems; and (4) continuation of the baseline scenario. Based on these alternative scenarios, conclusions were drawn regarding their impacts on MAL 2019 planning, namely on housing policy, living environment (i.e., land-use) and transportation (HSL, 2017b).

However, the 'official', law-required impact assessment procedure of the MAL 2019 plan, conducted at a later stage of the planning process, was still largely determined by the conventional forecasting-based approach. In the impact assessment process, the impacts of alternative versions of the plan were assessed against unplanned development by 2030. Such an impact assessment setup in transportation system planning in the HMR is specifically required and institutionalized by law (SEA Decree, 1 §). But, in this impact assessment procedure, also the land-use and housing-related interventions were assessed in such a manner, not only the impacts of transportation system interventions. The unplanned development was treated as a trend scenario, against which the impacts of alternative land-use, housing and transportation measures (according to certain key indicators) and related versions of the plan were assessed. However, the 'trend scenario' used in this impact assessment procedure was not the baseline scenario developed during the earlier scenario planning exercise, but one formed on the basis of a conventional forecast of population, employment, and travel demand. The results of the impact assessment were utilized in refining the MAL 2019 plan (HSL, 2019.). The earlier scenario exercise was thereby treated as a tool for assessing the impacts of possible longer term futures on the plan's goals, and the plan's related flexibility and adaptability. The role given to the explorative scenarios 2030–50 was to 'highlight aspects related to preparedness and adaptation' (HSL, 2019, pp. 111–117).

Contrasting the MAL 2019 scenario exercise with the scenario-planning framework for LUT planning

Overall, it is evident that the scenario exercise had a marginal role in determining the goals of the MAL 2019 plan. It was not aimed to support actual planning work but to enrich the assessment of the impacts of the plan. It served in broadening future perspectives, to have a rounded basis in preparing for threats and opportunities in the longer term, while pursuing for the given goals. Contrary to what we suggest with our scenario-planning framework, it seems that explorative scenarios were not used in the sense of informing the setting of strategic goals of the MAL 2019 plan, but instead as material in assessing the longer term implications of these goals and in 'adding sensitivity' to the plan in view of them. Similarly to Bartholomew's observations of the scenario practices in the US metropolitan regions, the strategic goals of sustainable

city-regional structure and mobility were determined with critical reference to the forecasting-based trend scenario, and related indicators, that is, 'predict and prevent'. And here also Bartholomew's criticism applies: the explorative scenarios were not duly considered in this process.

The dominant modes of knowing in the MAL 2019 planning process were thus *explanation* and *argumentation*: explanation in producing the evidence-based trend scenario for the impact assessment of the plan, and argumentation in determining and justifying the normative goals of the plan – the frame of reference for which was provided by the calculated impacts of the trend scenario.

As regards drafting explorative scenarios in the scenario exercise, the mode of knowing employed was not *narration*, but rather 'simulated explanation'. It did involve, in the first step of the process, the creative skill of imagining wild cards and amplifications of weak signals, besides identifying existing global trends. But these change phenomena were then not used as material for drafting explorative scenarios in the form of narratives or storylines. Instead, they were treated as 'imagined evidence' alongside the 'evidence' of trends, in the identification of cause and effect-type impact trajectories with varying weights. In this 'forecasting within scenarios' (Bishop et al., 2007), the trajectories were then selected and aggregated in formulating core ideas for each of the three explorative scenarios, which were then further elaborated with the planners, in view of their implications, threats and opportunities for goal achievement of the MAL 2019 plan. This was a rather mechanistic method for producing explorative scenarios. The kind of overall coherence that is sought for in the storytelling approach to scenario work, was not a concern in producing them. Thereby they did not rely on the coherence theory of truth, but rather on correspondence theory – although the 'reality' 'out there', that the explorative scenarios represented, was in part an 'imagined reality'.

Such a method for producing explorative scenarios may indeed be appropriate when the scenarios are intended to be used in the impact assessment of the plan. Moreover, incasting-based explorative scenario work may be methodologically well coupled with forecasting, as it has a similar approach to knowledge formation – explanation (although 'simulated'). However, what we suggest with our scenario-planning framework is the use of explorative scenarios primarily as *planning* instruments, to inform the problem framing and goal-setting of the strategic planning process itself. For this purpose, we find explorative scenario planning in the form of storytelling better suited. As noted by Albrechts (2005, p. 255), having the format of storytelling, explorative scenario work can be integrated with planning work which, in itself, is conceived as storytelling (see also Forester, 1999; Throgmorton, 1996), especially the storytelling of strategic planning (Mäntysalo et al., 2020; Olesen, 2017).

CONCLUSIONS

In this article, we have suggested a framework for identifying how to use four different scenario-planning approaches successively in the strategic city-regional LUT planning process, in direct relation to different approaches to knowledge formation in planning. Following Davoudi's (2015) categorization of modes of knowing in planning practice, we have found each of the four scenario-planning approaches to represent a specific mode of knowing in the process. We call these modes of knowing *explanation* (knowing what), *narration* (knowing how), *argumentation* (knowing to what end and practical judgment) and *instrumentalization* (doing). Thereby we have identified fundamental differences between the scenario-planning approaches in their understandings of knowledge and truth, yet recognized their mutual complementarity as regards the different phases of planning work. The trend scenario method that follows the correspondence theory of truth (explanation) is necessary in identifying the need to explore alternative futures, if the forecasted future indicates undesirable outcomes. Drafting explorative scenario plans, then, follows the coherence theory of truth (narration), and opens an array of plausible future horizons and related planning responses. Thereby, explorative scenario plans serve the selection of the normative plan (vision), in an argumentative process that follows the consensus theory of truth (argumentation). Finally, in programming steps of implementation from the present towards the vision, the backcasting scenario method is taken into use, relying on the pragmatic theory of truth (instrumentalization).

Each process of strategic city-regional LUT planning has its own contextual challenges and demands, as regards the needs of developing knowledge and acting. In each process and its different stages, one has to consider how the four modes of knowing should be weighed and used to complement each other. This, in itself, is a strategic issue requiring wisdom. In some processes, technical challenges may dominate; in some, political dilemmas, lack of evidence, or the need to probe future opportunities. By combining different modes of knowing, in the strategic city-regional LUT planning task at hand, one may estimate where lie the limits of reliability of evidence, potency of imagining possible futures, and viability of configuring a development path – and, moreover, the political justifiability of defining planning problems and goals. What is essential to gain is the capability of becoming orientated in the present, with a development path configured towards a politically agreed vision, while, at the same time, building reflective preparedness for undesired long-term scenarios – and for the need to re-explore possible futures and reassess the vision at a later stage.

The ideas we presented, on combining a variety of scenario-planning approaches, and related modes of knowing in strategic LUT planning, were for the most part supported by the practitioners. In turn, their insights on practice-related, institutional, and contextual challenges and opportunities contributed to our theoretical work.

However, the workshop participants' evident difficulties in relating to the explorative scenario-planning approach indicates the persistence of approaching futures

in terms of forecasting and explanatory evidence. Even the role of normative scenario and the role of backcasting as an instrument for configuring a path towards its vision, were crucially understood by taking the forecasted trend scenario as a frame of reference. The value of exploring 'what futures are possible' as a resource for probing 'what future is desirable' remains a conceptual learning challenge. Instead, identifying the normative scenario through 'short-cutting' from the undesirability of the trend scenario to the 'non-undesirability' of the normative scenario seemed to be the dominant mindset among the planning practitioners. What requires further understanding in the practice realm is that choosing a non-undesirable future is a *reactive* choice of rejecting the trend ('predict and prevent') – whereas choosing a desirable future among some plausible ones would be a *proactive* choice of path formation.

In comparison, in our review of the scenario exercise and impact assessment of the MAL 2019 plan of the HMR, in view of our framework of scenario planning and related modes of knowing, we noticed a similar 'predict and prevent' setup. The scenario exercise was framed to enrich the long-term impact assessment of the plan's goals, for which the forecasting-based trend scenario provided the primary frame of reference. Three explorative scenarios were produced, but their role was rather to inform of the resilience of the plan's goals, in view of longer term threats and opportunities – instead of producing them to inform the goal setting of the plan itself.

As noted in the introduction, with few recent exceptions, strategic LUT planning has been too focused on developing a single preferred scenario, without adequately considering multiple uncertain futures. Hence, explorative scenario planning seems to be still a 'missing link' in strategic city-regional LUT planning – and our empirics on planning in Finland and the HMR do not suggest otherwise. The present Covid-19 pandemic has highlighted the importance of exploring weak signals and wild cards beyond existing trends. Explorative scenario planning is thus essential in shaping strategic LUT planning agendas, by widening the scope of plausible future horizons and planning responses to them, and thereby in informing argumentation on what to choose as the normative scenario plan. In the form of *storytelling*, it is an approach in its own right, and it embodies a distinct mode of knowing, telling it apart from other scenario-planning approaches. The latter rather serve purposes *related* to planning (analysis, decision-making and implementation) than *actual* planning.

Our workshop involved LUT planning professionals exclusively, but it is worth noting that, by its nature, explorative scenario planning can provide a forum for broad participation and become an exercise for collaborative capacity building. Through exploration of different scenarios, narrow perspectives may be widened and thereby new participants may become engaged, while their mutual interdependencies may be revealed and shared momentum towards an envisioned future built. Zegras and Rayle (2012) regard these collaboration-inducing properties of explorative scenario planning as its

'second-order effects'. While, at one level, different possible futures are explored, at another level, capabilities for inclusiveness and collaboration are built. Moreover, the diversity of participants engenders diversity in the range of scenario perspectives, enhancing the imaginativeness of the process (Lyons et al., 2021; Soria-Lara et al., 2021; Zapata & Kaza, 2015.).

The distinctiveness of explorative scenario planning as storytelling, with the *narration* mode of knowing, needs to be properly acknowledged and understood, before adding the 'missing link' can be attempted. Alongside psychological and professional–cultural factors that inhibit the exploration of scenarios beyond the trend scenarios and normative visions, institutional inhibitors ought to be better understood, too. For example, the norm-based impact assessment framework of city-regional transportation system planning may, as an unintended consequence, discourage futures explorations, as our MAL 2019 plan case study implies (Duman et al., 2022). Regarding theoretical and methodological work on incorporating explorative scenario planning, there are already a few contributions (e.g., Zegras et al., 2004; Zegras & Rayle, 2012), but further research and development work is needed. Such development work would also have to account for other potentially synergistic methods, such as multicriteria analysis (Te Boveldt et al., 2021), and further incorporate the iterative nature of planning processes in line with organizational learning theory.

ACKNOWLEDGEMENTS

DISCLOSURE STATEMENT

FUNDING

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