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Uncertainty and Triple Access Planning in European Sustainable Urban Mobility Plans: a long way to go yet?

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ABSTRACT

Triple Access Planning (TAP) is the idea that accessibility can be delivered through physical mobility, digital connectivity, and spatial proximity. There is great uncertainty as to how far one of these three elements will substitute for or complement the others in delivering the accessibility we need in future. Sustainable Urban Mobility (SUM) Planning is touted as a relatively new paradigm in local transport planning oriented to the achievement of a wide range of societal objectives. The paper presents a review of how well SUM Plans from eight European countries, and national guidelines from four currently account for TAP and uncertainty in their approach. Our findings suggest that while the concept of physical proximity is well-understood, other aspects of the TAP and uncertainty approach are not. Digital connectivity is largely ignored. The planning future is treated as largely certain, with no consideration of disruptive factors that might alter this future.

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SUMP; mobility planning; transport planning; digital accessibility; decarbonisation

1. Introduction

To rise to the challenge of decarbonisation, transport planning must change further and faster by rethinking access and accommodating uncertainty. This paper explores the following question in the context of the decarbonisation imperative with which sustainable urban mobility planning in Europe has to grapple: How much can urban transport planning contribute to overcoming the decarbonisation challenge and, if it is not changing fast enough, what is stopping it from doing so?

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1.1. Changing access

Transport is a derived demand, arising from the need to connect people with goods, employment, services and opportunities; it is a means of access. Motorised transport has, for decades, been seen as essential to economic prosperity with a presumption that traffic grows with the economy (Banister and Stead 2002; Tapio 2005). As traffic growth has been accommodated in pursuit of economic growth, our built environment has been shaped around motorised transport. Pursuit of access in this form has come at the cost of burgeoning carbon dioxide emissions and other environmental problems. The transport sector accounts for over a quarter of emissions in Europe with the majority from road transport (Marrero et al. 2021). If global decarbonisation is to occur at the pace required and a 45 per cent decrease in global emissions is required by 2030 to limit global warming to 1.5°C (United Nations Environment Programme 2022), we will have to change how we access key activities and facilities. This must be at the heart of how we plan for a low-carbon future.

1.2. Accommodating uncertainty

Transport planning has historically been forecast-led, based on the so-called predict and provide paradigm (International Transport Forum 2021; Lyons and Marsden 2021). Yet commitments across nations and cities to decarbonise their economies and transport systems are now vision-led, not forecast-led. Scotland was globally leading in setting a national target to reduce total car kilometres per year by 20 per cent by 2030 and providing a route map for how to achieve this (Transport Scotland 2022a). This is an example of the emerging 'decide and provide' paradigm in transport planning (Lyons and Davidson 2016). This paradigm also recognises that being vision-led sits in the context of a changing and uncertain world, and that planning can no longer presume a knowable future as its basis. Even before the global shock of the Covid-19 pandemic, the need for transport planning to accommodate uncertainty was growing – '[w]hile uncertainty in road traffic demand has always existed, it is perhaps now more uncertain than ever given the changes that are currently being experienced in the system and the changes that could lie ahead' (Department for Transport 2018, 27). Scenario planning is a means of accommodating uncertainty. It involves considering different futures that reflect drivers of change beyond the (full) control of any strategy to shape the future. For a strategy or plan to be effective, it must be responsive to uncertainty by considering how its elements could perform – in relation to the outcomes it seeks – in different future contexts (Lyons et al. 2021; Marchau et al. 2019).

1.3. Triple Access Planning

Sustainable Urban Mobility (SUM) Planning and related guidance in Europe has for some time now recognised the need to plan to achieve a wide range of objectives, not just providing for transport demand, and for it to be as concerned with access as mobility (Rupprecht Consult 2019; May (2015)). However, conspicuous by its absence – at least in current guidance on developing Sustainable Urban Mobility Plans (SUMPs) (Rupprecht Consult 2019), and in much similar national guidance – is consideration of the role of

digital connectivity in access fulfilment and of accommodating uncertainty in SUMP development. The Covid-19 pandemic gave both of these issues much greater prominence. With lock-downs and restrictions on travel, there was much greater reliance upon maintaining access through digital connectivity and online services. The pandemic also amplified the sense that the world is in a state of flux – brought about by the collision and merging of the digital age and the motor age (Lyons 2015), with heightened environmental concerns, economic pressures and geopolitical tensions all increasing the feeling that we are in an age of deep uncertainty (Walker, Lempert, and Kwakkel 2013).

It is notable that since the arrival, mainstreaming and advancement of digital accessibility (in terms of speed and reliability of digital connectivity and the diversity, quality and usability of digital services) the traffic intensity of economic output in several countries has reduced (International Transport Forum 2021). In other words, over the last two decades, road traffic growth (measured by vehicle distance travelled) has not kept pace with economic growth (measured by GDP). It leads to the reasonable suggestion that economic output is reliant on access (in all its forms) rather than only on motorised traffic (to the extent that it once was or was perceived to be).

Emergent from work by Lyons and Davidson (2016) is the concept of Triple Access Planning (TAP). This recognises that in transport planning or sustainable urban mobility planning, we cannot isolate and plan for the transport system alone or even for transport and land-use interactions. We need to plan for the tripartite role of physical (motorised) mobility, spatial proximity (and the associated role of active travel) and digital connectivity in providing access that can support economic prosperity and social wellbeing in an environmentally sustainable way (see Figure 1).

TAP can be seen in its simplest form as a refreshed mindset for planning that takes explicit and deliberate account of triple access and uncertainty. through approaches employed in the planning process. Uncertainty becomes even more important to deal with in a context where the planning focus broadens from mobility to accessibility, because, for example, system boundaries broaden and complexity increases. The

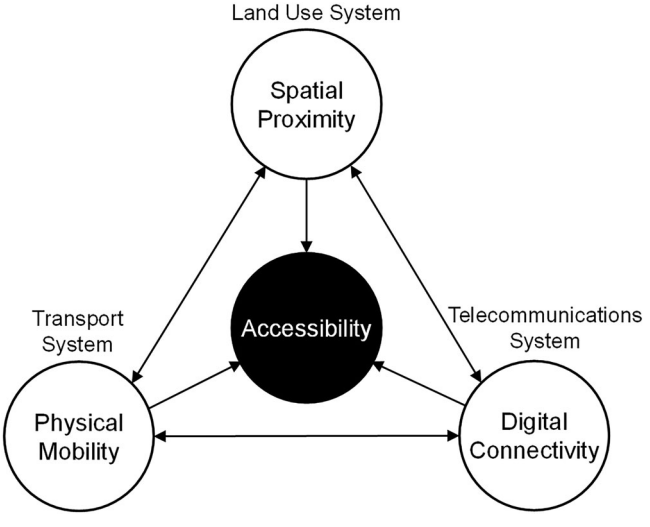

Figure 1. The Triple Access System (reproduced from Lyons and Davidson 2016).

current pan-European project 'Triple Access Planning for Uncertain Futures'[1] is exploring and developing such approaches further, including the roles of systems thinking and scenario development in co-creating mental models of the present and future possible triple access system. The Triple Access System, if planned well, offers tremendous opportunity to support urban living in ways that will reduce greenhouse gas emissions, for three main reasons: firstly, it should encourage more proximate accessibility of short trips which will reduce average trip lengths and make travel by low emission modes easier; secondly, it should lead to more substitution of physical and GHG emitting trips by digital accessibility; and, thirdly, an emphasis on uncertainty will tend to investment in smaller more adaptable transport measures which do not increase trip lengths in the way that major transport infrastructure can do.

1.4. Considering the current state of practice

It seems hard to refute the existence of the Triple Access System and of the sense of uncertainty many people and organisations feel about the future. This paper therefore examines what the state of practice is regarding TAP and uncertainty in urban mobility planning across different urban areas in Europe. Its objectives are to analyse how widely TAP and uncertainty are currently recognised, and dealt with, in urban transport planning in Europe, and to understand the challenges to incorporating them better into practice in future.

The paper is based on an examination of a sample of transport plans and interviews with their authors. The findings of the paper are important because transport planning takes as its starting assumptions, firstly, that trends will continue much as they have before; and, secondly, that physical (motorised) mobility will continue to be our primary means of accessing what we need, will not adequately account for an increasingly complex and uncertain future (including the uncertainty of how the three aspects of the triple access system will interact).

The next section of the paper introduces SUMPs, which serve as the transportation planning framework for the context of this paper. Subsequently, the paper explores the reasons behind the potential difficulties in integrating triple access and uncertainty into the planning of urban mobility. It proceeds to outline the methodology employed for the empirical research presented in the following section. The ensuing section delves into the discussion of the obtained results, followed by the formulation of conclusions.

2. Current state of the art

2.1. Sustainable urban mobility planning

This paper takes the SUMP as its context for examining how different forms of accessibility, and uncertainty, are reflected in current transport planning practice. The SUMP is a relatively new concept, seen by the European Commission, at least, as key to achieving more sustainable transport at the local and regional level; and in addition, several countries and regions, such as France, Slovenia, Flanders, Italy, Catalonia, Lithuania and Poland have produced national guidance, funding programmes and (more rarely)

legislation to encourage or require local government to implement SUMPs (Mladenovic, Plevnik, and Rye, 2002). The EU has produced much guidance on SUMPs and funds pilot programmes and training across the 27 member states and beyond (see https://eltis.org/mobility-plans/sump-concept accessed 14th July 2022), and in late 2021 the European Commission also proposed making SUMPs obligatory for 424 cities that are 'major urban nodes' on the Trans-European Network.

The EU Guidelines on SUM Planning essentially recommend a very conventional planning cycle: identify current problems and the baseline situation; define a vision and objectives; set smart targets and select indicators to measure progress towards objectives; select measures (interventions) designed to achieve objectives; implement measures; review progress towards targets; and finally modify the set of interventions if targets are not met within the defined timeframe. Furthermore, they recommend that this planning cycle should be supported by a programme of public participation and engagement at every step. Nonetheless, the concept is somewhat different from the historic conventional approach to transport planning, taking a much broader and objective-driven approach compared to the very infrastructure-construction focus of conventional transport planning. Therefore, if attempts to incorporate TAP and uncertainty into transport planning are to be found, this research worked on the assumption that they were more likely to be observed in SUMPs than in more traditional transport planning activity; hence SUMPs are the empirical focus of the paper.

2.2. Challenges to incorporating a TAP and uncertainty perspective in SUM planning

While the SUMP guidelines can be viewed as an ongoing attempt to support a shift from ´predict and provide´ to ´decide and provide´, previous literature on urban mobility planning indicates that neither the shift as such nor the development of broader perspectives on uncertainty and sustainable accessibility is easy or self-evident in planning practice. The field of SUMP-studies includes a range of studies on challenges to perform SUM planning in general, not considering TAP and uncertainty specifically, but providing a backdrop for added complexity due to the claimed paradigm shift in mobility planning (Banister 2008; Lyons and Davidson 2016). Such a transition requires a fundamental change in established patterns of behaviour and planning, which may be impeded by unintended rebound effects or ineffective outcomes, deviating understandings of what sustainable mobility implies, a need for strategies which account for the needs of different groups (Berger et al. 2014), vested interests and path dependencies (op cit; Hysing 2009), sometimes reinforced by incrementalism due to a strive for consensus that hamper radical shifts and the consideration of alternative futures (Fenton 2016). Hysing (2009) also points to barriers related technological lock-in, dominant discourse, unsupportive organisational forms, and lack of policy integration.

When it comes to the integration of perspectives on spatial proximity into physical mobility planning, previous literature has identified several challenges to effective SUM planning. A major part of the literature refers specifically to formal or informal institutional challenges or barriers (ECMT 2002; ELTISplus 2012; Hull 2008; May 2015), identifying poor policy integration and coordination, particularly between transport and land-use (see also Duffhues and Bertolini 2016; Hull 2005; Te Brömmelstroet

and Bertolini 2010). Other obstacles to successful implementation include counterproductive or conflicting institutional roles within institutional cooperation, both vertically and horizontally and including decision-makers; unsupportive regulatory frameworks; weaknesses in financing and pricing, both concerning plan preparation and implementation; poor data quality and quantity; limited public and/or political support and lack of political backing for sustainability principles and measures.

When it comes to challenges related to the integration of digital connectedness into SUM planning, far less has been investigated to date, albeit that research interest in the relationships between telecommunications and transport is now longstanding (Mokhtarian 1990; Mokhtarian 2002; Lyons 2015; and Lyons et al. 2018). Although there are many studies on ICT for the support of more efficient or sustainable mobility broadly, the concept of digital connectedness seems to be rather remote from being implemented in planning practice which may in part be due to it being deemed to sit beyond the remit of planning and transport planning (though there are some exceptions – see for example, at a national level, (Transport Scotland 2022a)). One recent study (Kamargianni et al. 2022) reports on changed priorities in sustainable urban mobility planning due to the Covid 19 pandemic. In this study, transport planners were asked whether they considered alternative options in the face of lockdown for the development of sustainable urban mobility. The results show no clear indication that digital connectivity has been prioritised more highly or raised more as a policy option. This can be viewed as an indication that there is still much to do when it comes to investigating the potential of digital connectivity in SUM planning. Remarkably it would seem that digital connectivity and digital accessibility are pervasive in society and yet still almost invisible in urban mobility planning documents.

Consideration of the Triple Access System and ways to incorporate uncertainty in SUM planning can be expected to require more effort concerning the vertical and horizontal integration of policy sectors, professions, and tiers of government, not least when it comes to the integration of transport and land-use (Straatemeier and Bertolini 2020; Te Brömmelstroet and Bertolini 2010).

Horizontal and vertical integration refers to the coordination and cooperation among different organisations or agencies involved in various aspects of transport planning at different levels. Horizontal integration refers to the coordination and collaboration among institutions or agencies that operate at the same administrative level or within the same mode of transportation. It involves aligning the efforts and functions of various organisations that share a common focus or objective. Vertical integration involves the coordination and cooperation among institutions or agencies that operate at different levels or layers of the transportation system. It focuses on aligning the functions and responsibilities of organisations at various administrative levels or levels of the decision-making hierarchy.

In this sense, there are great similarities between TAP and land-use-transport integration (LUTI), where the latter has been found to be difficult to implement, if not in goal setting but in policy implementation (Duffhues and Bertolini 2016). The final section of our paper returns to how these implementation issues may also affect TAP and uncertainty, but also makes recommendations on overcoming such challenges. Establishing a local and contextual understanding of sustainable mobility and accessibility is emphasised as important if this perspective is to permeate planning (Curtis and

James 2004), thereby supporting effectiveness of plans and planning. Sharing responsibilities, visions, and views locally on central concepts such as accessibility may increase policy integration both within and between different tiers of government (Hull 2008; Straatemeier and Bertolini 2020). Further, policy integration may be best achieved when new ideas are aligned with the dominating local discourse (Hrelja 2015). This kind of institutional and processual design-thinking has been found to be important in arranging a mix of policy instruments to orchestrate interaction and transfer of resources across horizontal and vertical boundaries in a context-sensitive way, rather than applying a 'one-size-fits-all' format for integration of accessibility and sustainability perspectives (Stead 2016; Van Geet et al. 2021).

When it comes to uncertainty and sustainable urban mobility planning, challenges have been found to arise from the practice of focusing on forecasts rather than scenario evaluation when developing policy and SUMPs, although there is often local professional awareness of uncertainty (Mäntysalo et al. 2023). Insufficient handling of uncertainty may also be related to strong influence from national guidelines or weak incentives to deviate from high tiers of government due to economic dependencies (Marsden and McDonald 2019). Deep uncertainty requires planning to be more adaptive and resilient to change (Marchau et al. 2019). In this regard, adaptive policymaking, and planning under deep uncertainty in more general terms may also be hindered by lack of consideration of the local decision-making context, including institutional, organisational and personal aspects (Stanton and Roelich 2021). In turn, it points to the challenge of having policy design fit with political and institutional realities to achieve legitimacy and enable implementation of plans that are uncertain (Howlett and Mukherjee 2018; Kalakou et al. 2021). Apart from pointing out challenges, the literature also points to scenario thinking and planning as a means to think differently about the possible, plausible and/or preferable futures and better accommodate uncertainty in transport planning (Lyons and Davidson 2016; Lyons et al. 2021; Mäntysalo et al. 2023; Soria-Lara and Banister 2018), as previously emphasised in this article.

The previous studies presented above direct our attention to the following aspects for the development of SUMPs and SUM planning in the context of decarbonisation and making transport and urban development more sustainable:

- A shift from prediction-led (predict and provide) to vision-led (decide and provide) planning, which requires raised awareness of both substantial, procedural and institutional challenges and emphasises the importance of the design of both plan content (policy), process and institutional arrangements. To what extent is SUM planning vision-led in current planning practice?
- A broadened view on sustainable urban mobility to include spatial proximity and digital connectedness, forming the integrated triple access system and thereby supporting the change needed for decarbonisation. To what extent is SUM planning practice accounting for this?
- Handling deep uncertainty to help identify more robust policy measures and to make planning processes and decision-making more adaptive. Literature points to scenario thinking and planning as a means to handle complexity and uncertainty and to reflect the changing context for which policy measures may be predictably, exploratively, and normatively designed and orchestrated to be more resilient and adaptive to handle

uncertainty and complexity better. To what extent and by what means is uncertainty handled in SUMPs and SUM planning?

The empirical part of this paper investigates how and to what extent these issues are handled in current SUM planning practice, and why. This may not only provide an insight regarding the questions raised above but also a perspective on the diversity of approaches and variation of the design of SUMPs and the policy process, related to the observations of Stead (2016) and Van Geet et al. (2021) about a need for a context-sensitive mix of policy instruments, in contrast to the current SUMP guidelines (Rupprecht 2019).

3. Methodology

This paper explores current planning practice for transition pathways, and obstacles towards sustainable transport. It has a distinct explorative nature: it is based on an inventory of SUMPs from across Europe (see Figure 2). The data were gathered through analysing SUMP documents by a collaboration of the authors' institutes from Italy, Sweden, the UK, Slovenia and the Netherlands. Purposeful (or judgmental) sampling

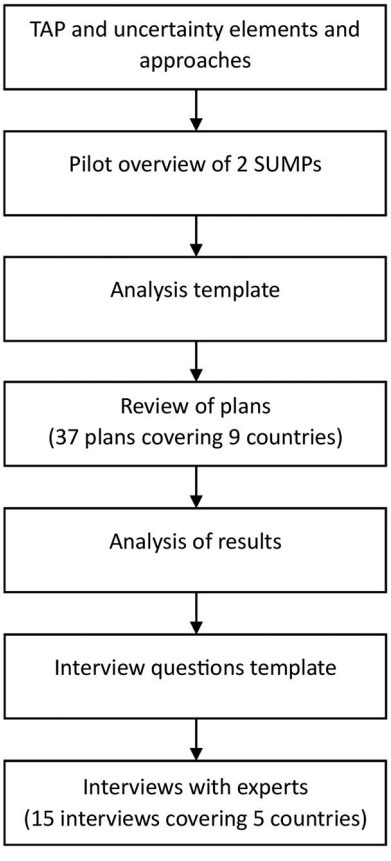

Figure 2. Used methodology overview flowchart.

has been applied in selecting case studies (Suri 2011). For this study, this meant that SUMPs were identified on the basis of expert judgement. One motive for the inclusion of a particular SUMP was that it is considered to be 'leading' in its approach to sustainable transport and creating pathways for the transition required to meet the decarbonisation imperative; Bologna in Italy or Lund in Sweden, for example, or have distinct and typical approaches that set them apart from others; Tilburg in the Netherlands, or Novo Mesto in Slovenia, for example. Besides the leading SUMPs, the analysis deliberately also included cases that were not leading (e.g. Worcester in the UK). These were included to deal with potential selection bias from selecting only frontrunners. The paper does not seek high external validity or reliability that could have been reached through more probabilistic methods of case selection. Instead, it aims to explore pathways that are applied in practice, which one could assume are the best observed by including those 'leading' cities and not-leading cities, through purposive sampling.

A total of 37 SUMP documents were analysed, for cities of varying sizes, see Table 1. The study was not limited to the countries of origin of the researchers: besides Italy, Sweden, the UK, Slovenia and the Netherlands, SUMP documents from Belgium, France, Germany and Austria are also included in the analysis. The documents were all identified and analysed in their original language. The document is not necessarily called a Sustainable Urban Mobility Plan (SUMP) – this depends on the country. For example in Sweden, there is a wide range of names given to such documents, from SUMP (in Malmo) through to Traffic Strategy (Norrkoping). In the Netherlands, whilst something similar to a SUMP used to be required to be produced, they are now subsumed within a broader municipal vision document covering various policy domains, the Omgevingsvisie (Area Vision). In Slovenia and Italy, they are known as SUMPs due to national guidance and/or legal requirements, and in the UK as Local Transport Plans or Strategies. In all cases, the municipal land-use plan was also reviewed to understand what it says about transport, and how transport and planning are integrated, or not. The included SUMP documents analysed consider the most recent SUMP of that particular city. The publication year of documents range from 2008 (Freiburg) up until 2021 (Turin), with a median publication year of 2015.

The sample of 37 SUMPs in this paper principally reflects the native countries of the authors (and hence familiarity with within-country heterogeneity of planning authorities, as well as with languages for both document review and interviewing). Some other countries are also covered where appropriate familiarity allowed. It should be noted that the sample does not and cannot purport to reflect all countries in Europe and their heterogeneous geographies and planning regimes. Nevertheless, the sample and the paper's insights offer others a benchmark against which to consider developments in other parts of Europe and for particular urban areas.

In order to structure the analysis and make it as consistent as possible across countries, two initial plans, from Aberdeen (Scotland, UK) and Nova Gorica (Slovenia) were reviewed as pilots and then an analysis template developed to capture the points in the plans most relevant to the objectives of the study, and thus related to the triple access framework, and theories of how uncertainty can be dealt with in planning. This template was then used to analyse the two pilot plans, and after further minor revisions to the template, SUMPS from each country were reviewed. The results were discussed

Table 1. Assessment of inclusion of key TAP and uncertainty concepts in each SUMP document reviewed (city with asterisk – interview also carried out here).

	Year of publication	Uncertainty	Explorative scenarios	Proximate accessibility	Digital accessibility	Adaptive capability
Aberdeen UK*	2016, 2020					
Antwerp BE	2015					
Bologna IT	2019					
Borlänge SE*	2020					
Brighton UK	2015					
Bristol UK*	2020					
Cagliari IT*	2021					
Cardiff UK	2015					
Edinburgh UK	2021					
Eindhoven NL	2014					
Freiburg* DE	2008					
Genoa IT	2019					
Gent BE	2015					
Gothenburg SE	2014					
Groningen NL	2020					
Karlstad SE	201					
Ljubljana SI*	2017					
Lund SE	2020					
Malmö SE*	2016					
Manchester UK*	2021					
Milan IT	2021					
Nantes FR	2018					
Naples IT*	2021					
Nijmegen NL*	2019					
Norrkoping SE*	2022					
Nova Gorica SI*	2017					
Novo Mesto SI	2017					
Palermo IT	2019					
Rome IT	2019					
Skelleftea SE	2020					
Stockholm SE	2012					
Sundyberg SE	2017					
The Hague NL	2021					
Tilburg NL*	2016					
Trieste IT*	2021					
Turin IT	2021					
Umea SE	2018					
Utrecht NL*	2021					
Vienna* AT	2014					
Vitoria-Gasteiz ES	2019					
West Midlands UK[5]	2022					
Worcestershire UK	2016, 2017					
		3 addressed 17 partially 20total	0 addressed 8 partially 8 total	28 addressed 5 partially 33 total	3 addressed 21 partially 24 total	8 addressed 33 partially 41 total

once again and then finally all plans were analysed and a document produced for each plan where text answers were written regarding each question in the analysis framework, for each plan.

Thereafter, interviews were arranged with two to three cities per country to discuss the findings from the document review. Again, a consistent set of questions, informed by the study objectives, was drawn up, piloted with two cities and reviewed by the research team before being used across Europe in 15 interviews with the civil servants that authored and implemented the SUMPs. Those cities that were interviewed are marked with an asterisk

in Table 1. They were selected on the basis of having SUMPs that had some recognition of TAP and/or uncertainty and in some cases because they were recommended to the research team by another city – thus a mixture of deliberative and snowball sampling. All the empirical work took place in autumn 2021 and spring 2022.

4. Findings: results from review of SUMP documents

This section considers, on the basis of the documents' review, how far TAP and uncertainty appear to be incorporated into SUM planning, and how the relationship between the two is dealt with. In short, with very few exceptions, the documents in general showed little cognisance of any aspect of TAP and uncertainty with the exception of proximate accessibility (spatial planning to reduce the need to travel), which was observed in all cases, except in Italy (where there is a strong functional divide between administrations responsible for SUMPs, and those responsible for spatial plans).

We postulated that a planning process that does not embrace TAP and uncertainty would be likely to be much more traditional and that, in such cases, this would manifest itself in a 'predict and provide' approach within the documents (Filippi 2022). However, in fact, very few of the SUMPs reviewed take a predict and provide approach, where forecasts of future travel demand are used to justify investments in road and large-scale public transport infrastructure to cater for that demand – exceptions to this being in Aberdeen and among the Italian SUMPs, where a four stage area-wide transport model is used as a basic input to the planning process. Instead, the SUMPs reviewed took a decide and provide approach, setting targets for modal share that imply a stabilisation or reduction in demand for travel by private car, and then selecting measures that they judge to be capable of achieving these targets (but in most cases not using quantitative models to test that judgement – an exception to that rule being Freiburg's plan from 2008). This use of decide and provide was also strongly associated with a clear vision for the contribution of transport to the city's future development and quality of life, so there was evidence of SUMPs being vision-led. However, the decide and provide paradigm (Lyons and Davidson 2016) addresses not only a vision-led approach but also the accommodation of uncertainty. So were these plans 'fully' decide and provide in this respect, including the application of triple-access thinking to plan development?

In terms of dealing with increasingly difficult and significant uncertainties (such as fuel price shocks, wars, epidemics and so on), few plans have considered this. The biggest uncertainty considered was usually population forecasts (dealt with in Malmö's plan) or financial uncertainty in terms of the measures that can be funded. Most plans, like Vienna's for example, simply do not mention uncertainty in any way and assume that trends will continue as they have. Freiburg's plan is unusual in our sample in that it does consider such uncertainties and (qualitatively) their effects on the achievement of plan objectives. Turin's and Naples' plans, too, explicitly mention uncertainty, mainly because they post-date the COVID-19 epidemic. In most cases, though, there is silence as regards uncertainty, including a lack of reflection on how the three pillars of TAP might interact with each other and thus influence demand for physical mobility in the future. Equally, there is little to no consideration of how disruptive factors such as new technologies will impact the achievement of plans' objectives.

Concomitant with this lack of consideration of uncertainty, scenarios are either not used in the documents reviewed, or are only defined as different packages of measures; there is no use of explorative qualitative scenarios to consider possible differing futures whose impact on plan measures and objectives can then be assessed. Digital accessibility is occasionally considered, in the more recent plans (for example in Greater Manchester's), but mostly without specific measures to promote digital accessibility. (The interview section below shows that sometimes scenarios and uncertainty were considered in the work on the plan, but for a variety of reasons did not make their way into the documents reviewed.)

In terms of proximate accessibility, there are varying approaches from not mentioned (Cagliari) to considered but without any measures or processes to realise the integration of planning and transport (Nova Gorica, Bologna), to fully integrated (Vienna, and Dutch and Swedish SUMPs). For example, the Vienna SUMP is a sub-plan of the city's spatial strategy, but even within the SUMP it says 'Vienna is building new areas in a compact, mixed, foot and cycle path-oriented manner in order to create high-quality urban living' and 'This requires a planning system that consistently directs growth to existing areas with potential, be it inner-city brownfield sites, areas around train stations or already well-developed areas in the outskirts' (both from this web page as part of STEP2025, accessed July 2021).

The measures included in the plans are mostly small-scale, scalable and adaptable, such as measures to improve walking and cycling conditions, improvements to public space, and small-scale public transport. In comparison to major infrastructure investments, this makes them more adaptable to future uncertainties, but in the plans this choice of measures is not linked to this reasoning, but rather to the objectives of the plans and to finances. In some plans (particularly in Sweden), few specific measures are mentioned at all, as these are defined in other less strategic documents, but in line with the SUMP.

Table 1, below, shows a *qualitative* assessment from the document review of the degree to which different aspects of TAP and uncertainty can be found in each document. The scale is as follows:

- White – Little or no consideration of concept in document
- Grey – Some awareness/appreciation of concept in document
- Black – Concept directly addressed as part of the document

The assessment of each document against the scale was carried out by a minimum of two members of the project team. The common analysis framework used to structure the reading of each document enabled the readers to assess each document on the three-point scale.

There are a few patterns in this data. Plans from Italy stand out as somewhat different, due to their greater reliance on modelling and much lesser mention of proximate accessibility than their counterparts elsewhere. We see UK plans as perhaps more cognisant of the relationship between digital and other forms of accessibility than plans elsewhere. Other than this, it is only in the areas of proximate accessibility and adaptable measures that the majority of the plans reviewed mention these concepts in some detail and integrate them into the SUMP. The more recent plans in general are more likely to mention uncertainty, but this same observation cannot be made for digital accessibility, which is not included anymore in more recent compared to older SUMPs.

To give more depth to the results summarised in the table, we here refer to documents analysed to explain how they 'scored' as they did. Obviously, the different TAP concepts in the columns of the table were conspicuous by their absence in those plans with cells shown in light grey. An example of a plan that had some mention of uncertainty was Malmö, where the uncertainty of different population forecasts was acknowledged. In contrast, Freiburg's plan discussed in more detail uncertainty about future transport preferences, vehicle technologies, fuel prices and so on, and in a qualitative way how this could affect the outcomes of the plan.

The term 'explorative scenarios' refers to the use in the plan of different possible futures that are not based solely on different combination of plan measures, but that consider some of the uncertainties mentioned earlier. It can be seen that there was not a single plan document that was found to include this type of scenario. The most sophisticated approach that came closest to the use of explorative scenarios was found in Turin in Italy where scenarios were composed of different combinations of SUMP measures, but where these scenarios were 'stress-tested' against possible disruptions such as a new pandemic, but also very different population growth forecasts, and also disruptive change in travel preferences.

'Proximate accessibility' is the consideration of land-use, and in particular increased densities and transit-oriented development, to influence mode choice and reduce travel distances, whilst 'digital accessibility' refers to the use of digital connectivity to substitute for physical mobility. In the case of the Hague in the Netherlands, a key plank of the vision for transport is a compact city, and land-use planning measures such as higher densities and transit-oriented development operationalise this. In most of the Swedish plans, proximate accessibility is also a core element, not least because in several cases the SUMP is a sub-plan of the land-use plan (also seen in Vienna). In Slovenia, in contrast, whilst the connection between mobility and land-use is recognised in SUMPs, it is difficult for them to include measures, as land-use is a statutory competence of another city department.

In terms of digital accessibility, the SUMP in Manchester explicitly recognises that, whilst connectivity was previously based on transport, digital access is increasing in importance in providing access, regardless of location. The SUMP adopts a 'holistic' approach to travel, encouraging more people to work from home rather than commute. It also refers to Greater Manchester's Digital Strategy and notes an aim of achieving the UK target of full broadband in all houses by 2033 and 5G being available to most people in the area by 2027.

Finally, 'adaptive capability' tries to encapsulate the idea that measures are scalable, and adaptable in the face of future uncertainties. Vitoria (Spain) gains a moderate score here because it has a very wide range of measures in its SUMP, and many of them are small-scale and adaptable – but they have not been selected because of their capability to be adapted, but rather because they are seen to be the best set of measures to achieve the plan's objectives. On the other hand, Antwerp takes a further step and explicitly recognises that measures need to be adaptable and flexible in the face of uncertainties such as unexpected modal shifts, increased demand and new technologies.

5. Findings: results from interviews

Digital accessibility as a substitute for physical mobility is one of the components of the Triple Access System. From the interviews, it emerged that the concept of digital accessibility is relatively new and many of the plans were developed before the recent development of technologies. As a result, only recent SUMPs, especially those developed after COVID-19 pandemic, included this aspect, though mainly in terms of reductions in modelled travel demand (increased number of people working from home, changed peak hours in commuter traffic) rather than specific measures to encourage it. In this regard, some interviewees expressed their concerns on the role of digital accessibility in SUMPS, as it is still unclear how technology will evolve in the future and will shape citizens' lives. For example, one UK interviewee said:

> Digital accessibility measures are harder to understand than digital connectivity measures and questions remain regarding whether digital access leads to fewer trips, or different trips (more leisure trips for example). In addition, commercially driven elements of digital access (such as online shopping for example) are hard for local authorities to influence.

Because TAP requires the integrated planning of physical mobility, spatial proximity and digital connectivity, it is crucial that figures with different backgrounds work at the development of SUMPs. The analysis of the interviews revealed that the level of inter-departmental collaboration within municipalities greatly varies depending on the local context of the SUMP. Difficulties in collaboration between different departments were found in Italy, where the land-use plan and the SUMP are two very different documents, and SUM planning is subject to norms and rules defined in the land-use plan. A similar situation was observed in the UK's case studies where land-use planners were seen by interviewees to attach lower priority to transport considerations. An interviewee in one UK case said that, in their case, transport planners strived to collaborate with spatial planners, but it was challenging to coordinate the whole work:

> So we had planning project teams, we had transport project teams and everyone did their best to work together on the plan. But they're naturally different activities and I just found it was a bit difficult getting things to work.

On the other hand, we found an excellent level of collaboration in Swedish municipalities, where often the SUMP is a subplan of the spatial plan. The same was recorded in the Netherlands, where, as already mentioned, SUMP is part of 'omgevingsvisie', a strategic plan which involves almost all departments, though some places decide to put more emphasis on intra-departmental collaboration than others, and found out that this is not always easy:: 'It was difficult to move from a model and mobility driven department, to a department that works from a narrative on a liveable and accessible city. New people and expertise was required'. Also in Slovenia a good level of inter-department collaboration was recorded, with some of the proposed measures included in the plan supporting a better integration between transport and land-use, though 'procedures to change the spatial plan to adapt to SUMP are demanding, complex and time consuming'.

Another notable level of collaboration that emerged from interviews was between different levels and types of government (and regions). Some good examples of this were found in the Netherlands, Sweden, where SUMPs are often dealt with as part of

a comprehensive land-use plan rather than a document on their own, and also in the UK where some SUMPs cover a region and are therefore the product of collaboration between several authorities. In one UK case, for example, participants explained that the SUMP required the final approval from five different local authorities but this process, due to huge political uncertainties, took two years of discussions and because of this the major schemes list of the plan started to get out of date.

In terms of uncertainties, the different interviews revealed that some of them were identified in the development of SUMPs. In some cases (Italy, UK, Slovenia) political and financial uncertainties were acknowledged as biggest uncertainties. In Italy, for example, one common uncertainty characterising the process of the development of the SUMP of the different municipalities involved in the study concerned the monetary resources needed to implement the measures included in some of the policy scenarios, as for some of them the source of funding was unknown. Other plans considered other kind of uncertainties, related mainly to population growth rates (e.g. Trieste, Malmö) or reduction in trip rates due to teleworking and teleshopping (e.g. Naples). In the case of Trieste the private firm who worked at the SUMP of the city, explained that, because Trieste is a city whose population is, on average, older than the population of the rest of Italy, in their scenarios they did not consider an increase of the travel demand because of a change in the characteristics of the resident population. Another uncertainty emerged during interviewees regarded the diffusion and impact of future technological developments (MaaS, EVs, autonomous vehicles).

Overall, though, uncertainty was not dealt with in many plans, and it was insightful to listen to interviewees' reasons for not considering it. In some cases, the interviewees explained that for politicians it is easier not to think about it, so as to avoid giving any perception of 'negativity' to citizens and adding complexity to SUMPs development process. For instance, one of the interview participants who worked on one UK SUMP mentioned that there was an attempt to use five explorative scenarios during the development of the regional strategic transport plan, but this was not progressed because of concerns regarding the 'scaremongering' the most pessimistic scenarios might prompt in the population. In other cases, e.g. in Italian and to an extent Dutch SUMPs, the use of mathematical modelling to measure the impact of different measures makes dealing with uncertainty difficult because these models work in a very linear fashion with a limited range of inputs and assumptions and/or are specified on the basis of some trends set at a national level (Dutch models). This makes practitioners not so eager to deal with the issue of uncertainty because it would lead to the proliferation in the number of different scenarios to be considered and, as a consequence, to increase the time needed to develop the document.

On the other hand, some of the municipalities interviewed positively embrace uncertainty. One Dutch case included explorative scenarios in 2040, with three variants, based on degrees of transition. These options were optimising, transforming, and integrating, and covered the degree to which mobility is connected to other domains, by including the ambitions of different departments (housing, social, etc.) in the integrated models. The scenarios were then used to calculate area-specific effects, leading to 10-year plans with main choices. Next, short-term agendas (5 years) were developed and these cover how the municipality should accommodate the needs. As explained during the interview, the whole approach included imagination of customer journeys to make it more tangible (i.e. explore how the vision affects everybody's life and how it covers different needs).

As described in the Introduction section, one way of taking into account uncertainties in the TAP approach is through the development of different explorative scenarios. Nevertheless, in almost all SUMPS the different scenarios were mainly developed as a package of different measures, without including the effect of external factors. An exception was in one of the UK SUMPs, as explained during the interview:

> Scenario planning was not thought about for the original version of the SUMP, in 2017. Since then, it has been proactively used: to develop the City Centre Transport Strategy for example. After the SUMP was published, scenarios were also used to map possible post-pandemic scenarios. This was useful in lobbying central government for support.

Another source of weakness that came out during interviews concerned the approach followed by SUMP developers when proposing measures. Because of the influence they get from above, in many cases the measures included in the plan focus too much on specific problems (congestion, carbon emissions) instead of adopting a holistic perspective. In this context, the Netherlands and Sweden stand out as somewhat different from other countries, with their municipalities proposing actions as part of an integrated transport land-use vision. Difficulties were found also in applying measures – such as parking management, or circulation plans where road networks are partially closed for private vehicles – aligned with a 'decide and provide approach'. In fact, in some interviews, participants complained about the lack of evidence that these measures, which are often politically sensitive, actually work. Another element that affects the choice of measures is the short-term horizon (5-10 years) of the plans. Interestingly, in the case of Manchester, participants said that short-term measures were chosen because they can be made adaptable in the face of uncertainty much more easily than major long-term measures.

Finally, when participants were asked about the possible barriers to the inclusion of all the elements of TAP into future SUMP processes, different responses were given. Perhaps curiously none mentioned that the non-statutory nature of SUMPs in almost all countries militates against their preparation in general. Many points were raised, however. In some cases, respondents indicated the difficulty of measuring accessibility with quantitative indicators and therefore to communicate benefits of measures related to improving accessibility. Another barrier was the absence of existing guidance on TAP and uncertainty, making it difficult for anyone who is interested to apply it. Indeed, planners mainly follow current European and National guidelines, which do not require consideration of uncertainty, especially for modelling. As pointed out in one of the interview we held in the UK: 'National frameworks do not encourage local areas to expose uncertainty in their plans. There is a sense then that uncovering uncertainty may have costs.' At the same time, some interviewers showed the desire to learn about TAP (e.g. Malmo) but they complained about a lack of agency and capacity, with municipalities very limited in their human and financial resources.

6. Discussion

The insights from the literature review, above, lead to some ideas as to how SUMP might develop if it is to deal with TAP and uncertainty. The degree to which these developments

have been observed empirically in the cases in this paper, and the reasons for this, are summarised in Table 2.

Many of the issues identified in the literature review are echoed in the empirical findings summarised in Table 2. The integration of TAP and uncertainty into SUM planning is limited at present for reasons such as:

- Poor collaboration within and between institutions (those responsible for land-use planning and transport planning, for example) leading to a lack of policy integration (Duffhues and Bertolini 2016).
- A certain level of incrementalism in SUM planning, so it is quite difficult to introduce new ways of doing things, even if the need to do them (for example, to try to deal with uncertainty) is recognised (Fenton 2016).
- Dominant discourses (Hysing 2009) in some countries, such as Italy for example, around transport planning based on 4 stage models, which have difficulties in dealing with uncertainty. It can also be argued that dominant discourses about the content of a SUMP make it more difficult to integrate concepts from outside this discourse, such as digital accessibility.
- Lack of political will to embrace, in this case, planning for uncertainty, to avoid a situation where the planning authority and its politicians are, as a result, seen to be too weak.
- Related to the above point, in Bristol and Manchester, for example, the challenges of having policy design fit with political realities (Howlett and Mukherjee 2018). The need for the many local authorities within these regions to reach a consensus on the objectives and measures in their SUMP may leave little room for incorporating newer or 'difficult' concepts such as uncertainty and digital accessibility.

However, the experience of one or two more innovative cases, also bears out the findings from the work of Hull (2008) and Straatemeier and Bertolini (2020), on the benefits of sharing responsibilities, visions and views when developing a SUMP that is more aligned with TAP and uncertainty. The interview findings also revealed a much deeper awareness of uncertainty, and a desire to try to incorporate it into SUM planning, than is indicated only from a review current planning documents.

7. Conclusions and recommendations

This paper has made a significant contribution to the journal and the Special Issue by describing a novel approach to make SUMPs better able to deal with uncertainty and to better reduce emissions from transport.

Returning to the objectives of this paper, they were as follows: to analyse how widely TAP and uncertainty are currently recognised, and dealt with, in urban transport planning in Europe today; and to understand the challenges to incorporating them better into practice in future. In this paper, the context for analysing the integration of TAP and uncertainty into current transport planning practices is based on the use of SUMPs. This choice is based on the fact that, for numerous European countries, SUMPs represent a relatively new approach to transportation planning. Consequently, it is within the framework of SUMPs that the concepts from TAP and uncertainty are most likely to be observed.

Table 2. Key elements of TAP and uncertainty, how they are currently dealt with in the SUMPs reviewed, and why.

Aspects of a SUMP that incorporates TAP and uncertainty	How far is this observed in current practice?	Reasons for observation
SUMP not only includes transport measures but also measures to promote proximate and digital accessibility	Measures promoting proximate accessibility are often found in SUMPs or linked documents, but digital accessibility is rarely mentioned.	Transport planners have for many years been aware of the importance of proximate accessibility to reduce the need to travel. However, the degree to which this awareness translated into actual measures in the SUMPs reviewed varied considerably due to differing degrees of institutional integration. Digital accessibility is a new idea and transport planners have not yet spent time thinking how to include it in SUMPs. In certain cases, they have thought about it, but have been unable to generate options for measures in this category. In addition, in most cases they do not have good contacts with those responsible for digital connectivity.
SUMP includes explorative scenarios to try to account for future uncertainties and in general make the planning process more robust	With a few exceptions scenarios were not used in this way in the SUMPs reviewed Because of the very limited use of explorative scenarios, their use as a way of strengthening the planning process was not observed. In Freiburg, there was a qualitative consideration of the possible effects of megatrends on the SUMP's measures and outcomes.	There was more awareness of the need to use explorative scenarios to plan for uncertainty amongst those interviewed than manifested itself from a desktop review of SUMP documents, but this is in part because COVID19 and other recent societal 'shocks' have raised awareness, but this awareness is predated by most of the plans reviewed. The understanding of uncertainty did not generally relate to the uncertainty surrounding the relative importance in future of the three forms of accessibility in the TAP model. Other reasons for not using explorative scenarios in plans included political unwillingness to appear uncertain; a use of 4 stage transport models in certain plans, which are costly and time-consuming to run for a wide variety of scenarios; and simply a lack of knowledge about how to develop and use explorative scenarios.
A range of resilient (adaptable and scaleable) measures is chosen	Measures in the SUMPs reviewed are in the main adaptable and scaleable, with the exception of some major public transport investments in Freiburg, Vienna, Manchester, Stockholm and larger Italian cities	Usually, such measures were not selected to respond better to future uncertainty. They were selected for financial reasons (small measures can be financed bit by bit) and also because the majority of the plans reviewed were seeking to reduce travel by car, which implies a choice of measures that can be implemented incrementally: traffic calming, cycling and walking infrastructure, improved public space, parking management, and lower cost public transport improvements.

In relation to the first objective we have found that there is little incorporation of the ideas from TAP and uncertainty into current SUMP practice, with the one exception of spatial proximity, or land-use planning to reduce the need to travel, which is well-recognised across the sample of SUMPs that was reviewed. However, the most recent SUMPs that were developed after the COVID-19 pandemic include much clearer consideration of future uncertainty, and interviews with other transport planners also showed that they understood the need to try to build consideration of uncertainty and digital accessibility into their future plans.

In relation to the second objective we have found many challenges to incorporating TAP and uncertainty into future transport planning. These challenges are set out in greater detail in the discussion section, above. However, in brief, they fall into five main categories:

1. (Lack of) institutional and policy integration. If digital accessibility and spatial proximity are to become even stronger parts of current SUM planning practice, planning professionals need to be able to work across departmental and organisational boundaries, and to share visions and policy objectives.
2. The difficulty of changing existing planning practices, which can include tools (such as 4-stage transport models) that are not easily compatible with a greater focus on uncertainty.
3. Lack of clarity about the ways in which digital accessibility can actually be facilitated within a SUMP – the concept is recognised, but it is not clear how to translate it into measures.
4. Lack of knowledge of how to plan for TAP and uncertainty – clear guidance does not yet exist.
5. Lack of political desire to embrace uncertainty in planning, since politicians often prefer to give an image of certainty and decisiveness.

Overall, then, it appears that there is quite some way to go before TAP and uncertainty become more closely integrated into the SUM planning process. Further research within the project with which this paper is associated will test and report on practical approaches to delivering this integration. The project will also produce a Handbook for practitioners which will provide much clearer guidance on points 3 and 4 above, and which will help to raise awareness and build professional capacity to help to overcome barriers 1 and 2, above. There is however need for further work on how modelling approaches currently used in transport planning could be modified and adapted to take into account TAP and uncertainty.

Bringing about the better integration of TAP and uncertainty into SUMP is an issue of changing professional practice, and the other way in which this can occur is where some leading organisations themselves begin to embrace TAP and uncertainty as a way of working, which will encourage others that look to them for a lead to do the same. Transport Scotland, the national transport agency of that country, responsible for planning and building national transport infrastructure, but also funding local transport and producing national transport appraisal guidance, has been at the forefront of this change – its appraisal guidance (Transport Scotland 2022b) makes the following statement (page 5) (but also provides detailed technical support on how to operationalise this):

Recognising and dealing with uncertainty is a critical aspect of appraisal, and scenario planning approaches have been applied for the development of [national transport

strategies and plans]. Uncertainty analysis is built in … throughout the appraisal lifecycle and should provide a greater understanding of the potential impact of disruptors and uncertainties at each stage of the process.

Other examples from the UK include the next Local Transport Plan (LTP) for the West Midlands, under development at the time of writing. A green paper[2] produced in 2021 as part of the preparation for LTP included explicit reference to the Triple Access System. In September 2022 Oxfordshire County Council approved 'new requirements for transport planning based on the principle of "decide and provide" rather than "predict and provide"'.[3] Nationally the UK Department for Transport has published in 2022 a set of 'Common Analytical Scenarios'[4] which it is expecting transport authorities promoting new schemes to use in the interests of exploring and addressing uncertainty and looking to make more robust investment decisions to shape the future. In Slovenia, a new national transport strategy is under development and a new (2022) law on sustainable urban mobility planning is in force, requiring the update of all SUMPs in the country, and both of these factors are likely to increase the consideration of uncertainty in transport planning in the country. Thus overall there is evidence that innovative practitioners are starting to apply TAP and uncertainty which will gradually raise awareness of the approach with other practitioners and show that the barriers listed on the previous page can be overcome.

Notes

1. https://www.tapforuncertainty.eu/
2. https://www.tfwm.org.uk/who-we-are/our-strategy/green-paper-2021/
3. https://news.oxfordshire.gov.uk/new-transport-planning-approach-approved/
4. https://www.gov.uk/government/publications/tag-uncertainty-toolkit
5. Work in progress, draft core strategy published in 2022

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