Transport Policy 182 (2026) 104090

Contents lists available at ScienceDirect

Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

Policy prioritization in participatory planning: Which approach to use, when and why?

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ARTICLE INFO

Keywords:
City logistics
Stakeholder engagement
Participatory planning
Policy acceptability
SUMP
SULP

ABSTRACT

This paper addresses the critical challenge of policy prioritization within Urban Freight participatory planning. While the objectives and activities of such planning are generally defined, clear methodological guidance on selecting the most suitable approach, contingent on specific contextual factors, remains limited. This research systematically classifies and compares alternative approaches against key contextual factors. Jointly considering a comprehensive systematic scientific/grey literature review (64 articles and 11 items, respectively) and scenario analysis allows the study to evaluate both strengths and weaknesses of each approach across various hypothetical planning contexts. Results indicate that, while there is no best solution, *Discrete Choice Models* generally represent the most suitable approach across diverse scenarios, particularly when dealing with high stakeholder heterogeneity and controversial, monetary-focused policies. Conversely, *Discuss and Deliberate* methods, while effective for high complexity, are often time-consuming and less suitable when highly heterogeneous groups are key. This paper provides policymakers and practitioners with evidence-based recommendations for selecting context-appropriate participatory methodologies, thereby enhancing the efficiency and legitimacy of UFT policy design while mitigating the risks of delayed or blocked policymaking processes.

1. Introduction

Urban Freight Transport (UFT) encompasses all logistics activities related to the movement and handling of goods in urban areas, including loading, unloading, storage, and distribution. It plays a strategic role in sustaining urban economic functions and ensuring the smooth operation of commercial activities. However, despite its critical importance, UFT often still remains a secondary focus in urban mobility policies compared to passenger transport (Dablanc, 2006; Smart Freight Centre, 2017).

Currently, UFT functioning is unsustainable, producing excessive environmental and societal external costs (Marcucci et al., 2023). Commercial vehicles contribute 20% ÷ 40% of urban transport CO2 emissions and 30% ÷ 50% of major air pollutants (i.e., PM and NOx), despite accounting for only 10% ÷ 15% of equivalent vehicle miles travelled in urban areas (Rodrigue, 2020; Smart Freight Centre, 2017). World Economic Forum (2020) highlights that new phenomena, such as urbanization, logistics sprawl, e-commerce, and on-demand economy, will generate, in a business-as-usual scenario, a 36% increase in last-mile deliveries, resulting in a 32% rise in emissions and an 11-min increase in average commuting time.

The main stakeholder categories commonly involved in UFT include transport operators—such as carriers, freight forwarders, and shippers—and receivers, including retailers and end consumers. Other relevant actors comprise trade associations, business organizations, property owners, citizens and policymakers, reflecting the broad and diverse range of stakeholders' categories urban freight policies have an impact on.

Key UFT characteristics include: (1) dominance of private sector actors (Le Pira et al., 2017a; Lebeau et al., 2018); (2) high stakeholders' heterogeneity with over 150 supply chains (Dablanc, 2006; Marcucci et al., 2021); (3) intense competition and limited cooperation (Allen et al., 2018; Marcucci et al., 2017c) and (4) conflicting interests/objectives among stakeholders (Gatta et al., 2019; Marcucci et al., 2020; van den Bossche et al., 2017). This contextualisation underscores the need for framing UFT policies within a long-term planning horizon aimed at promoting efficiency while balancing public and private interests in seeking UFT sustainability.

Numerous solutions have been proposed in the literature to address UFT challenges, ranging from regulatory measures (e.g., low-emission

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https://doi.org/10.1016/j.tranpol.2026.104090
Received 2 October 2024; Received in revised form 15 January 2026; Accepted 21 February 2026
Available online 7 March 2026

zones, access restrictions), technological innovations (e.g., electric and autonomous delivery vehicles), and behaviour change initiatives (e.g., off-hour delivery programs, voluntary eco-driving and fleet efficiency schemes, receiver-oriented incentives and awareness programs). While each of these strategies potentially offers valuable contributions, they remain subordinate to the fundamental requirement of effectively involving stakeholders through appropriate methodologies. Inadequate engagement or mismanagement of conflicting interests can severely undermine the success of any intervention, regardless of its technical merit.

Sustainable Urban Mobility Plans (SUMPs) have emerged as a comprehensive framework, promoted by the European Union since 1992, integrating multiple dimensions of mobility and sustainability while emphasizing stakeholders' participation within the policy-making process (Rupprecht et al., 2019).

Participatory planning can enhance the quality of decisions, minimize costs and delays (Beierle, 2002; Creighton, 2005; Drazkiewicz et al., 2015), build consensus (Forester, 1989; Innes and Booher, 1999; Sager, 2017), and anticipate stakeholders' concerns and attitudes (Creighton, 2005; Le Pira et al., 2017b). Given UFT initiatives have a strong private sector characterisation, participation becomes crucial when tackling conflicting objectives (Gatta et al., 2017). Participatory planning necessitates the integration of technical and economic evaluation tools (e.g., cost-benefit analysis) with stakeholder involvement ones (Le Pira et al., 2017a). These tools can be used for various purposes, including preliminary policy identification, technical evaluation, policy implementation, ex-post evaluation and monitoring (Janjevic et al., 2019; Le Pira et al., 2017a; Nesterova and Quak, 2016).

It is important to note that participatory planning and stakeholder engagement are functionally interdependent components of collective decision-making, with a clear hierarchical and operational relationship. Stakeholder engagement constitutes the enabling strategy through which participatory planning becomes possible, while the latter represents the structured process that gives purpose, direction, and analytical coherence to engagement activities. While the literature emphasises structured stakeholder involvement and collaborative governance as prerequisites for effective decision-making, in practice participation is often constrained by limited institutional capacity, fragmented processes, and consultative rather than influential engagement (Ballantyne et al., 2013; Lindholm and Behrends, 2012; Fossheim and Andersen, 2022). Freight Quality Partnerships and Living Labs are examples of institutionalised participatory planning settings designed to support continuous dialogue and coordination between public authorities and UFT stakeholders. They provide a stable environment in which carriers, shippers, receivers, business associations, and local administrations collectively discuss problems, exchange knowledge, and negotiate feasible solutions.

Co-design and co-creation are fundamental in any planning process, as SUMP guidelines outline (Rupprecht et al., 2019). The first six steps of the SUMP cycle (see Fig. 1) focus on mobility analysis, strategy development, and target setting. Step 7, central to this paper, involves bundling measures into integrated policy packages, discussing and assessing them with stakeholders to validate the selection. This articulated procedure helps preserving planning process credibility, supporting legitimacy, and guaranteeing efficacy (Creighton, 2005; Le Pira et al., 2017a).

While both outcomes to achieve (i.e., *why*) and activities to perform (i.e., *what*) are clear, there is no suggested and agreed-upon methodology to employ (i.e., *how*) that, in turn, might depend on the contextual factors characterizing a given participatory planning process. In fact,

Fig. 1. SUMP process.
Source: (Rupprecht et al., 2019)

one could *adopt* different approaches to analyze stakeholders' opinions/preferences regarding specific policy components, *prioritize* them, and *select* the most accepted policy package at the end of the process.

Identifying the most appropriate context-specific approach to adopt when performing participatory planning activities represents a paramount challenge. To the best of our knowledge, no scientific research has systematically *classified, compared, and evaluated* alternative participatory planning approaches for identifying the ex-ante most accepted policy package, on the basis of different contextual factors. There are only two fairly similar studies addressing this issue. Vacik et al. (2014) assess participatory planning methods by partitioning them into problem identification, modelling, and solving. However, this work lays within a different domain, namely natural resource management, and does not evaluate approaches based on contextual planning factors. Polydoropoulou et al. (2021) compare specific methods in terms of preference collection and analysis, focusing on knowledge creation rather than policy selection, a gap that this paper aims to address as its core contribution.

Accordingly, the research seeks to answer the following questions: (1) which are the approaches most frequently applied in UFT participatory planning?; (2) which are the main contextual factors affecting UFT planning?; (3) which are the pros and cons of each approach in

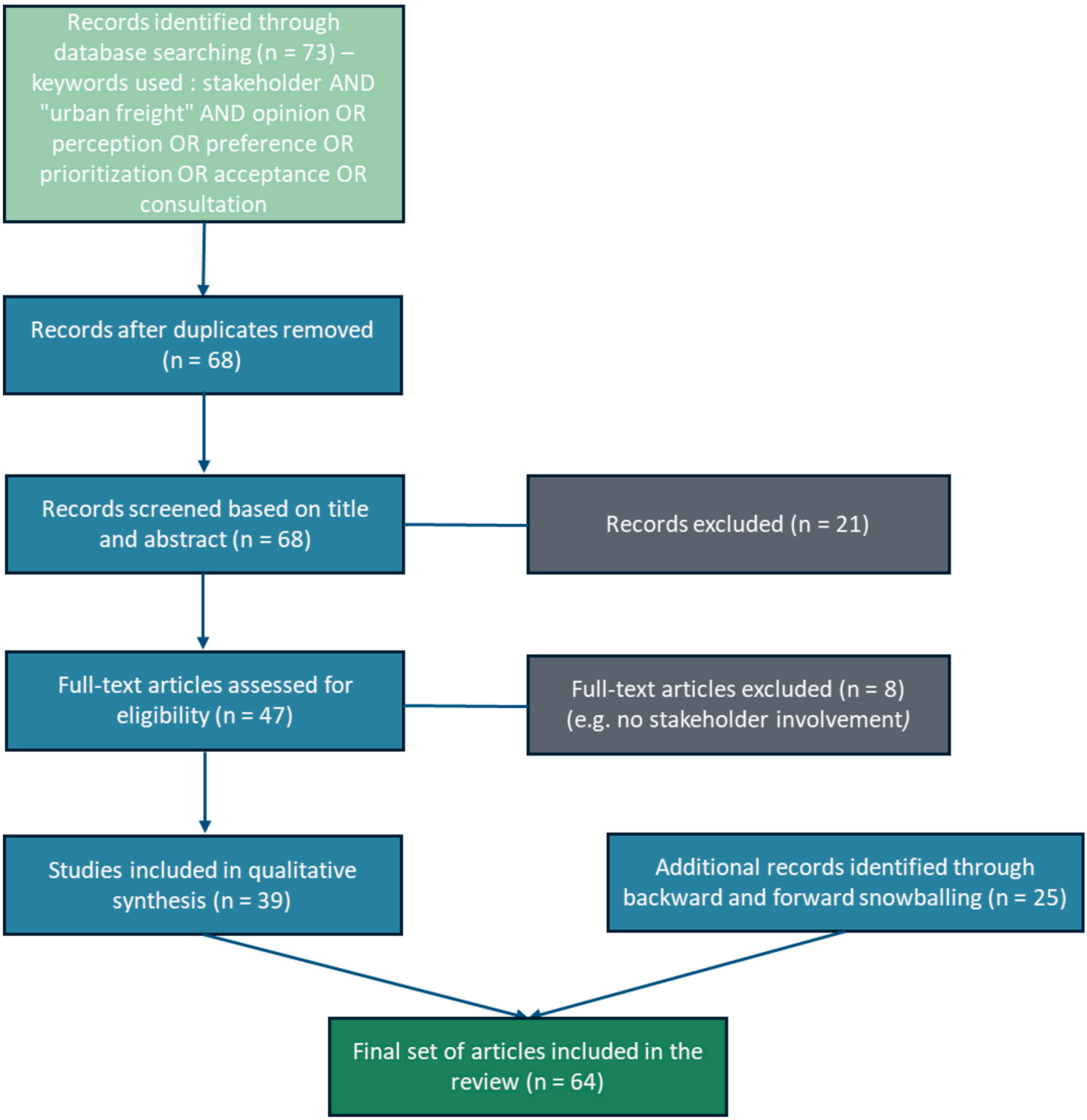

Fig. 2. PRISMA reporting chart for scientific literature.
Source: Authors' own elaboration

relation to specific planning conditions?; and (4) which are the best/worst approach to adopt with respect to a given set of planning scenarios?

The paper answers the research questions above by performing a systematic literature review to classify various UFT approaches and define key contextual planning factors through a grey literature review, evaluating the pros and cons of the identified approaches in connection with the pinpointed factors, and conducting a scenario analysis to suggest the most suitable methodological approach to adopt given different hypothetical situations. The paper contributes to the literature by providing policymakers and practitioners with recommendations for adopting the correct approach to select stakeholder-centric policy measures within UFT participatory planning processes.

The paper is structured as follows: Section 2 clarifies the methodological approach, Section 3 presents the results, Section 4 discusses their implications, while Section 5 concludes.

2. Methodology

The paper performs an extensive review of both scientific and grey literature to define the current state of affairs with respect to the methodological approaches employed in selecting context-specific policy priorities and the specific contextual factors characterising participatory planning processes. The procedure developed involves the following four phases.

1. Reviewing scientific papers that analyze stakeholders' opinions/preferences on UFT policy measures to classify distinct *approaches*;
2. Appraising grey literature that focuses on the practical aspects of a participatory planning process to identify *contextual factors*;
3. Combining the outcomes of the previous two phases to assess the suitability of the approaches based on the contextual factors;
4. Creating scenarios based on different set of contextual factors and assessing the most and least suitable approaches for each scenario, based on information obtained from point 3.

Phase 1 follows a specific and established procedure (Lame, 2019). Fig. 2 outlines the main steps of the selection process. The following keyword combinations were used to interrogate Scopus: *stakeholder AND "urban freight" AND (opinion OR perception OR preference OR prioritization OR acceptance OR consultation)* to interrogate Scopus. The query retrieved 73 high-quality peer-reviewed articles. Among these, 5 were removed as duplicates. A preliminary screening of titles and abstracts led to the exclusion of 21 articles not aligned with research objectives (i.e., only studies addressing the prioritization of UFT intervention measures within case study contexts were included). An in-depth reading of the remaining papers resulted in the elimination of additional 8 articles, as they did not include any form of stakeholder involvement in their

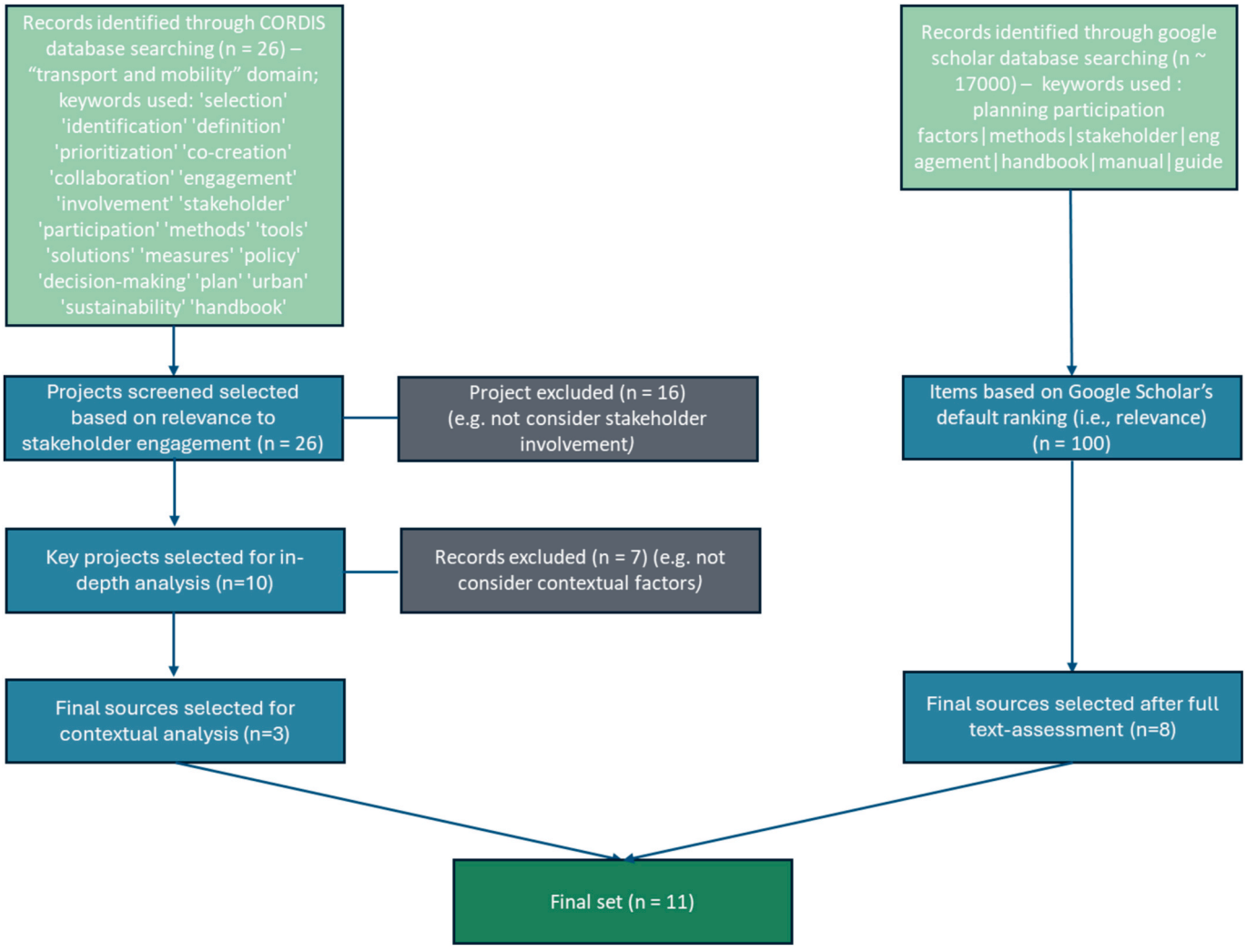

Fig. 3. PRISMA reporting chart for grey literature.
Source: Authors' own elaboration

methodological design, either consultative, collaborative, or participatory. This process yielded 39 eligible articles. Subsequently, a snowballing procedure was used to expand the sample. Following Wohlin (2014), both backward and forward snowballing were conducted. References cited in the 39 selected papers (backward) and articles that cite them - identified using Scopus' "cited by" function (forward) - were screened to identify additional relevant studies. Through this process, 25 further articles were identified and included in the final corpus, bringing the total to 64 articles.

Phase 2 directs the investigation toward contextual factors by examining grey literature and expanding the search beyond UFT domain. The procedure begins with an initial search for European project reports focusing on participatory planning in transport, followed by a Google Scholar search targeting practical insights from handbooks, manuals, or guides, also those not specifically related to the transport sector. This approach provides practical yet robust stakeholder engagement insights and identifies the contextual factors influencing real-life participatory planning experiences. Fig. 3 reports the main steps of the selection process.

Using the European project database CORDIS with "Transport and Mobility" as the application domain and the following keyword combination: *selection AND identification AND definition AND prioritization AND co-creation AND collaboration AND engagement AND involvement AND stakeholder AND participation AND methods AND tools AND solutions AND measures AND policy AND decision-making AND plan AND urban AND sustainability AND handbook* produced 26 results. From this initial sample, 10 projects were selected based on their explicit relevance to stakeholder involvement in planning processes. For each of these projects, we carried out a targeted analysis of available deliverables, specifically identifying documents that addressed stakeholder engagement. Among these, we focused on those deliverables that included reflections on the contextual factors influencing the planning process. This refined search led to the selection of 3 key projects.

Using Google Scholar with the following keyword combination: *planning participation factors methods|stakeholder|engagement|handbook|manual|guide* produced approximately 17,000 items. The first 100 results, based on Google Scholar's default ranking (i.e., relevance), were selected. After assessing the full texts, only those papers discussing relevant contextual dimensions (8 items) were retained.

Table 1 reports the final list of sources used to map and analyze the contextual factors characterizing participatory planning processes. Their final selection rests on their recurrence across the 11 sources analyzed (three project deliverables, three books, and two scientific articles). This frequency-based criterion allows prioritizing the most consistently mentioned factors thereby ensuring a robust and evidence-informed framework for interpreting participatory planning dynamics.

Table 1
Sources for identifying contextual factors.

Source	Type	Domain
CITYLAB (2015)	Project deliverable	Urban freight transport
Creighton (2005)	Book	General
Grossardt and Bailey (2018)	Report	Passenger transport
Kelly et al. (2004)	Book	Passenger transport
Lienhoop et al. (2015)	Article	Biodiversity and ecosystem services
Polydoropoulou et al. (2021)	Report	General
Slocum-Bradley (2003)	Book	General
SMARTEES (2021)	Project deliverable	Transport
SUNRISE (2017)	Project deliverable	Passenger transport
Vacik et al. (2014)	Article	Natural resource management
Van den Bossche et al. (2017)	Report	Urban freight transport

Source: Authors' own elaboration

Phase 3 integrates previously acquired knowledge to critically assess both advantages and disadvantages of all the approaches with respect to specific contextual factors considered. For each contextual factor, a qualitative performance score was assigned to all approaches, based on the evidence collected. If multiple sources indicated that a given approach performs well in the presence of a specific factor, a positive score (+) was assigned. Conversely, if evidence indicated poor compatibility, a negative score (−) was attributed. In cases where performance was shown to vary depending on additional conditions, a neutral score (+/−) was applied. This structured scoring process allowed for a qualitative evidence-based evaluation of the contextual robustness of each approach.

Phase 4 further refines the analysis by constructing a set of scenarios derived from specific combinations of contextual factors. These scenarios reflect typical configurations that may emerge in real-world participatory planning processes. Each approach was then evaluated by using information obtained in point 3 against these scenarios to determine how well it performs in complex, multi-factor contexts.

3. Results

This section includes two sub sections: (3.1) classifies and describes the approaches used for selecting stakeholder-centric policy measures within UFT participatory planning; (3.2) illustrates the contextual factors and, for each of them, evaluates their suitability with respect to each context considered.

3.1. Approaches to select stakeholder-centric policy measures

The paper refers to *approaches* as the set of homogeneous methods with respect to data acquisition and analysis. It classifies them in two broad categories, namely: *quantitative* - Descriptive Analysis (DA), Discrete Choice Models (DCM), Multi-Criteria Analysis (MCA), and *qualitative* - Discuss and Deliberate (DaD).

Table 2 provides a comprehensive mapping of the approaches present in the literature, showing, for each, those articles explicitly referring (or not) to participatory planning. This allows understanding the existing and potential adoption of available approaches within a participatory planning context. Results reveal that *quantitative* approaches are more commonly used than *qualitative* ones. Several papers explicitly mention MCA, less DCM, and none DA. The few qualitative papers concerning DaD clearly refer to a participatory planning context.

The lack of information with respect to the approaches actually used in real planning contexts further underline the relevant gap between theory and practice, thus calling for an in-depth investigation.

3.1.1. Quantitative

3.1.1.1. Descriptive Analysis. DA encompasses methods that utilize simple statistics to analyze stakeholders' opinions/preferences. Studies employing this approach provide information on central tendency (e.g., mean, median, and mode), dispersion (e.g., range, variance, and standard deviation), frequency (e.g., count, percent, and frequency), or multivariate indicators. This approach usually involves: (i) a one-step data collection process (i.e., questionnaire administration); (ii) data analysis focusing on direct policy prioritization questions. The literature review indicates that DA is often used for comparing various policies rather than different components of a single policy.

3.1.1.2. Discrete Choice Models. DCM comprise a variety of econometric models (e.g., multinomial logit, mixed logit, latent class, etc.), based on random utility theory, that allow quantifying the relationship between a given alternative chosen from a set of two or more and a set of explanatory variables (Hensher and Johnson, 2018). DCM are often used to forecast market shares or evaluate choice determinants (Lancsar and

Table 2
Approaches used to ex-ante identify alternative policies embedding stakeholders' opinions.

Quantitative		
Descriptive Analysis (DA)	Description	Employs descriptive statistics for opinion/preference analysis, with data collection typically taking place via one-shot questionnaire administration
	Papers mentioning participatory planning	N/A
	Papers not mentioning participatory planning	Alvarez et al. (2018); de Oliveira and de Oliveira (2016, 2017); de Oliveira et al. (2018, 2019a, 2019b, 2020, 2021); Guedes Furquim et al. (2020); Karakikes and Nathanail (2020); Le and Ukkusuri (2019); Matusiewicz (2019, 2022); Stathopoulos et al. (2011, 2012); Vieira et al. (2021)
Discrete Choice Models (DCM)	Description	Uses econometric models to analyze stated preference data collected via one-shot questionnaire administration
	Papers mentioning participatory planning	Le Pira et al. (2017a); Marcucci et al. (2017b)
	Papers not mentioning participatory planning	Amaya et al. (2020); Borghetti et al. (2022); dell'Olio et al. (2017); Gatta et al. (2020); Gatta and Marcucci (2016); Kijewska et al. (2022); Marcucci et al. (2015, 2017a); Marcucci and Gatta (2013, 2016); Polydoropoulou et al. (2022)
Multi-Criteria Analysis (MCA)	Description	Adoption of mathematical models considering objectives and multiple criteria with data mainly collected via questionnaire administration
	Papers mentioning participatory planning	Aljohani and Thompson (2019); Alves De Senna et al. (2021); Brusselaers et al. (2021); Buldeo Rai et al. (2017); Cruz-Daraviña and Bocarejo Suescún (2021); de Carvalho et al. (2020); Elvsaas Nordtømme et al. (2015); Gatta et al. (2019); Kin et al. (2017); Knoppen et al. (2021); Lebeau et al. (2018); Macharis et al. (2010, 2011, 2014); Milan et al. (2015); Muñuzuri et al. (2016); Nathanail (2018); Nathanail et al. (2021); Perera and Thompson (2021); Sgura Viana and Delgado (2019); Szmelter-Jarosz and Rześny-Cieplińska (2019); Verlinde et al. (2014); Verlinde and Macharis (2016); Vermote et al. (2013)
	Papers not mentioning participatory planning	Aljohani and Thompson (2020); Anderluh et al. (2020); Bennani et al. (2022); Rześny-Cieplińska and Szmelter-Jarosz (2019); Sgura Viana and Delgado (2019); Taefi et al. (2016); Watróbski et al. (2017)
Qualitative		
Discuss and Deliberate (DaD)	Description	Uses stakeholders' dialogue to critically discuss, broaden perspectives, and reach consensus, with data collected through voting procedures (e.g., by show of hands)
	Papers mentioning participatory planning	Österle et al. (2015); Paddeu and Aditjandra (2020)
	Papers not mentioning participatory planning	N/A

Louviere, 2008). This approach typically involves: (i) data collection via stated preference questionnaires based on experimental designs; (ii) data analysis allowing for indirect policy package prioritization. DCM-based literature predominantly focuses on investigating stakeholders' preferences towards a specific policy intervention (e.g., Marcucci et al., 2017a; Holguín-veras et al.; Maltese et al., 2021).

3.1.1.3. Multi-Criteria Analysis. MCA, also known as Multiple Criteria Decision-Making or Multiple-Criteria Decision Analysis, includes a range of methods that explicitly consider multiple objectives and criteria when analysing policy measures (Dean, 2020). MCA can be subdivided into several categories: continuous (e.g., linear programming), full aggregation (e.g., AHP, MAUT, SMART), partial aggregation (e.g., ELECTRE, PROMETHEE), and simplified (e.g., simple additive weighting model). Different MCA methods can yield diverse results, and currently, no guidelines exist clarifying which method should be used under given circumstances. This approach commonly involves four steps: (i) identifying objectives and evaluation criteria; (ii) weighing objectives and/or evaluation criteria; (iii) assessing measures with respect to the identified evaluation criteria; (iv) grouping results to prioritize policies. Unlike DA and DCM, MCA specifically focuses on assessment criteria for alternative policy measures. The literature discusses the wide use of MCA ranging from a general (set of policies) to a specific (single policy components) focus (Aljohani and Thompson, 2020; Elvsaas Nordtømme et al., 2015; Milan et al., 2015; Verlinde et al., 2014).

3.1.2. Qualitative

3.1.2.1. Discuss and deliberate. DaD encompasses various methods where stakeholders deliberate on relevant facts from diverse perspectives, broaden their understanding and viewpoints and finally engage in a dialogue to critically evaluate options (Shortall, 2021). Central to this approach is consensus-seeking, aimed at reaching acceptable compromise solutions through discussion-based procedures. DaD usually involves informal preference aggregation through discussion or simple voting procedures to prioritize policies. Literature linked to UFT reveals the use of simple DaD methods based on focus groups and workshops (Österle et al., 2015; Paddeu and Aditjandra, 2020). Looking at other realms, one discovers other well-known DaD methods (e.g., Citizens' Juries, Planning Cells, Deliberative Polls, Consensus Conferences, Charrettes, Consensus Assembly) that could also be tailored to a UFT context.

3.2. Approaches for context-specific assessment

As a result of the grey literature analysis, a total of 32 contextual factors were initially identified. These were then categorized into three main groups: (1) Problem-related; (2) Stakeholder-related; and (3) Organization-related.

The third group was excluded from further consideration, based on the rationale that effective participation requires the organizing entity to guarantee certain minimum standards which should be considered prerequisites rather than variables. In fact, effective participatory planning processes necessitate some essential basic requirements: (1) comprehensive stakeholder participation across all phases (Creighton, 2005); (2) absence of preselected policy alternatives/characteristic and presence of open-minded decision-makers/planners who are prone to consider a wide range of possible options (Creighton, 2005; Sager, 2004); (3) integration of the process into the political-administrative system, ensuring that outcomes from participatory planning can inform political and administrative decisions (Bjørgen et al., 2021; Creighton, 2005; Grossardt and Bailey, 2018); (4) agreement on stakeholder engagement design, including participants, moderators, information to be shared, methodologies to be used, etc. (Chwalisz, 2020; OECD, 2020; Schaafsma et al., 2018); (5) adequate problem knowledge among stakeholders, facilitated through learning meetings, information provision, and other procedures to ensure effective participation.

The first two groups relate to contextual factors that might affect the successful deployment of any of the approaches previously mentioned

which, in turn, could influence the effectiveness of the entire participatory planning process. A process of aggregation and consolidation was undertaken. Overlapping or closely related factors were functionally merged to improve clarity and reduce redundancy, leading to a more streamlined and operationally relevant framework. The former includes monetary relevance, complexity, and importance of the topic, while the latter relates to the number of stakeholders, their heterogeneity, and time availability. Table 3 summarizes the outcomes of a comparative analysis, assessing the suitability of the identified approaches with respect to given contextual factors.

3.2.1. *Problem-related contextual factors*

3.2.1.1. Monetary relevance. Monetary relevance can represent the primary focus of a policy (e.g., toll implementation for freight vehicles) or a key policy package component (e.g., delivery costs for a newly implemented last-mile delivery service). When monetary relevance is key, DCM represent the most suitable approach. In fact, it allows for the ex-ante estimation of willingness to pay/accept measures with respect to different policy characteristics, while resting on robust micro-economic principles (Domínguez et al., 2012; Gatta and Marcucci, 2014; Jaller and Holguín-Veras, 2013; Le Pira et al., 2023; Marcucci et al., 2012). In contrast, other approaches do not provide the same level of insights a theoretically robust framework can grant. For example, MCA can incorporate monetary considerations but cannot determine specific monetary values to different alternatives (Balasubramaniam and Voulvoulis, 2005). Similar considerations apply to DA (Holguín-Veras et al., 2017a), while DaD does not offer reliable quantitative evaluations at all (Shortall, 2021).

3.2.1.2. Complexity. Complexity refers to the difficulty in both evaluating alternative policies as their number increases and selecting the best policy package for all stakeholder groups. All quantitative approaches potentially are not reliable when complexity is high. DaD is the best option assuming that discussions and reflection time influence individuals' perceptions of their own preferences. The idea is that deliberative processes lead to more rational decision-making (Dryzek and List, 2004; List et al., 2013). Grainger and Stoeckl (2019) suggest that subsequent rounds of preference elicitation can generate logically consistent social preferences, supporting the assumed preference convergence effect of deliberation. Numerous studies indicate that preferences can often change after implementing a deliberative processes in participatory planning (Farrell et al., 2013; Lienhoop and Volker, 2016; O'Malley et al., 2020). Knoppen et al. (2021) illustrate in a UFT context, how deliberation can shift priorities by fostering cognitive consensus among stakeholders on proposed policy measures. However, literature analysis also reveals that preference changes are primarily driven by information provision (Fournier, 2011; Goodin and Niemeyer, 2003; Luskin et al., 2002; Thompson et al., 2021).

3.2.1.3. Importance of the topic. Planning inherently provokes controversy, particularly when it involves value-laden decisions or affects the interests of sensitive stakeholders (Creighton, 2005). Manipulation and aggregation issues might arise in case of high perceived importance of the planning topic.

Manipulation is, to some extent, intrinsic to strategic stakeholders' behaviour. In MCA, stakeholders can manipulate alternative rankings by overstating weights if they know experts' scores in advance (Macharis and Nijkamp, 2011). To address this issue, one can avoid group aggregation or discuss extreme values with stakeholder groups. In DA, stakeholders might understate/overstate their willingness to pay (Haghani et al., 2021; Meginnis et al., 2021; Sager, 2004) or even declare zero willingness to pay as a form of protest (Haghani et al., 2021; Saam, 2018). Solemn oaths, honesty priming, and inferred valuation are possible solutions to mitigate this issue (Haghani et al., 2021). DCM minimize manipulation risk through indirect questioning about trade-offs between multiple attributes (Bennett and Blamey, 2001). In DaD, stakeholders may state false preferences during small and conditional pairwise comparisons (Sager, 2004). Dryzek and List (2004) argue that DaD naturally mitigates informational deception by promoting cooperative behaviour.

Aggregation refers to the way individual (or group) opinions/preferences are combined to reach the overall final result. Voting (DaD) and analytical calculations/estimations (DA, DCM, MCA) represent possible aggregation techniques to use. Determining the more reliable aggregation technique is fundamental. Voting procedures are transparent but require high-quality moderators and might exclude minority opinions. Analytical calculations/estimations can represent preferences more accurately but often require technical expertise thus creating a stakeholders "black box" effect. Different aggregation levels further distinguish quantitative approaches. MCA aggregates objectives, criteria, weights, and scores of alternatives, whereas DCM and DA combine only alternative scores. This represents an advantage for the latter, since it reduces potential conflicts during the decision-making process (Dean et al., 2019). Te Boveldt et al. (2021) suggest involving a small number of stakeholders per group to avoid aggregation issues during each MCA step, involving all stakeholders only for the final one.

3.2.2. *Stakeholder-related contextual factors*

3.2.2.1. Number of stakeholders. Literature reports a high variation of the number of stakeholders partaking to participatory planning, ranging from 5 (e.g., CITYLAB, 2014) to more than 100 and up to 500 participants (e.g., Carson and Hartz-karp, 2003; Verlinde and Macharis, 2016). Involving many stakeholders may be practically challenging or, in some cases, unfeasible. This limits the use of approaches requiring a large number of respondents to ensure robust results. DaD is less affected by this issue, as the validity of the final outcome does not depend on the number of participants. Moreover, the number of participants usually varies depending on the specific method used: 12–25 in a Citizens' Jury, 10–25 in a Consensus Conference, 100–150 in a Citizens' Assembly, and 100–450 in a Deliberative Poll (Shortall, 2021). MCA is generally insensitive to small samples (Darko et al., 2019). Although there is not a general agreement on the optimal number of stakeholders required,

Table 3
Joint analysis of approaches and contextual factors.

	Problem-related			Stakeholder-related		
Factors	Monetary relevance	Complexity	Importance of the topic	Number of stakeholders	Stakeholders' heterogeneity	Stakeholders' available time
Approaches						
Quantitative						
DA	-	-	+/−	+	+	+
DCM	+	-	+	-	+	+
MCA	-	-	-	+	+/−	+
Qualitative						
DaD	-	+/−	-	+	-	-

Source: Authors' own elaboration. Note: "+": suitable; "-": not suitable; "+/−": suitable if some conditions hold.

MCA typically involves around 30 stakeholders (Dean, 2020). Conversely, DCM, relying on econometric estimations, require a substantial number of respondents to obtain statistically significant results (Rose and Bliemer, 2013). The literature typically recommends involving at least 100 participants (e.g., Bekker-Grob et al., 2015) with Bridges et al. (2012) being the only example where a small sample (20 respondents) is used. However, one could argue that results robustness should not be measured in terms of inferential performances, since typically the stakeholders participating to the planning process represent the *population* and not a *sample*.

3.2.2.2. Stakeholders' heterogeneity. UFT is deeply characterized by heterogeneous stakeholder groups in terms of constraints, objectives, and preferences. Managing this diversity represents a primary concern, and not all approaches can appropriately do so in a convincing fashion. DCM represent the most powerful approach for handling heterogeneous stakeholders' preferences in both data acquisition (Holguín-Veras et al., 2007, 2008; Marcucci and Gatta, 2013, 2016) and data modeling (Hess et al., 2012; Vass et al., 2022). Similarly, DA allows flexible management of heterogeneous stakeholders' preferences (de Oliveira et al., 2020; Stathopoulos et al., 2011). On the contrary, MCA handles this issue by selecting objectives and criteria per stakeholder group (e.g., applying multi-actor MCA; Lebeau et al., 2018) or clustering stakeholders based on their selected objectives and criteria (Brusselaers et al., 2021). This might provoke various risks when aggregating preferences, such as: (i) logical inconsistency in responses; (ii) reversal of alternatives order; (iii) failure to satisfy homogeneity condition (Aull-Hyde et al., 2006; Ossadnik et al., 2016; Tsakalerou et al., 2022; Wang and Luo, 2009). Conflicting objectives among stakeholders can complicate DaD adoption (van den Bossche et al., 2017). Managing and weighing dissenting opinions through informal discussion can produce blurred results (Grossardt and Bailey, 2018). Rad and Roy (2021) argue that rational deliberation may not solve but rather reinforce distant group preferences, especially if participants strongly adhere to their initial viewpoints. However, some authors suggest that specific voting mechanisms (Schaafsma et al., 2018), structured deliberation processes (Curato et al., 2017), or accounting for heterogeneous preferences within deliberative groups (Völker and Lienhoop, 2016) can, *de facto*, mitigate group polarization.

3.2.2.3. Stakeholders' available time. Planning procedures require time. However, stakeholders often face stringent time constraints. This can represent a significant limitation for the use of a given approach when participation is taken seriously. DaD is the most challenging approach, as it requires stakeholders to dedicate a substantial amount of time to the prioritization processes. For instance, Citizen Jury and Planning Cells can take more than 3 days to be properly deployed (Česnulaitytė, 2020). Conversely, DA and DCM are the least time-consuming approaches. Conducting a stated choice experiment using DCM can take up to 30 min (Cunningham et al., 2010), similar to the time required for administering a questionnaire in the case of DA. The time required to complete all MCA steps can vary significantly. This variability depends on stakeholder participation requirements, which can range from scoring weights and alternatives on predefined criteria to defining evaluation criteria. Multi-actor MCA workshops typically last 2 to 4 h, including results presentation (CITYLAB, 2014).

4. Discussion and policy implications

This section further examines the results obtained by considering plausible UFT planning scenarios characterized by specific contextual factors, discussing, selecting and motivating, for each of them, the best and worst approaches one can use (Table 4). The terms "best" and "worst" should be interpreted as context-dependent assessments of methodological suitability, rather than as indicators of frequency of use.

Table 4
Best and worst approaches under specific urban freight transport planning scenarios.

Scenario	Example	Contextual factors	Approaches evaluation
S1	Specific and controversial policies	Importance of the topic: *high* Stakeholders' heterogeneity: *high*	*Best*: DCM *Worst*: DaD
S2	Strategic and controversial policies	Complexity: *high* Importance of the topic: *high* Stakeholders' heterogeneity: *high*	*Best*: DCM *Worst*: MCA, DaD
S3	Strategic policies with limited participation	Complexity: *high* Number of stakeholders: *low* Stakeholders' available time: *low*	*Best*: DA, MCA *Worst*: DCM
S4	Strategic and controversial policies with a monetary focus and limited participation	Monetary relevance: *high* Complexity: *high* Importance of the topic: *high* Number of stakeholders: *low* Stakeholders' heterogeneity: *high* Stakeholders' available time: *low*	*Best*: DCM *Worst*: DaD

Note: DA = Descriptive Analysis; DCM = Discrete Choice Models; MCA = Multi-Criteria Analysis; DaD = Discuss and Deliberate.

The paper considers four hypothetical, yet representative, contexts representing most of the possible relevant scenarios.

4.1. Scenario 1: specific and controversial policies

Scenario 1 groups specific and controversial planning contexts. The focus is placed on the components of a single policy with limited problem complexity. Stakeholders, either participants or groups, are many, heterogenous, and potentially affected by decisions on this matter. Examples of Scenario 1 are: (1) crowdshipping (Marcucci et al., 2017), (2) last-mile delivery using drones (Borghetti et al., 2022), (3) last-mile delivery using autonomous vehicles (Polydoropoulou et al., 2022), (4) off-hour deliveries (Dell'Olio et al., 2017; Holguín-Veras et al., 2017a), and (5) pricing and parking (Marcucci et al., 2015).

Results indicate that DCM are the most suited since they manage effectively stakeholders' heterogeneity and suffer, in comparative terms, less from the limitations pertinent to the perceived high topic importance for the stakeholders involved. Both MCA and DA can deal with stakeholders' heterogeneity but not effectively when the topic importance is high within the planning process.

By contrast, DaD is the least suitable since it does not appropriately manage both high heterogeneity and high importance of the topic. In fact, adopting DA could reinforce distant group preferences delaying or potentially causing the abortion of the whole participatory planning process.

4.2. Scenario 2: strategic and controversial policies

Scenario 2 is quite similar to Scenario 1 with the main difference being policies targeting strategic issues (i.e., typically numerous). This implies choosing among them is challenging. Measures' prioritization within a Sustainable Urban Logistics Plan (SULP) context may exemplify Scenarios 2 (Macharis et al., 2010; Morfoulaki et al., 2016).

Here, DCM still represent the best option. In fact, although they cannot deal with complexity in the same way as DaD, they still outperform DA, DaD and MCA, if one jointly considers all three factors

characterizing scenario 2.

On the other hand, DaD represents the worst option for the same reasons as reported for Scenario 1, even if it can, in principle, partially deal with high complexity.

4.3. Scenario 3: strategic policies with limited participation

Scenario 3 differs from scenario 2 due both to the smaller number of stakeholders coupled with their limited time available for planning activities. The examples Scenario 2 provides can also characterize Scenario 3.

In this case, MCA and DA suit the planning context better since they work well with a small number of stakeholders involved. Furthermore, one should prefer them to DaD due to its limitations when it comes to stakeholders' time needed.

DCM can be problematic, as they may produce non-significant estimates when only a few stakeholders are involved in the planning process.

4.4. Scenario 4: strategic and controversial policies with a monetary focus and limited participation

Scenario 4 groups and synthesizes all the planning contexts where strategic, controversial policies, strong monetary focus, limited stakeholders' time availability characterize the participatory planning process. Examples may include the implementation of a freight toll, the extension of a restricted freight traffic zone, or the introduction of an urban consolidation center (Perera and Thompson, 2021b; Van Duin et al., 2010).

In this case DCM outperform other approaches when it comes to monetary relevance, importance of the topic, and heterogeneity, but their adoption is hindered by the typical presence of few stakeholders as for Scenario 3. MCA, although performing well with respect to few stakeholders and low stakeholders' time availability, does not constitute a satisfactory solution when considering high topic importance for different stakeholders. Overall, DCM can be considered the preferable approach when estimation accuracy is prioritised over inferential validity.

Conversely, DaD proves the least desirable considering stakeholders' heterogeneity, topic importance, and time availability.

4.5. Policy implications

The findings of this study yield several critical implications for transport policy, particularly concerning the effective governance and implementation of UFT initiatives.

A primary policy implication is the imperative for context-specific methodological selection in participatory planning. The research unequivocally demonstrates that no single approach is universally optimal across all scenarios. Policymakers must therefore move beyond generic engagement strategies and adopt a diagnostic approach to select methodologies that are best suited to the unique characteristics of the problem and the stakeholders involved. Failure to align the participatory method with the contextual factors risks undermining policy legitimacy, exacerbating conflicts, and ultimately delaying or derailing the implementation of crucial UFT measures. This might have serious consequences, leading to the selection of measures that are not widely accepted, or to decision-making processes hindered by unresolved controversies, generating significant direct and indirect costs for public authorities and planners.

A second significant policy implication pertains to the strategic role of quantitative approaches in facilitating policy consensus and robust decision-making. Policymakers should consider integrating such approaches, especially DCM, into their participatory frameworks to gain a more precise understanding of stakeholder trade-offs for specific policy attributes. This can lead to the design of more economically efficient and publicly acceptable policies, moving beyond qualitative consensus-building alone.

While qualitative approaches are valuable for exploring complexity and fostering deeper understanding, policymakers must be cognizant of their potential to reinforce group polarization or consume excessive resources if not appropriately combined with more structured methods. This suggests a hybrid policy approach, combining qualitative and quantitative methods to address their respective limitations. The former could better address concerns related to complexity, while the latter may, more effectively, deal with stakeholders' heterogeneity and time availability issues (Álvarez-Farizo and Hanley, 2006; Bunse et al., 2015; Gatta et al., 2019; Ito et al., 2009; Kenter, 2016; Kenter et al., 2011; Owuor et al., 2019; Proctor and Drechsler, 2006; Robinson et al., 2008; Schoon and Chi, 2022; Shapansky et al., 2008; Straton et al., 2011; Völker and Lienhoop, 2016). One can suggest strategically using qualitative methods in early stages for problem framing and understanding diverse perspectives, while leveraging quantitative ones for preference aggregation and policy package validation.

All in all, tailoring participatory approaches to contextual factors is not merely a theoretical exercise, but a strategic necessity for efficient and legitimate transport policy design.

5. Conclusions

This paper addresses the complex topic of UFT participatory planning by exploring one of the most critical phases of the SUMP cycle, namely policy measures selection. While goals and activities are typically well-defined, there is limited guidance on the most suitable methodology to use, whose choice may well depend on the specific participatory planning context. Various approaches could be employed to analyze stakeholders' opinions and preferences, prioritize policy components, and select the most accepted policy package.

It represents a first attempt to classify, examine, and compare distinct approaches considering different planning circumstances and providing guidelines/recommendations on the most appropriate choice to make given the context in hand. To achieve this, the paper: 1) conducts a thorough literature review to classify various UFT approaches and identify key contextual planning factors; (2) assesses strengths and weaknesses of these approaches in relation to the identified factors; and (3) performs a scenario analysis to evaluate, compare, and recommend the most appropriate approaches for different hypothetical contexts.

Results highlight the existence of a set of approaches suitable for various planning contexts. In particular, *quantitative* approaches perform essentially well when stakeholders'-related contextual factors are important whereas, even if to different degrees, all approaches suffer severe limitations with respect to problem-related factors. In more detail, DCM represent the most suitable approach overall. They are, in fact, the preferred option in three out of the four scenarios considered. Their only shortcoming concerns their potential weakness in planning situations involving only a small number of stakeholders. If future research scientifically validates their estimation accuracy, DCM could be deemed as the most appropriate solution available. Furthermore, DA and MCA perform well when dealing with strategic level policies with limited participation. They operate relatively less well when dealing with controversial policies, where both "importance of the topic" and "stakeholders' heterogeneity" are relevant issues. Finally, DaD is the least preferable approach in many scenarios mainly due to its qualitative and time-consuming characteristics.

One can safely state that there is not an always superior approach to take, thus it might prove appropriate to consider adopting a mixed strategy depending on the specific context.

It is important to acknowledge two limitations of this study. First, the research does not assess the relative importance of the contextual factors investigated, which could have enhanced the practical relevance of the scenario-based recommendations. Second, the analysis involves a significant degree of subjectivity, which is typical in qualitative studies.

Future research should concretely apply the proposed approaches within UFT planning processes to reinforce the findings of this paper, especially in the cases mentioned above, where further testing and validation in real-world planning contexts are needed.

CRediT authorship contribution statement

Gabriele Iannaccone: Writing – original draft, Visualization, Investigation, Formal analysis, Data curation, Conceptualization. **Valerio Gatta:** Writing – review & editing, Validation, Methodology, Investigation, Data curation, Conceptualization. **Edoardo Marcucci:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization.

Data availability

Data will be made available on request.

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