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Combining quantitative and qualitative approaches in urban freight participatory planning

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Abstract

Urban freight transport is essential for ensuring the timely delivery of goods within cities. However, its operations generate significant environmental and societal costs due to private sector dominance, fragmented stakeholder groups, and conflicting objectives. Addressing these issues requires implementing long-term participatory planning frameworks capable of prioritizing effective and acceptable policies while balancing public and private interests. Stakeholder participation plays a pivotal role in overcoming these challenges by fostering collaboration, building consensus, and enhancing the effectiveness of planning processes. This paper systematically classifies and evaluates methods for policy prioritization. A comprehensive review highlights the strengths and limitations of both quantitative and qualitative approaches. The paper also discusses the potential of combining these approaches, providing actionable insights for policymakers and practitioners to develop robust urban freight participatory planning processes.

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1. Introduction

Urban freight transport (UFT) plays a critical role in supporting urban livability and economic growth by facilitating the timely delivery of goods to stores, businesses, and households. Despite its importance, current UFT operations are often unsustainable, generating substantial environmental and societal externalities (Allen *et al.*, 2018).

Key characteristics of UFT include: (1) the dominance of private sector actors (Le Pira *et al.*, 2017; Lebeau *et al.*, 2018); (2) significant stakeholder heterogeneity, with more than 150 supply chains involved; (3) intense competition and limited collaboration (Allen *et al.*, 2018; Marcucci *et al.*, 2017); and (4) conflicting interests and objectives among stakeholders (Gatta *et al.*, 2018; Gatta and Marcucci, 2014). Tackling these challenges necessitates implementation of long-term participatory planning frameworks that can prioritize effective and acceptable policies while balancing public and private interests.

Sustainable Urban Mobility Plans (SUMP) aim to integrate goods and passenger mobility with economic, environmental, and social sustainability objectives through active stakeholder participation in policymaking. Participatory planning is an acknowledged tool for improving decision-making, minimizing costs and delays, building consensus, and proactively addressing stakeholder concerns (Creighton, 2005; Le Pira *et al.*, 2017). In the predominantly privatized and competitive environment of UFT, such approaches are essential for reconciling conflicting objectives.

In this context, participatory methods should be understood as complementary to, rather than a replacement for, quantitative technical and economic evaluation. These traditional assessments include financial viability indicators for private actors, such as Return on Investment (RoI) and productivity metrics, as well as public sector-oriented tools like Social Cost-Benefit Analysis and performance metrics like Vehicle Kilometres Travelled and average vehicle speeds. Participatory methods add a layer of legitimacy and shared understanding by incorporating stakeholder values and preferences into the evaluation and prioritization of policy measures (Le Pira *et al.*, 2023).

Participatory approaches are utilized throughout the policy cycle, which includes the identification, technical evaluation, implementation, and monitoring phases (Janjevic *et al.*, 2019; Le Pira *et al.*, 2017). SUMP guidelines highlight the importance of co-design and co-creation, particularly in Step 7, which focuses on combining measures into integrated policy packages and validating these selections through stakeholder discussion and evaluation (Rupprecht Consult *et al.*, 2019). This process ensures the credibility, legitimacy, and effectiveness of planning activities (Creighton, 2005; Le Pira *et al.*, 2017). While the goals (why) and tasks (what) of participation are clearly defined, the methodological approach (how) remains context-sensitive and less standardized. Various methods can be employed to analyze stakeholder preferences, prioritize measures, and identify policy packages with broad acceptance.

This paper addresses this research gap by systematically classifying and evaluating participatory planning approaches in UFT. Specifically, it aims to: (1) review existing literature to categorize methods for prioritizing intervention measures; (2) assess quantitative and qualitative approaches by exploring their advantages, limitations, and real-world applications; and (3) propose their integration to improve participatory planning practices. By focusing on the prioritization of intervention measures, this study seeks to assist policymakers and practitioners in adopting effective approaches for stakeholder-centred UFT planning.

The paper is structured as follows: Section 2 describes the methodological approach, Section 3 presents the results, Section 4 discusses the implications, and Section 5 provides the conclusions.

2. Methods

This paper conducts a two-phase literature review to analyze the methodological approaches used for selecting policy priorities in participatory planning processes.

Phase 1 consists of a systematic review of scientific articles that explore stakeholder opinions, preferences, and perceptions of UFT policy measures. It employed specific keyword combinations (i.e., stakeholder AND "urban freight" AND opinion OR perception OR preference OR prioritization OR acceptance OR consultation) to search the Scopus database, which yielded 73 peer-reviewed articles. After analyzing the abstracts and excluding papers not aligned with the research objectives, the sample was narrowed down to 39 articles for in-depth analysis. A snowballing

technique was then applied, identifying an additional 25 relevant articles. Figure 1 summarizes the article selection process.

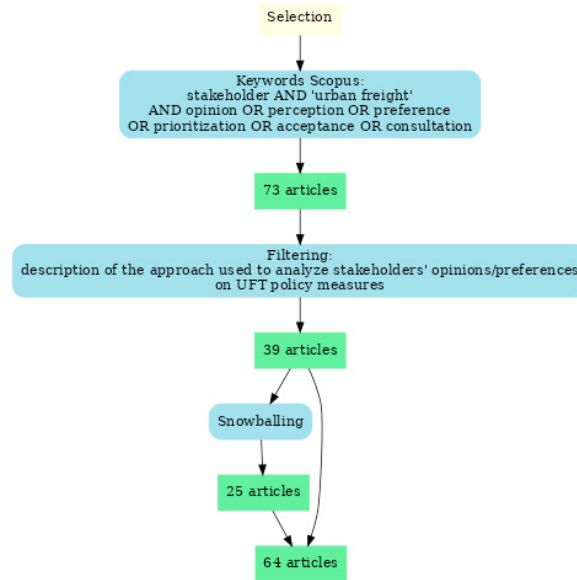


Figure 1. Article selection process.

Phase 2 extends the investigation by expanding the search beyond the UFT domain to include grey literature. This phase focused on specific methods that characterize participatory planning, aiming to identify additional techniques and gather practical insights for assessing their respective advantages and disadvantages.

3. Results

Table 1 provides an overview of the methods used for selecting stakeholder-centric policy measures in participatory planning, which this paper classifies into quantitative and qualitative approaches.

The quantitative approach includes all methods that prioritize measures by embedding stakeholder opinions within a quantitative assessment framework. These methods include Stated Preference (survey-based techniques where participants express preferences for hypothetical scenarios to model decision-making), Multi-Criteria Analysis (techniques that evaluate alternatives against multiple objectives and criteria), and Descriptive Analysis (techniques that utilize descriptive statistics on central tendency, dispersion, and frequency).

The qualitative approach comprises methods that provide qualitative outputs based on learning, discussion, or deliberation (Shortall, 2021). Within this category are sophisticated methods such as the Citizen Jury (a deliberative process where a small, representative group of citizens evaluates an issue and provides informed recommendations after consulting experts), Consensus Conference (a technique involving experts and citizens who deliberate to reach an informed agreement), Citizen Assembly (a process where randomly selected citizens deliberate on a public issue to produce recommendations reflecting a broad societal consensus), and Planning Cells (a method where a small group of citizens or stakeholders collaboratively analyse policy issues to provide detailed recommendations). This category also includes simpler methods, such as Workshops (collaborative meetings to exchange ideas and solve problems).

Findings reveal that methods from the quantitative approach are predominantly employed, with Multi-Criteria Analysis being the most frequently used. While all these methods are adopted in UFT participatory planning, the same is not true for the qualitative approach. In fact, only workshops have been applied in the UFT context.

Table 1. Methods for policy prioritization in participatory planning.

<i>Methods</i>	<i>Category</i>	<i>Applied in Urban Freight</i>
Stated Preference	Quantitative	Yes
Multi Criteria Analysis	Quantitative	Yes
Descriptive Analysis	Quantitative	Yes
Workshop	Qualitative	Yes
Citizen Jury	Qualitative	No
Citizen Assembly	Qualitative	No
Planning Cells	Qualitative	No
Consensus Conference	Qualitative	No

Table 2 summarizes the pros and cons of each approach. The primary difference between them lies in their intrinsic nature, which confers distinct advantages. The quantitative approach excels at precisely identifying optimal policy packages through rigorous calculations, whereas the qualitative approach has greater difficulty achieving this level of specificity (Shortall, 2021). However, quantitative methods often overlook that preferences and values can be shaped through a process of information-sharing, learning, and deliberation (Kenter, 2014).

The quantitative approach is generally more effective at managing heterogeneous preferences and precisely quantifying trade-offs among values, criteria, and policy components (Hess et al., 2012; Lancsar and Louviere, 2008). Methods in this category are particularly suitable for addressing complex problems by accommodating both qualitative and quantitative data (Dean, 2020; Barfod and Leleur, 2014). Despite their strengths, they often rely on large samples, making them costly and time-intensive (Holguín-Veras et al., 2017; Rose and Bliemer, 2013). They also face challenges in balancing transparency with accuracy and in selecting methods non-arbitrarily (Dean et al., 2019; Te Boveldt et al., 2021; Dean, 2020).

The qualitative approach, by contrast, derives its strength from its characteristic elements. Information-sharing, learning, and discussion can lead to the formation of more rational group opinion (List et al., 2013). Consequently, methods in this category are often considered appropriate for contexts characterized by high uncertainty, complexity, and difficult-to-compare policy alternatives (Kenter, 2014; Shortall, 2021; Lienhoop et al., 2015). They can be used even with a small number of participants (Shortall, 2021). However, they require significant time commitments from stakeholders and are susceptible to risks such as agenda control, dominance by strong personalities, or off-topic discussions (Sager, 2004; Shortall, 2021).

Combining the analytical rigor of the quantitative approach with the deliberative depth of the qualitative one appears promising, as it could address the limitations of each method while leveraging their respective strengths (Schaafsma et al., 2018; Shortall, 2021; Schoon and Chi, 2022; Proctor and Drechsler, 2006).

Table 2. Pros and cons of quantitative and qualitative approaches.

Quantitative approach		Qualitative approach	
Pros	Cons	Pros	Cons
Use of sophisticated models and the employment of different data acquisition strategies allows accurately taking into account heterogeneous preferences (Hess et al., 2012)	High cost makes traditional survey formats very expensive (Holguín-Veras et al., 2017)	Improvement of preference structuration can lead to more rational group decisions (List et al., 2013)	Requirement for stakeholders to dedicate extended periods makes the co-creation process demanding (OECD Publishing, 2020)
Ability to study different types of problems makes it possible to deal with a wide array of data and information, whether quantitative or qualitative in nature (Barfod and Leleur, 2014; Dean, 2020)	Failure to consider that preferences and contextual values may not be pre-formed but instead need to be generated through a transformative process of learning and deliberation is a limitation (Kenter, 2014)	Utility of these methods becomes evident when addressing complexity and uncertainty (Kenter, 2014; Shortall, 2021)	Agenda control can represent a significant challenge (Sager, 2004)
Explicit consideration of multiple objectives and criteria provides valuable insights into the nature of the problem (Dimitriou et al., 2016; Macharis and Bernardini, 2015))	Need for a sufficient number of participants arises if the goal is to obtain statistically significant results (Rose and Bliemer, 2013)	Flexibility of these methods allows adaptation to different numbers of participants (Shortall, 2021)	Lack of neat and tidy results makes easy comparison between options challenging, as outputs tend to be qualitative and lengthy (Shortall, 2021)
Ability to identify both monetary and non-monetary trade-offs enables stakeholders to implicitly weigh various policy features (Lancsar and Louviere, 2008)	Absence of universally accepted guidelines for technique selection implies a high degree of arbitrariness (Dean, 2020; Dean et al., 2019)	Potential for effective interaction between multiple decision-makers enables an iterative process (Proctor and Drechsler, 2006)	Absence of moderation creates a high risk of domination by strong personalities, discussions going off topic, or groups splintering (Shortall, 2021)
Potential reduction in aggregation levels minimizes potential conflicts during the decision-making process (Dean et al., 2019)	Trade-off between transparency and accuracy presents a challenge for results (Dean et al., 2019; te Boveldt et al., 2021)	Value of these methods is particularly evident when the issue involves incommensurability and/or collective values (Lienhoop et al., 2015).	Risk of interest groups hijacking deliberative decision-making processes poses a challenge (Blue and Dale, 2016)
	Imprecision of results may occur due to several sources of bias (Haghani et al., 2021)		High cost of implementation makes these methods potentially very expensive (OECD Publishing, 2020)

4. Discussion

This section discusses when and how to combine quantitative and qualitative approaches in UFT planning.

Drawing on the research by Lienhoop et al. (2015), such a combination is appropriate when: (1) collective values play a significant role in decision-making, (2) the planning object is difficult to quantify, and (3) it is unfamiliar or highly complex. The third condition commonly applies to UFT. Although UFT decisions often reflect individual stakeholder interests rather than collective values (Allen et al., 2018), and policy alternatives are generally comparable, the planning object is typically highly complex (Hansson, 2023). This complexity, due to its multifaceted nature, may require discussion and information-sharing among stakeholders to reshape their initial preferences (Kenter, 2014), thereby supporting the combination of quantitative and qualitative approaches.

There are only a few examples of such a combined "quali-quantitative" approach in the UFT literature, although they are not always explicitly situated within a participatory planning process. Lebeau et al. (2018) and Mohri et al. (2022) applied Multi-Actor Multi-Criteria Analysis within a workshop setting. Similarly, Gatta et al. (2019) used this

methodological combination, where stakeholders collaboratively defined criteria and achieved consensus on the weights assigned to different objectives. Janjevic et al. (2019) proposed an advanced approach, integrating information sharing and stakeholder discussions before and after a Multi-Criteria Analysis during a workshop. However, these cases often lack an iterative and structured negotiation process that incorporates continuous updates based on stakeholder feedback (Proctor and Drechsler, 2006).

Drawing from other planning domains, the case study by Proctor and Drechsler (2006) represents an excellent example that could be transferred to the UFT context. They adopt a novel quali-quantitative approach, combining Multi-Criteria Analysis and a Citizen Jury, to address the complex challenge of managing recreation and tourism in Australia. A stakeholder jury is asked to select a preferred management strategy from a set of alternatives. Through deliberation and expert input, participants refine their understanding of the issues and the associated trade-offs. This iterative process results in a robust and shared weighting of criteria, ultimately leading to the identification of the most preferred option.

Such an approach could be adapted to various UFT planning contexts, particularly when collective values are crucial and society as a whole is potentially impacted (e.g., drone delivery systems or new railway infrastructure). Combining Stated Preference techniques, such as Discrete Choice Experiments, with a Citizen Jury allows for the incorporation of phases for information exchange, discussion, and learning, either before or after preference elicitation rounds. This could be particularly useful when a problem is narrowly focused on freight stakeholders or involves monetary valuations (e.g., assessing willingness to pay for a crowdshipping system or designing a low-emission zone with adequate parking and pricing).

5. Conclusions

This paper investigated methods for policy prioritization in UFT participatory planning. It employed a systematic literature review to highlight the distinct characteristics of these methods, categorizing them into quantitative and qualitative approaches. The findings reveal a significant underutilization of qualitative methods in UFT planning.

By drawing from applications in other planning contexts and analyzing the strengths and weaknesses of both approaches, the paper identifies opportunities for adopting a combined quali-quantitative approach. This integrated methodology could leverage the analytical rigor of quantitative tools and the deliberative depth of qualitative techniques.

Further research is necessary to adapt and implement this combined approach in real-world frameworks, enabling stakeholders to achieve mutually acceptable compromise solutions in UFT participatory planning.

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