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Public roles in mobility as a service: Governing MaaS through context-sensitive metagovernance

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ABSTRACT

Mobility as a Service (MaaS) has emerged as a promising approach to integrating diverse transport modes under a unified digital platform. Yet, if poorly governed, MaaS risks exacerbating inequalities and contributing to transport gentrification. While the literature widely acknowledges the need for public sector involvement to ensure equitable outcomes, there remains limited guidance on how authorities should determine their appropriate level of engagement. This study addresses this gap by developing a decision-support tool to assess and define the role of public transport authorities (PTAs) in MaaS implementation. Drawing on an empirical classification of 74 existing MaaS and "MaaS-like" systems worldwide, the research identifies key institutional, infrastructural, and regulatory factors that shape the extent of public sector involvement. Using the multi-level perspective on socio-technical transitions and metagovernance theory as the conceptual foundation, these insights are operationalised into a flowchart that supports context-specific role definition. The proposed tool provides policymakers with a practical framework to align governance strategies with institutional capacity, thereby fostering equitable and sustainable MaaS development.

1. Introduction

Mobility as a Service (MaaS) represents a paradigm shift in urban transportation, integrating diverse mobility options into a unified, on-demand digital platform that simplifies planning, booking, and payment across modes (Mladenović, 2021; Smith & Hensher, 2020). This integration promises enhanced efficiency, sustainability, and user convenience, yet its effective implementation requires robust governance frameworks to navigate the complexities of multi-stakeholder environments and emerging technological landscapes. However, translating this promise into practice has proven challenging, and the diffusion of MaaS at scale remains limited and uneven (Mukhtar-Landgren & Smith, 2019).

Among others, implementation challenges stem from fragmented service landscapes, institutional inertia, varying market structures, and regulatory complexity across cities and regions. These structural and governance barriers raise important questions about how MaaS can be realized effectively, equitably, and sustainably across diverse urban contexts (Butler et al., 2021; Karlsson et al., 2020; Polydoropoulou et al., 2020).

Within this context, the business model for MaaS remains a central barrier to its large-scale diffusion. Questions remain about whether implementation should follow a private-led, public-led, or hybrid (public–private) model, how to structure tariff integration and revenue allocation among operators, and how to regulate data-sharing and platform interoperability. While these issues are vital to ensure the economic viability of MaaS ecosystems, existing debates tend to prioritize financial sustainability over social equity. Yet, as Karlsson et al. (2020) demonstrate, institutional configurations at macro, *meso*, and micro levels critically determine not only the feasibility of MaaS but also its inclusiveness. Their findings emphasize that without active public-sector involvement through regulatory adaptation, fiscal incentives, and collaborative governance, MaaS risks reproducing or amplifying existing mobility inequalities rather than mitigating them.

Moreover, the "one-size-fits-all" premise proposed by Hietanen (2014) is increasingly untenable given the institutional and infrastructural heterogeneity across cities. For instance, London's institutional design constrains mobility policymaking in ways distinct from Seattle (Moscholidou & Pangbourne, 2020), while many cities in the Global South lack the digital infrastructure or administrative capacity required for fully integrated MaaS ecosystems (Hasselwander & Bigotte, 2022). Differences in micromobility regulation, data-sharing policies,

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and public funding further complicate the design and governance of universal MaaS frameworks. Consequently, the role of public authorities must be defined through a context-specific perspective that accounts for local institutional capacity, market maturity, and societal objectives.

Stakeholders and decision-makers have long assumed that MaaS will play a central role in future mobility systems (Surakka et al., 2018). However, practical questions remain regarding how PTAs should position themselves within evolving ecosystems. For instance, in Budapest, MaaS was seen primarily as a mechanism to optimize existing public transport services, reinforcing the perception of the PTA as the most important actor, yet without concrete recommendations on how its participation should be structured (Polydoropoulou et al., 2020). At the same time, MaaS governance must navigate the "coopetition" dynamic, where actors collaborate on shared platforms while competing for market share (Pagoni et al., 2022).

This requires close coordination among key MaaS stakeholders: the MaaS integrator, who aggregates services and manages the user interface; operators, who provide mobility services such as public transport, bikeshare, and rideshare; the public authority, which sets policies and ensures equity; technology enablers, who provide digital infrastructure and payment systems; and end-users, whose mobility needs ultimately shape system design. In this regard, state institutions remain pivotal in steering smart mobility toward sustainability and urban development objectives (Lajas & Macário, 2020; Orozco-Fontalvo & Moura, 2023).

In this light, conceptualizing the public sector as a sovereign, top-down regulator of MaaS is both outdated and analytically insufficient. Contemporary transport policy increasingly acknowledges the need for pluricentric governance, grounded in interdependence, negotiation, and trust between public, private, and civic actors (Sørensen & Torfing, 2008). Despite the proliferation of MaaS governance typologies—ranging from the public authority serving as regulator, provider, or integrator—there remains no consensus on how authorities should determine which role to adopt under varying institutional, technological, and market conditions. Wandelt et al. (2025) argue that contemporary transport policy research must evolve toward frameworks that enable adaptive, context-sensitive decision-making across multi-stakeholder systems. The central governance challenge, therefore, lies in balancing competing imperatives: over-steering versus under-steering (excessive control may stifle innovation, whereas minimal intervention risks market monopolization); legitimacy (clarifying who defines and enforces the "rules of the game"); and flexibility versus stability (ensuring adaptive governance while maintaining predictable conditions for investment).

Building on this line of reasoning, this study addresses the following research question: How can public transport authorities systematically determine an appropriate governance role in MaaS ecosystems, given variation in institutional capacity, system maturity, and regulatory context? To answer this question, the study aims to develop an analytical decision-support tool that, informed by the multi-level perspective (MLP) on socio-technical transitions and metagovernance theory, operationalizes governance adaptability by enabling public authorities to assess the appropriate extent and nature of their involvement in MaaS implementation. In doing so, the paper bridges the gap between normative governance models and actionable institutional practice, offering a structured mechanism to align governance roles with contextual realities.

This manuscript is structured as follows. Section 2 reviews the literature on MaaS business models, governance frameworks, and the institutional determinants of public authority involvement. Section 3 presents the methodology, including data collection and the operationalization of institutional, infrastructural, and regulatory variables. Section 4 introduces the decision-support tool for determining PTA roles and illustrates its application. Section 5 discusses the implications for policy, ethics, and practice, as well as limitations and future research directions. Lastly, Section 6 introduces the main conclusions of the work.

2. Literature review

MaaS has evolved from a technological concept into a governance challenge shaped by institutional fragmentation, financial feasibility, and regulatory constraints. Specific barriers identified in the literature include limited collaboration among stakeholders (Mladenović & Haavisto, 2021), a lack of shared vision, and data governance challenges (Butler et al., 2021), broader concerns related to business models, policy integration, and user expectations (Li & Voege, 2017).

Addressing MaaS governance issues is critical, as governance failures can lead to monopolization, price manipulation, or insufficient service coverage (Pangbourne et al., 2020), underscoring the need for public oversight. For instance, MaaS systems led primarily by private companies may generate risks such as "transport gentrification" and the erosion of institutional capacity (Pangbourne et al., 2020). Likewise, Docherty et al. (2018) argue that without adequate public intervention, smart mobility initiatives may reinforce existing transport inequalities rather than address them. Despite a growing body of MaaS research, policymakers still lack clear guidance on how to position themselves within these evolving ecosystems (Smith & Hensher, 2020).

Differences in cultural, legislative, and administrative contexts further complicate governance decisions (Bruzzone et al., 2025). Comparative analyses between countries such as Finland and Switzerland demonstrate that variations in institutional autonomy, subsidies, and transport system design shape MaaS implementation pathways (Surakka et al., 2018). Similarly, recent discussions emphasize that MaaS should be understood within a broader mobility ecosystem involving multiple sectors and policy domains (Mulley & Bell, 2025). While these studies recognise the pivotal role of government in coordinating stakeholders, they often suggest a high level of involvement for PTAs (Kandanaarachchi et al., 2025), without guiding the appropriate level and type of involvement, given each case's context. This reinforces the need to differentiate between normative governance ideals and context-sensitive role definition. These contextual differences have led scholars to propose distinct governance configurations for MaaS implementation, reflecting varying degrees of public and private involvement.

The literature typically classifies MaaS governance into three broad models: market-driven approaches dominated by private actors, public transport extensions led by PTAs, and hybrid public–private partnerships (Alyavina et al., 2022; Li, 2019; Narupiti, 2019; Smith et al., 2018). Each model presents trade-offs. Market-driven systems may prioritize efficiency over equity if insufficiently regulated, whereas public-led initiatives may reproduce institutional inertia and resist innovation (Chesbrough, 2002; Geels, 2014). Regardless of the governance configuration, PTAs remain embedded actors in MaaS ecosystems, although the scope and intensity of their involvement vary significantly across contexts.

Governance is understood here as the spectrum of political steering mechanisms involving public and private actors, ranging from hierarchical control to informational and collaborative approaches (Windhoff-Héritier, 2002). Recent scholarship suggests that public authorities increasingly shift from direct operators to coordinators or orchestrators, enabling collaboration within MaaS ecosystems while safeguarding public interests (Mukhtar-Landgren & Smith, 2019). This transformation reflects a broader transition toward metagovernance (Gjaltema et al., 2020), in which authorities regulate and steer self-organizing governance networks rather than directly control them. This shift has led to policy recommendations advocating metagovernance arrangements at the local, national, and transnational levels (EU, 2001).

Although conceptual frameworks such as the "Public MaaS" model (König et al., 2016) highlight the centrality of public actors, they do not specify the extent to which PTAs should be involved. For instance, proposals such as the Common Framework Platform (Kandanaarachchi et al., 2025) emphasize coordination among stakeholders but leave

unanswered the question of how public authorities should position themselves within such arrangements. Addressing this ambiguity is central to the study's objective.

Jittrapirom et al. (2018) further propose a dynamic adaptive policymaking (DAP) approach to address uncertainty in MaaS ecosystems through iterative monitoring, learning, and adjustment. Similarly, Wong et al. (2020) argue that MaaS governance should integrate institutional oversight and social welfare objectives, advocating hybrid or government-contracted models that internalise equity and public value. Together, these studies reinforce the core proposition of this work: that the appropriate role of PTAs in MaaS cannot be predetermined but must emerge through contextually responsive governance frameworks.

In summary, the large-scale diffusion of MaaS is unlikely to be constrained by technological development, but rather by governance challenges (Arias-Molinares et al., 2022). While public transport authorities (PTAs) are widely recognised as key enablers of MaaS implementation, the appropriate extent and nature of their involvement must be defined in light of context-specific institutional, infrastructural, and regulatory conditions. In this regard, Hirschhorn et al. (2019), drawing on the multi-level perspective (MLP) (Geels, 2002), analysed how public authorities have responded to MaaS by conceptualizing governance roles based on network characteristics, institutional design, and stages of MaaS development. However, although this and related work provide valuable analytical classifications of public authority roles, they remain primarily descriptive and explanatory, offering limited guidance on how authorities can determine an appropriate role in practice. This study departs from role description by translating governance theory into a procedural decision logic grounded in comparative empirical patterns observed across existing MaaS implementations. In doing so, it advances the literature from conceptual typologies toward an operational framework that supports context-sensitive governance decision-making by PTAs.

2.1. Multi-level perspective (MLP) on socio-technical transitions

MLP is a widely used approach for addressing socio-technical transitions and has been applied to MaaS (Surakka et al., 2018), which involves interactions among niches, regimes, and broader landscape pressures. Landscapes include macro-level dynamics such as demographic change and environmental awareness; regimes represent established transport systems and institutional arrangements; and niches refer to emerging innovations, such as digital mobility platforms. Transitions occur when niche innovations challenge or reshape dominant regimes.

However, MLP has been criticised for failing to adequately address actor strategies and governance roles (Meadowcroft, 2011). Hirschhorn et al. (2019) respond to this limitation by integrating metagovernance concepts (Sørensen & Torfing, 2005) —which have already been applied to MaaS studies (Mukhtar-Landgren & Smith, 2019)— to classify public authority roles in MaaS implementation. Their framework identifies roles such as Analyzer, Architect, Convener, Experimenter, Lawmaker, and Provider, depending on institutional design, network characteristics, and MaaS maturity. Building on this perspective, the present study adopts MLP to contextualise why PTA roles vary across cities and stages of development. It extends through a decision-support approach grounded in empirical observations.

2.2. Metagovernance and MaaS governance

Governance network theory emphasises non-hierarchical coordination among public and private actors (Sørensen & Torfing, 2008). Within this framework, metagovernance emerges as a higher-order mode of steering that coordinates different governance mechanisms to mitigate failures and align collective goals (Gjaltema et al., 2020). Rather than replacing state authority, metagovernance reframes public actors as designers of institutional conditions, facilitators of collaboration, and guardians of accountability.

Multiple theoretical strands inform metagovernance. Interdependency theory highlights hands-on coordination through diplomacy and resource mobilisation (Jessop, 2002), whereas governability theory emphasises institutional design and the “rules of the game” (Kooiman, 2010). Integration perspectives focus on shaping shared identities and capacities among stakeholders (Scott, 2014), while governmentality approaches stress indirect steering through norms and performance frameworks (Burchell & Foucault, 2009). These perspectives are not mutually exclusive and may coexist within MaaS governance contexts characterised by high complexity and multi-stakeholder interactions.

Applying metagovernance to MaaS acknowledges its complex multi-stakeholder environment. Public authorities may act as coordinators, defining regulatory frameworks, enabling collaboration, and allowing innovation to emerge from the market (Mukhtar-Landgren & Smith, 2019). Yet existing approaches rarely provide operational guidance on how active or passive this involvement should be. Hirschhorn et al. (2019), drawing on Sørensen and Torfing (2009), proposed a set of roles tailored to MaaS governance. Still, there is no practical mechanism to assign these roles based on contextual characteristics systematically.

Several attempts have been made to operationalise MaaS governance through readiness and diagnostic tools. The checklist proposed by Li and Voege (2017) was among the first approaches to assess MaaS feasibility. Since then, several MaaS “readiness” indexes have been proposed. Núñez and Antoniou (2025) proposed the MaaSPI, a tool to assess the conditions to make MaaS feasible; however, it was applied at the country level, which, given the internal disparities of each country in terms of transport systems and regulations, makes it hardly useful for decision-making and for cross-region strategic comparison. Moreover, this index does not provide insights into the PTA's role in cities where it has potential. Aba and Esztergár-Kiss (2024) proposed the MaaS Readiness Index (MRI), a diagnostic framework that measures a region's readiness to support MaaS, considering technical, policy, and coopetition variables. The MRI is a useful tool for assessing readiness, but it does not explicitly dictate the PTA's role.

Nevertheless, these indices may unintentionally disadvantage cities with lower institutional maturity, like many in the Global South. In this sense, the MaaSINI (Dadashzadeh et al., 2022) aimed to provide a framework to assess MaaS inclusiveness, at the service level, rather than the city level, meaning it does not address governance models. We argue that MaaS could be the push some cities need to innovate and modernize their system. For instance, applying metagovernance, an interested PTA could assume the role of an “experimenter”, conducting pilots of MaaS concepts under controlled conditions.

Taken together, the metagovernance literature highlights that public authority involvement in MaaS is not a binary choice between intervention and non-intervention, but a matter of calibrated steering across multiple governance modes. While existing frameworks clarify the types of roles public authorities may assume and readiness indices assess enabling conditions, neither provides a systematic mechanism to translate contextual characteristics into a concrete governance position for public transport authorities. This gap is particularly consequential in heterogeneous and resource-constrained contexts, where misaligned governance choices may hinder rather than support MaaS development. These limitations underscore the need for an operational approach that links metagovernance roles to empirically observable institutional, infrastructural, and regulatory conditions—an issue addressed in this manuscript.

2.3. Research gap and contribution

Governance studies across the literature explain how MaaS ecosystems can be organized and detail stakeholders' perspectives, while business studies on MaaS identify barriers and requirements for its implementation feasible. However, three limitations remain evident. First, existing studies primarily describe governance configurations

rather than offering operational guidance for PTAs navigating implementation decisions (Audouin & Finger, 2018; Butler et al., 2021; Pangbourne et al., 2020; Singh, 2020; Smith & Hensher, 2020). Second, frameworks such as readiness indices or conceptual platforms assess conditions for MaaS adoption but do not specify the role a PTA should assume or how to define it (Aba & Esztergár-Kiss, 2024; Dadashzadeh et al., 2022; Li & Voege, 2017; Núñez & Antoniou, 2025). Third, transition literature is mostly analytical and rarely translates theoretical insights into practical decision-making tools grounded in empirical governance patterns. All this results in unclear allocation of responsibilities and weak guidance on public authority roles across contexts. Table 1 synthesizes the literature review and the contribution of the present study.

Consequently, despite extensive debate on MaaS governance, policymakers lack a context-sensitive mechanism to determine how deeply public authorities should engage in MaaS ecosystems. This research addresses these gaps by proposing a decision-support framework that links multi-level transition dynamics with metagovernance theory to operationalise PTA role definition.

This study integrates MLP as an analytical lens to structure variables across landscape, regime, and niche dynamics and metagovernance, explaining how institutional capacity and system maturity shape governance choices. Methodologically, it translates empirical observations from existing MaaS systems into a structured flowchart that suggests context-appropriate public roles. In practice, it provides public authorities and practitioners with a transparent tool to assess governance readiness, identify strategic pathways, and avoid misaligned investments, while recognising that PTA involvement may range from hands-off facilitation to full provision.

Table 1
Literature review & contribution summary.

Current Literature	This study		
Topic	Gaps identified	MLP-Metagovernance approach	Contribution
Conceptual and typological MaaS governance frameworks (Kandanaarachchi et al., 2024; König et al., 2016; Mukhtar-Landgren & Smith, 2019)	Governance roles are described conceptually but lack systematic operationalization. PTA decision-making; allocation of responsibilities is often unclear.	Metagovernance role typologies translated into a structured decision-support logic, linked to contextual variables	PTAs can assess the appropriate level and type of intervention while considering accountability and operational feasibility
MaaS readiness indices focus on feasibility conditions (Aba & Esztergár-Kiss, 2024; Li & Voege, 2017; Núñez & Antoniou, 2025)	Diagnostic tools assess technical and policy readiness but do not specify PTA roles.	MLP is used to identify and structure contextual variables across landscape, regime, and niche levels; metagovernance informs differentiated role typology.	Authorities can move from feasibility diagnosis to actionable governance strategies, tailored to the local context and system maturity.
MaaS case studies address stakeholder perspectives and local dynamics (Pagoni et al., 2026, 2022; Polydoropoulou et al., 2020; Ye & Zheng, 2024)	Insights are often context-specific and difficult to transfer across cities; weak guidance for cross-context learning; limited practical operational guidance.	Empirical insights were synthesized across cases and integrated into a generalizable decision logic / flowchart.	Supports cross-context policy learning without imposing uniform governance models; helps PTAs adapt to local institutional and market conditions.
Public-authority role frameworks remain primarily analytical (Hirschhorn et al., 2019; Pagoni et al., 2022)	Conceptual role definitions do not translate into procedural guidance or practical tools for PTA engagement; implementation constraints, accountability, and equity considerations are often not addressed	Integration of MLP (for contextual analysis) with metagovernance (for role definition) enables operational translation of theory into actionable guidance	Bridges transition theory and policy practice, supporting context-sensitive role assignment, ensuring equity, and allowing for flexibility.

3. Methodology

To develop the role-definition tool for PTAs within the MaaS ecosystem, this study adopted the MLP on socio-technical transitions as its guiding conceptual framework. We followed five methodological steps, progressing from conceptual variable identification to empirical testing and expert refinement, as presented in Fig. 1. These steps include (1) variable selection & role identification, (2) empirical classification, (3) decision support-tool development, (4) expert validation, and (5) synthesis into the final framework.

The MLP enables the systematic examination of how technological innovations, such as MaaS, evolve through the interplay among macro-level landscape developments, meso-level regime dynamics, and micro-level niche experimentation (Geels, 2002). Applying this lens allowed us to situate PTAs within their broader institutional and regulatory environments and identify structural and institutional variables that shape their capacity to engage in MaaS governance. These variables were subsequently categorized and operationalised to inform the development of the decision-support tool.

Variables capturing institutional capacity and regime characteristics were derived from the MLP perspective, reflecting how niche innovations interact with established governance structures. Governance roles were grounded in metagovernance theory, which conceptualizes varying degrees of hands-on and hands-off steering. The decision-support logic emerges from the intersection of these two perspectives: contextual variables indicate transition readiness, while metagovernance roles define strategic positioning.

3.1. *Variable selection and operationalisation*

Table 2 presents the variables included in the analysis and their operational definitions. Variables were selected based on prior MaaS governance literature, barriers identified in socio-technical transition studies, MaaS literature, and institutional characteristics observed across existing MaaS implementations (Butler et al., 2021; Hasselwander & Bigotte, 2022). Rather than measuring performance outcomes, the variables capture contextual conditions influencing governance capacity.

The classification of variables across niche, regime, and landscape levels follows the MLP, where niche variables capture emerging mobility innovations, regime variables reflect institutional and governance structures shaping MaaS implementation, and landscape variables represent broader contextual pressures influencing public authority decision-making.

MaaS itself is conceptualised as the focal niche innovation that motivates the analysis. Therefore, it is not operationalised as an independent variable. Instead, Table 2 focuses on regime characteristics and selected contextual factors that condition public authorities' responses to this niche development. Landscape pressures such as digitalisation or broader policy agendas are acknowledged but operationalised through variables capturing funding availability and market pressure. These were selected as measurable proxies of landscape dynamics, since many macro-level drivers remain relatively stable across contemporary urban mobility systems and offer limited discriminatory power for role

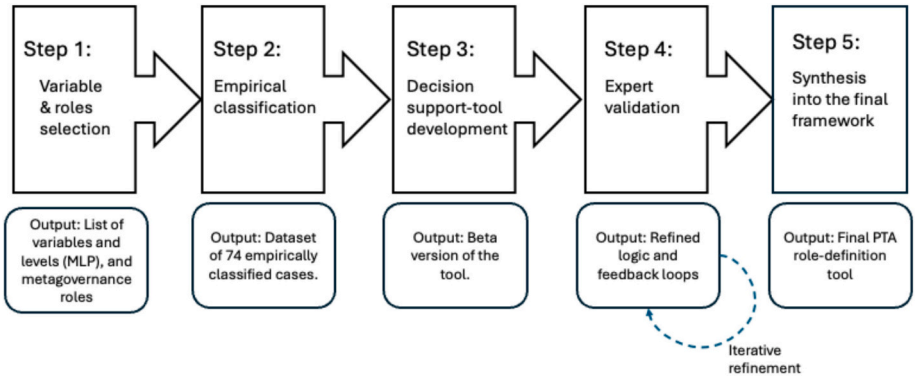

Fig. 1. Methodological steps.

definition.

Building on Ye and Zheng (2024), who conceptualize governmental policy support strategies as binary (providing or not providing support for MaaS), this study expands the possible roles by drawing on the metagovernance MaaS literature. The governance roles—ranging from minimal hands-off engagement to fully hands-on involvement, in which the PTA functions as the MaaS provider—were adapted from the typology proposed by Hirschhorn et al. (2019) (Table 3).

3.2. Empirical classification of MaaS cases

To establish relationships between contextual variables and PTA governance roles, we analysed 74 operational MaaS or "MaaS-like" systems across cities worldwide. Data were drawn from Audenhove et al. (2021), Lopes et al. (2023), and an original database of documented MaaS implementations compiled by the authors (Appendix A).

Each case was systematically coded according to the variables outlined in Table 2, capturing institutional, infrastructural, and regulatory characteristics. Variable levels and governance roles were assigned based on policy documents, project reports, MaaS apps, operators' websites, and contextual evidence describing the PTA's level of involvement.

When uncertainties emerged regarding institutional arrangements or service status, additional verification was conducted through local contacts familiar with the transport ecosystem. Each variable was coded according to predefined operational definitions, and ambiguous cases were revisited during the expert validation stage. The objective of this empirical classification was not statistical generalisation but the identification of recurrent governance configurations across diverse institutional contexts. As methodological examples, we present two cases of renowned PTAs: Transport for London (TfL) and Transport for NSW, provides the following results:

1. Transport for London (TfL): TfL meets the conditions for the **Provider** role. London's network is highly integrated, with unified fares (Oyster/contactless), multimodal coordination, and advanced digital systems, placing it in the High PT IMPReSS category. TfL has led multiple complex transitions, including the Oyster and contactless rollout, bus contracting reforms, congestion charging, ULEZ implementation, and the integration of digital platforms, reflecting strong enabling experience. Its institutional autonomy is high: TfL plans services, regulates fares, controls infrastructure, and contracts operators. Engagement is hands-on, with unified mobility branding, strong platform governance, and controlled open APIs. The regulatory regime is coordinated, and high institutional visibility and international recognition reinforce its leadership and brand value.
2. Transport for NSW (TfNSW) most suitable role would be **Convener**. Sydney has a highly integrated multimodal network with unified ticketing (Opal) and coordinated planning, placing it in the High PT IMPReSS category. TfNSW has successfully managed complex transitions, including Opal smartcard rollout, integrated contracting reforms, and digital platforms with open data, demonstrating enabling experience. The authority is highly centralized, planning and regulating services, contracting private operators, and controlling fares and integration, reflecting full institutional autonomy. TfNSW adopts a hands-on engagement strategy, actively shaping MaaS-like integration through apps, fare integration, and platform coordination, but it does not provide MaaS commercially itself. Its regulatory regime is coordinated, with structured entry for operators under formal regulation. Collectively, these features position TfNSW as a Convener: a strong orchestrator that steers collaboration without fully owning the MaaS system.

3.3. Decision-support tool development

The approach follows a qualitative comparative and pattern-matching logic to identify recurring governance structures. By comparing variable configurations across all cases, recurrent patterns and contextual conditions associated with each PTA role were identified. These empirical regularities informed the construction of a decision-support flowchart designed to guide authorities in determining their optimal level of engagement in MaaS governance.

The decision logic was derived iteratively by analysing how combinations of variables aligned with observed governance roles across the case studies. Relationships between variables and roles were first conceptualised through pattern matching and then translated into sequential decision pathways, forming the structure of the flowchart.

3.4. Expert validation and refinement

To validate and refine the decision-support tool, a qualitative expert validation process was conducted using in-depth, semi-structured sessions with domain experts drawn from key segments of the MaaS ecosystem. In total, five expert validation sessions were carried out, each lasting approximately 50–70 min, involving participants from public transport authorities, private mobility operators, consultancy firms, and academia (Table 4). Experts were selected through purposive sampling to ensure coverage of diverse institutional roles, governance responsibilities, and levels of MaaS maturity. The sample spans five countries—The Netherlands, Colombia, Finland, Portugal, and Spain—capturing variation across both Global North and Global South contexts and reflecting heterogeneous regulatory, institutional, and market conditions.

Each session followed a structured validation protocol. The preliminary version of the flowchart was presented to participants, who were then guided through the decision logic step by step. Experts were invited to critically assess (i) the conceptual clarity and operational relevance of each variable, (ii) the internal consistency and logical

Table 2
Variables considered.

City's characteristics	Description	Levels	MLP
Public transport network IMPReSS classification	Refers to the quality and integration of the existing public transport using the IMPReSS classification method as a benchmark (Orozco-Fontalvo et al., 2024)	Low (⟨20)/Medium (20–40) /High (>40) IMPReSS scores were applied following the original scoring framework without methodological modification and were used as an indicator of transport system maturity rather than a performance evaluation metric	Regime
Shared mobility services availability	Refers to the availability of more than two shared mobility services operating within the city.	Yes / No	Niche
Electronic fare	Refers to whether there is paperless ticketing validation and digital payment systems (Kandanaarachchi et al., 2024)	Yes / No	Regime
Complex transitions experience	Indicates whether the Public Transport Authority (PTA) has previously managed complex institutional, technological, or operational transitions (e.g., large-scale reforms, new system integrations, digitalization). This serves as a proxy for the PTA's internal capacity and skill level of its human resources.	Yes / No (A "Yes" classification was assigned when documented evidence existed of previous large-scale implementation or reform processes led by the authority.)	Regime
Institutional autonomy	Refers to the degree of decision-making the PTA holds on planning, regulation, contracting, and enforcement across the transport system. Classification was based on governance structures described in policy documents, legislative frameworks, and institutional arrangements.	1. **Full authority** – to plan, regulate, and enforce policies across the transport network 2. **Shared/Partial authority** – it can influence policies but has limited enforcement or planning power. 3. **Limited authority** – minimal control; decisions are centralized or fragmented across other institutions.	**Regime**
Institutional engagement strategy	Refers to the intended posture of the PTA toward MaaS, ranging from hands-on involvement to enabling or non-engagement positions.	• **Hands-on** – PTA intends to actively shape, coordinate, or lead MaaS efforts. • **Hands-off** – enabling private actors, offering data or regulatory support, but avoiding direct operational roles. • **No action** – does not plan to engage in MaaS at this stage, either due to lack of interest, resources, or strategic alignment.	**Regime**
Regulatory control regime	Captures the degree of market openness and data-sharing requirements governing mobility services (Audenhove et al., 2021; Kandanaarachchi et al., 2024)	• **Liberal** *Open market with minimal barriers to entry,* **and** *data-sharing is required and accessible to all. Governance under light but clear rules.* • **Open** *Low regulation — private operators can enter freely, but there's* **little or no requirement** *for data-sharing or coordination with public authorities.* • **Coordinated** *Entry of private operators is permitted but requires compliance with specific conditions. Require* **some level** *of data-sharing. Governance aims to balance innovation with public interest.* • **Restricted** *Tight regulatory control. Market access is highly regulated. Data is held centrally by authorities.*	**Regime**
Institutional visibility and brand recognition (brand value)	Refers to the presence of a recognisable institutional mobility brand supported by integrated communication strategies, unified service identity, or international recognition (e.g., Transport for London or BVG Jelbi, RATP) (Arias-Molinares et al., 2022; Ye & Zheng, 2024)	High / Low-Indifferent	Regime
Funding (availability) for MaaS	Captures whether financial resources are accessible for MaaS implementation or pilot deployment, regardless of whether funding originates from public or private sources.	Yes / No	Landscape
Private companies' interest	Indicates the presence of market actors actively exploring MaaS deployment within the local ecosystem.	Yes / No-Indifferent	Landscape

Note: Levels reflect the dominant analytical position within the MLP, acknowledging interactions across levels.

coherence of the decision pathways, and (iii) the practical applicability of the resulting role assignments within their own governance contexts. Particular attention was paid to identifying ambiguities, missing decision points, or unrealistic assumptions that could limit real-world usability. All feedback was systematically documented and analysed using an iterative refinement approach. Insights from each session informed successive revisions of the framework, including the clarification of variable definitions, adjustment of categorical thresholds, reordering of decision steps, and simplification of pathways where experts identified unnecessary complexity. This process followed a convergence logic: expert consultations continued until conceptual saturation was reached and no further substantive modifications were suggested, resulting in a stable, consensus-based version of the decision-support tool (Francis et al., 2010).

4. The role definition tool

The resulting decision-support flowchart is presented in Fig. 2. The application of the tool begins with the IMPReSS methodology (Orozco-Fontalvo et al., 2024) to assess the transport system or city under analysis, allowing the user to determine the maturity level of its infrastructure, institutional arrangements, and governance capacity. IMPReSS evaluates six features: the availability and reliability of a multimodal trip planner (Information); the inclusion of public transport and other modes (Multimodality); the ability to make seamless in-app payments (Payment); the capability to make reservations within the app (Reservation); the provision of more than one subscription option (Subscription); and the integration of local or regional policies and goals into the service (Societal goals). These features are assessed in ascending order of implementation complexity and systemic relevance, with each feature scored as 0 (absent) or 1 (present). The binary score is then converted to a decimal value for classification purposes. Based on the final score, systems are categorized as High (>40), Medium (20–40), or Low (<20), with the maximum possible score being 63.

Based on this assessment, users follow the flowchart step by step, referring to Table 2 for detailed descriptions of each variable and

Table 3
Possible PTA roles (Hirschhorn et al., 2019).

Role	Description	MLP	Sørensen and Torfing (2005)
Analyzer	Conducts scoping activities. Devolves responsibilities but seeks knowledge, collects evidence, and closely follows different initiatives to be equipped to intervene in a free market if deemed necessary.	Regime	–
Architect	Enables the niche with soft hands-off intervention to set broad goals and frame policies and resources. Tasks are carried out by other network actors (contracted out) that are free to act within the policy and financial frameworks	Regime	Policy and resource framing
Lawmaker	Enables the niche with strong hands-off intervention. Regulation is the instrument for (re)designing the system's institutional setup to allow market forces to drive innovation.	Regime	Institutional design
Convener	Enables the niche with soft hands-on intervention, using influence to help build relationships and networks. Supports and mediates dialogue and collaboration. Seeks mutually acceptable solutions. It relies on free-market incentives for parties to develop solutions, but it ensures that these solutions align with societal goals.	Regime and Niche	Facilitation
Experimenter	Enables the niche with strong hands-on intervention. The main aim is scoping via learning-by-doing. Seeks to maximize the use of living labs as 'controlled experiments'. Tasks are carried out by other network actors (contracted out), but outputs follow detailed guidelines.	Regime and Niche	–
Provider	Uses strong hands-on intervention. Mobilizes resources to design and offer desired solutions, ascertaining a position of leadership, i.e., maintaining/recovering the original balance of power in a changing scenario.	Regime and Niche	Participation

guidance on how to evaluate them. Once a governance role is suggested, decision-makers are encouraged to critically reflect on whether the outcome aligns with their strategic objectives and the contextual reality. If the resulting role diverges from initial expectations or ambitions, the tool allows users to trace back the decision path and identify which variables constrain or enable the different governance positions.

This way, the tool not only supports role identification but also highlights potential leverage points for policy interventions, institutional reforms, or capacity-building aimed at enabling future role transitions.

4.1. Illustrative applications

To facilitate interpretation, two illustrative applications of the flowchart are presented. The selected illustrations are drawn from the 74 empirically analysed cases and include one city from the Global North (Lisbon) and one from the Global South (Barranquilla). The examples are illustrative and do not imply broader generalisation across Global North–South contexts.

Table 4
Profiles of experts interviewed for the stakeholder validation phase.

Code	Position / Role	Type of Institution	Country / Region	Area of Expertise
INT1	Coordinator of shared mobility and innovation	Transport consultancy	The Netherlands	Shared mobility, innovation, MaaS implementation
INT2	Technical chief at a metropolitan mobility authority	Public authority	Colombia	Transport planning, public-sector management
INT3	Senior policy advisor and university professor	Consultancy/ Academia	International (Portugal based)	Governance, policy strategy, MaaS development
INT4	Former policy analyst at an international transport organization	International organization	Spain (Europe based)	Transport governance, public relations, policy analysis
INT5	Professor of transport technology	Academia	Finland	Intelligent transport systems and innovation, research

Illustration 1 Transportes Metropolitanos de Lisboa (TML), Lisbon metropolitan transport authority (Fig. 3)

TML is classified as a high-IMPReSS system, reflecting a mature institutional and infrastructural context. The authority demonstrates experience with complex transitions, notably through the implementation of the Navegante integrated ticketing system and app and exhibits a high degree of institutional autonomy. Although its branding as a transport system is still evolving, its largely hands-on governance approach suggests a Provider role.

Illustration 2 Area Metropolitana de Barranquilla (AMB), Barranquilla's transport authority (Fig. 4)

In contrast, AMB operates within a lower-IMPReSS transport system, characterised by more limited institutional and infrastructural maturity. Despite this, the authority has experience with complex transitions through the implementation of a Bus Rapid Transit (BRT) system. Given the greater intention to use MaaS in immature transport contexts (Orozco-Fontalvo, 2025), we could expect private operators' interest, while regulatory control is likely to remain coordinated rather than centralized. Accordingly, the flowchart suggests a Lawmaker role, emphasizing regulatory oversight, rule-setting, and coordination rather than direct operational involvement. This example demonstrates how PTAs in less mature contexts can still play a decisive governance role by shaping market conditions and safeguarding public interests without assuming responsibility for service provision.

4.2. Interpretation and positioning within the MaaS governance literature

The governance role suggested by the tool should not be interpreted as prescriptive or exclusive. Regardless of the role identified, policymakers are encouraged to consider complementary governance measures, such as the checklist for successful MaaS uptake presented by Pagoni et al. (2022), for both operators and policymakers.

Recent research highlights that MaaS outcomes emerge from strategic interactions between governments, transport service providers (TSPs), and travellers. Ye and Zheng (2024) show that when TSPs choose not to participate in MaaS, and travellers refrain from using it, governments tend to adopt supportive policy strategies to stimulate adoption. Conversely, when governments provide policy support, and TSPs participate, travellers are more likely to adopt MaaS solutions. These findings reinforce the central insight of the proposed flowchart: PTA involvement is a key driver of MaaS evolution, but its form and intensity

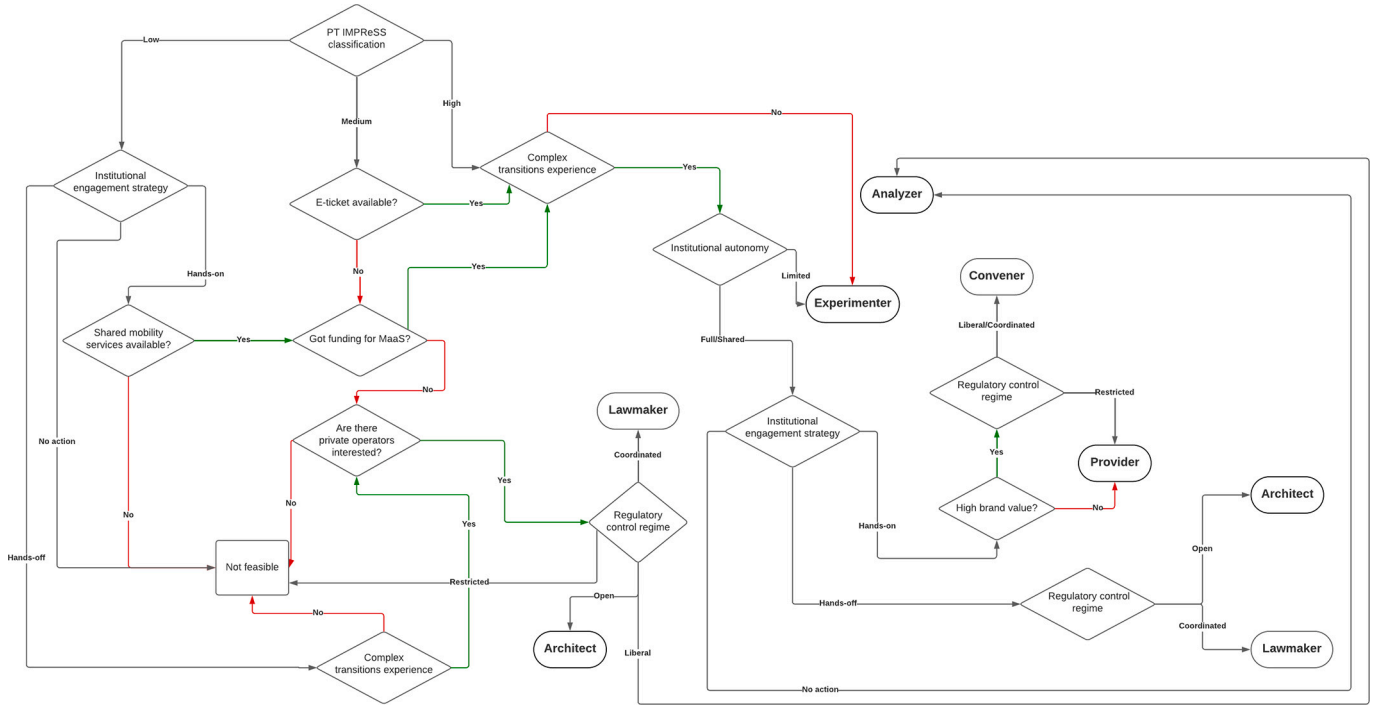

Fig. 2. Flowchart for PTA's role definition.

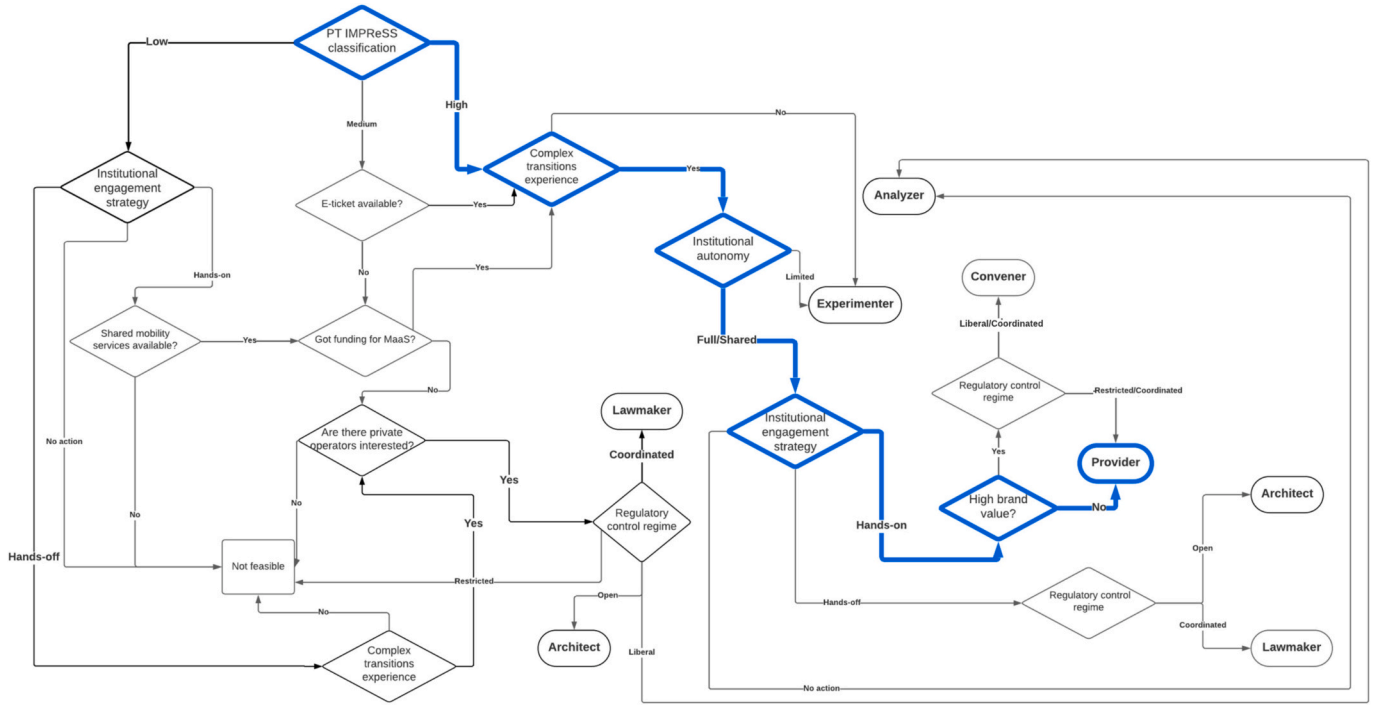

Fig. 3. TML example.

must be aligned with contextual conditions and actor behaviour.

Consistent with Kandanaarachchi et al. (2024), results confirm that active PTA involvement is crucial for scaling MaaS solutions. However, this does not imply that PTAs should necessarily become MaaS operators in all contexts. Instead, the appropriate role may range from regulatory oversight to orchestration or full provision, depending on institutional capacity, system maturity, and strategic objectives. The decision-support flowchart operationalises this insight by offering a structured mechanism for PTAs to identify feasible governance roles while retaining flexibility to evolve as conditions change.

Overall, the results demonstrate that the proposed tool functions not only as a classificatory instrument but also as a strategic reflection device. By making explicit how contextual variables shape governance choices, it supports adaptive decision-making and clarifies the pathways through which PTAs may transition between roles as MaaS ecosystems mature.

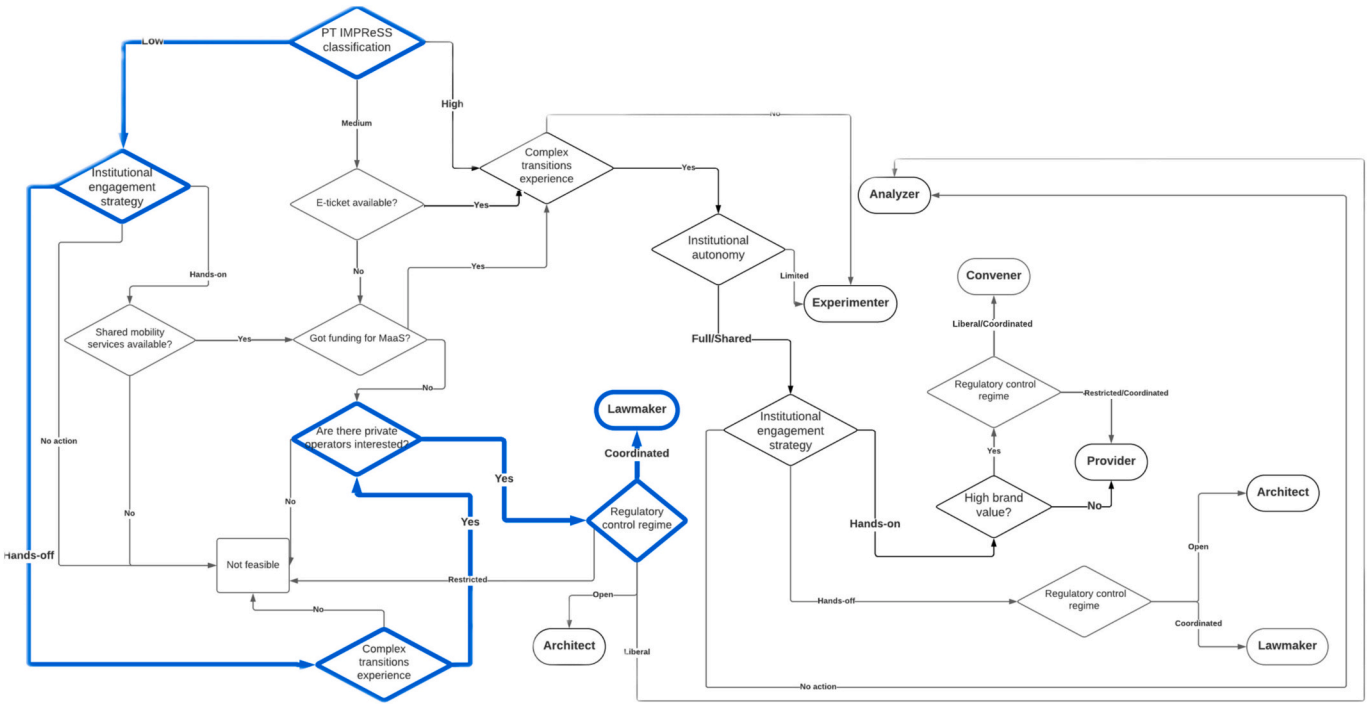

Fig. 4. AMB example.

5. Discussion

The decision-support flowchart demonstrates that identifying the most suitable governance role for a PTA within MaaS ecosystems is inherently context-dependent, reflecting variations in institutional design, infrastructural maturity, and governance capacity. While some PTAs may express strong ambitions to adopt a hands-on role, the analysis indicates that such engagement is not always strategically or operationally optimal. Agencies characterised by robust infrastructure, high institutional maturity, and advanced integration levels —as captured by high IMPReSS scores— are best positioned to assume the Provider role, taking direct leadership of MaaS delivery and coordination. Conversely, PTAs operating under constrained resources or lower maturity conditions may derive greater strategic benefit from roles such as Analyzer, Architect, or Experimenter, which emphasize monitoring, facilitation, and incremental learning.

The influence of contextual variables is not uniform; for instance, experience with complex transitions becomes a decisive factor only when a PTA seeks to deepen its operational involvement. This finding aligns with Wandelt et al. (2025), who highlight the need for adaptive, context-sensitive governance frameworks capable of steering transport innovation across multi-actor and evolving institutional environments. Our findings corroborate previous research emphasizing that MaaS governance must be aligned with local institutional and infrastructural capabilities (Jittrapirom et al., 2017; Smith et al., 2019). By operationalising these empirical patterns into a structured flowchart, this study provides a transparent, replicable tool that enables decision-makers to align their governance approach with contextual realities, help preventing misaligned investments, minimize opportunity costs, and identify strategic priorities while revealing pathways for institutional improvement.

In this sense, applying the tool in cities or regions where transport governance is fragmented or institutional authority is distributed across multiple agencies, or informal operators play a significant role (e.g., some Global South megacities), should consider contextual sensitivity. In such settings, variables such as institutional autonomy and regulatory control regime must be interpreted in light of multi-level and hybrid governance structures rather than assuming a consolidated PTA. The framework should then be applied to the dominant coordinating body or used comparatively across agencies to identify gaps in governance coherence.

Importantly, public leadership in MaaS does not preclude private sector involvement: even within the Provider role, outsourcing or contracting private operators for service delivery, software development, or integration remains feasible, thereby balancing public oversight with operational flexibility. This distinction helps avoid the common misconception that public leadership implies public exclusivity. The tool further supports strategic planning across multiple dimensions of MaaS governance, including procurement, partnership negotiation, and platform design, where misalignment between institutional capacity and strategic ambition often leads to implementation failures.

5.1. *Ethical and normative considerations*

Structured tools such as the one presented inevitably embed normative assumptions about effective and legitimate governance. The typologies and pathways proposed may privilege actors with higher technical or institutional capacity, potentially marginalizing stakeholders whose needs or perspectives fall outside the formal PTA mandate. Standardization and quantification facilitate comparability and transparency but can reinforce existing power asymmetries. These considerations underscore the need for reflexive governance, where decision-support tools are complemented with participatory processes that foreground diverse stakeholder voices, scrutinize the values embedded in frameworks, and ensure that efficiency does not override equity, accessibility, or procedural justice (Gordon & Fomin, 2019; Li, 2019; Wong et al., 2020).

While the tool prioritizes the PTA's perspective to ensure operational feasibility and policy relevance, future applications should integrate **deliberative, collaborative, and inclusive processes** to validate assumptions and enhance legitimacy. Reflexivity is particularly important in dynamic MaaS ecosystems, where institutional, technological, and market conditions evolve rapidly. In this regard, the tool should not be interpreted as a neutral or value-free instrument, nor as a mechanism to

legitimize predetermined governance choices. Its outputs reflect the variables selected, the thresholds applied, and the institutional perspective embedded in its design. As such, there is a risk that decision-support tools may be selectively mobilized to rationalize existing power structures or to defer politically sensitive decisions under the guise of technical objectivity. To mitigate this risk, the framework should be used transparently and in conjunction with explicit political deliberation, stakeholder engagement, and accountability mechanisms, ensuring that governance choices remain contestable and subject to democratic scrutiny.

5.2. Limitations

Several methodological limitations of this study should be acknowledged. First, using publicly available online sources to determine system characteristics and operational status introduces uncertainty, as some systems listed as "operating" may, in practice, be inactive or permanently closed. Second, the empirical approach linking system characteristics to governance roles and the tool's strategic setting, while intuitive and practical, is not exhaustive and may overlook variables, levels, and operational categories that influence PTA decision-making. Third, although the tool has been iteratively refined through stakeholder consultations to enhance clarity, categorical definitions, and decision pathways, challenges remain in assessing factors such as data-sharing practices (D'Agostino et al., 2019) and institutional autonomy (Li, 2019) due to opaque or evolving regulatory environments.

Regarding the decision tool, there is a limitation for long-distance MaaS schemes (Bruzzone et al., 2025), as it does not support scenarios to define multi-authority roles. Which should be further explored, considering initiatives such as MaaS Scotland (2024). Lastly, further empirical validation in diverse Global South contexts is necessary to ensure that informal mobility systems, equity concerns, and political economy dynamics are adequately captured.

5.3. Future research directions

From a strategic standpoint, each governance role has operational implications that fall outside the current scope of the tool but merit further exploration. Once a role is identified, additional aspects and business model conditions should be defined, such as tariff structures, profit-sharing agreements, resale contracts, API integration, and data-sharing protocols, which should be addressed in future work.

The tool will also benefit from further refinement as more successful implementations of MaaS are documented. Incorporating key performance indicators (KPIs) could help reduce subjectivity while preserving flexibility. However, the aim should not be to over-quantify a system that is dynamic and context-specific. Strict reliance on rigid metrics may fail to capture the diversity of local realities, potentially leading to inadequate conclusions. It may also neglect ethical considerations in standardization, which is of great importance in emerging technologies, as this will impact the daily lives of commuters and their privacy (Gordon & Fomin, 2019).

Future research should explore iterative monitoring and adaptive management strategies (Jittrapirom et al., 2018), enabling PTAs to refine their governance approach over time in response to emerging technological, market, and social conditions. Additionally, incorporating participatory processes will ensure inclusivity, legitimacy, and flexibility. In practice, the tool can serve as a first step, followed by other frameworks such as the CFP (Kandanaarachchi et al., 2025), particularly for PTAs adopting Analyzer, Convener, or Architect roles.

6. Conclusions

As MaaS and related smart mobility innovations gain global momentum, PTAs face the dual challenge of fostering innovation while ensuring alignment with societal goals and preventing transport gentrification. If left entirely to market forces, MaaS may exacerbate socio-territorial inequalities by privileging commercially viable areas and user groups over accessibility and inclusion. Accordingly, PTAs must assume either an active or enabling governance role to ensure that the societal value generated by MaaS both justifies and sustains the required public investment.

Across existing MaaS research, most studies focus on stakeholder perceptions, institutional motivations, readiness conditions, or business and regulatory feasibility. These contributions have been essential for understanding barriers and opportunities, yet they rarely provide operational guidance for public authorities facing an imminent governance decision. Previous work has described governance arrangements, proposed readiness indices, or analysed individual case studies, but none offers a structured mechanism that translates contextual characteristics into a concrete public role.

In response to this governance challenge, this study developed a decision-support framework that aligns PTA engagement strategies with their integration maturity, institutional capacity, and regulatory context. Based on an empirical analysis of 74 global MaaS and MaaS-like systems, and grounded in the MLP on socio-technical transitions and metagovernance theory, the resulting flowchart provides a structured, context-sensitive approach for PTAs to define their most suitable role in MaaS implementation. The framework was iteratively refined through stakeholder validation across multiple governance and urban contexts, ensuring both theoretical robustness and practical applicability. This tool is applicable to any context worldwide.

Our findings support that combining MLP and metagovernance offers a powerful analytical lens for addressing governance challenges in contemporary transport systems—particularly in an era characterised by rapid innovation, niche experimentation, and evolving institutional arrangements. MaaS has the potential to significantly improve urban transport performance and to serve as a strategic mechanism through which public authorities can regain steering capacity over increasingly fragmented mobility networks. As a platform-based system, MaaS can continuously integrate emerging services and technologies while dynamically providing reliable information and transaction mechanisms for users, thereby enabling PTAs to guide mobility ecosystems toward equitable, sustainable, and democratically legitimate outcomes.

7. Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the authors used ChatGPT in order to enhance the readability and improve the wording on several paragraphs. After using this service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

CRediT authorship contribution statement

Mauricio Orozco-Fontalvo: Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Conceptualization. **Oscar Oviedo-Trespalacios:** Writing – review & editing, Writing – original draft, Supervision. **Filipe Moura:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

Country	City/Region	Name	MaaS operator	IMPReSS	Shared mob	*E*-ticket	Complex transition experience	Autonomy	Engagement strategy	Brand Value	Regulatory control regime	Private int	Funding	Role
Australia	Sydney	iMOVE	SkedGo	High	Yes	Yes	Yes	Full/shared	Hands-off	Yes	Restricted	Yes	–	Architect
Australia	Sydney	Tripi	Transport for NSW	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Coordinated	Yes	Yes	Convener
Austria	Vienna	WienMobil	Wiener Lienen (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Open	–	Yes	Provider
Austria	Vienna	Whim	Whim	High	Yes	yes	Yes	Full/shared	Hands-off	Yes	Open	Yes	–	Architect
Belgium	Antwerp	Whim	Whim	High	Yes	Yes	Yes	Full/shared	Hands-off	Yes	Open	Yes	No	Architect
Belgium	Brussels	MoveBrussels	STIB (PTO)	High	Yes	Yes	yes	Full/shared	Hands-on	Yes	Coordinated	Yes	Yes	Experimenter
Belgium	Ghent		De lijn	High	Yes	Yes	Yes	Full/shared	Hands-off	No	Coordinated	Yes	–	Lawmaker
Brasil	Porto Alegre		PTA	Medium	Yes	No	No	Coordinated	Hands-off	No	Open	Yes	–	Lawmaker
Canada	Vancouver	Cowlines	PTA	High	Yes	Yes	Yes	Full/shared	Hands-off	Yes	Coordinated	Yes	Yes	Lawmaker
China	Beijing	MaaS Beijing	Alibaba and BTC	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Restricted	–	Yes	Provider
China	Shenzhen	Maishi	PTA	High	Yes	Yes	Yes	Limited	Hands-off	Yes	Restricted	Yes	Yes	Lawmaker
Colombia	Bogota	Trafi	Vettica	Medium	Yes	No	Yes	Full/shared	Hands-off	Yes	Restricted	Yes	No	Lawmaker
Colombia	Barranquilla		AMB	Low	No	No	Yes	Full/shared	Hands-off	No	Coordinated	Yes	No	Lawmaker
Czech Republic	Praga	Citymove	SKODA AUTO DigiLab	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Liberal	Yes	–	Convener
England	London	London	Transport for TFL	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Coordinated	–	Yes	Provider
Finland	Helsinki	LexyPass	PTA	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Liberal	Yes	–	Convener
Finland	Helsinki	Whim	Whim	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Liberal	Yes	–	Convener
Finland	Turku	Whim	Whim	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Liberal	Yes	–	Convener
France	Mulhouse	Compte Mobilité	Mulhouse Alsace Agglo (PTA)	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Closed	Yes	–	Convener
France	Saint-Etienne	Moovizy	STAS (PTA)	High	Yes	Yes	No	Full/shared	Hands-on	No	Restricted	Yes	Yes	Experimenter
Germany	Banberg	Wikimove	PTA	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Coordinated	Yes	–	Convener
Germany	Aachen	movA	ASEAG (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	No	Restricted	–	Yes	Provider
Germany	Berlin	Jelbi	BVG (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Restricted	–	Yes	Provider
Germany	Düsseldorf	redy	Rheinbahn AG (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Closed	–	Yes	Provider
Germany	Hamburg	hvv switch	Hamburg Hochbahn (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Restricted	–	Yes	Provider
Germany	Hanover	Mobilitätsshop	GVH (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	No	Restricted	–	Yes	Provider
Germany	Karlsruhe	KVV.mobil	KVV (PTO)/ Mobimeo	High	Yes	Yes	Yes	Full/shared	Hands-on	No	Restricted	–	Yes	Provider
Germany	Leipzig	LeipzigMove	LVB (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	No	Restricted	–	Yes	Provider
Germany	Munich	MVGO	MVG (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Restricted	–	Yes	Provider
Italy	Rome	KINTO Go	Toyota	Medium	Yes	Yes	No	Full/shared	Hands-off	No	Liberal	Yes	–	Architect
Italy	Turin	5 T	City of Turin	High	Yes	yes	No	Full/shared	Hands-on	No	Restricted	Yes	Yes	Experimenter
Japan	Fukuoka area Greater	my route	Toyota Motor Corp.	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Liberal	Yes	–	Convener
Japan	Tokyo	Whim	Whim	High	Yes	Yes	Yes	Full/shared	Hands-off	Yes	Open	Yes	–	Architect
Japan	Tohoku	Tohoku MaaS	East Japan Railway Company	High	Yes	Yes	Yes	Full/shared	Hands-off	Yes	Open	Yes	–	Architect
Lithuania	Vinius	Trafi	Trafi	High	Yes	Yes	No	Full/shared	Hands-off	No	Liberal	Yes	–	Architect
Malta	Malta	Meep	Meep	Medium	Yes	Yes	No	Full/shared	Hands-on	Yes	Liberal	Yes	–	Convener
Netherlands	Rotterdam/ Den Haag	9292	9292	High	Yes	Yes	Yes	Limited	No action	Yes	Coordinated	Yes	–	Analyzer
Netherlands	Rotterdam/ Den Haag	Tranzer	Tranzer BV	High	Yes	Yes	Yes	Limited	No action	Yes	Coordinated	Yes	–	Analyzer
Netherlands	Amsterdam	Amaze	Amaze	Mobility	High	Yes	Yes	Yes	Limited	Hands-off	Yes	Open	Yes	–	Architect
Netherlands	Eindhoven	Turnn	ICT Group	High	Yes	Yes	Yes	Limited	Hands-off	Yes	Open	Yes	–	Architect
Netherlands	Groningen-Drenthe	Via-Go	Arriva (PTO)	High	Yes	Yes	No	Limited	Hands-off	No	Liberal	Yes	No	Experimenter
Netherlands	Limburg	glimble	Arriva (PTO)	High	Yes	Yes	No	Limited	Hands-on	yes	Liberal	Yes	–	Experimenter
Netherlands	Rotterdam/ Den Haag	Moves	Moves	High	Yes	Yes	Yes	Limited	No action	Yes	Liberal	Yes	–	Analyzer
Netherlands	Twente	Goan	Qarin Tranzer	High	Yes	Yes	No	Limited	Hands-off	Yes	Open	Yes	–	Architect
Netherlands	Utrecht	Gaiyo	Gaiyo	High	Yes	Yes	Yes	Limited	Hands-off	No	Liberal	Yes	No	Lawmaker

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Country	City/Region	Name	MaaS operator	IMPReSS	Shared mob	*E*-ticket	Complex transition experience	Autonomy	Engagement strategy	Brand Value	Regulatory control regime	Private int	Funding	Role
Peru	Lima	Wego Navegante	The Wego Company	Low	Yes	No	Yes	Full/shared	Hands-off	No	Liberal	Yes	–	Lawmaker
Portugal	Lisbon	card	Bolt	Conever	Yes	No	Yes	Full/shared	Hands-off	No	Liberal	Yes	Yes	Provider
Portugal	Lisbon	Freenow	TML	High	Yes	No	Yes	Full/shared	Hands-off	No	Liberal	Yes	Yes	Provider
Portugal	Lisboa	Pick Hub	Ubirider	High	Yes	No	Yes	Full/shared	No action	No	Liberal	Yes	–	Analyzer
Spain	Barcelona	City Trips	City of Barcelona	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Restricted	Yes	Yes	Provider
Spain	Barcelona	Meep	Aena (Airport)	High	Yes	Yes	Yes	Full/shared	Hands-off	Yes	Restricted	Yes	Yes	Architect
Spain	Madrid	MaaS Madrid	EMT (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Restricted	–	Yes	Provider
Spain	Madrid	Wondo	Ferrovial (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Restricted	–	Yes	Provider
Spain	Sevilla Valencia,	Meep Sevilla	Globalvia (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	No	Restricted	–	No	Provider
Spain	Malaga	Meep	Meep	High	Yes	Yes	Yes	Full/shared	Hands-off	No	Open	Yes	–	Architect
Spain	Zaragoza	ZUM	PTA	High	Yes	Yes	No	Full/shared	Hands-on	No	Restricted	Yes	–	Experimenter
Sweden	Göteborg	LIMA	Lindholmen	High	Yes	Yes	Yes	Full/shared	Hands-off	Yes	Open	Yes	–	Architect
Sweden	Gothenburg	Ubigo	PTA Skånetrafiken	High	Yes	Yes	Yes	Full/shared	Hands-off	Yes	Open	Yes	–	Architect
Sweden	Skåne	MaaS in Skåne	(PTO)	High	Yes	Yes	No	Full/shared	Hands-on	Yes	Restricted	Yes	Yes	Experimenter
Sweden	Stockholm	Travis	Nobina (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Restricted	–	Yes	Provider
Switzerland	Geneva Zurich,	zenGo	TPG (PTO)	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Liberal	Yes	Yes	Convener
Switzerland	Basel, Bern	yumuv	SBB (RU)	High	Yes	Yes	Yes	Limited	No action	Yes	Coordinated	Yes	–	Analyzer
Tailand	Manila		PTA	Low	No	No	Yes	Full/shared	Hands-off	No	Liberal	Yes	–	Analyzer
Taiwan	Taipei	Umaji	Umaji	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Restricted	–	Yes	Provider
UAE	Dubai	S'hail	RTA (PTA/ PTO)	Medium	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Restricted	–	Yes	Provider
UK	Birmingham		PTA	Medium	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Liberal	Yes	–	Convener
UK	London West	Citymapper*	Citymapper	High	Yes	Yes	Yes	Full/shared	Hands-off	Yes	Open	Yes	–	Architect
UK	Midlands	Whim	Whim	High	Yes	Yes	No	Full/shared	Hands-on	No	Liberal	Yes	–	Convener
USA	Pittsburgh	Move PGH	DOMI	High	Yes	Yes	No	Limited	Hands-on	No	Coordinated	–	Yes	Provider
USA	San Diego	Umo Mobility	PTA	Medium	Yes	Yes	Yes	Limited	Hands-off	No	Open	Yes	–	Architect
USA	San Francisco	Moovit	PTA	High	Yes	Yes	Yes	Full/shared	Hands-off	Yes	Restricted	Yes	Yes	Lawmaker
USA	Denver	Uber Transit	Uber	Medium	Yes	Yes	Yes	Limited	Hands-on	Yes	Liberal	Yes	–	Convener
USA	Florida	Brightline	Brightline (Rail)	Low	Yes	Yes	Yes	Limited	Hands-off	No	Restricted	Yes	–	Architect
USA	Denver	Xerox	PTA	Medium	Yes	Yes	Yes	Limited	Hands-on	Yes	Liberal	Yes	–	Convener
China	Hong Kong		MTR	High	Yes	Yes	Yes	Full/shared	Hands-on	Yes	Restricted	Yes	Yes	Provider

Data availability

Data has been added as an Appendix

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