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Reimagining Urban Freight: Governance and Data Architectures for Logistics as a Service

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Abstract

The rapid transformation of urban freight systems, driven by the growth of e-commerce, advancing digitalisation, and increasing sustainability demands, has positioned Logistics as a Service (LaaS) as a promising paradigm in urban logistics. Extending the principles of Mobility as a Service (MaaS) to freight transport, LaaS provides on-demand access to shared logistics assets – such as vehicles, micro-hubs, and data – through digital platforms. While existing studies highlight the potential of LaaS to improve efficiency and environmental performance, critical challenges persist with regard to governance structures and data interoperability in complex, multi-actor urban environments. Current research offers only partial insights into these challenges. Demand-side approaches emphasise consumer integration and transparency but provide limited guidance on institutional coordination between public authorities and private operators. Platform-oriented conceptual models, in turn, focus primarily on technological architectures while largely neglecting governance arrangements, incentive alignment, and data-sharing mechanisms among competing stakeholders. Moreover, earlier work on the digitalisation of urban logistics predates the emergence of platform-based service ecosystems and therefore offers limited direction for managing shared data and value flows. Addressing these gaps, this study develops a hybrid governance framework for LaaS that integrates municipal oversight with the innovation capacity of private platforms. The framework introduces incentive-alignment instruments – including dynamic access pricing, sustainability-based credits, and open-data requirements – to reconcile public policy objectives with market-driven efficiency. In addition, it proposes a multi-layered data-sharing architecture that combines open urban data (such as emission regulations and curbside availability) with protected operational data via standardised APIs, thereby fostering interoperability, transparency, and accountability. By conceptualising LaaS not merely as a digital service model but as a governance innovation, this study contributes an institutional perspective to the LaaS literature and provides a foundation for future empirical research on hybrid governance models in European urban logistics ecosystems.

Keywords: Logistics as a Service, Urban Logistics, Governance, Data Sharing, Platform Economy, Sustainability, Smart City

1 Introduction

Urban freight systems are undergoing a profound transformation driven by the rapid expansion of e-commerce, advances in digital technologies, and increasingly stringent sustainability objectives. Urban areas concentrate both demand for goods and the negative externalities associated with freight transport, including congestion, emissions, noise, and competition for scarce curbside space (Dablanc, 2019). As cities seek to reconcile economic vitality with environmental and social goals, conventional, fragmented approaches to urban logistics are proving insufficient to address the growing complexity of last-mile delivery systems.

Digitalisation has emerged as a key enabler of new organisational models in urban freight. Platform-based coordination mechanisms increasingly mediate interactions between shippers, logistics service providers, infrastructure operators, and end consumers. In this context, Logistics as a Service (LaaS) has gained attention as an integrative concept that extends the principles of Mobility as a Service (MaaS) to freight transport. LaaS offers on-demand access to shared logistics assets – such as vehicles, consolidation hubs, and data resources – through digital platforms, with the aim of increasing utilisation rates, reducing redundancies, and improving environmental performance (Beckers et al., 2023).

Recent research highlights the potential benefits of LaaS-based models for urban sustainability and operational efficiency. By enabling dynamic matching of demand and capacity, LaaS platforms can reduce empty runs, support consolidation strategies, and facilitate the uptake of low-emission delivery solutions (Fioravanti et al., 2025). Moreover, enhanced data visibility may empower consumers and businesses to make more sustainable delivery

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choices, thereby aligning market behaviour with public policy objectives (Beckers et al., 2023). Despite these promising prospects, the implementation of LaaS in real-world urban environments remains limited.

A key reason for this gap between conceptual promise and practical uptake lies in unresolved questions of governance and data management. Urban logistics systems involve heterogeneous actors with divergent objectives, capacities, and regulatory constraints, ranging from municipal authorities and platform operators to competing logistics service providers. While cities are responsible for setting regulatory frameworks and safeguarding public interests, private platforms drive innovation and operational efficiency. Integrating these roles in a coherent governance structure poses significant challenges, particularly with respect to regulatory legitimacy, accountability, and adaptability (Dablanc, 2019). In addition, data interoperability and data-sharing arrangements remain critical bottlenecks. Effective LaaS operation depends on the integration of diverse data sources, including public data on traffic regulations or curb availability and private operational data held by logistics service providers. However, concerns regarding data sovereignty, competitive sensitivity, and unequal bargaining power often inhibit data sharing among actors (Fioravanti et al., 2025). Existing studies tend to address either technological architectures or behavioural aspects in isolation, offering limited guidance on how incentive structures and governance mechanisms can foster trust and collaboration in multi-actor environments.

Against this backdrop, this paper addresses two central research questions: (1) How can public governance and private platform operations be integrated in LaaS models to ensure both regulatory legitimacy and operational agility? (2) What incentive and data-sharing mechanisms can enable collaboration among heterogeneous logistics actors while respecting competitive dynamics and data protection concerns? To answer these questions, the study develops a hybrid governance framework for LaaS that explicitly links institutional design with platform economics and data architectures.

By conceptualising LaaS not merely as a digital service model but as a governance innovation, this paper seeks to bridge the gap between urban logistics policy and platform-based coordination mechanisms. In doing so, it contributes to the growing literature on urban freight digitalisation by introducing an institutional perspective on LaaS and by providing a structured foundation for future empirical research in European urban logistics ecosystems.

2 Conceptual Background and State of the Art in Logistics as a Service

2.1 Logistics as a Service in Urban Contexts

LaaS, inspired by MaaS, provides on-demand access to shared logistics resources such as vehicles, micro-hubs, and operational data, aiming to improve asset utilisation, reduce inefficiencies, and enhance environmental performance (Beckers et al., 2023). Unlike conventional siloed models, LaaS operates as a multi-actor digital ecosystem, enabling route optimisation, delivery consolidation, and dynamic resource allocation (Fioravanti et al., 2025). It can promote sustainable urban freight by shaping both supply- and demand-side behaviours: shared fleets and consolidation points reduce empty vehicle kilometres and support low-emission modes, while transparency on delivery options encourages greener choices (Beckers et al., 2023). Effective implementation, however, requires integrating diverse actors within coherent operational and regulatory frameworks, a challenge still insufficiently addressed. Key contributions include Fioravanti et al. (2025a, 2023), who frame Urban Logistics as a Service (ULaaS) as a comprehensive digital ecosystem with sustainable business models, while Beckers et al. (2023) and Cebeci et al. (2023) emphasise consumers' collaborative roles in last-mile logistics. Other studies highlight crowd-shipping (Cestaro et al., 2025), repurposing Bus Rapid Transit for middle-mile logistics (Ribeiro et al., 2025), technology selection under uncertainty (Puška et al., 2025), autonomous rural LaaS (Hausladen et al., 2023), and transport automation impact assessments (Capkin, 2023), collectively stressing the need for urban-specific LaaS designs addressing spatial, stakeholder, sustainability, and technological considerations.

2.2 Digitalisation and Platform Ecosystems in Urban Logistics

Digital platforms form the technological core of LaaS, enabling resource sharing and service orchestration through standardised interfaces, predictive analytics, and real-time tracking (Fioravanti et al., 2025). They create multi-sided market ecosystems where value grows with participation from municipalities, logistics service providers, and end users (Evans & Schmalensee, 2016), supporting scalable innovations such as crowdshipping, micro-consolidation, and freight pooling. Yet, they also introduce challenges in data interoperability, ownership, and governance: without standard protocols and trust mechanisms, data sharing may be limited, reducing efficiency and sustainability (Fioravanti et al., 2025; Dablanc, 2019). Digitalisation reflects convergence of cloud computing, Industry 4.0, and platform economics, prerequisites for integrated urban logistics shaped by e-commerce demand and cross-sector mobility integration (Dablanc, 2019a, 2019b; Kuzkin et al., 2025). Technical foundations include cloud-based control, distributed coordination, and ontology-based semantic interoperability (Hung, 2019a, 2019b; Temjanovski et al., 2021; Krizhanovsky et al., 2012; Sandkuhl et al., 2013), while cloud logistics represents a

business model transformation rather than purely technological shift (Leukel & Scheuermann, 2014; Ludwig, 2014). Multi-sided platform theory, complemented by X-as-a-Service, the Physical Internet, cyber-physical systems, and Logistics 4.0 frameworks, collectively position digitalisation as the key enabler of modern LaaS ecosystems (Evans & Schmalensee, 2016; Jiao et al., 2024; Pan et al., 2025; Suárez-Riveros et al., 2021; Ilin et al., 2019; Ellinger et al., 1997).

2.3 Governance Challenges in Urban Logistics Platforms

Persistent tensions exist between public governance objectives and private operational priorities: municipalities focus on regulation, safety, and sustainability, while platforms prioritise efficiency and profit. Research often emphasises technical or demand-side aspects, leaving governance underexplored. Beckers et al. (2023) address consumer integration for sustainability but not institutional coordination, and Fioravanti et al. (2025) offer ULaaS concepts without detailing incentive alignment or multi-actor governance. Dablanc (2019) highlights digitalisation but predates platform ecosystems, offering limited guidance on data governance, value creation, or collaboration in shared infrastructures. Addressing these gaps requires frameworks integrating governance, incentives, and interoperable data structures to align platform efficiency with public policy goals. Key governance issues – including stakeholder coordination, regulatory compliance, and multi-sided platform dynamics – remain underdeveloped. While Fioravanti et al. (2025a, 2023) and Beckers et al. (2023) acknowledge governance needs through sustainable business models and consumer participation, regulatory frameworks, power relations, and enforcement mechanisms receive limited attention. Technical contributions such as ontology-based architectures support coordination but largely ignore institutional governance, and platform economics theory remains underapplied to urban logistics. Collectively, despite emphasis on technical and business model dimensions, institutional and regulatory governance remains a critical research gap.

3 Research Gap and Analytical Framework

Despite growing interest in LaaS and ULaaS, research remains fragmented, with most studies focusing on technological architectures (Krizhanovsky et al., 2012; Sandkuhl et al., 2013; Hung, 2019a; Fioravanti et al., 2025) or business and consumer models (Beckers et al., 2023; Fioravanti et al., 2023, 2025a), while governance, incentives, and data-sharing in multi-actor urban contexts are underexplored. Three key gaps emerge. First, governance deficits persist: municipalities define regulatory frameworks, while platforms drive operational innovation, risking misaligned incentives, weak compliance, and reduced legitimacy (Dablanc, 2019). Fioravanti et al. (2025a, 2023) highlight stakeholder coordination but not the mediation of conflicting interests, and platform economics (Evans & Schmalensee, 2016) offers limited guidance for practical urban logistics governance. Second, data-sharing and governance are insufficiently addressed. ULaaS depends on continuous flows among logistics providers, consumers, and authorities, yet semantic interoperability frameworks (Krizhanovsky et al., 2012; Sandkuhl et al., 2013) and cyber-physical systems (Suárez-Riveros et al., 2021; Tian & Hu, 2025) focus on technical coordination without resolving ownership, access, privacy, or power asymmetries. Cloud logistics and Physical Internet concepts (Temjanovski et al., 2021; Ludwig, 2014; Pan et al., 2025) assume extensive data sharing but lack governance mechanisms for equitable, secure, and transparent exchange. Third, public-private coordination gaps remain: studies on automation, crowd-shipping, and technology selection (Capkin, 2023; Cestaro et al., 2025; Puška et al., 2025; Hausladen et al., 2023) note sustainability and safety concerns but do not clarify how authorities can align commercial incentives with congestion reduction, environmental goals, or social equity, with data governance tensions further complicating planning access versus operator confidentiality (Dablanc, 2019b; Beckers et al., 2023).

To address these gaps, LaaS is conceptualised as a governance innovation, integrating actors and governance structures to define roles and decision-making, incentive alignment mechanisms such as pricing, sustainability credits, and performance contracts, and data-sharing architectures for secure, standardised flows combining open urban and proprietary data. Empirical investigation is needed using case-based theory-building (Eisenhardt, 1989) and engaged scholarship (Van de Ven, 2007) to analyse multi-stakeholder ULaaS implementations. Without robust governance and data frameworks, ULaaS risks inefficiency, conflict, regulatory backlash, and data concentration, making a governance-oriented research agenda essential for sustainable, equitable, and publicly legitimate urban logistics platforms.

4 Methodological Approach

Given the fragmentation in LaaS and ULaaS research, particularly regarding governance, incentives, and data-sharing, this study adopts a qualitative, theory-building approach that treats LaaS as a governance innovation rather than purely a technological or business model phenomenon. It focuses on institutional arrangements, stakeholder interactions, and data governance in real-world urban logistics platforms. An exploratory multiple-case study design is used, suitable for investigating complex socio-technical systems involving public authorities, platform

operators, logistics service providers, technology firms, and end users across heterogeneous regulatory and market conditions (Eisenhardt, 1989; Yin, 2018).

Cases are selected based on theoretical variation rather than statistical representativeness, reflecting differences in governance structures, public-sector involvement, and data-sharing practices, including municipal pilots, privately operated platforms under regulation, and hybrid partnerships. Comparative insights from adjacent contexts, such as automation and crowd-shipping, further contextualise governance dynamics (Cestaro et al., 2025; Hausladen et al., 2023).

Data collection relies on triangulation, combining semi-structured interviews with municipal officials, platform operators, logistics service providers, and technology developers, with document analysis of policies, governance guidelines, regulatory frameworks, and technical architecture descriptions. Where available, secondary sources such as sustainability reports are included to validate stakeholder perspectives and examine formal versus informal governance mechanisms (Capkin, 2023).

Analysis follows thematic coding around three dimensions: actors and governance structures, incentive alignment, and data-sharing architectures. Deductive codes draw on existing literature, while inductive coding captures context-specific practices and tensions. The process is iterative and comparative, identifying recurring patterns, divergences, and causal links between governance arrangements, platform performance, and policy objectives, consistent with engaged scholarship principles (Van de Ven, 2007).

Overall, this methodology bridges existing gaps by providing empirically grounded insights into how ULaaS platforms can balance operational agility with public legitimacy, data efficiency with accountability, and private innovation with urban sustainability. It supports both theoretical development and practical guidance for policymakers and platform actors implementing Urban Logistics as a Service (Eisenhardt, 1989; Van de Ven, 2007).

5 Hybrid Governance Framework for LaaS

The analysis of the state of the art demonstrates that LaaS and ULaaS extend beyond technological innovation and represent a fundamental reconfiguration of coordination and control in urban freight systems (Fioravanti et al., 2025; Beckers et al., 2023). Platform-based logistics ecosystems integrate heterogeneous actors – public authorities, logistics service providers, platform operators, and consumers – within shared digital infrastructures, thereby generating new governance challenges related to legitimacy, accountability, and data control (Evans & Schmalensee, 2016; Dablanc, 2019). In response, this chapter proposes a **Hybrid Governance Framework for LaaS**, designed to reconcile public policy objectives with private operational efficiency in multi-actor urban contexts.

5.1 Rationale for Hybrid Governance in LaaS

Hybrid governance refers to institutional arrangements combining hierarchical regulation, market-based coordination, and network-based collaboration. Such arrangements are particularly appropriate for LaaS, where neither traditional public regulation nor purely private platform governance is sufficient to address sustainability, efficiency, and equity objectives simultaneously (Dablanc, 2019a; Fioravanti et al., 2025).

Existing LaaS and ULaaS research implicitly acknowledges governance hybridity through references to stakeholder coordination, sustainable business models, and consumer integration (Fioravanti et al., 2023, 2025a; Beckers et al., 2023). However, governance is rarely conceptualised explicitly, and responsibilities for regulation, operation, and data stewardship remain ambiguous. The proposed framework addresses this gap by formally distinguishing governance functions and allocating them across public and private actors, while preserving the flexibility and innovation potential of platform-based logistics (Evans & Schmalensee, 2016).

5.2 Core Components of the Hybrid Governance Framework

The framework is structured around three interdependent components:

(1) governance and institutional structures,
(2) incentive alignment mechanisms, and
(3) data-sharing and interoperability architectures.

These components correspond directly to the analytical dimensions derived from the literature review.

Governance and Institutional Structures At the institutional level, the framework differentiates between **strategic governance**, **operational governance**, and **oversight mechanisms**.

Strategic governance is primarily exercised by public authorities, who define regulatory conditions, sustainability targets, and minimum service standards for urban freight operations. This role reflects the responsibility of municipalities to manage congestion, emissions, safety, and urban liveability (Dablanc, 2019b).

Rather than directly operating logistics services, public actors function as system stewards, establishing boundary conditions within which platforms can operate.

Operational governance is assigned to platform operators and logistics service providers, who manage routing, consolidation, capacity allocation, and service innovation. This preserves the efficiency advantages of digital platforms and multi-sided markets, allowing platforms to respond dynamically to demand fluctuations and operational constraints (Fioravanti et al., 2025; Evans & Schmalensee, 2016).

Oversight mechanisms connect strategic and operational governance through public–private coordination bodies, contractual arrangements, or platform governance boards. Such mechanisms enable performance monitoring, conflict resolution, and adaptive regulatory adjustment, recognising that urban logistics systems are characterised by continuous technological and organisational change (Beckers et al., 2023; Capkin, 2023).

Incentive Alignment Mechanisms A central challenge identified in the literature is the misalignment between public sustainability objectives and private efficiency-driven decision-making (Dablanc, 2019; Fioravanti et al., 2025). The hybrid governance framework addresses this challenge through incentive-based mechanisms that translate policy goals into operational signals.

These mechanisms include dynamic access pricing, sustainability-linked performance indicators, and incentive schemes rewarding delivery consolidation, low-emission modes, or off-peak operations (Beckers et al., 2023; Puška et al., 2025). Rather than relying solely on command-and-control regulation, incentives are embedded within platform algorithms and contractual arrangements, enabling public objectives to be internalised within private optimisation processes (Evans & Schmalensee, 2016).

Incentive design is thus treated as a governance function. Public authorities define targets and evaluation criteria, while platforms operationalise these incentives through pricing structures and allocation rules, maintaining both accountability and operational flexibility (Fioravanti et al., 2023, 2025a).

Data-Sharing and Interoperability Architecture Data constitutes the central coordinating resource of LaaS platforms, enabling real-time optimisation, predictive analytics, and multi-actor coordination (Fioravanti et al., 2025). At the same time, data governance remains one of the least developed aspects of ULaaS research (Dablanc, 2019; Beckers et al., 2023).

The hybrid governance framework conceptualises data as a **layered resource** rather than a homogeneous asset. It distinguishes between open urban data provided or mandated by public authorities, shared operational data necessary for system-wide optimisation, and protected proprietary data retained by private actors. Technical interoperability is enabled through standardised APIs and semantic frameworks (Krizhanovsky et al., 2012; Sandkuhl et al., 2013), while governance rules define access rights, usage purposes, and accountability mechanisms.

This approach aligns with cloud-based logistics architectures and cyber-physical system concepts, which emphasise distributed coordination without centralised data ownership (Hung, 2019a; Suárez-Riveros et al., 2021). By supporting conditional and purpose-bound data sharing, the framework addresses concerns related to confidentiality, competition, and power asymmetries within platform ecosystems (Evans & Schmalensee, 2016; Dablanc, 2019).

5.3 Public–Private Coordination and Platform Legitimacy

Public–private coordination is a defining feature of the proposed framework. Urban logistics platforms operate at the intersection of private commercial interests and public policy objectives, including congestion reduction, environmental sustainability, and equitable access to goods (Dablanc, 2019b). Hybrid governance enables public authorities to retain visibility and oversight without direct operational control, while providing private actors with regulatory clarity and reduced uncertainty.

This coordination is particularly relevant in emerging domains such as automation, crowd-shipping, and consumer participation, where issues of liability, labour standards, and safety extend beyond traditional logistics governance (Cestaro et al., 2025; Hausladen et al., 2023; Beckers et al., 2023). Hybrid governance allows such challenges to be addressed through adaptive, negotiated arrangements rather than static regulatory instruments.

In summary, the proposed Hybrid Governance Framework for LaaS offers a structured response to the governance and data-sharing gaps identified in the literature. By integrating public authority, private operational control, and differentiated data governance, it enables sustainable and adaptable urban logistics platforms. This framework provides the conceptual foundation for the subsequent empirical analysis of governance arrangements in real-world ULaaS implementations.

6 Discussion: Implications for Urban Logistics Systems

The proposed Hybrid Governance Framework for LaaS emphasises governance in shaping urban logistics, framing LaaS as a socio-technical innovation extending debates on platform coordination, power and accountability (Fioravanti et al., 2025; Dablanc, 2019). A key implication concerns the evolving role of public authorities amid persistent tensions between municipal sustainability objectives and private efficiency-driven imperatives (Dablanc, 2019; Beckers et al., 2023). Hybrid governance positions cities as system stewards, guiding platform behaviour through boundary-setting, incentives and data governance rather than direct operation, building on ULaaS concepts whilst addressing institutional design and power asymmetries previously overlooked (Fioravanti et al., 2023, 2025a), though requiring administrative capacity and introducing coordination costs, particularly for smaller municipalities.

Platform performance depends on both digital infrastructure and governance arrangements influencing data access, participation and incentives. Cloud-based coordination and semantic interoperability remain essential for operational efficiency (Hung, 2019a; Krizhanovsky et al., 2012; Sandkuhl et al., 2013), yet integrating public objectives may reduce short-term efficiency whilst reporting obligations may slow innovation (Evans & Schmalensee, 2016). Data governance functions as both enabler and constraint: whilst platforms rely on real-time data sharing (Fioravanti et al., 2025; Suárez-Riveros et al., 2021), cities require oversight access without compromising proprietary information (Dablanc, 2019b). Standardised APIs and ontology-based interoperability frameworks (Krizhanovsky et al., 2012; Sandkuhl et al., 2013) can enable transparent exchanges, though enforcement, compliance costs and platform resistance remain challenges, reflecting broader issues of data concentration and power in multi-sided markets (Evans & Schmalensee, 2016).

The framework integrates insights from platform economics, digital logistics and urban governance, addressing fragmentation identified in the state of the art (Evans & Schmalensee, 2016; Fioravanti et al., 2025), positioning governance as the central organising principle of LaaS ecosystems. It provides practical guidance for policymakers and platform designers implementing efficient, scalable and publicly legitimate ULaaS systems through regulatory oversight, incentive alignment and shared data stewardship, supporting experimentation whilst mitigating risks of platform monopolisation, regulatory backlash and stakeholder conflict (Dablanc, 2019; Beckers et al., 2023).

The framework has limitations: it is primarily conceptual, abstracting from local political, legal and market contexts whilst assuming institutional capacity and stakeholder collaboration that may not exist in fragmented urban markets. Trade-offs exist: strong public oversight improves legitimacy and sustainability but may reduce responsiveness and deter investment, whilst excessive reliance on voluntary coordination risks platform dominance (Dablanc, 2019; Beckers et al., 2023).

Future empirical research should examine comparative ULaaS case studies, incentive effectiveness such as dynamic pricing or sustainability-linked contracts, and data-sharing agreement structures and enforcement (Beckers et al., 2023; Cebeci et al., 2023; Dablanc, 2019b; Evans & Schmalensee, 2016). Longitudinal studies should track governance evolution as platforms scale, technologies mature and regulatory expectations shift, particularly regarding automation and crowd-shipping (Cestaro et al., 2025; Hausladen et al., 2023). Ultimately, LaaS transformation depends on governance arrangements balancing efficiency, sustainability and legitimacy, with the hybrid governance framework providing a structured approach requiring empirical validation and adaptive implementation across diverse urban contexts.

7 Policy Implications and Recommendations

The emergence of LaaS and ULaaS platforms presents both opportunities and regulatory challenges for urban policymakers. Effective intervention should not rely solely on command-and-control regulation nor defer entirely to market governance. Instead, hybrid governance arrangements are needed to balance innovation, public oversight, and sustainability objectives (Dablanc, 2019; Fioravanti et al., 2025).

Public authorities should act as system stewards, setting clear boundaries for platform operation – including sustainability targets, service quality standards, and access rules – while allowing private actors flexibility in optimisation (Beckers et al., 2023). Municipalities can translate urban freight objectives, such as emission reduction, congestion mitigation, and spatial equity, into platform-compatible requirements, for instance through zoning for micro-hubs, conditional curb access, or differentiated environmental performance standards (Fioravanti et al., 2025a).

Incentive-based regulation should complement this stewardship. Platforms respond more effectively to economic and behavioural incentives than rigid mandates (Beckers et al., 2023; Evans & Schmalensee, 2016). Cities can use pricing, performance-linked contracts, or sustainability subsidies to promote consolidation, low-emission vehicles, and off-peak deliveries. This approach is particularly suited to distributed logistics actors, such as crowd-shipping participants or autonomous services, though schemes must be transparent and monitored to avoid unintended outcomes like market concentration or exclusion of small providers (Cestaro et al., 2025; Hausladen et al., 2023).

Data governance is another critical pillar. While platforms rely on extensive data flows for coordination (Hung, 2019a; Fioravanti et al., 2025), cities require access to operational data for planning and oversight, without

compromising proprietary information (Dablanc, 2019b). Standardised APIs and ontology-based interoperability frameworks (Krizhanovsky et al., 2012; Sandkuhl et al., 2013) can enable secure, transparent data exchange, supported by clear rules on ownership, privacy, and liability.

Finally, hybrid governance requires strengthened institutional capacity. Managing multi-stakeholder ecosystems demands technical expertise, legal knowledge, and cross-departmental coordination. Cities should invest in specialised logistics units, public-private dialogue platforms, and pilot projects to iteratively test and refine governance models (Capkin, 2023; Puška et al., 2025). Inter-city collaboration can reduce fragmentation and support platform scalability, particularly as urban mobility and logistics increasingly converge (Kuzkin et al., 2025).

Overall, the policy implications of LaaS extend beyond efficiency gains to questions of governance, data control, and public legitimacy. Cities that proactively shape platform ecosystems through hybrid governance, incentive-based instruments, and robust data frameworks are better positioned to realise the sustainability and efficiency potential of LaaS while mitigating risks of market power, data asymmetries, and regulatory capture.

8 Conclusion and Future Research Directions

This study examined LaaS in urban contexts, with a particular focus on governance challenges arising from platform-based logistics ecosystems. While LaaS and ULaaS are widely recognised for their potential to improve efficiency, flexibility, and sustainability in urban freight, their implementation remains constrained by unresolved institutional, regulatory, and data-governance issues. The literature review demonstrates a strong emphasis on technological architectures, digital platforms, and service-oriented business models, establishing digitalisation as a necessary condition for contemporary urban logistics coordination. However, digital capability alone is insufficient. In the absence of explicit governance mechanisms, platform-based logistics risk reinforcing fragmented responsibilities, misaligned incentives, and asymmetric power relations among public authorities, platform operators, logistics service providers, and users. To address this gap, the study conceptualises LaaS as a form of governance innovation rather than solely a technological or market-driven model. The proposed hybrid governance framework integrates three interdependent dimensions: actor roles and governance structures, incentive alignment mechanisms, and data-sharing and interoperability architectures. By combining public steering with private operational flexibility, the framework offers a structured approach to aligning platform efficiency with public policy objectives such as sustainability, safety, and spatial equity, while acknowledging the multi-sided nature of urban logistics platforms. The analysis highlights inherent trade-offs in hybrid governance arrangements. Strong public involvement can enhance legitimacy and policy alignment but may increase administrative complexity, while excessive reliance on market coordination risks data monopolisation, regulatory avoidance, and diminished public trust. These findings suggest that ULaaS governance must remain context-specific and adaptive rather than follow a uniform model. From a policy perspective, the results indicate a need for cities to shift from reactive regulation towards proactive ecosystem stewardship, supported by strategic goal-setting, incentive-based instruments, and proportionate data governance frameworks. Institutional capacity within public administrations emerges as a key enabling factor, particularly in managing digital infrastructures and engaging with platform operators. Future research should empirically examine ULaaS implementations to validate and refine governance frameworks, with comparative case studies across diverse urban and regulatory contexts. Further work is also needed on distributional impacts, labour conditions, access equity, and the growing role of data as a strategic resource. Overall, LaaS can contribute significantly to sustainable urban freight systems, but only if accompanied by deliberate and well-designed governance arrangements that recognise its socio-technical and institutional dimensions.

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