



# Planning of urban freight innovation ecosystems: analysing two cities incentives

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## Abstract

The climate crisis has given local authorities an enhanced role to achieve net zero. In this context, the transport sector is seen as a key player as it's hard to decarbonise, especially in the case of urban freight transport as there is a lack of planning frameworks to do so. We look into the literature dealing with freight innovation ecosystems, using a systematic literature review methodology, and formulate a framework of incentives based on those directed at improving the public sector capabilities, those directed at ecosystem actors and those that enhance city conditions to innovate. We then apply the framework to two case studies to strengthen the framework with empirical knowledge.

*Keywords:* urban freight, innovation ecosystems, incentives frameworks.

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## 1. Introduction

Cities are major carbon emitters (UNEP, 2024) and in this context, transport plays a very important role. The global transport sector is responsible for a quarter of EU CO<sub>2</sub> emissions, and while most sectors have started a downward trend to decarbonise, we find that in road transport this is not the case. Considering the 1990's baseline, by which most climatic targets assume their reduction needs, transport has seen an increase in emissions (EEA, 2022). At the same time, traffic is affecting health, well-being and economic efficiency. The 2019 Urban Mobility in the EU Audit estimates in €110 billion the cost of congestion in the EU, around 1% of GDP (ECA, 2019).

Considering freight as a major player in city planning and operation, the Lights Goods Vehicle fleet grows at a 1.7% rate annually (ACEA, 2023) and e-commerce at a 10% rate (Ecommerce Europe, 2022). There are few city freight active mode statistics, and with transport emissions rising, it is unclear how the transport planning sector plans to transition to sustainable transport. Freight and logistics planning is also considered in few European cities' local transport plans. EU guidance was released in 2019 (Aifandopoulou and Xenou, 2019), but it is too early to tell if local policymakers have followed it.

In 2011, Sustainable Urban Mobility Plans were expanded to include logistics-specific SULPs (Sustainable Urban Logistic Plan). SULPS has similar steps and stages. These go

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from preparation and analysis, moving on to strategy development and measure planning (Aifandopoulou and Xenou, 2019). However, only 20% of cities have a planning approach that took urban logistics into account. Also, only 13% of the cities surveyed had a Sulp, and bigger cities are more aware of this planning tool than smaller ones. Nevertheless, the absence of an extensive planning framework aimed at enhancing freight transport in urban areas should not be interpreted as an indication that cities are dismissive or patronising in their efforts to combat climate change. Cities may choose to adopt a more focused or gradual strategy by allocating funds towards trials, projects, or regulations, as a result of several factors including limited resources and insufficient administrative and planning capabilities.

The shift to thinking about freight as a key area for systemic change through the management of innovation ecosystems in cities requires clarity on stakeholders and their roles in organising such ecosystems. With demand for city logistics to triple by 2050 (Van Audenhove et al., 2015), cities struggle to balance job creation and business taxes from increased sales and activity with the social-environmental externalities of more transport-related trips. To increase revenue and comply with environmental regulations, businesses are streamlining and optimising their processes (Cui et al., 2015). However, the institutional setting in which urban freight stakeholders move is disjointed in terms of objectives and sometimes lacks vision as it is mostly based on specific public policies and not in frameworks such as Sustainable Urban Logistics Plans (Sulp). This perhaps makes it the ideal arena or sector in which to experiment in real life settings.

Urban freight mobility systems must be redesigned to align with climate goals (McKinnon, 2021). Technology innovation alone does not solve transitions, according to the literature. A systematic approach to influence current mobility regimes, including “user preferences, policies, technologies, market rules, culture, and regulatory mechanisms” (de Souza et al., 2019), is needed.

Innovation in this sense responds to a co-evolutionary development between niche radical innovation (referring to the development technology that allows for a different trajectory), regimes (sets of rules, regulations, and user preferences that support any system that allows for incremental innovation), and landscapes (macro economy, ideology, and social values) (Geels, 2011). Thus, organising innovation ecosystems can aid the transition to a more sustainable system.

Local governments can plan and manage innovation ecosystems that lead to a more sustainable system. Existing reviews on urban logistics, sustainable logistics and innovation are available (Suominen et al., 2019; Golinska-Dawson and Sethanan, 2023). However, only some focus indirectly on planning of ecosystems by the local public sector. To answer the questions below, a literature review is needed due to the multidisciplinary nature and complexity of urban freight innovation implementation. This will help develop a framework of analysis that can clarify local planning approaches to develop urban freight innovation ecosystems and understand stakeholders' incentives to innovate. It can also help other disciplines beyond urban freight to understand how to include innovation as a key consideration in their decarbonisation pathways.

How cities plan for urban freight innovation can be regarded as the main research question of this paper. While current literature focuses on describing pilots, case studies, and experiences in cities. This research aims at comparing case studies to analyse the structure in which the experiments are designed to capture the variables that had more influence on the success of innovation management. In this paper, it can also be seen the transfer of an idea from city to city and how it is adapted to its peculiarities.

The questions that will guide the paper are:

(Q1) Which fields of the literature deal with planning for innovation ecosystems?

(Q2) What are the main incentives and framework to analyse urban freight innovation ecosystems?

(Q3) How can we look through the lenses of innovation ecosystem frameworks real case studies?

The paper is organised as follows. In Section 2 we define the methodology. In Section 3 we provide the main findings of the review. The section deals with the content analysis based on the clustering of the literature in four distinctive groups and the design of a framework of analysis. In Section 4 we present two case studies based on the SUMP-PLUS project and analyse them under the incentives' framework. Finally, Section 5 concludes by identifying research gaps and avenues for future research.

## 2. Methods

To respond to Q1 and Q2, we will make use of the Systematic Literature Review methodology (add reference). This will help to identify the main currents of thought that deal with the main research topic. In particular we will use a bibliometric approach, which is deemed useful in order to analyse large quantity of data (Donthu et al., 2021). Once streams of knowledge are defined, we will make use of content analysis to explain them and create the incentives framework.

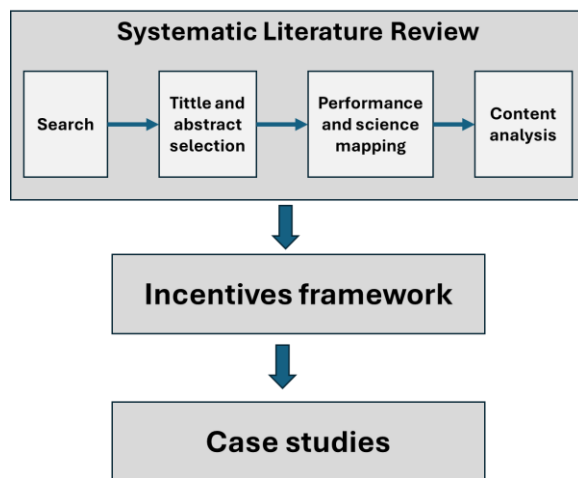


Figure 1: Methodology.

Source: Created by the authors

Finally, we will look into two cities: Antwerp and Lucca who participated in the SUMP-PLUS project in which one of the authors participated and have gained specialists' insights. Additionally, project documents and publications on the topic will be analysed to understand whether the incentives framework bears any relationship with empirical cases (Figure 1).

### 2.1 Bibliometric approach.

Bibliometric is not new to innovation, cities, and freight literature. Sharifi et al. (2023) analyse five decades of urban studies knowledge in the Web of Science. Examples of this methodology can also be seen in climate change and organisational literature (Diaz Tautiva et al. (2024), smart urban governance (Sulistyaningsih et al., 2024), last mile delivery (Ha et al., 2023), innovation ecosystems (Foguesatto et al. 2021).

The bibliometric review methodology includes several steps. The first step includes defining the string search in two large databases, Scopus and Web of Science. Results from the search were downloaded and merged using R Studio.

The bibliometric search was done between February and April 2023. Multiple combinations of words were used iteratively until the final combination was adopted: innovation AND ( transport OR freight OR city AND logistics ) AND public AND policy OR policymaking AND ecosystem OR city AND management for the years 2010-2023. Several exclusions were applied to exclude mainly natural sciences. We found 2098 papers after duplicates were removed.

We conducted a title and abstract selection and which saw papers relating to supply chain, humanitarian logistics and public transport being removed. We ended up with 98 documents, on which we performed bibliographic clustering. If at least one cited source appears in both articles' reference lists, two articles are said to be bibliographically clustered (Aria and Cuccurullo, 2017; Kessler, 1963). The analysis was conducted using the global citation score as impact measure and the walkstrap clustering algorithm was employed. We set the units of analysis on 50 documents to allow for a stronger clustering effect and avoid clusters with less than 10% of total documents.

Clustering and mapping go hand in hand, however both may rely on different techniques (Waltman et al., 2010). The use of the Biblioshiny app based on the Bibliometric R Package (Aria and Cuccurullo 2017) allows for both processes to be aligned. The clusters are shown in a two-dimensional graph according to centrality and impact. Centrality is defined as Callon Centrality index that measures the intensity of links between a given community and other communities. It is an indicator of the importance of the theme across a full set of publications (Yu et al., 2021).

### **3. Findings**

#### *3.1 Performance publication and science mapping analysis.*

Annual growth rates show a steep increase in documents published with almost none published in 2010 (Figure 2). This is in line with other reviews on similar topics where urban freight and innovation topics were almost non-looked at.

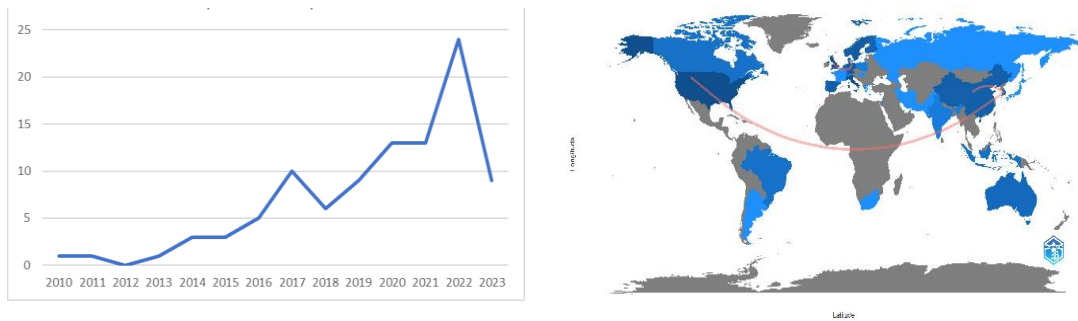


Figure 2: Publication frequency and science mapping

Source: Created by the authors

As regards where papers are published, the analysis shows a concentrated output with CITIES publishing 10.2% of papers and European Planning Studies 9.2%. It can also be appreciated how non-transport related sources such as Economic Development Quarterly, Industry and Innovation, Journal on Urban Technology, Environment and Planning Part A appear in the list, showing the multidisciplinary nature of the object of study.

Table 1: Top journals.

<i>Journal/Sources</i>	<i>N. of papers</i>	<i>% of papers</i>
Cities	10	10.2
European Planning Studies	9	9.2
Research in Transportation Business and Management	5	5.1
Research in Transportation Economics	4	4.1
European Transport Research Review	3	3.1
Case Studies on Transport Policy	2	2.0

Source: Created by the authors

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The University of North Carolina, Molde University in Norway, and Techion in Israel top the ranking as source institutions. Delft University appears in the fifth place. What is interesting is the appearance of several business schools like Copenhagen Business School and NECE, a Research Unit in Business Science in Portugal, a similar trend seen in the type of journals where papers are published. As regards global output we can see in the map those countries with darker blue being the most prolific and those in grey not having output. Country collaboration is limited to the United States, Korea, China and within Europe.

### 3.2 Content analysis on “Specific” Dataset C.

Bibliographic clustering was used to create groupings that would allow for a better interpretation of the database (Table 2). If at least one cited source appears in both articles' reference lists, two articles are said to be bibliographically clustered (Aria & Cuccurullo, 2017; Kessler, 1963). Four distinctive clusters were formed and the most central papers in each are described in the following Sections.

Table 2: Clusters for innovation ecosystems in urban freight.

<i>Cluster Label</i>	<i>Group</i>	<i>Frequency</i>	<i>Centrality</i>	<i>Impact</i>
Entrepreneurial ecosystems - conf 94.7%	1	18	1.95547703	2.30881492
Smart city - conf 73.7%	2	5	1.82342486	2.62741013
Urban freight - conf 100%	3	16	2.05517973	1.79285714
innovation ecosystem - conf 66.7%	4	11	2.07285577	2.2379391

Source or specifications.

#### 3.2.1 Cluster 1: Entrepreneurial ecosystems.

First introduced as “business ecosystem,” the term was later linked to innovation, knowledge, and entrepreneurship in the context of start-ups (Hemmert et al., 2019). The entrepreneurial ecosystem approach emphasizes the external business environment and focuses more on the entrepreneur than the enterprise (Stam, 2015).

In this approach, the public sector's role is secondary (Ferraris et al., 2020). However, local governments still view innovation as crucial for satisfying stakeholder demands and boosting entrepreneurship through stakeholder management, action planning, communication strategies, among others. National policies, public procurement and free education can sometimes promote innovation ecosystems more effectively than local policies, as seen in cities like Tokyo, Seoul, and Beijing (Hemmert et al., 2019).

Access to capital is widely recognized as a critical success factor for entrepreneurs. Frimanslund et al. (2023) identify determinants of finance access, noting that a lack of a track record impedes financing.

Bosma and Stam (2012) classify enabling policies that influence high-growth businesses. These include regulations, finance, culture, demography, and targeted policies like accelerators. The design of such programs can affect funding efficacy, as seen in the United States and Germany (Clayton et al., 2018). Entrepreneurial support organizations also impact ecosystems through leadership, partnerships, mentoring, and joint activities (Harper-Anderson, 2018).

#### 3.2.2 Cluster 2: Smart city.

The ambiguity in smart city research (Mora et al., 2020) and the lack of a general theory (Costales, 2022) highlight the need to consolidate theoretical knowledge to improve smart city strategies. Governments use information and communication technologies (ICT) to provide public products and services, creating smart cities. The most accepted definition involves using ICT to achieve city goals based on institutional and cultural contexts (Abdulkader et al., 2020).

From the city administration perspective, the cluster's main activities are community building, strategic framework, services and applications, and digital infrastructure (Mora

et al., 2020). Local government is seen as the key enabler for Smart Cities, focusing on enhancing government performance and economic growth to meet citizens' expectations (Abdulkader et al., 2020). The aim is to achieve economic development, measured by quality of life and prosperity, with environmental sustainability as an indicator. However, other social measures are less developed (Costales, 2022).

Local governments deliver planning and operational tools, recommendations, and evaluation methods (Mora et al., 2020). Costales suggests the idea of co-development, reformulating city archetypes based on Leminen et al. (2021) study of living labs. These archetypes include city as an organizational learner, city as a neo-liberal seeker, city as a community learner, and city as an investor.

### *3.2.3 Cluster 3: Urban freight.*

The urban freight cluster focuses on urban logistics. Nine documents were analysed, including the top eight and a systematic review by Kervall and Pålsson (2022). The literature primarily addresses planning frameworks and stakeholder engagement.

Sustainable Urban Logistic Plans have replaced traditional frameworks like Local Transport Plans and Sustainable Urban Mobility Plans in Europe. Fossheim and Andersson (2017) contrast Nordic and British practices, noting that freight is typically an appendix in Local Transport Plans, which are legally required but do not mandate a freight section. Marcucci et al. (2017a) show how Turin aligned freight-specific policies with the SUMP.

Stakeholder diversity in logistics is a common theme. Logistic service providers, suppliers, receivers, parish councils, road haulage operators, delivery companies, and heavy cargo vehicles are usually consulted during plan development (Fossheim and Andersen, 2017). Stakeholder participation is crucial. Gatta et al. (2017) propose a three-step strategy for urban freight planning based on a desk approach, use of living labs and modelling.

There is often a gap between stakeholder involvement in planning and actual implementation, as stakeholders may resist adaptation (Gammelgaard et al., 2017). The authors highlight the need for better communication and management during implementation. Lack of communication with logistic stakeholders often leads to project failure (Anand et al., 2021). Identifying added value for each stakeholder group is crucial (Tzokas and Saren, 1997).

### *3.2.4 Cluster 4: Innovation Ecosystems.*

The main concern within this cluster is the lack of empirical research on innovation ecosystems and the concrete steps to organize them (Lingens et al., 2021; Autio, 2022). Innovation ecosystems are distinct due to participant heterogeneity, a coherent system-level output, interdependence between participants, and ecosystem governance (Autio, 2022). Nepelski et al. (2019) found that diverse stakeholders facilitate commercialization.

The orchestrator, responsible for designing alignment and bringing resources, often is a large corporation but can also be the public sector (Sotarauta and Suvinen, 2019) or another key network player (Lingens et al., 2021). A joint value proposition is essential, and ecosystem design must account for environmental conditions (Lingens et al., 2021; Hemmert et al., 2019).

In innovation ecosystems, rival firms often collaborate to establish technical standards. Internal factors affecting selective knowledge transfer include resource modularity and capacity to extract external knowledge, while competitive threats reduce it. Firms can construct a multi-level innovation ecosystem, using methods like establishing an innovation platform and encouraging network effects (Sun and Wei, 2019).

#### **4. Findings**

Entrepreneurs and businesses are central to entrepreneurial and innovation ecosystems, but the public sector also plays a crucial role through geographic regulatory power. Sotarauta and Suvinen (2019) argue that the public sector should lead green growth. Key ecosystem components include ecosystem-supporting organizations, accelerators, agencies, service firms, finance and venture capital firms, and universities (Autio, 2022; Frimanslund et al., 2023). Smart city and urban freight clusters involve technology providers, smart city agencies, and urban logistics stakeholders, requiring triple or quadruple engagement. Ferraris et al. (2020) emphasize the public sector's role in stimulating ecosystems through stakeholder management, action planning, long-term communication strategies, and impact measurement tools. Public procurement and direct contracts, like in Beijing and Seoul, also drive innovation (Hemmert et al., 2019). Entrepreneurial support organizations can impact through referrals, mentoring, partner support, and joint activities (Harper-Anderson, 2018) and public organisations can add value to the ecosystem by providing strategic management, monitoring and knowledge exchange (Sandhu, Al Ameri and Wikstron 2019).

Only the urban freight cluster allows consolidated planning through Sustainable Urban Freight Plans and Sustainable Urban Mobility Plans. Most authors emphasize incorporating stakeholder perspectives into vision formulation, policy selection, and evaluation. Current urban freight planning often overlooks changing freight stakeholders' goals, addressed by agent-based models (Marcucci et al., 2017b; Le Pira et al., 2017). Other clusters, like Mora et al. (2020)'s Smart City approach, need more empirical research.

Autio (2022) compares top-down and bottom-up approaches in innovation ecosystems. The top-down approach requires orchestrators to define value and actors to perform roles, with the public sector overcoming the challenge of persuading ecosystem actors of mutual value growth. This involves stakeholder management and defining benefits

Entrepreneurial and innovation ecosystem literature provides most ecosystem incentives. Bosma and Stam (2012) classify enabling policies for high-growth businesses as regulation (work market flexibility, non-compete agreements), finance (venture capital, informal investors, seed capital), culture (awareness, role models), demography (attracting talent), and targeted policies (accelerators, specific programs). Effective funding relies on program design, as seen in US and German examples (Clayton et al., 2018).

Contextual factors, like those studied by Penco et al. (2020), also incentivize ecosystems. They focus on built-in assets and public policies promoting the city as a knowledge hub. Policies should support innovation dissemination and environment development. Four dimensions—social and talent-cultural, economy and knowledge economy, urban environment and networking, and environmental and infrastructure—provide a framework for external ecosystem incentives.

To sum up, we designed a framework on how cities can incentivise or orchestrate their innovation ecosystems (Figure 3). The first category consists of incentives that emphasise the internal role of the public sector and potential roles for organisations that support ecosystems. Good governance, project management, and policy design are the incentives for the public sector or semi-public organisations to benefit the ecosystem. In contrast, external incentives target the private sector, including research institutions, and consider the ecosystem as a whole. This category includes more general enabling policies like return-to-work incentives or demographic incentives like migration.

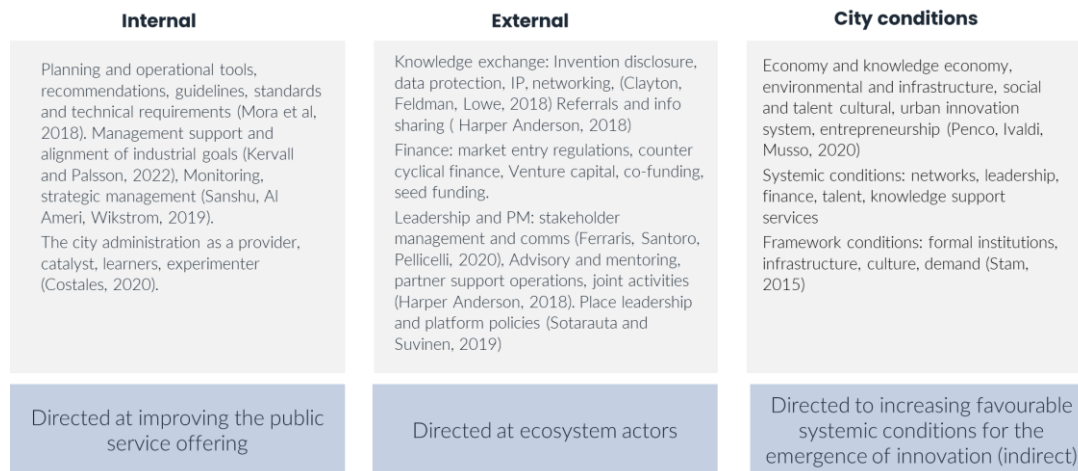


Figure 3: Incentives framework from content analysis.  
Source: Created by the authors

### 5. Case studies: the use of living labs and innovation calls to orchestrate urban logistics innovation ecosystems in Antwerp and Lucca

In the mobility transition literature, we find several concepts related to the public sector approach to innovation. The idea of living labs is to produce innovation by experimenting in real-life settings. Schuurman et al. (2013) provide a good paper including the main characteristics, goals, and categories of living labs. Eschenbächer et al. (2010) look into living lab service offerings and promote thinking on what the best choice of a living lab, managers or designers should go for, however, it lacks a clear answer. Living labs can be single-project endeavours or living lab platforms (Alexandrakis et al., 2022). A similar distinction can be found between product-oriented living labs (Neef et al., 2017) and transition living labs. In the first type (product oriented) a fixed group of actors determines the physical environment in which the experiments will happen, it includes a strong lead that decided and organises the innovation process. We can draw comparisons between product-oriented living lab approaches to single projects or targeted innovation public policy. On the other hand, transition-oriented living labs are set by multiple actors with the city as a whole lab and with longer goals, where strategic learning and feedback are seen as crucial components.

Other tools to plan for innovation at the city level can be the creation of specialised organisations, within the administration, or hybrid organisations. An example could be a local or municipal accelerator (Witte et al., 2018) or special delivery organisations that

can encompass several goals (not only freight) like the London Legacy Development Corporation after the Olympics.

### *5.1 The cases of Antwerp and Lucca in the context of SUMP-PLUS.*

The organisation of the logistics and innovation ecosystems in these cities was promoted, among others, by the SUMP-PLUS (H2020) project. This section presents the main characteristics of such efforts in two European cities, participants of the project: Antwerp in Belgium and Lucca in Italy.

The cities organised their activities in City Labs, whose objectives were to:

- Forge cross-sector links between transport, public services, and commercial activity
- Implement and monitor cutting-edge mobility solutions
- Create new forms of public-private partnerships and business models

#### *5.1.1 Antwerp.*

The municipality of Antwerp is home to a population of 530,504, rendering it the largest urban centre within the Flemish region. The city includes the largest port by tonnage in Europe after combining with the port of Brugges in 2022 (Schuler, 2022). The port serves as a significant contributor to Belgium's economy, generating an additional value of €21 billion, which accounts for approximately 4.5% of the country's Gross Domestic Product (GDP). Additionally, it serves as a significant catalyst for the advancement of innovation and the transportation of goods to and from the port, thereby influencing the accessibility of resources within the city.

The urban area has undergone a significant transformation in terms of transportation governance. The Flemish government established transport regions, which encompassed Antwerp along with 32 additional smaller municipalities. In the process of redefining competencies, it is imperative for both large and small municipalities to establish mechanisms for collaboration. The primary objective of the City Masterplan 2020 is to promote the adoption of sustainable transport modes by enhancing the range of options available to commuters. Additionally, the plan entails significant infrastructural advancements, including the establishment of new parks and the construction of a new ring road. The different scale of planning governance was considered as barriers to the upscaling of innovation to the metropolitan level due to a lack of expertise, different administration practices, and organisations (Halpern., 2022)

In order to accomplish the stated goals, the City employed the research programme of the project and proceeded with the planning for stakeholder engagement and idea generation, as outlined in the forthcoming Sustainable Urban Logistics Plan. The initial phase involved strengthening collaboration with key industry sectors, specifically retail and logistics partners.

The Marketplace for Mobility was initiated by the City of Antwerp in 2016 as part of the PORTIS project. According to Kishchenko et al. (2019), the Marketplace serves as a platform that facilitates partnerships between providers in order to offer various mobility solutions, encompassing both passenger and freight transportation. The mobility solutions must be designed with the objective of facilitating modal shift, time shift, location shift, and technology shift. The partnership options were categorised based on the level of

support they provide, with the order of increasing support being determined by the investment of time and resources.

- Promotional support is provided to companies by the Smart Ways to Antwerp agency in order to enhance the optimisation of their products.
- The City periodically initiates a project call to solicit proposals from companies aimed at mitigating congestion. These proposals are eligible for both financial and non-financial support, which may include promotional assistance.
- The proposed approach entails establishing a long-term partnership through a tender process, wherein the city assumes the role of contract owner for the development of two mobility applications. The primary objective of these applications is to mitigate traffic congestion. This app is called “Smart Ways to Antwerp” and consists of a route planner with active travel and MaaS options.

In the first call, the 4 logistics-related projects selected from the open call impacted the reduction of 2866 road movements per month (Kishchenko et al., 2019). According to the monitoring data of the most recent call in the year 2020/2021, freight operators conducted over 9 thousand trips using utility e-bikes. These trips resulted in the delivery of a total of 16,498 packages in a sustainable manner. Additionally, 15 companies collaborated to enhance their supply efficiency (SUMP-PLUS, 2022).

Antwerp was the only city developing a Sustainable Urban Logistics Plan (SULP) during the entire Fast Track project, which aimed to accelerate sustainable urban mobility innovations (Civitas, 2023). The project allocated funding to Antwerp specifically for the SULP, amounting to 1.5 full-time roles. The city is also receiving external expertise from consultants to establish timelines.

Persistent obstacles in Antwerp, as identified in the project evaluation, include a lack of sustainable business models for micro-logistics hubs and ongoing legal and bureaucratic challenges. Additionally, the absence of sufficient data remains a significant concern, particularly in forming partnerships with the private sector that could provide logistics flow data (Civitas, 2023).

### *5.1.2 Lucca.*

The City of Lucca, situated in the Italian region of Tuscany, accommodates an estimated population of 89,000 individuals. It serves as the administrative centre of the Province of Lucca, which encompasses a total population of 382,000 inhabitants. The city's robust paper industry serves as a catalyst for economic growth while concurrently necessitating heightened freight transportation. Years of excessive PM10 and other gas readings in the city prompted a European Court of Justice case against Italy. Poor air quality improvement is a driver for public policy at the local level. Since then (2010), an Environmental Zone has been defined in the city center with access restriction regulations.

The city centre has experienced a rise in the presence of light vehicles as a result of the recent surge in e-commerce and home deliveries. The increasing presence of logistics vehicles in urban areas poses a threat to various sustainability objectives, including environmental concerns such as air quality and noise pollution, economic considerations such as the cost of logistics and administrative externalities, as well as societal issues such as accidents and conflicts related to accessibility. To deal with these issues in terms of urban planning, the city administration pushed for a number of steps to be taken to

improve logistics in the city and get transport companies to work with the city administration on long-term solutions for sustainable urban mobility.

The City has been trying out new, environmentally friendly logistics ideas for years, working with different groups all the time, but not under the name of a "living lab."

Within the past eight years, they have tested equipment for automatic access control in the restricted city centre area, The Lucca Port Urban Distribution Centre (which is now closed), loading and unloading bay ITS, a public cargo bike sharing service, and an RFID monitoring system that has been added to the next innovation call. It is interesting to note that experiments or new ideas that are thought to be good for people and the environment, like the Urban Distribution Centre, which is expected to have benefits like lowering air pollution by 35% to 80%, might not always be financially viable. The experience has prompted the city to seek alternatives to continue working with the private sector to develop other innovative policies.

In essence, the administration pledges to work with selected operators to provide more sustainable transportation in the city centre by involving them in specific sustainability projects or assisting them in developing their specific projects. In some ways, this is similar to the approach taken by Antwerp with its mobility marketplace. However, an interesting difference is the fact that the operators are identified by exploiting the sustainability ranking of the transport operators authorized to circulate in the Real-Time Zone (RTZ). The innovation call stipulates that certain operators, chosen from those with the appropriate level of ranking, will be invited to discuss city logistics sustainability projects with the city administration.

In this case, the innovation call functions as an award based on the sustainability ranking, as well as the exchange of ideas and discussion of barriers to the implementation of the Municipality's sustainable goods solutions. Points are awarded for static and dynamic parameters, such as the engine of the vehicles used, as shown in Table 3.

Table 3: Static parameters for Eco-points allocations in Lucca.

<i>Emission standard/powertrain</i>	<i>Ecopoints</i>
Euro 3	0
Euro 4	0
Euro 5	20
Euro 6	30
GPL	30
Biogas	30
Hybrid	30
Bi-modal (EV mode)	50
Hybrid PHEV (EV mode)	50
FEV	80

Source: Local administration of Lucca

The dynamic parameters encompass various factors such as the temporal dimension within the RTZ, the frequency of RTZ utilisation, the utilisation of loading and unloading areas, the availability of cargo bike sharing service, and the timing of access (morning or afternoon).

Three categories of freight operators were established: those who depend on fossil fuels for deliveries, those who are in the process of transitioning, and inspirers who obtained

over 50 Ecopoints (representing a mere 3% of the overall total). This final group was the focus of the innovation call.

The initial invitations to participate in the calls were issued to the five most sustainable logistics companies as determined by the ranking in May and September 2021. Amidst those discussions, the matter concerning the utilisation of environmentally friendly vehicles and time constraints came face-to-face with the fact that a rise in the consolidation factor required an update, as it was having an adverse effect on businesses (more trips meant less space in smaller, greener vehicles).

Furthermore, organisations that responded to the inquiry expressed interest in:

1) Parking solutions that effectively address the requirements of logistics operators to park in proximity to delivery points and the city's desire to alleviate congestion on specific streets intended primarily for pedestrian use;

2) improved access time window definitions. It is thought that a better way to solve the problems would be to increase the consolidation factor of light-duty commercial vehicles. This would lower the number of vehicles that are moving around in the city, which would help reach the goals of reducing carbon emissions and pollution from freight transport in cities.

The private sector holds a favourable perception of the awards ceremony, considering it as an intangible element. Sustainable awareness is increasingly important for Social Corporate Responsibility.

## **6. Discussion and application of the framework**

The two case studies demonstrate how local governments approached freight innovation through innovation calls within City Labs, supported by the EU's Horizon research and innovation programme. These cases use a framework of incentives to analyze internal, external, and city conditions, summarized in Figure 4.

Both cities have Sustainable Urban Mobility Plans but not SULPs. Antwerp is developing a Sulp with Fast Track project support, indicating that while high-level strategies can guide transport and logistics innovation, shorter-term initiatives like innovation calls are also effective. Both municipalities leveraged City Labs to collaborate with the sector, using universities and research centers to facilitate discussions and provide expert perspectives. This approach helps urban areas secure external funding to generate ideas and discussions that contribute to project formulation. Municipalities used allocated funds and City Lab participation to experiment with engagement tools like the City Integrator and Mobility Forums.

Mutual learning among City Labs was facilitated through the research and innovation project setting, with Lucca's innovation call influenced by Antwerp's experience. This means that they were able to learn from one city in order to make changes in piloting and adapting in another city. But this does not always happen. As an example, we can see how an urban consolidation center in Lucca didn't work and how it did in Madrid (LEAD, 2023). The implementation of innovation can be influenced by the characteristics and relative position of the city and its stakeholders.

Examining specific innovation call projects shows the city's focus on enhancing the private sector's capacity for innovation in sustainability:

- **Funding:** In Antwerp, funding supports both project-based and long-term initiatives, including human resources. In Lucca, funds were allocated to officers' time and intelligent data gathering for sustainability ranking assessment.

- **Technical Assistance:** Optimizing products, business models, and networking, requiring skilled human resources supported by European Innovation and Research projects.
- **Marketing and Visibility:** Antwerp aids businesses in marketing, while Lucca offers awards to businesses committed to sustainability.
- **Incentives for Operations and Rules:** Opportunities for real-world testing, such as data collection in Antwerp or city center access in Lucca.
- **Reverse Feedback:** Companies with higher sustainability rankings influence future collaboration plans.

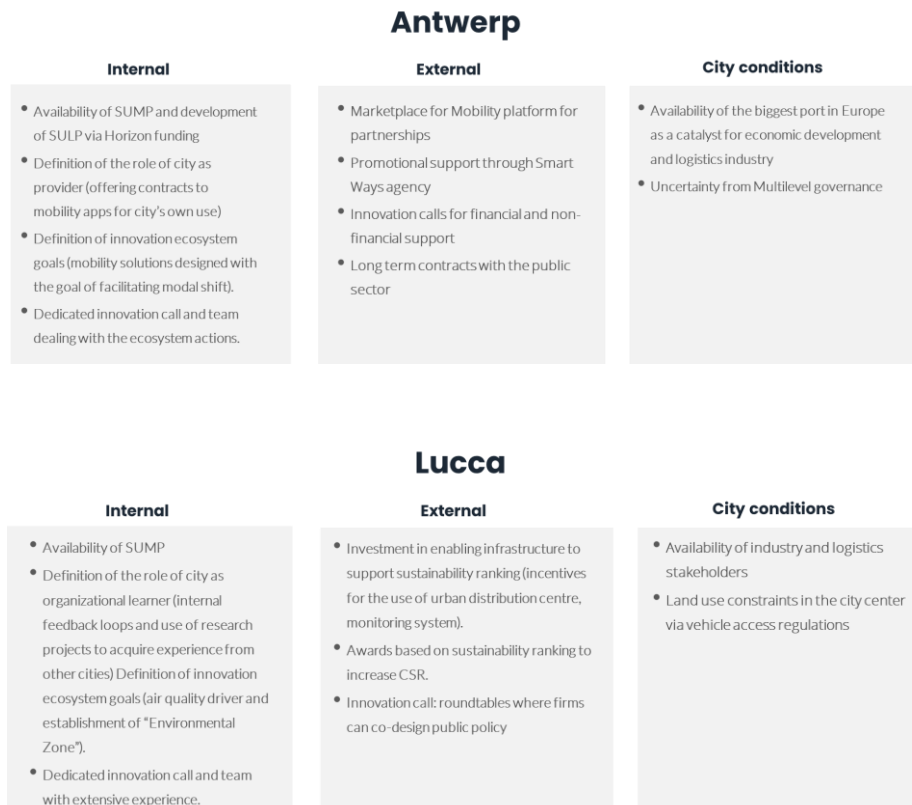


Figure 4: Application of the framework in Antwerp and Lucca.

Source: Created by the authors

Antwerp and Lucca benefited from knowledge sharing, though results vary by city characteristics. For example, an urban consolidation center in Lucca failed, while it succeeded in Madrid. Planning frameworks for innovation, urban freight, and sustainability remain limited (Bjørngen and Ryghaug, 2022), but there's a growing trend for city administrations to facilitate or coordinate ecosystems. Key factors include enhancing knowledge transfer, stable funding, effective marketing, and fostering engagement.

The case studies show the public sector leading sustainability objectives in innovation calls, supported by EU funding (SUMPs and the Mobility White Paper (EC, 2011)). Private sector engagement is motivated by business opportunities, marketing strategies, and Corporate Social Responsibility initiatives. The involvement of citizens and research

institutions, crucial in the quadruple helix approach, needs further exploration. Universities provided substantial support, and citizen engagement was ensured through mobility forums.

Knowledge generation's location is a significant gap, with a need for broader geographical focus beyond Europe, the US, and China. Urban freight innovation ecosystems lack integration, suggesting the need for better planning by local authorities.

Content analysis reveals that the triple bottom line of sustainability requires more practitioner application than research. More analytical and empirical work is needed to determine if entrepreneurial and innovation ecosystem incentives and smart city factors can enhance urban freight collaboration.

This review highlights the public sector's role in urban freight innovation planning, considering urban freight characteristics, entrepreneurial and innovation ecosystems, and smart cities. It aims to help practitioners understand urban freight systems, their actors, and relationships beyond conventional planning methods. The framework's application to two cities bridges gaps in academic literature and grey literature, limited by the search scope and language constraints.

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