City Logistics – A Complex, Yet Manageable System

DOI
https://doi.org/10.18690/um.fl.1.2026.4

ISBN
978-961-299-073-2

Tina Cvahte Ojsteršek
University of Maribor, Faculty of Logistics, Celje, Slovenia
tina.cvahte@um.si

City (urban) logistics involves the management and optimization of distribution processes in urban areas, primarily focusing on the flow of goods, but occasionally also on people and information flows. In urban settings, freight traffic accounts for 10-15% of all distances travelled, causing issues such as congestion, environmental pollution, and road damage. Particularly, the activities of last-mile logistics in cities constitute a significant portion of transportation costs. Managing urban logistics involves various stakeholders, from city authorities, carriers, and merchants to residents and urban planners, all of whom play a crucial role in shaping and implementing effective urban logistic solutions. Solutions in this field can be categorized into soft measures, which focus on improving existing systems without major investments, and hard measures, which involve physical infrastructure changes and require more substantial investments. Some of the most vital measures include concepts like time windows, delivery points, parcel lockers, electric vehicles, consolidation centres, and even modern solutions such as crowdshipping. For smaller cities, which are common in Slovenia, these measures need to be adapted. National guidelines for the preparation of the Urban Logistics Management Plan were recently developed, laying the foundation for holistic and sustainable urban logistics in Slovenia.

Keywords:
city logistics,
freight traffic,
distribution,
sustainability,
traffic flows

Univerzitetna založba
Univerze v Mariboru

1 What is Urban Logistics?

Urban (also known as city) logistics is a complex concept referring to the management and optimization of distribution processes in urban environments. It primarily concerns the flow of goods within city areas, though it occasionally also includes the movement of people and information, especially in the context of smart cities. This chapter explores the need for managing urban logistics, understanding why its effective management is crucial for improving city performance and enhancing the quality of life for urban residents.

Batarlienė and Bazaras (2023) estimate that, in urban environments, freight transport accounts for 10–15% of the total travel distances. As freight flows in cities increase, various issues arise, such as loading and delivery delays, elevated environmental pollution and noise, a shortage of heavy vehicle drivers, road degradation, and more. From a supply chain perspective, last-mile delivery[1] operations account for 28% of total transport costs in supply chains (Papoutsis & Nathanail, 2016). Additional challenges arise when deliveries must occur within narrow time windows due to recipient needs, or when the recipient must be present at home or another designated location (Oršič et al., 2022). According to UN projections, nearly 70% of the world's population will live in urban areas by 2050 (United Nations, 2019), making the issue of urban supply and traffic management increasingly urgent and relevant.

In both practice and literature, various terms are used to describe urban logistics concepts. Cardenas and colleagues (2017), following an extensive review, defined three levels of freight analysis in urban environments (see Figure 1.1). The macro level represents urban logistics in its truest sense and focuses on stakeholder interactions and relationships. Its primary distinction lies in its focus on improving citizens' quality of life. Objectives at this level of urban freight regulation include long-term measures and goals such as land use, emission reduction, and improved urban living conditions. Decision-makers at the macro level, address logistics from a systemic perspective, requiring a holistic approach to challenges—this is strategic-level management. The meso or intermediate level focuses on the distribution of

[1] ***Last-mile delivery:*** Since the term originates from English-speaking contexts where imperial units are used, the expression "last mile" is also most commonly used in Slovenian, even though "last kilometer" might be more accurate. One mile is approximately 1.6 kilometers. The term refers to the very final segment of the journey that goods travel through the supply chain—namely, the delivery to the end user or consumer of a shipment.

goods within urban areas, from the point they enter the city zone. Key challenges are related to transport systems, logistics infrastructure, location decisions, consolidation schemes, storage, the interaction between freight and passenger vehicles and infrastructure, externalities, and the overall efficiency of freight transport management. This level deals with the interplay between transport and logistics systems. The micro level refers to last-mile delivery and pickup operations and focuses on the distribution of goods at the micro level. It covers the final or initial stage of transport within the supply chain. Main goals include, for instance, multi-stop routing problems and restricted access to certain urban areas that lack adequate logistics infrastructure (see Figure 4.1).

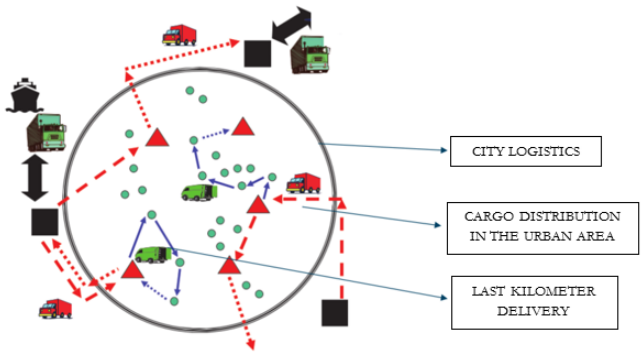

Figure 4.1: Three Levels of Urban Freight Movement
Source: adapted from Cardenas et al. (2017)

1.1 Challenges of Urban Logistics

The growth of freight traffic in urban areas increases congestion, as both goods and passengers add to traffic density. Urban freight distribution faces challenges, includingcongestion, reduced travel speeds, and the need for frequent deliveries due to limited storage capacity in urban environments and the rise of e-commerce. Additionally, there is an increasing demand for reverse logistics in cities—such as recycling—and growing concern over social impacts, including accidents and pollution. Urban areas are subject to strict regulatory pressures due to high population densities and diverse regulations. Together, these factors present challenges that efficient urban logistics must address and resolve (Rodrigue, 2020).

The problems associated with freight traffic in urban environments, and targeted by urban logistics solutions, include:

- Congestion and traffic jams: Freight vehicles contribute to road congestion, leading to longer travel times and increased fuel consumption.
- Air pollution: Freight vehicles, especially those powered by fossil fuels, emit pollutants that degrade air quality and harm public health.
- Noise: Freight traffic generates noise, which can disturb residents and reduce the quality of life in city centers.
- Safety risks: Increased freight traffic density raises the likelihood of traffic accidents, particularly in interactions with pedestrians and cyclists.
- Limited parking and spatial contraints: Freight vehicles often occupy large parking areas, potentially creating shortages for personal vehicles and other users. Providing delivery zones and parking also means limited space for green areas and infrastructure for non-motorized transport.
- Infrastructure wear: Heavy freight vehicles accelerate the deterioration of road infrastructure, and may cause vibrations that negatively affect nearby buildings, leading to increased maintenance costs.
- Energy efficiency: Inefficient urban logistics practices can lead to higher fuel consumption and increased greenhouse gas emissions.

Batarlienė and Bazaras (2023) identified the most important factors influencing urban logistics, ranked in order of importance:

1 Urban road infrastructure
2 Traffic regulations
3 Geographic location of the city
4 Cooperation between city administration and businesses
5 Geographic distribution of businesses
6 Cooperation among businesses
7 Legal frameworks
8 Innovation and information technology

1.2 Stakeholders in Urban Logistics

Key stakeholders in urban logistics include shippers (manufacturers, wholesalers, retailers), receivers (end consumers), public administration (national, regional, and municipal), logistics service providers, city residents, and others (e.g., planners, traffic engineers and carriers, educational institutions, non-governmental organizations) (de Carvalho et al., 2019). These stakeholders are various individuals, organizations, and entities that have an interest in, or influence over the planning, implementation, and management of urban logistics systems.

The roles of the most important stakeholders are outlined below:

- City authorities: Urban managers (e.g., municipal administrations) and urban planning departments are central stakeholders responsible for regulating and shaping urban logistics policies and infrastructure.
- Transport companies: Freight carriers, logistics service providers, and delivery companies are key stakeholders involved in the actual movement of goods throughout urban environments.
- Retailers and businesses: Retailers, wholesalers, and businesses operating in or relying on urban areas are significant stakeholders, as they both generate and receive goods in cities. They are often involved in last-mile delivery planning.
- Residents: City residents are crucial stakeholders affected by urban logistics activities, including noise, pollution, and traffic congestion. Their feedback and behavior can influence logistics strategies.
- Urban planners: Urban planners and architects contribute to the design of urban spaces, including transport infrastructure, distribution centers, and logistics hubs.
- Trade associations: Trade associations representing various sectors, such as retail, manufacturing, and transport often participate in discussions and negotiations related to urban logistics policies and regulations.
- Technology providers: Companies offering technological solutions, such as route optimization software, IoT sensors, and telematics, are stakeholders that enable the implementation of smart urban logistics.
- Non-governmental organizations (NGOs): NGOs with interests in urban planning, sustainability, and transportation can advocate for environmentally friendly logistics practices and can influence urban logistics policies.

2 Strategies and Measures for Managing Goods Flows in Cities

Urban logistics solutions are generally divided into two categories: *soft* and *hard* measures.

Soft measures do not require major investments or infrastructure changes. Instead, they focus on improving existing systems and practices. These include awareness-raising, information sharing, and encouraging cooperation among various stakeholders such as retailers, carriers, and local authorities. Hard measures, on the other hand, involve physical infrastructure changes. These include the construction of new roads, terminals, or warehouses, the introduction of access restrictions, time windows for freight traffic, and other actions requiring significant investment and long-term planning. The acceptability of such measures depends on specific characteristics of each urban environment, especially the factors described earlier.

Based on the requirements for managing flows in cities and a comprehensive literature review, Papoutsis and Nathanail (2016) identified six categories of urban logistics strategies, each with different objectives and elements:

- New distribution and logistics models for operators: Mostly private-sector measures such as off-peak deliveries, consolidation schemes...
- Capacity sharing: Measures in which multiple operators share existing infrastructure or vehicles, e.g., multi-purpose traffic lanes.
- Infrastructure development and vehicle features: Includes ICT-based measures, ITS and vehicle technology, and construction of distribution centers or micro pick-up locations.
- Access control: Measures that restrict access to urban areas based on environmental criteria, vehicle weight, or traffic calming measures.
- Activity-enabling regulation: Regulatory measures imposing limitations on logistics processes such as time windows, parking rules, and related soft measures.
- Enforcement, route optimization, and training: Includes law enforcement, driver training (e.g., eco-driving), and route optimization tools.

These broad strategy categories serve as a framework within which cities plan and implement tailored actions suited to their environments. Based on assessments by urban logistics experts, some of the most impactful measures or initiatives that significantly contribute to regulating distribution flows within city centers can be ranked by importance— from most to least effective (Batarlienė & Bazaras, 2023):

1. Prohibition of heavy vehicles entering the city center,
2. Environmental taxes for urban freight transport,
3. Creation of a network of small self-service terminals on the city outskirts,
4. National incentives for the purchase of environmentally friendly vehicles,
5. Integration of logistics companies into a unified urban freight transport information system,
6. Relocation of large businesses to the urban periphery,
7. Tax relief for businesses cooperating in urban freight transport,
8. Government support for IT adoption and integration into the smart city system.

In the following sections, we describe the most commonly highlighted measures or initiatives in urban logistics and the management of freight flows in urban environments.

Managing and Optimizing Urban Freight Traffic Flows

Managing freight traffic flows involves strategies and practices aimed at directing, controlling, and optimizing the movement of goods from their point of origin to their final destination. In urban contexts, this refers specifically to the movement of goods from their point of entry into the city to their destination, or vice versa. This involves planning optimal routes, selecting the most efficient means of transport, reducing congestion, and improving overall transport efficiency. Optimization focuses on the use of mathematical models, algorithms, and technologies to enhance efficiency and reduce costs associated with freight transport. The goal is to find the best solutions to specific logistical challenges, such as minimizing travel distance, reducing delivery times, and vehicle capacity utilization.

Such initiatives are driven by individual delivery providers and carriers. Examples include: vehicle tracking systems, route optimization software, and similar tools. On the public side, city authorities may implement measures that require changes to delivery patterns. These changes may affect routes, delivery locations, vehicle types, and more.

Most of the measures described in the following sections are at least indirectly aimed at optimizing freight flows within cities.

Time Windows and Other Access Restrictions

Time windows for urban freight deliveries are specific time intervals during which delivery or pick-up of goods is permitted in certain city zones. This is one of the approaches cities employ to reduce traffic congestion, noise, and other negative externalities associated with freight transport in city centers—particularly by minimizing traffic during peak traffic hours.

By restricting deliveries to specific time slots, the number of freight vehicles operating during peak times can be reduced. This, in turn, improves overall traffic flow, lowers emissions, and minimizes noise. Time windows allow carriers to plan and optimize delivery routes more effectively, which can lead to greater efficiency and cost savings when implemented appropriately. While time windows bring numerous advantages – especially in terms of improving urban quality of life for residents and visitors–they may also pose challenges for carriers, who must adapt their operations to meet the restrictions. This may lead to increased costs, such as the need for night-time deliveries or hiring additional staff. Some cities allow flexible time windows that adjust based on traffic conditions, city events, or other factors. Modern technologies such as telematics and advanced fleet management systems enable carriers to better monitor and plan deliveries in accordance with time windows. Sánchez-Díaz et al. (2016) identified a wide spectrum of approaches to encouraging deliveries outside of peak traffic hours. These range from market-driven methods–such as voluntary schemes without specific regulations, congestion-based infrastructure pricing, and incentive-based programs–to more regulatory approaches, such as granting access to freight vehicles outside peak hours, but enforcing (or applying existing) noise level regulations, restrictions on the use of loading/unloading zones at certain hours, or prohibitions that require carriers to deliver at night. On the receiving end, recipients are also affected by the shift to off-peak deliveries, which often means night-time delivery. Sánchez-Díaz et al. (2016) identified three main schemes for receiving night or off-peak deliveries: staffed reception, unattended reception, and facility manager-coordinated reception in large traffic generators. The costs, risks, and reliability of each scheme differ significantly depending on the model chosen.

In addition to time windows, cities implement various access restrictions based on vehicle weight, EURO engine emissions classifications, and similar criteria. For European cities, access restrictions by location are compiled on the website https://urbanaccessregulations.eu/.

Delivery Zones and Related Spatial Restrictions

Delivery zones and other spatial restrictions are integral components of modern urban logistics strategies implemented by city authorities to optimize freight transport in urban centers. Delivery zones are specifically designated areas used exclusively for the loading and unloading of goods. Their locations and dimensions are determined based on analyses of traffic flows, accessibility, and the needs of local businesses. This is one of the easiest measures to implement and primarily addresses the issue of delivery vehicles occupying non-designated spaces. Additional spatial restrictions, such as specific delivery-only zones or prohibitions on freight traffic in certain areas or streets, are introduced to reduce the broader negative impacts of freight transport on the urban environment.

The implementation of such measures brings several advantages for different stakeholders. For shippers and receivers, designated delivery zones contribute to more predictable and efficient delivery processes. These zones are designed to minimize conflicts with other road users, thereby improving safety and reducing space occupation for other transport users.

Hammami (2020) identifies several factors that should be considered when planning delivery zones in urban environments:

- type of businesses and activities in the area;
- size of retail spaces;
- how deliveries are currently made: using existing delivery bays, sidewalks, or other traffic areas—or none;
- type of vehicles used (large truck, small truck, car);
- duration of loading/unloading operations;

- number and schedule of daily/weekly deliveries;
- suitability of placing delivery zones on existing infrastructure.

Parcel Lockers and Other Self-Service Pickup Options

Parcel lockers are automated pickup stations where customers can collect their packages independently. These lockers are typically located at strategic points such as shopping centers, transit hubs, and gas stations, allowing customers to retrieve parcels at their own convenience regardless of courier operating hours. This approach reduces the need for repeated delivery attempts, which, in turn, decreases congestion, and emissions. One notable limitation of parcel lockers is parcel size. Therefore, other self-service points or lockers are often used to accommodate larger or specific types of goods, such as refrigerated items. Some retailers use these points as an alternative to home delivery, allowing customers to collect their orders while commuting or running errands. By introducing parcel lockers, the responsibility for last-mile delivery is effectively shifted from delivery providers to end consumers themselves. This in turn also changes traffic flow patterns. Eliyan et al. (2021) showed that, considering the travel distance by recipients and sufficient locker occupancy, the carbon footprint of parcel delivery can be reduced by up to 50%.

Electric Vehicles and Cargo Bikes

Electric vehicles (EVs) are increasingly being adopted in urban logistics as an alternative to conventional fossil-fuel-powered vehicles. With zero tailpipe emissions and quiet operation, EVs are well-suited for urban areas where air quality and noise pollution are significant concerns. Consequently, city authorities often promote—or even mandate—the use of EVs by offering benefits such as reduced tolls, access to city centers, and dedicated parking zones. However, EVs in urban logistics also face several challenges, including limited driving range, longer charging times, and insufficient availability of fast-charging infrastructure.

A related alternative for performing small-scale delivery tasks or for use in bike-sharing schemes are cargo bikes, especially those with electric assist. These allow for fast and efficient short-distance deliveries while avoiding traffic congestion and vehicular restrictions commonly found in city centers. However, cargo bikes are limited by reduced load capacity, vulnerability to adverse weather conditions, and the physical effort required to operate them, even with electric assistance.

Urban Consolidation Centers

Urban Consolidation Centers (UCCs) are transshipment terminals, usually located on the outskirts of major cities. Their purpose is to optimize infrastructure, operations, and services between interurban and intra-urban segments of the supply chain. At UCCs, goods arriving from outside urban areas are collected and consolidated for last-mile delivery. The main goal of UCCs is to eliminate the need to deliver partial loads to city centers or similar destinations (e.g., construction sites, airports) by providing facilities where shipments are combined for further delivery to urban areas using appropriate vehicles with high load utilization (Gogas & Nathanail, 2017).

Despite their potential environmental and societal benefits, the main obstacle to implementing UCCs is the lack of a sustainable business model. As a result, UCCs are often heavily subsidized and cease operations when subsidies expire (Kin et al., 2016). The challenge is even greater in smaller cities, where achieving the critical mass of users is needed to make such centers financially viable.

A best-practice example of a successful UCC in a smaller city is Lucca, with approximately 80,000 residents and an area of just over 185 km^2. The city center, enclosed by 4.2 km of Renaissance walls, forms the core of a vibrant commercial system with more than 1,400 businesses, leading to significant traffic challenges. Specific traffic measures such as time windows and pedestrian zones are in place in the historic center. In 2005, the LuccaPort Urban Consolidation Center was established. It offers typical services, including transshipment, optimized delivery organization, dedicated warehouses, a fleet of electric vehicles, and advanced ICT services for tracking and information sharing across the logistics chain. LuccaPort performs over 120 daily deliveries, operates at full capacity, and makes about 15 deliveries per trip–representing 15% of urban deliveries and reducing the number of freight vehicles in the historic center by 44% (Foltyński, 2014).

Micro Urban Logistics

Micro urban logistics integrates concepts such as hyperlocal fulfillment and micro consolidation centers. As such, it is becoming a key strategy for optimizing deliveries in city centers (Moline, 2018). The concept involves setting up small, localized distribution hubs within cities that enable faster and more efficient short-distance deliveries, thus reducing dependence on large, centralized warehouses. It allows businesses to respond more quickly, shortens transport times, and reduces delivery costs. Micro logistics also helps reduce traffic and emissions, contributing to a more sustainable urban environment.

A key concept within micro urban logistics is the simplified form of consolidation centers, so-called "microhubs"–small distribution centers or warehouses strategically located in or near city centers. These are designed to collect, sort, and distribute goods in smaller urban areas or districts. Their implementation often includes options for self-service pickup by end customers (Rosenberg et al., 2021). Using microhubs reduces the need for heavy trucks to enter urban centers, as goods can be brought to the hub using larger vehicles and then delivered with smaller, often eco-friendly vehicles such as electric vans, bicycles, or even on foot.

In contrast to larger UCCs typically situated on urban peripheries, microhubs focus more on last-mile delivery and are closer to final destinations. While UCCs serve as collection and sorting points for incoming goods, microhubs function as satellite units that enable faster, more flexible deliveries in city centers–often using bikes, small carts, or walking couriers.

Crowdshipping

Crowdshipping is a concept that involves engaging the public to pick up and deliver parcels, ideally on their pre-planned routes. This means that individuals—such as public transit riders—can act as couriers during their daily routines. In this context, the availability of a large number of ordinary citizens connected by mobile devices has created numerous opportunities for last-mile delivery in a more environmentally friendly manner. However, due to numerous logistical challenges, assigning delivery tasks to the crowd is a complex, multi-layered process (Ghaderi et al., 2022).

A successful pilot project of crowdshipping was conducted in the city of Jyväskylä, Finland. This test involved a crowd-based delivery service using the "PiggyBaggy" platform for book deliveries from the city library between March 15 and April 30, 2014. Despite the low compensation (2–5 euros per delivery), the initiative quickly attracted many drivers, mostly cyclists. Paloheimo et al. (2016) calculated that this system could reduce transport-related resource usage by up to 55% with added benefits such as increased social cohesion and economic savings.

Reverse Logistics

When planning and managing goods flows, the focus is often solely on incoming flows to the city–such as raw materials, deliveries, and support materials–while the importance of reverse flows is often neglected. These include products generated within the city center, waste, and similar outputs. Therefore, it makes sense to integrate urban logistics with the concept of reverse logistics. Reverse logistics refers to the processes and activities related to collecting, transporting, and processing used, unwanted, or surplus products and materials from urban areas back to production or processing centers. This approach is essential for sustainable urban management, as it enables waste reduction, resource optimization, and lower environmental impact (Rubio et al., 2019).

3 Urban Logistics in the Slovenian Context

Urban logistics in Slovenia faces specific challenges, particularly in the context of small towns. Slovenian towns often feature distinctive historical centers characterized by narrow streets, small squares, and unique architecture heritage. These features complicate traffic and difficult access for larger freight vehicles and pose a greater risk of damage to older buildings due to heavy traffic. In smaller towns, the short distances between delivery points require greater flexibility in planning and managing freight flows. Furthermore, due to limited coverage areas and fewer potential customers, the implementation of large-scale or costly logistics measures is challenging because the critical mass needed to justify and sustain these services is often lacking. While larger Slovenian cities have introduced numerous urban logistics improvements–such as urban distribution centers, restricted access zones, and electric delivery vehicles–such solutions must be adapted to suit smaller towns. The use of small electric vehicles or even cargo bikes is more appropriate in small urban environments than larger trucks, which struggle with the spatial limitations of narrow streets. Distribution centers in such towns can be smaller and more flexible, adapted to shorter distances and specific resident needs, or combined with parcel lockers and shared pickup points. Collaborating with local stakeholders is also crucial to developing solutions tailored to the specifics and needs of each town.

In the Slovenian context, National Guidelines for the Preparation of Urban Logistics Management Plans (Lep et al., 2022) were recently developed. According to the Act on Comprehensive Transport Planning (Official Gazette of the RS, 130/22), urban municipalities with more than 100,000 residents are required to prepare an Urban Logistics Management Plan (ULMP), while other municipalities are encouraged to incorporate urban logistics measures into their Municipal Sustainable Urban Mobility Plans (SUMPs). This plan serves as a prerequisite for national co-financing of freight consolidation measures in cities.

The ULMP preparation process consists of seven stages, ranging from preparation and outlining the desired state to analyzing the current situation, defining measures, strategic planning, and long-term implementation. It is vital that the ULMP incorporates a sustainable, long-term vision based on a comprehensive assessment of current and future conditions and involves all relevant stakeholders. The ULMP offers an optimal framework for economic efficiency of urban logistics while promoting a environmental sustainability. Therefore, it is essential to consider combining conventional and unconventional delivery methods, such as electric vehicles, cargo bikes, and the integration of freight and passenger transport. The guidelines for ULMP development recommend that urban freight flows and urban logistics in the Slovenian context focus on the implementation of ICT solutions, restricting freight vehicle access to city centers, stakeholder inclusion, accommodating the demands of e-commerce, and adopting environmentally friendly vehicles.

4 Conclusion

Urban logistics is facing growing challenges as a result of urbanization, increased consumption, and changing consumer habits. Managing freight traffic and deliveries to and from cities is essential for maintaining urban vitality and supporting economic development. Modern approaches to urban logistics management are increasingly supported by digitalization, which plays a key role in optimizing urban logistics.

These technologies enable better delivery route planning, real-time freight tracking, and efficient communication among all stakeholders. Since proper and effective urban logistics management contributes to sustainable development, emission reduction, and improved quality of life in cities, this is a topic of critical importance in today's world.

In small towns–such as many across Slovenia–urban logistics challenges manifest differently. Limited infrastructure, narrow streets, and historic city centers impose additional constraints on delivery planning and execution. Solutions developed for larger cities must be adapted to fit the specific characteristics and needs of smaller towns. In the Slovenian context, it is crucial to combine traditional and modern approaches to ensure an efficient, sustainable, and adaptable urban logistics environment.

References

Batarlienė, N., & Bazaras, D. (2023). Solutions to the Problem of Freight Transport Flows in Urban Logistics. *Applied Sciences*, *13*(7). https://doi.org/10.3390/app13074214

Cardenas, I., Borbon-Galvez, Y., Verlinden, T., Van de Voorde, E., Vanelslander, T., & Dewulf, W. (2017). City logistics, urban goods distribution and last mile delivery and collection. *Competition and Regulation in Network Industries*, *18*(1-2), 22-43. https://doi.org/10.1177/1783591717736505

de Carvalho, P. P. S., de Araújo Kalid, R., Rodríguez, J. L. M., & Santiago, S. B. (2019). Interactions among stakeholders in the processes of city logistics: a systematic review of the literature. *Scientometrics*, *120*(2), 567-607. https://doi.org/10.1007/s11192-019-03149-1

Eliyan, A., Elomri, A., & Kerbache, L. (2021). The last-mile delivery challenge: evaluating the efficiency of smart parcel stations. *Supply Chain Forum: An International Journal*, *22*(4), 360-369. https://doi.org/10.1080/16258312.2021.1918532

Foltyński, M. (2014). Electric Fleets in Urban Logistics. *Procedia - Social and Behavioral Sciences*, *151*, 48-59. https://doi.org/10.1016/j.sbspro.2014.10.007

Ghaderi, H., Tsai, P.-W., Zhang, L., & Moayedikia, A. (2022). An integrated crowdshipping framework for green last mile delivery. *Sustainable Cities and Society*, *78*. https://doi.org/10.1016/j.scs.2021.103552

Gogas, M. A., & Nathanail, E. (2017). Evaluation of Urban Consolidation Centers: A Methodological Framework. *Procedia Engineering*, *178*, 461-471. https://doi.org/10.1016/j.proeng.2017.01.089

Hammami, F. (2020). The impact of optimizing delivery areas on urban traffic congestion. *Research in Transportation Business & Management*, *37*. https://doi.org/10.1016/j.rtbm.2020.100569

Kin, B., Verlinde, S., van Lier, T., & Macharis, C. (2016). Is there Life After Subsidy for an Urban Consolidation Centre? An Investigation of the Total Costs and Benefits of a Privately-initiated Concept. *Transportation Research Procedia*, *12*, 357-369. https://doi.org/10.1016/j.trpro.2016.02.072

Lep, M., Letnik, T., Toplek, S., Klemenčič, M., Kukovec, M., & Kuzmanić, A. (2022). *Zelena mestna logistika za višjo kakovost življenja v mestu: Nacionalne smernice za pripravo Načrta upravljanja mestne logistike*. Ministrstvo za infrastrukturo. https://www.sptm.si/application/files/3816/5389/8518/NacSmernice_NUML_BROSURA_april2022_.pdf

Paloheimo, H., Lettenmeier, M., & Waris, H. (2016). Transport reduction by crowdsourced deliveries – a library case in Finland. *Journal of Cleaner Production*, *132*, 240-251. https://doi.org/10.1016/j.jclepro.2015.04.103

Papoutsis, K., & Nathanail, E. (2016). Facilitating the Selection of City Logistics Measures through a Concrete Measures Package: A Generic Approach. *Transportation Research Procedia*, *12*, 679-691. https://doi.org/10.1016/j.trpro.2016.02.021

Rosenberg, L. N., Balouka, N., Herer, Y. T., Dani, E., Gasparin, P., Dobers, K., Rüdiger, D., Pättiniemi, P., Portheine, P., & van Uden, S. (2021). Introducing the Shared Micro-Depot Network for Last-Mile Logistics. *Sustainability*, *13*(4). https://doi.org/10.3390/su13042067

Rubio, S., Jiménez-Parra, B., Chamorro-Mera, A., & Miranda, F. J. (2019). Reverse Logistics and Urban Logistics: Making a Link. *Sustainability*, *11*(20). https://doi.org/10.3390/su11205684

Sánchez-Díaz, I., Georén, P., & Brolinson, M. (2016). Shifting urban freight deliveries to the off-peak hours: a review of theory and practice. *Transport Reviews*, *37*(4), 521-543. https://doi.org/10.1080/01441647.2016.1254691

Zakon o celostnem prometnem načrtovanju (Comprehensive Transport Planning Act), Official Gazette of the Republic of Slovenia, No. 130/22.