



CHALMERS

Microhubs Impact on Last-Mile Delivery: Improving Efficiency for E-Commerce Companies

Bachelor thesis for International Logistics Program

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PREFACE

Chalmers University of Technology

International Logistics 180 hp

Thesis 15 hp

We would like to extend our sincere thanks to our supervisor, Ivan Dario Cardenas Barbosa, for valuable guidance and feedback throughout the entire process. We would also like to thank the respondents who participated in the interviews and generously shared their experiences and insights. Without their contribution, this study would not have been possible.

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SAMMANDRAG

Den snabba tillväxten inom e-handeln har ökat behovet av effektiva och hållbara lösningar för leveranser på den sista sträckan, särskilt i urbana miljöer. En möjlig lösning är användningen av mikrohubbar – små, strategiskt placerade logistiknoder där gods överförs från större fordon till mindre, utsläppsfria alternativ som lastcyklar eller eldrivna transportfordon. Denna studie har genomförts som ett kandidatarbete inom logistik och urban godstransport med syftet att undersöka mikrohubbars potential i en svensk kontext.

Studien undersöker tre centrala frågor: (1) Vilka är de främsta styrkorna, svagheter, möjligheter och hoten vid implementering av mikrohubbar för last-mile-leveranser? (2) Hur har mikrohubbar implementerats i andra länder, och vilka lärdomar kan svenska företag dra av dessa fall? (3) Vilka faktorer bör svenska e-handelsföretag beakta vid beslut om att använda mikrohubbar för sista kilometers logistik? Undersökningen bygger på en litteraturgenomgång, internationella fallstudier, samt semistrukturerade intervjuer med två branschaktörer. Resultatet presenterades i en SWOT-analys i tre steg, där den första analysen baserades på befintlig litteratur, den andra förfinades genom fallstudier, och den slutliga SWOT-analysen togs fram efter intervjuerna och inkluderade alla tre forskningsmetoder.

Resultaten visar att mikrohubbar kan minska utsläpp, förbättra leveranseffektiviteten och minska trängsel i stadskärnor. Utmaningar som begränsad tillgång till stadsyta samt brist på samverkan mellan logistikaktörer kan dock försvåra implementeringen. Kommunalt engagemang och flexibel hubbutformning lyfts fram som centrala möjliggörare. Studien är avgränsad till ett svenskt urbant sammanhang och fokuserar främst på privata aktörers perspektiv. Resultaten bidrar till ökad förståelse för hur mikrohubbar kan stödja en mer hållbar och effektiv urban logistik i Sverige.

Nyckelord:

mikrohubbar, last-mile leverans, e-handel

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ABSTRACT

The rapid growth of e-commerce has increased the demand for efficient and sustainable last-mile delivery solutions, particularly in urban environments. One potential solution is the use of microhubs—small, strategically located logistics nodes where goods are transferred from larger vehicles to smaller, emission-free alternatives such as cargo bikes or electric vans. This study was carried out as a bachelor thesis within the field of logistics and urban freight transport, with the aim of exploring the potential of microhubs in a Swedish context.

The study investigates three key questions: (1) RQ1: What are the key advantages, challenges, opportunities, and threats of implementing microhubs for last-mile delivery? (2) How have microhubs been implemented in other countries, and what lessons can Swedish companies learn from these cases? (3) What factors should Swedish e-commerce companies consider when deciding whether to adopt microhubs for last-mile logistics? The research was based on a literature review, international case study analysis, and semi-structured interviews with two industry stakeholders. The result was presented in a three-stage SWOT-analysis, where the first SWOT was based on existing literature, the second was refined by case study analysis. After results from the interviews a final SWOT was made, including all three research methods.

The results show that microhubs can reduce emissions, improve delivery efficiency, and relieve urban congestion. However, challenges such as limited urban space, and a lack of collaboration between logistics actors may hinder adoption. Municipal involvement and flexible hub design are identified as key enablers. The study is limited to a Swedish urban context and focuses primarily on perspectives from the private sector. The findings contribute to a better understanding of how microhubs can support more sustainable and effective urban logistics in Sweden.

Keywords:

microhubs, last-mile delivery, e-commerce

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1. Introduction

The rapid growth of e-commerce has reshaped consumer behavior and placed increasing pressure on urban logistics systems. As customers demand faster and more flexible delivery options, cities are experiencing a sharp rise in last-mile delivery volumes. This has led to growing concerns about traffic congestion, greenhouse gas emissions, and inefficient use of transport capacity. These challenges are particularly prominent in dense urban environments. In many cities, the last mile has become not only the most expensive and inefficient part of the logistics chain but also the most environmentally damaging.

To address these issues, researchers and logistics professionals have begun exploring alternative delivery models. One of the most promising innovations is the microhub—a small, strategically located transshipment point within the city. From the microhub goods can be distributed using sustainable vehicles such as electric vans or cargo bikes. Microhubs have already been piloted in several international cities, where results indicate potential for reduced emissions, shorter delivery distances, and improved traffic flow. However, information about successful microhub implementations in Sweden is lacking. The successful implementation of microhubs requires careful coordination between stakeholders, supportive policy frameworks, and tailored solutions that fit the local context.

In light of these developments, this thesis explores the viability of microhubs as a sustainable last-mile delivery solution in Swedish cities. Through a combination of literature review, international case study analysis, a SWOT analysis, and interviews with industry stakeholders, we aim to identify the key strengths, weaknesses, opportunities, and threats of microhub implementation. By focusing on the Swedish e-commerce sector, we seek to provide practical insights and recommendations for companies considering this logistics innovation as a path toward more efficient and environmentally friendly urban freight distribution.

1.1 Background

E-commerce has experienced a significant increase during recent decades, changing consumer buying behavior and creating high demand in the transportation sector (Pahwa & Jaller, 2022a). E-commerce, or electronic commerce, refers to the buying and selling of goods or services via electronic medias, primarily the internet (Vipin Jain et al., 2021). The COVID-19 pandemic has increased the speed of the shift from traditional retail to online shopping (Castillo et al., 2024).

During the last decade, e-commerce sales rate grew with 15% every year. Because of this the number of freight movements keeps growing due to consumers' increasing demands for speed of delivery, same-day deliveries and sometimes same-hour deliveries (Ignat & Chankov, 2020). This growth has put significant pressure on urban logistics, particularly the last-mile segment. This results in a surge in urban deliveries and highlights the need for more sustainable distribution models (Castillo et al., 2024a).

When we began our work, we quickly realized that today's urban delivery systems are not sustainable in the long term. More transport in cities not only increases costs for companies but also burden on the urban environment. This raised questions about how e-commerce deliveries can be made smarter and more sustainable – both from an economic and environmental perspective. We then started looking at alternative solutions and came across the concept of microhubs early on. These have already been tested in several international

cities, where the results point to shorter delivery distances, reduced emissions and more efficient use of vehicles and space. This made us wonder: could microhubs be a sustainable solution for Swedish cities as well? To find out, we needed to understand strengths, weaknesses, opportunities and threats linked to microhubs in a Swedish context – something we analyze using SWOT analysis. At the same time, we realized that there is a lot to learn from other countries implementations. Therefore, we chose to also examine case studies from other countries to identify patterns, success factors and common challenges.

The background to this work thus lies in the need for more sustainable and efficient logistics solutions in line with the growth of e-commerce. By combining theory, international examples, a SWOT analysis, and interviews with stakeholders in the logistics sector, we hope to contribute insights and recommendations to Swedish e-commerce companies that are considering using microhubs.

1.2 Aim of the study

The purpose of this thesis is to evaluate the strengths, weaknesses, opportunities, and threats associated with the implementation of microhubs in urban environments through a multi-stage SWOT analysis. Initially, a SWOT analysis was conducted based on existing literature to establish a theoretical foundation. This was then refined by incorporating findings from case studies, resulting in an updated SWOT analysis that combines theoretical and empirical insights. Finally, a third SWOT analysis was developed, integrating information from interviews with industry professionals to provide a comprehensive and practice-oriented evaluation. By progressively combining literature, case studies, and interview data, the study aims to offer actionable insights and provide strategies for Swedish e-commerce companies on implementing microhubs in Sweden.

1.3 Research questions

RQ1: What are the key strengths, weaknesses, opportunities, and threats of implementing microhubs for last-mile delivery?

RQ2: How have microhubs been implemented in other countries, and what lessons can Swedish companies learn from these cases?

RQ3: What factors should Swedish e-commerce companies consider when deciding whether to adopt microhubs for last-mile logistics?

1.4 Delimitations

This thesis will be limited to only looking at the economic efficiency (costs, time) and environmental sustainability (emissions, noise, congestion) of micro hubs in cities. The thesis solutions and recommendations will be limited to e-commerce in Swedish cities. The social aspect will not be included.

2. THEORY

In this part the theory will be presented.

2.1 Last-Mile Delivery

Last-mile delivery – the final transport leg from the distribution point to the end customer – is widely recognized as the most costly and inefficient part of the supply chain (Silva et al., 2023a). As e-commerce grows rapidly, the volume of intra-city transport is also increasing, posing significant economic and environmental challenges. Last-mile deliveries are often made by diesel trucks that drive directly from central warehouses to customers, leading to increased congestion, emissions and noise in urban areas (Sochor et al., 2023a).

Studies show that delivery vehicles today use an average of only 50% of their capacity, largely due to limited access to loading zones and inefficient route planning. In addition, up to 62% of travel time is spent parked at the curb while packages are delivered on foot (Silva et al., 2023a). This contributes to congested urban environments and increased costs.

Demand for last-mile deliveries is expected to increase by 78% globally by 2030, underscoring the need for innovative and sustainable solutions (World Economic Forum, 2020). One option that has received increasing attention is the implementation of so-called microhubs – small, strategically located logistics nodes that enable the consolidation of goods and the transition to more sustainable means of transport in the last stage of delivery (Pahwa & Jaller, 2022a).

2.2 Microhub definition



Figure 1: Delivery of goods with microhub

The term microhub is used to describe a small logistics node located in urban areas, close to the end customer. The purpose is to act as a transshipment point where goods from larger vehicles can be sorted and distributed further using more flexible, sustainable means of transport such as electric bicycles or light electric vehicles (Castillo et al., 2024b). The terminology varies with terms such as urban consolidation center (UCC), city-hub, micro-terminal, and micro-depot. It is worth noting that some sources, for example Klicka eller tryck här för att ange text., distinguish between microhubs and UCCs. They argue that UCCs are typically larger facilities located on the outskirts of urban areas, whereas microhubs are smaller in scale and situated closer to the city center.

However, most definitions share certain common principles; Proximity: The hub is located close to or directly adjacent to densely populated areas with high demand. Size: The microhubs have a smaller physical footprint, with smaller and lighter loads of cargo. Transportation shift: The microhub enables the transition from heavy fossil-fueled vehicles to electric bicycles, walking or other light and emission-free alternatives. Flexibility: Microhubs can be temporary, mobile (e.g. containers), permanent or integrated into existing infrastructure. They can easily be moved or modified which contributes to higher efficiency. One example of a mobile microhub is the Oslo City Hub, located at the port of Oslo which utilizes a shipping container, contributing to lower financial and temporary investment (Katsela et al., 2022).

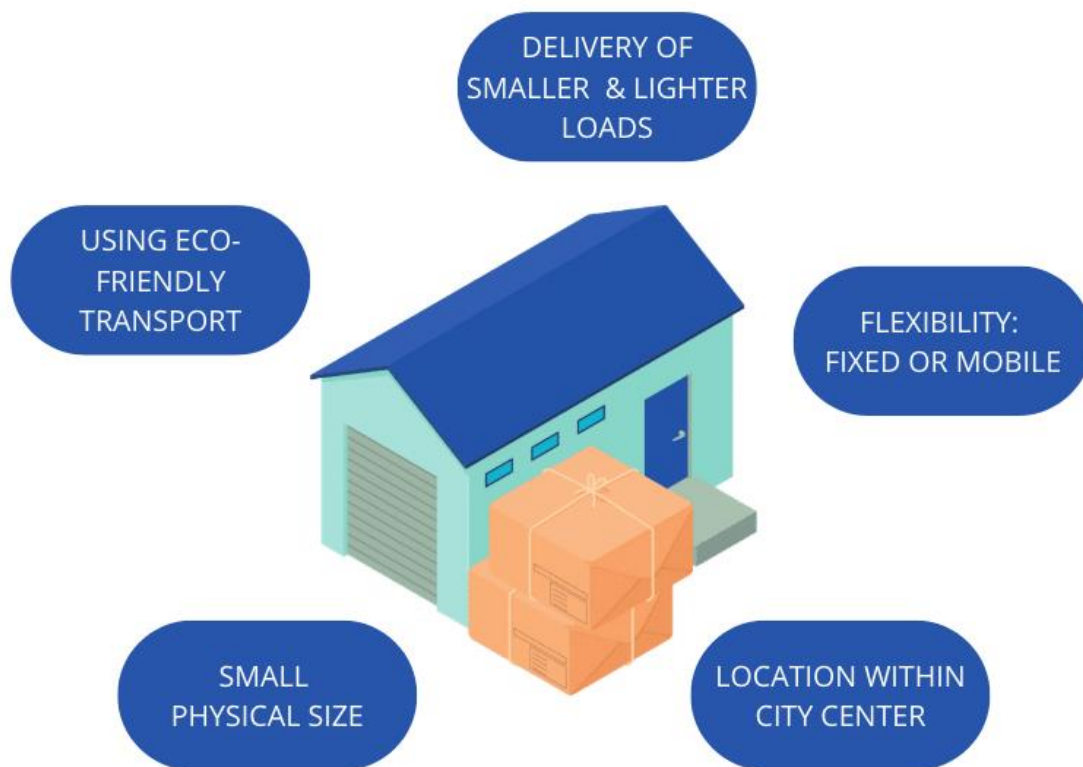


Figure 2: Characteristics of microhubs

Urban Freight Lab (2020) defines a microhub as “a logistics facility within city limits where goods are consolidated before being distributed to a limited number of recipients in a given area, with the aim of enabling low-emission or zero-emission transport”. According to Huang et al. (2020) the microhub is an emerging warehouse model, where small facilities are established near customer-dense areas to serve as a refueling point for vehicles, reducing the number of trips from central warehouses and thereby lowering transportation costs.

Carolyn Kim & Nitish Bhatt (2019) emphasize the smaller physical scale of microhubs compared to traditional UCCs, but with the same function: to enable more efficient and sustainable last-mile logistics. Herrchen et al., (2022a) describe microhubs as both fixed and mobile structures, which can be temporary or permanent. They can function as parcel lockers, distribution areas or service points integrated into, for example, stores. The other sources mentioned above did not however define parcel lockers, service points, or stores as a microhub.

An important characteristic is their ability to reduce dependence on fossil-fueled trucks. By allowing transshipment to alternative modes of transport close to the recipient, microhubs can, according to several studies, reduce driving distances, fuel consumption and emissions – sometimes by up to 80% per delivery (Katsela et al., 2022b). Overall, microhubs can be seen as a tool to address urban logistics challenges through a combination of proximity, consolidation and sustainable transport technologies. They represent a key component of the urban distribution system of the future. The picture below describes different types of last-mile solutions.¹

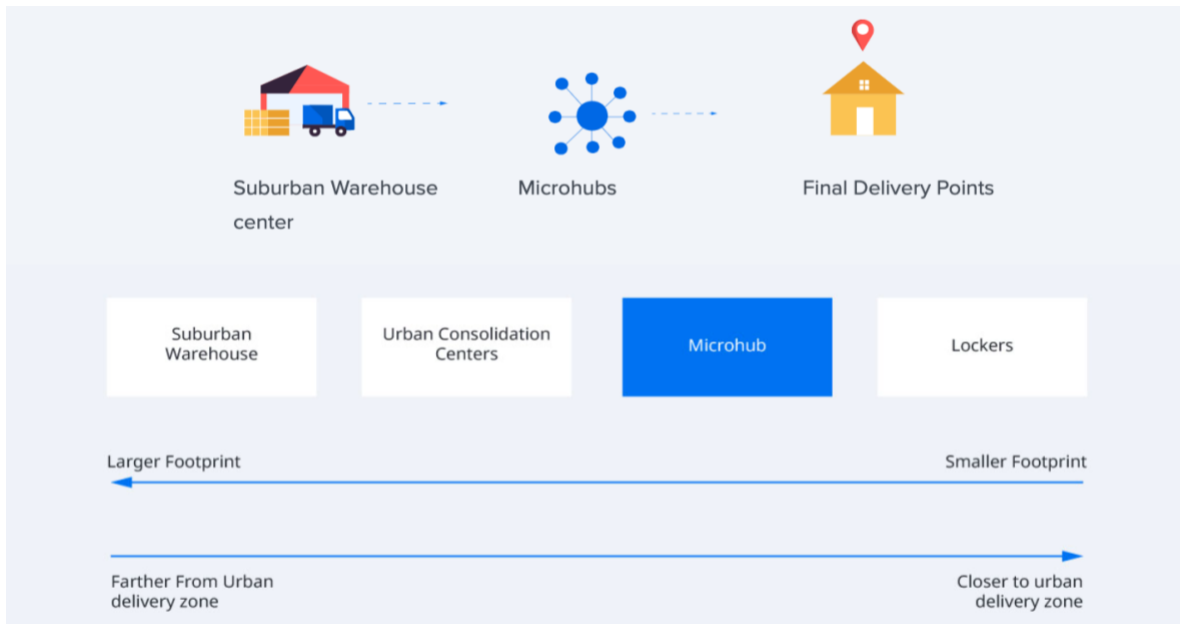


Figure 3: What is a microhub? (Build an Efficient Urban Logistics with Microhubs, n.d.)

2.3 Cargo Bikes

Using microhubs allows the use of sustainable alternative vehicles, such as cargo bikes (Castillo et al., 2024a). Cargo bikes are by definition a bike used for the transportation of goods, passengers or other forms of freight (Vasiutina et al., 2021). It is specially designed for transportation purposes and has been existent for almost a century. Depending on the design, number of wheels, and intended use, cargo bikes can be called different things (Vasiutina et al., 2021). There are post bikes, two-wheelers with cargo space in front of the handlebars and/or behind the saddle. The maximum transport weight is typically 50 to 75 kg. A longtail is equipped with an extended cargo area at the rear. It can be handled like a regular bike with loads up to 50 kg.

Another cargo bike model is the frontloader, where the cargo is located in front of the cyclist, as low as possible. It is also available in versions with multiple axles, with two front wheels for added stability. A trike is a multi-wheeled bike with the largest cargo space, designed to carry loads up to 500 kg. Most modern cargo bikes have electric assistance, but it is not required, thus this solution significantly improves the cyclist's efficiency and working comfort (Nürnberg, 2019). See figure 4.

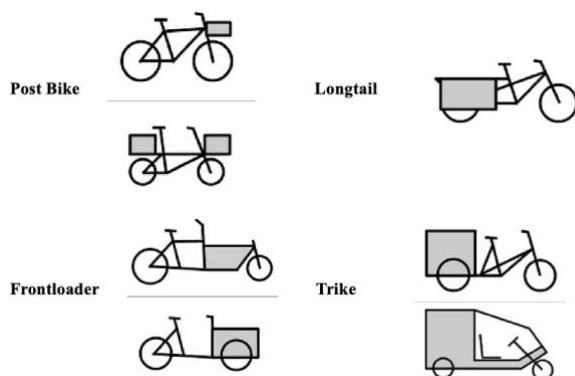


Figure 44: Different types of cargo bikes. (Nürnberg, 2019b)

The use of cargo bikes can reduce congestion in cities as they can use bike lanes and do not get stuck in traffic jams. They also help improve air quality by eliminating emissions (Nürnberg, 2019a). Cargo bikes reduce the use of parking space, as they can park on sidewalks and don't have to park on regular parking spots. They are also flexible and can travel in areas restricted to motorized traffic and through dense streets. Additionally, due to their small size, they contribute to reducing congestion compared to regular last-mile delivery vans (Ceccato & Gastaldi, 2023).

2.4 Microhub Trends

E-commerce is continuously growing which can be regarded as a huge opportunity for microhubs, as there is a higher demand for fast and efficient last-mile services, making microhubs attractive (Hribernik et al., 2020). Stakeholders within e-commerce are competing by offering cheaper and faster deliveries. This increases the pressure of finding cost efficient and sustainable distribution strategies, where microhubs might play an important part (Pahwa & Jaller, 2022a). E-commerce consumers are expecting faster and smoother deliveries, and more customization (Silva et al., 2023b). Microhubs help meet these expectations by enabling faster and more flexible delivery options, including nighttime deliveries or deliveries to specific pickup locations (Pahwa & Jaller, 2022a).

Integration with Sustainable Transport Modes

Another major opportunity associated with implementing microhubs is the possibility to use zero-emissions vehicles. By enabling the switch to low- or zero-emission vehicles, such as electric cargo bikes and light electric vehicles (LEVs), for last-mile delivery, microhubs contribute to greener transportation. De Bok et al., (2024a) states that the implementation of microhubs, in combination with ZEZ-policies which limits delivery to only zero-emission vehicles, can foster more organized, efficient, and greener last-mile logistics.

Cargo bikes present a significant opportunity for microhubs to enhance last-mile delivery by offering a sustainable and space-efficient alternative to traditional delivery vehicles. However, current regulations, particularly weight restrictions on e-assist cargo cycles like, create barriers for businesses looking to integrate them into their logistical operations. One example is regulation 369/09 under the Highway Traffic Act in Ontario, Canada, where the use of power assisted bicycles (PAB) is only permitted to use under 120 kg (Government of Ontario, 2009).

Standardizing and updating these regulations across jurisdictions could unlock the full potential of cargo bikes, allowing businesses to transport heavier loads more efficiently while reducing urban congestion and emissions. Additionally, regulatory improvements could enable more inclusive employment opportunities in cycle logistics by making e-assist functions accessible to individuals with diverse mobility and fitness levels. By addressing these regulatory challenges, cities can better support microhubs in scaling up cargo bike deliveries as a key component of sustainable urban freight (Davis & Figliozzi, 2013).

Real Time Navigation

The Port of Hamburg successfully implemented a system that alerts delivery trucks when a loading zone is occupied. The system redirects the truck to another available loading spot (www.hamburg-port-authority.de, 2025). To manage this, accurate monitoring of loading zone occupation, as well as notifications to the delivery vehicles navigation systems would be necessary (Herrchen et al., 2022b).

Horizontal Collaboration

Horizontal collaboration between competitors can lead to more efficient routes and better resource utilization according to Aktas et al., (2021). Klicka eller tryck här för att ange text. writes that by eliminating overlapping routes, increasing vehicle utilization and coordinating deliveries while maintaining customer service levels, cost savings and environmental benefits can be achieved. Examples of successful collaborations, such as between Morrisons and Ocado in the UK, illustrate the benefits of shared delivery services. Both the UK and Greece show that there is a clear demand for horizontal collaboration to address last-mile challenges (Argyropoulou et al., 2023). Aktas et al., (2021b) states that having shared logistics instead of independent operations can reduce the number of routes with 17% if the vehicle capacity is 10 orders.

Urbanization and Infrastructure

According to the United Nations (2018), more than half of the world's population live in urban areas today. That number is expected to increase to around two-thirds in 2050. The urbanization is continuously increasing, creating a threat to microhubs, as it contributes to space shortage (Pahwa & Jaller, 2022a). Increasing urbanization leads to limited access to suitable microhub locations and higher real estate prices. This makes it hard to establish economic viable microhubs. Additionally, as microhubs are already competing with other businesses for limited urban space, the implementation of new microhubs is threatened (de Bok et al., 2024b).

Uncertain and inadequate infrastructure can hinder the implementation of microhubs, especially when cargo bikes are used for last-mile deliveries. This includes insufficient bike lanes and sidewalks that cannot accommodate both light electric vehicles and non-motorized freight transport, commercial loading/unloading, pedestrians, and bicyclists. Not enough infrastructure for sidewalk and lane space can cause collisions and injuries. To reduce the negative external effects of urban freight, cities need to implement well-thought-out design and planning principles prioritizing pedestrians, bicyclists and shared transportation systems, according to Katsela et al., (2022).

2.5 Efficiency

Microhubs functions as a place where goods from different suppliers can be gathered and sorted before being delivered to the end customers. By consolidating shipments destined for the same recipient, a single vehicle can be used instead of separate vehicles for each supplier. This reduces the number of vehicles in the city, as well as the kilometers driven in the city, according to Heijndeman & Van Amsterdam (2018). Microhubs facilitate the consolidation of goods, meaning that multiple shipments are combined into a single delivery. In addition to streamlining deliveries, microhubs allow for optimizing the delivery route, which according to Katsela et al. (2022b) decreases both the number of vehicles needed and the total mileage. Urban Freight Lab (2020)states that microhubs contribute to improving the overall productivity of urban supply chains. By strategically locating the microhub close to the city center it can facilitate comprehensive distribution that meets the city's daily needs for e-commerce deliveries (Castillo et al., 2024).

The concept of co-loading and consolidation of goods via microhubs is aimed at increasing the filling grade of vehicles. De Bok et al. (2024a) mentions that this reduces the number of vehicles that need to travel the same distances, which in turn lowers the share of empty miles driven. This is because the goods are consolidated at the microhubs, and the last-mile is

carried out with more efficient and often smaller vehicles. This reduces the need for long trips with potentially empty or partially filled larger vehicles in densely populated areas. Consolidation of goods enables a higher filling grade on each delivery trip. De Bok et al. (2024b) also highlights that full collaboration between transport companies is the most advantageous solution in terms of less empty miles driven. Additionally, using microhubs enables a more localized delivery operation, which contributes to shorter average trip distances. This reduces the risk of long distances with empty vehicles.

However, Verlinde et al. (2014) states that microhubs may lead to a drop in service level, as it did in Brussels where TNT Express implemented a microhub. This was mainly caused by the additional time it takes to load the cargo bikes at the microhub. There were however no complaints from customers.

Accessibility

According to (Urban Freight Lab, 2020) microhubs enhance accessibility by enabling last-mile deliveries with smaller, more agile vehicles such as cargo bikes and light electric vehicles. These vehicles can operate in narrow streets and pedestrian zones where larger trucks cannot easily enter and where competition for limited curbside space is high (Urban Freight Lab, 2020). Delivery trucks need curbside space to park or make temporary stops, such as in loading zones, while completing deliveries. In dense urban centers, this space is high demand. Delivery vehicles, taxis, garbage trucks, food trucks and construction workers all compete for access General Manager (2017).

While attempting to find space to unload deliveries, trucks may be forced to circle around a delivery zone to find a place to stop. (Lee et al., 2019) says that fuel costs, air pollutants and emissions then increase. Delivery operators might make illegal stops when curbside space is occupied, resulting in fines and parking tickets for companies. In contrast, cargo bikes can bypass traffic congestion and park closer to delivery points, even in areas inaccessible to larger vehicles (Lee et al., 2019).

Delivery Distance

Setting up more microhubs in a service region will according to (Pahwa & Jaller, 2022a) improve coverage, reduce delivery tour length and distribution costs by an average of 0,81% for every additional microhub. Additionally, splitting service between collection points and microhubs, and using cargo bikes for last-mile delivery can result in lower distribution costs and emissions compared to traditional door-to-door delivery with diesel costs (Pahwa & Jaller, 2022). Implementing microhubs can potentially increase efficiency for freight companies by reducing time, travel distance, and costs. Areas with microhub facilities experience a decrease in total freight vehicle miles traveled (Pahwa & Jaller, 2022a).

In accordance with Urban Freight Lab (2020), microhubs enable off-hour deliveries, improving the productivity of supply chains and cutting costs by up to 35%. Microhubs enable integration with more sustainable transport modes than regular cargo vans. Gunes et al. (2024) states that electric cargo tricycles emit less carbon and occupy less street space compared to regular cargo vans. Packages delivered by electric cargo tricycles indicates 74% fewer vehicle miles traveled compared to regular vans.

A study by (de Bok et al., 2024a) was made analyzing the effects of implementing microhubs for urban transports in Rotterdam through a simulation. The study analyzed how microhubs affect transport kilometers with focus on transport inside a Zero-Emissions-Zone in the city

center. They found that the total transport kilometers were considerably reduced inside the Zero-Emissions-Zone when using microhubs, particularly for transports with vans. Light Electric Vehicles travelled more kilometers in models where they replaced vans, but the total number of kilometers still decreased (de Bok et al., 2024c). See figure with numbers down below:

Total vehicle kilometers travelled inside and outside of the ZEZ per vehicle type.

Scenario	0	1	2	3	4	5	6	7	8	9
Business model	REF	Individual CEP model			Hybrid model			Full-collaboration model		
Mode	VAN	AR	EB	LEV	AR	EB	LEV	AR	EB	LEV
TRUCK	Total	284.8	284.8	284.8	270.3	270.3	270.3	278.9	278.9	278.9
	Inside ZEZ	82.9	82.9	82.9	69.7	69.7	69.7	139.4	139.4	139.4
	Outside ZEZ	201.9	201.9	201.9	200.6	200.6	200.6	139.5	139.5	139.5
	Total KM	958.4	-	-	-	-	-	-	-	-
VAN	Inside ZEZ	776	-	-	-	-	-	-	-	-
	Outside ZEZ	182.4	-	-	-	-	-	-	-	-
	Total KM	-	94.1	-	-	59.6	-	155.9	-	-
AR	Inside ZEZ	-	94.1	-	-	59.6	-	155.9	-	-
	Outside ZEZ	-	-	-	-	-	-	-	-	-
	Total KM	-	1623.2	1663.1	-	1664.5	1689.6	-	893.4	953.4
EB	Inside ZEZ	-	1623.2	1663.1	-	1664.5	1689.6	-	893.4	953.4
	Outside ZEZ	-	-	-	-	-	-	-	-	-
	Total KM	-	-	-	333	-	-	218.5	-	101.3
LEV	Inside ZEZ	-	-	-	333	-	-	218.5	-	101.3
	Outside ZEZ	-	-	-	-	-	-	-	-	-

Figure 5 6: Total Vehicle Kilometers Traveled Inside and Outside of the ZEZ per Vehicle Type. (de Bok et al., 2024c)

2.6 Costs

(World Economic Forum, 2020) says that microhubs can contribute to reducing the unit cost, meaning the total cost of delivering one unit to the end customer including transportation, fuel, labor, handling costs and other operational costs. By consolidating goods closer to the final destination, the deliveries can be streamlined, reducing both total mileage and costs associated with total mileage, according to Pahwa & Jaller (2022b). The use of low- or zero-emission vehicles will also reduce costs significantly, in terms of fuel and maintenance costs. Replacing conventional vehicles will eliminate the use of fuel, eliminating fuel costs, mentioned by Katsela et al. (2022). Low- or zero-emission vehicles such as cargo bikes have lower maintenance costs compared to diesel trucks. Additional costs like parking fees or delivery time restrictions in city centers are also avoided, says Sarah Konrad (2021).

Some cities impose fees on truck operation in Low Emission Zones (LEZs) if they fail to meet particular standards. London has an Ultra-Low Emission Zone (ULEZ) with congestion charges, requiring most smaller vehicles to pay £12.50 if they do not meet emissions standards (Transport for London, 2019). According to this source, the cost of last-mile delivery vary significantly by vehicle type. Figures 5 and 6 respectively show the breakdown under conditions with high and low demand of the average costs for delivery scenarios. They show that cargo cycles have the lowest daily costs, while package cars have the highest. According to Lee et al., (2019) this is mainly due to labor expanses and longer operational times. Additionally, package cars produce up to 53 kg of CO₂ per day, whereas cargo cycles and electric vans generate zero tailpipe emissions.

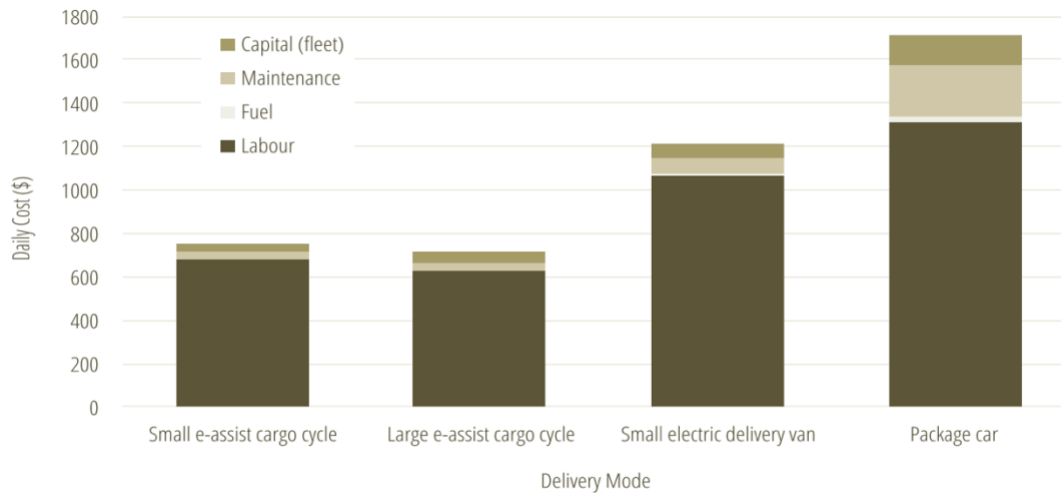


Figure 67: Average scenario costs under high demand conditions. Lee et al., (2019)

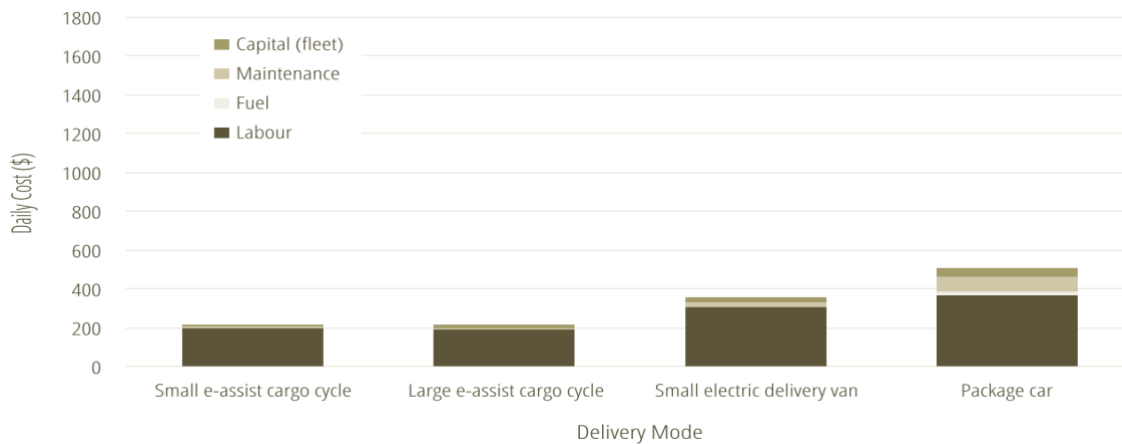


Figure 78: Average scenario costs under low demand conditions. Lee et al., (2019)

Despite the cost savings due to vehicle type, Verlinde et al. (2014) proposes additional costs as a weakness of microhubs. When TNT Express implemented a microhub in Brussels, they discovered a cost increase of 100%. However, only 40% of the microhubs capacity was used, and TNT Express states that the costs have a possibility to decrease as the full capacity is used. The cost increase for terminals, vehicles, and administration is also a fact, according to Verlinde et al. (2014).

Katsela et al., (2022) states that microhubs require investments in infrastructure as well as labor. Microhubs in combination with electric cargo bikes will increase labor costs due to the smaller carrying capacity of cargo bikes. According to Katsela et al., (2022) the usage of cargo bikes can multiply the traveled distance for last-mile. This leads to an increase in the number of drivers and labor hours needed, which increases labor costs. To handle these increased costs, it is suggested by Katsela et al., (2022) to include the costs for external effects, such as reduced CO2 emissions and congestion in the overall financial evaluation. By taking these aspects into account, microhubs may appear more economically sustainable despite the increased direct costs.

Another obstacle for implementing microhubs identified by de (de Bok et al., 2024c) is in what range different stakeholders are willing to face the financial costs in exchange for the advantages microhubs will bring. The distribution costs may increase more significantly if a growing share of parcels is delivered from a limited number of microhubs. While adding more microhubs can improve coverage and reduce delivery times, (Pahwa & Jaller, 2022a) states that it also increases the fixed costs, diminishing the benefits of additional microhubs.

Revenue Generation

Gunes et al., (2024) states that microhubs gives an opportunity for long term financial competitiveness, as they offer alternative sources of revenue and value-added services. This means that microhub stakeholders can strengthen their economic sustainability by diversifying the revenue streams and offering more services than just parcel deliveries. Such services could be warehousing, consignment, unpacking, product preparation for presentation and pricing, as well as waste management, maintenance, and repairs. (Katsela et al., 2022b) highlights that revenue from these services can help reduce delivery prices, making the projects more economically attractive for users.

One example of microhubs offering value-adding services includes Nordstan Cargobike Hub and Oslo City Hub. They offer storage space, warehousing, and order fulfillment for local or online retailers (Ørving & Eidhammer, 2019). Cargo bike couriers also have the opportunity to offer other services, according to (Katsela et al., 2022b). B-Line in Portland offers flexible warehousing and fulfillment services (including cold storage) to third-party retailers, as well as advertising space on its tricycles.

2.7 Environment

The growing e-commerce sets requirements on environmental acts in urban areas. The private car usage elimination in Oslo is a good example of an environmental act (Ørving & Eidhammer, 2019). Gunes et al. (2024) regards microhubs as environmental acts, as they enable the switch to more sustainable vehicles, such as electric cargo bikes. Using microhubs can reduce the number of pollutant vans in city centers, contributing to better air quality, lower emissions of greenhouse gases, and reduced traffic congestion, according to Pahwa & Jaller (2022b).

Emissions

Katsela et al., (2022) states that microhubs can contribute to reducing emissions due to the opportunity to use more sustainable vehicles for last-mile delivery. An area of 5 km² was supplied entirely by electric cargo bikes from a microhub in Stuttgart, Prague, to provide emission-free deliveries to the city center. The delivery goods CO₂ emissions to and from Stuttgart was reduced by 23,35% (Herrchen et al., 2022a).

Another aspect, though, is that e-retailers often outsource the last-mile to provide a high level of service while keeping costs low. The delivery is outsourced to a crowdsourced fleet, or a pick-up point like lockers or stores for customers. This may lead to more emissions in urban environments according to Hur & Won, (2023), due to the increased number of traveled miles with trucks. Electric delivery vehicles and drones are therefore used for last-mile distribution to reduce delivery emissions.

Congestion

Can microhubs contribute to reducing traffic congestion? By optimizing cargo distribution in delivery zones, microhubs can contribute to reducing the total number of vehicles transported

in urban areas. Microhubs offer a designated space for transport providers to optimize load distributions before entering denser market areas. Serving as a consolidation center for not only goods but also vehicles, microhubs diminish the number of vans needed to deliver to end customers, as mentioned by Katsela et al., (2022b).

Space-consuming vehicles and delivery vans for last-mile delivery are usually time-consuming, especially during peak hours, when moving them in dense urban areas. According to Nagappa & Veeraghanti, (2024), reducing the number of these vehicles on the roads will reduce traffic congestion. The usage of microhubs leads to the opportunity to use alternative vehicles such as cargo bikes. Cargo bikes are not affected by traffic congestion and parking problems. They can travel in zero-emission zones, through dense streets, and park on sidewalks. This means that they don't have to park on regular parking spots, reducing the use of parking space (Ceccato & Gastaldi, 2023). As microhubs increase the efficiency of the delivery process, the time spent on roads decreases also leading to less congestion, as mentioned by Urban Freight Lab, (2020).

Noise

According to Sochor et al., (2023), microhubs can contribute to reducing noise in urban areas. The hubs allows for a switch to more sustainable vehicles; these vehicles generally produce significantly less noise than traditional diesel-powered trucks and vans (Gunes et al., 2024). In Stuttgart, Prague, a delivery network was established using two electric trucks and electric cargo bikes, each with a capacity of 250kg. This ensured that all deliveries in the area were made entirely with electric vehicles. Noise pollution was reduced to 69 decibels from the complete use of electric vehicles in Stuttgart city center (Herrchen et al., 2022). By consolidating goods and relocating transshipments points closer to final destinations, large and noisy vehicles are needed less in city centers. Instead, they deliver to the microhubs, where quieter vehicles can handle local distribution (Katsela et al., 2022b).

Safety

One potential weakness of microhubs relying on cargo bikes for last-mile delivery is the lack of sufficient data and infrastructure to ensure safe and efficient operations. Safety concerns exist not only for cargo cyclists but also for other road users, including pedestrians and conventional cyclists who share urban streets and curbside space. While research suggests a 'safety in numbers' effect for cycling, there is little data specific to cargo bikes, making it difficult to assess potential risks (Elvik & Bjørnskau, 2017). Additionally, existing cycling infrastructure is often not designed to accommodate larger cargo cycles according to (Lee et al., 2019), which require wider bikeways for safe maneuvering and passing. Without targeted infrastructure improvements and better data on safety outcomes, the scalability and effectiveness of cargo bike deliveries from microhubs may be limited.

Urban Space

A possible threat to microhubs is the limited urban space. According to Rainer Kiehl, Project Manager for City Logistics at UPS Hamburg, microhubs are not operated city-wide yet mainly because of the difficulty of finding the space. A study about implementation of microhubs in Rotterdam (de Bok et al., 2024b) showed that the lack of public space and high property prices in cities result in competition for space and other activities in the city. According to Urban Freight Lab, (2020), there is also high competition for curbside space in city centers. Herrchen et al., (2022b) states that in case of non-existing loading zones in the city centers, a system for loading zones would need to be developed. This could then lead to

parking spaces being removed. Herrchen further mentions that there's also a threat from historical centers, which could hinder some implementations.

2.8 Government Support

According to Lee et al., (2019), microhubs rely on government support to remain financially viable. The high cost of land in dense urban areas makes it difficult for microhubs to operate without subsidies or incentives. Furthermore, without sustained public funding, microhub initiatives may struggle to scale or maintain long-term operations. Lee continuously stating that dependency raises concerns about their financial sustainability, especially in cities where public funding priorities may shift overtime

Stricter regulations and limitations on freight transport in cities can impact microhub operations and make it more challenging to achieve their goals, as reported by Sochor et al., (2023). The missing European Union standards for electric cargo bikes is threatening to microhub implementation, as they don't include these vehicles in their operational plan. This creates an uncertainty for manufacturers and operators of electric cargo bikes. Clear framework regarding these vehicles is crucial for microhub operations according to Raimondi et al., (2024).

There are areas in city logistics where there is lack of knowledge or where there's uncertainty, particularly regarding the implementation and impact of microhubs. De Bok et al., (2024b) mentions that although microhubs is a well-studied topic in urban logistics, it remains difficult to predict how different microhub configurations impact the transport system in terms of vehicle movements and total distance traveled. Katsela, (2025) states that there is limited understanding of cost structures and revenue streams in urban logistics, which further complicates the large-scale adaption of microhubs. These uncertainties emphasize the need for further research to assess the economic viability and operational efficiency of microhub-based distribution models (Katsela et al., 2022b).

3.METHODS

In this part, the method will be presented.

3.1 Research Strategy

This section outlines the overall research strategy, which integrates a literature review, case study analysis, and interviews to support a three-stage SWOT analysis.

This study employs a qualitative and exploratory research design, aiming to understand the implementation potential of microhubs in Swedish urban logistics. A stepwise method is used, where different types of data sources – theoretical, empirical, and practical – are synthesized through a three-stage SWOT analysis. The process is illustrated in Figure 8 and consists of the following stages:

1. A SWOT analysis based on a systematic literature review (SLR).
2. An updated SWOT including insights from international case studies.
3. A final SWOT integrating interviews with Swedish logistics professionals.

This layered approach allows for both breadth and depth, ensuring that conclusions are grounded in both theory and real-world application.

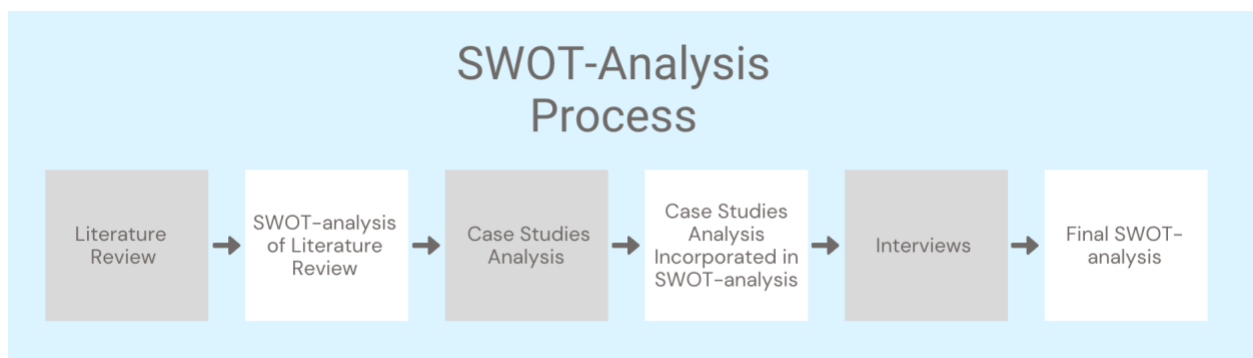


Figure 89: Stepwise Structure of the SWOT-analysis Process.

3.2 Systematic Literature Review (SLR) & Initial SWOT

The research begins with a systematic literature review to gather theoretical insights on microhubs. Based on the findings, an initial SWOT analysis is developed to identify key strengths, weaknesses, opportunities, and threats from a theoretical perspective.

The Systematic Literature Review (SLR) aimed to gather and analyze previous studies on microhubs and their significance in urban freight distribution. Literature reviews play a crucial role in research by constructing a coherent argument based on prior empirical work (Brenda T. McEvoy & Lawrence Machi, 2022). This systematic approach enables a comprehensive examination of the research questions (RQs) by critically engaging with relevant sources.

Following established methodological principles, as outlined by (Denscombe, 2017) the SLR ensures transparency and rigor in the selection of sources. The process incorporates well-defined inclusion criteria and quality assessment measures to reduce potential bias in literature selection. By systematically identifying and evaluating relevant research, the SLR

provides a reliable framework for synthesizing knowledge and advancing the study's objectives.

To ensure a comprehensive and reliable literature review, predefined search criteria were applied to identify relevant academic articles, industry reports, and case studies. The databases used included Google Scholar, Scopus, and the Chalmers Library. The review primarily focused on key aspects of microhub implementation, including **Economic efficiency**: costs analysis and time savings, **Environmental sustainability**: CO2 emissions, noise pollution and traffic congestion. By consolidating findings from existing research, the SLR establishes a solid knowledge base for understanding the operational dynamics of microhubs in urban logistics. Additionally, it lays the groundwork for the case study analysis, ensuring a comprehensive evaluation of both theoretical perspectives and real-world applications. The results of the literature review formed the basis for the first SWOT analysis, identifying theoretical strengths, weaknesses, opportunities, and threats linked to microhub implementation.

3.2.1 Research model

To systematically address the research questions (RQs), this study employs a structured Systematic Literature Review (SLR) methodology. According to Kitchenham et al. (2009), an SLR is a rigorous and replicable approach to synthesizing existing research, ensuring transparency and minimizing bias. The methodology follows a six-step process: (1) defining research questions, (2) determining the required characteristics of primary studies, (3) establishing a baseline sample, (4) selecting pertinent results, (5) synthesizing literature, and (6) reporting findings. Table 1 outlines the research design and associated activities.

Table 1: Research Design and Performed Activities.

Steps	Performed Activity
1) Define research question	RQ1: What are the key advantages, challenges, opportunities, and threats of implementing microhubs for last-mile delivery? RQ2: How have microhubs been implemented in other countries, and what lessons can Swedish companies learn from these cases? RQ3: What factors should Swedish e-commerce companies consider when deciding whether to adopt microhubs for last-mile logistics?
2) Determine required characteristics of primary studies	Inclusion criteria's: - P-reviewed articles, journals and books - Relevant subject matter - Published in English - Full-text availability - Reasonable citation count relative to publishing year
3) Baseline sample	Literature search conducted using Scopus, Google Scholar, and the Chalmers Library with structured search queries.
4) Select pertinent results	Selection of studies based on inclusion criteria defined in Step 2.
5) Synthesize literature	Findings were categorized thematically based on the research questions and summarized accordingly.
6) Report the results	Findings were synthesized into a structured analysis, highlighting key insights relevant to the research questions

3.2.2 Literature Gathering

The literature search and data collection took place in February, 2025 using Google Scholar, Scopus, and the Chalmers Library. To ensure comprehensive coverage of relevant studies, a combined search string was developed, targeting key topics related to microhubs and last-mile logistics. Table 2 presents the structured search strategy.

Table 2: Combined search string used for retrieving literature.

Key Phrase	Keywords RQ1	Keywords RQ2	Keywords RQ3
Microhubs AND Advantages AND Implementation AND Efficiency			
OR	Challenges	Integration	Environment
OR	Opportunities	City	Performance
OR	Threats	Operation	Costs

Following the search, all retrieved studies were filtered based on predefined inclusion criteria. Non-relevant studies were excluded if they did not meet the following requirements:

- Peer-reviewed publication type (journals, books, conference papers)
- Relevance to last-mile logistics and microhubs
- English language publication
- Full-text availability
- Sufficient citation counts relative to the year of publication

The literature obtained from Scopus underwent a multi-step filtering process. Initially, irrelevant studies were removed based on abstract screening, followed by a thorough full-text analysis of the remaining studies. Forward snowballing, a technique recommended by (Wohlin, 2014) was applied to identify additional relevant sources by analyzing references cited in primary studies. Table 3 summarizes the data collection and refinement process.

Table 3: Summary of the Literature Collection Process.

Parameter	Result
Number of retrieved literatures	678
Number of studies excluded by inclusion criteria	420
Number of studies excluded after abstract screening	198
Number of studies excluded after full-text analysis	36
Additional studies included via forward snowballing	7
Total studies included in analysis	31

This structured and systematic approach ensures that only high-quality, relevant studies are included, strengthening the reliability and validity of the research findings

3.3 Analysis of Case Studies & Updated SWOT

In the second phase, 8 international case studies were analyzed to examine real-world implementations of microhubs. The findings are then integrated into the SWOT analysis to update and refine the initial results with empirical evidence.

Case study analysis was used due to its ability to examine a phenomenon in its real-world context, providing a deeper understanding (Rowley, 2002). Case study analysis of eight cities were conducted: Brussels, Oslo, Nijmegen, Yokohama, London, Rotterdam, Miami and Gothenburg. These cities were selected based on their established microhub initiatives, providing diverse examples across different geographic, economic, and regulatory contexts.

The case of Brussels was selected due to its promising results in reducing vehicle kilometers traveled and CO2 emissions. Oslo was included for its strong environmental policies, which were regarded as key drivers for microhub implementation. The Nijmegen case stood out for its receiver-focused approach, offering valuable insights into the shared benefits for all stakeholders. Yokohama was chosen primarily due to the knowledge of the Motomachi Street shopping area being highly congested, and the desire to gain insights of how to streamline such areas.

The case of London was selected for its innovative collaboration between the implementing company and its clients, enabling an expansion of microhub facilities without additional costs. Although the Rotterdam case was a simulation rather than a real-world implementation, it provided valuable insight through its scenario study and projected outcomes. The case of Miami was included to further strengthen the evidence of successful microhub implementation.

Finally, Gothenburg was chosen as a Swedish case, aligning with the overall purpose of this thesis. The analyses were based on information gathered from academic literature and industry reports, focusing on different approaches to microhub implementation. This involved examining operational models, challenges encountered, and outcomes achieved to gain a comprehensive understanding of their impact. When the analysis was conducted, certain factors were considered. Those were what kind of microhub it was, distance to the city center, and what type of vehicle that were used to deliver goods from the microhub.

Table 4: Summary of considered factors of the case study analysis

City	Type of microhub	Distance to city center	Type of vehicles used
Brussels	Trailer	0 km	Electric/human powered vehicles
Oslo	Containers	2,8 km	Electric delivery vehicles and electric cargo bikes
Nijmegen	Receiver-focused approach	1,5 km	Electric cargo bikes and vans driven by natural gas
Yokohama	Unclear	1 km	Low-emission vehicles powered by compressed natural gas
London	Depot or client facilities	Unclear	Electric vans
Rotterdam	Individual or full collaboration	0 km	Electric cargo bikes and autonomous delivery robots
Miami	Unclear	Right outside city center	Electric cargo bikes
Gothenburg	Shopping mall	0 km	Electric cargo bikes

The insights from these cases were used to update the initial SWOT analysis. This second SWOT combined the theoretical findings from the literature review with empirical data from the case studies. This allowed for a more nuanced understanding of how microhubs function in practice and what challenges or enablers exist in different contexts.

3.5 Semi-Structured Interviews with Industry Professionals & Final SWOT

In the final phase, semi-structured interviews were conducted with two professionals active in the Swedish logistics industry. The purpose was to validate and expand on the findings from the literature and case studies, and to provide a Swedish perspective on the potential for microhub implementation. The insights from these interviews are added to the SWOT framework to create a final, comprehensive SWOT analysis that reflects both theoretical and practical perspectives. The interview process is illustrated in Figure 9.

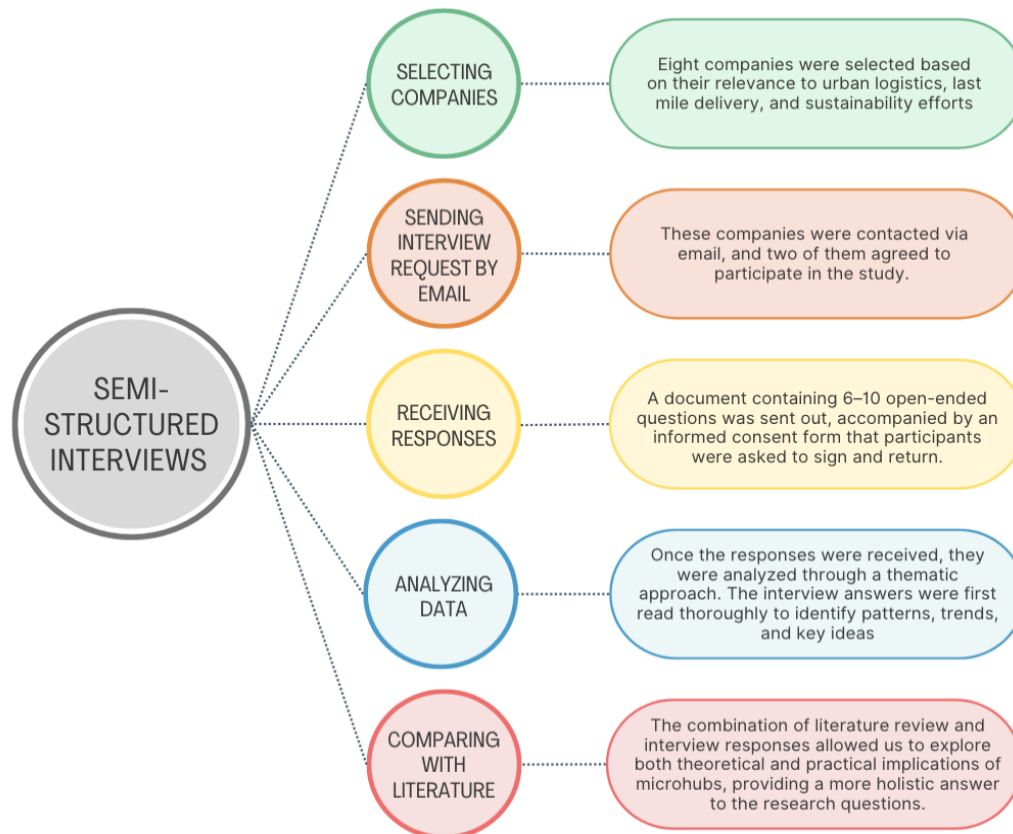


Figure 910: Overview of the Semi-Structured Interview Process.

3.5.1 Selection of Participants

To complement the systematic literature review and gain real-world perspectives on microhub implementation, we conducted semi-structured interviews with professionals in the Swedish logistics sector. Eight companies were selected based on their relevance to urban logistics, last mile delivery, and sustainability efforts. These companies were contacted via email, and two of them agreed to participate in the study. Respondent 1 were a parcel locker company in Sweden, and Respondent 2 were a company in the recycling and waste management sector. Although the number of respondents was limited, both participants offered valuable insights from companies actively working with or interested in microhub solutions. Their contributions serve to ground the theoretical findings in practical experience.

3.5.2 Interview Design and Distribution

The interviews were conducted via email. A document containing 6–10 open-ended questions was sent out, accompanied by an informed consent form that participants were asked to sign and return. The questions covered key areas such as: Views on microhubs and their role in urban logistics, perceived strengths and weaknesses, operational and infrastructural challenges, and future expectations and possibilities for microhubs in Sweden.

Conducting the interviews via email allowed participants to reflect on their responses and answer at a time that suited their schedule. While this format may have limited the opportunity for spontaneous follow-up questions or access to non-verbal cues, it enabled clear and thoughtful written responses.

3.5.3 Data Collection and Analysis Process

Once the responses were received, they were analyzed through a thematic approach. The interview answers were first read thoroughly to identify patterns, trends, and key ideas. Particular attention was paid to how the responses related to the SWOT categories developed in the literature review. Recurring thoughts and reflections were grouped into thematic categories:

- ◆ Views on microhubs in a Swedish context
- ◆ Strengths: Efficiency and sustainability
- ◆ Challenges: Infrastructure, economy and cooperation
- ◆ Future and possibilities in Sweden

These themes form the structure of the results chapter (Section 4.2) and highlight how industry perspectives align with or deviate from findings in previous research. Quotes from respondents were used throughout to illustrate key points and enrich the qualitative data.

We also remained open to identifying new insights or recommendations that may not have been emphasized in the literature. The combination of literature review and interview responses allowed us to explore both theoretical and practical implications of microhubs, providing a more holistic answer to the research questions.

3.5.4 Limitations

One potential limitation of using email interviews is the risk of delayed responses or missed communication due to email issues. Moreover, the lack of direct interaction means that non-verbal cues—such as tone, facial expressions, or emphasis—were not available, which may affect interpretation. Additionally, the small number of participants limits the generalizability of the findings. However, the depth and quality of the responses received offered valuable insights that support the qualitative focus of this research.

3.4 SWOT- Analysis

To present the insights from the different stages of the study, three separate SWOT-analyses were conducted. The SWOT-analysis is a widely used tool, dating back to the 1960s, providing a useful structure for organizing and categorizing information (Phadermrod et al., 2019). By assessing the strengths, weaknesses, opportunities, and threats associated with microhubs in last-mile logistics, the SWOT-analyses provides a detailed evaluation of each factor. This allows for a comprehensive understanding of the elements that influence the success or challenges of such initiatives. It also enables the identification of themes and trends (Phadermrod et al., 2019). This approach was particularly valuable in this thesis as it allowed for the structured evaluation of different patterns and trends related to microhub implementation in other countries.

The first SWOT analysis was based solely on findings from the systematic literature review. The second analysis was expanded to include insights from international case studies of microhub initiatives, enabling a comparative perspective between theoretical knowledge and real-world applications. The third and most comprehensive SWOT analysis incorporated

empirical data from interviews with professionals within the logistics sector. Through this stepwise integration of data sources, the analysis was gradually deepened, allowing for a more nuanced response to the study's research questions.

Each element of the SWOT framework provides insights into key areas of microhubs in last-mile logistics. The identification of strengths, weaknesses, opportunities, and threats of microhubs were conducted using systematic literature reviews (see table 1). Key words were used to retrieve the literature (see table 2).

3.6 Ethics

This section describes the ethical considerations of the study, including informed consent, confidentiality, and avoidance of harm to participants

According to Bell et al., (2019), four key ethical principles should be considered in business research. The first principle is avoidance of harm. This emphasizes the responsibility to ensure that participants are not exposed to any form of harm during the research process. Harm can take various forms, including physical harm, emotional distress, damage to self-esteem or personal development, increased stress, harm to career prospects, or being pressured into engaging in unethical actions.

The second principle is informed consent, which requires that prospective participants receive sufficient information about the study to make an informed decision about their participation. They should fully understand the purpose, scope, and potential implications of their involvement before agreeing to participate. The third principle is privacy, which highlights the importance of protecting the participants' personal information and ensuring their confidentiality throughout the study. Protecting privacy fosters trust and encourages open and honest responses.

The fourth principle is preventing deception. Researchers must avoid misrepresenting the nature of their study or misleading participants in any way. Transparency is essential to maintaining ethical integrity and respecting the trust of those involved. These ethical principles were carefully considered and strictly adhered to throughout the research process. Steps were taken to ensure that participants felt safe and comfortable sharing their insights and experiences openly. Additionally, all participants provided informed consent, demonstrating their full understanding of the study's purpose and their role in it before participating. Participants were anonymous, ensuring privacy and confidentiality, contributing to a more professional and respectful research environment.

4. RESULTS

This chapter presents the findings of the study, based on a combination of three SWOT-analyses, international case studies and qualitative interviews with stakeholders from the logistics industry. The aim is to explore both strategic and practical perspectives on the implementation for last-mile deliveries in Sweden.

4.1 SWOT-Analysis

This chapter presents the results from the three SWOT analyses, offering a structured overview of the strengths, weaknesses, opportunities, and threats associated with microhubs. The first analysis is grounded in findings from the existing literature. Building on this foundation, the second analysis incorporates insights from international case studies to provide a broader contextual understanding. Finally, the third SWOT analysis integrates information from interviews, enriching the evaluation with practitioner perspectives and real-world experiences.

4.1.1 First SWOT-Analysis (Literature)

This part presents the first SWOT-analysis from the systematic literature review.



Figure 1011: SWOT-analysis of microhubs based on existing literature

Strengths

The analysis underscores several pivotal strengths that enhance operational efficiency and sustainability. Firstly, there is an improvement in efficiency, evidenced by a reduction in the number of vehicles required. This leads to fewer empty miles driven and a shorter overall mileage. This operational optimization not only diminishes fuel and maintenance costs but also enables enhanced accessibility for end-users.

Microhubs enhance accessibility by providing secure unloading zones in densely populated urban areas, which in turn reduces the time delivery vehicles spend searching for parking. This leads to a decrease of operational costs and emissions. Research showed an average of 0,81% reduction in distribution costs for each microhub added, particularly when utilizing cargo bikes for last-mile delivery. Additionally, the findings indicate a significant reduction in delivery distance, which in turn correlates with lower carbon dioxide emissions. The use of electric cargo bikes for last-mile deliveries also contribute to this. It also contributes to mitigating traffic congestion in densely populated urban areas.

Microhubs are flexible, capable of adapting to urban logistics challenges while contributing to noise reduction by promoting the use of quieter, electric vehicles. The operational flexibility of mobile microhubs allows for relocations, addressing evolving urban delivery needs without significant infrastructure investment. Collectively, these strengths highlight a structure for promoting environmentally conscious transportation solutions while simultaneously ensuring operational efficiency.

Weaknesses

Despite the potential benefits of microhubs, there are several weaknesses associated with their implementation and operation. One drawback is the additional costs incurred for terminals, new vehicles, administration, and new infrastructure. Establishing and maintaining microhubs requires significant investments, which can impact overall profitability. Microhubs often rely on government support in terms of funding, incentives, and urban planning integration. Without sustained governmental backing, it might be hard to scale and maintain long-term operations. Safety concerns also present a challenge, as frequent transshipment of goods increases the risk of damage and injuries for other road users. Additionally, the use of microhubs may lead to a reduced service level in some cases. The added time it takes to load the cargo bikes at the microhubs is a fact.

Opportunities

Microhubs present several opportunities that can enhance urban logistics and contribute to more sustainable and efficient delivery systems. One key opportunity is the growing demand for sustainable e-commerce solutions. Consumers and businesses increasingly prioritize environmentally friendly logistics. There is also a higher demand for fast and efficient last-mile services which makes microhubs attractive.

Another opportunity is the use of real time navigation for delivery vans. By optimizing operations based on which loading spot is occupied and which are not, logistics providers can improve service quality. Horizontal collaboration between different stakeholders can also maximize the benefits of microhubs. By eliminating overlapping routes, sharing resources like vehicles, and coordinating deliveries, businesses can achieve higher efficiency, reduce costs, and minimize the environmental impact of urban freight transport.

Another opportunity lies in the integration of microhubs with sustainable transport modes such as cargo bikes and electric vehicles. These alternative vehicles reduce the CO2 emissions significantly. Additionally, microhubs offer potential for revenue generation. Offering value-adding services other than only microhub services creates new opportunities for revenue generation.

Threats

The implementation of microhubs faces several substantial threats that may hinder their effectiveness. Competition for urban space presents a significant challenge, as increasing population density has led to over half of the world's population currently residing in urban areas. The increasing urban density contributes to space shortages, resulting in limited access to viable microhub locations and escalating real estate prices, which jeopardize the economic feasibility of new microhubs.

Furthermore, competition for curbside space in city centers worsens these challenges, particularly insufficient infrastructure can worsen these issues, limiting the successful integration of microhubs into existing urban logistics systems. Moreover, regulatory restrictions and a lack of knowledge among stakeholders regarding microhub operations further complicate their development and scalability.

4.2 Implementation of Microhubs Around the World – Case Studies

One important aspect to consider is the location of the microhub. They should be strategically positioned to serve urban areas where deliveries are challenging due to restricted street access, limited curb space for large vehicles, and traffic limitations. Microhubs should be implemented in densely populated, high-demand regions where large volumes of deliveries are concentrated. This is crucial to ensure sustainable and efficient operations in the long term (Urban Freight Lab, 2020). It is advantageous to locate microhubs near major roads and those with high urban speed limits. Additionally, ensuring that trucks can easily access the microhubs is important, as they will need to stock them regularly (de Bok et al., 2024a)

In 2013, TNT Express pilot-tested the implementation of a microhub in Brussels. A trailer was loaded with all the goods for inner city delivery for one day and was transported from a suburban depot during off-hours to a central parking location in the city. This was located at Parc du Cinquantenaire, which is in the city center. The trailer was used as a microhub, fitted with a loading dock, warehouse facilities and an office. Electric or human-powered vehicles deliver the goods from the microhub to the final destination. According to Verlinde et al. (2014) this pilot test resulted in a 24% decrease in CO2 emissions. It also reduced the diesel kilometers traveled per stop from 1,34 km to 0,52 km.

In Oslo, Norway, several microhub pilot projects have been conducted as part of the city's progressive and environmentally friendly policies, which include eliminating private car use in the city center. The Oslo City Hub is one example, a temporary space built with portable containers and operated by DB Schenker. The microhub is located 2,8km from the city center. It facilitates the transfer of goods from larger to smaller electric vehicles, such as electric delivery vehicles and electric cargo bikes, supporting the city's zero-emission goals as well as reducing urban noise and congestion (Ørving & Eidhammer, 2019).

Another example of microhub implementation is in Nijmegen, the Netherlands. A company called Binnenstadservice located the microhub about 1,5 kilometers from the city center and conducted a receiver-focused approach. Receivers, primarily shop owners, request

Binnenstadservice to receive their goods from carriers, store them, and deliver them as needed. This enables cost savings for freight companies as their number of trips into the city reduces. Electric cargo bikes and vans driven by natural gas is used to deliver from the microhub. This service is currently available in eight cities across the Netherlands and has yielded several promising results. It has led to a reduction in both the number of trucks and the total truck mileage within Nijmegen. As a result, residents experience less disruption, and CO2 emissions have decreased by 40% (Van Rooijen & Quak, 2010).

In 2004, a notable initiative took place in Yokohama, Japan, where an association of retail shop owners established a microhub located only one kilometer from the heavily congested Motomachi Street shopping area. This microhub handled 85% of the deliveries to the area. Suppliers delivered parcels to the hub, and a neutral carrier was responsible for completing the last-mile deliveries using low-emission vehicles powered by compressed natural gas. As a result, the number of trucks operating in the area dropped significantly, from 100 vehicles managed by 11 different companies to just 29 vehicles operated by one single company, all within 10 days Urban Freight Lab, (2020).

In London, microhubs have also been implemented, notably by Gnewt Cargo, which operates the city’s largest fully electric fleet. Gnewt Cargo utilizes a multi-carrier consolidation model for these microhubs. During off-hours, client company trucks deliver cargo to either their own facilities or Gnewt Cargo’s depots. This collaboration allows Gnewt to use the client’s facilities as additional depots, optimizing the delivery process. The last-mile deliveries are carried out by Gnewt Cargo using electric vans stationed at the client’s facilities. This initiative has resulted in an 88% reduction in CO2 emissions per parcel and a 52% decrease in the total distance traveled by all vehicles in London per parcel Urban Freight Lab, (2020).

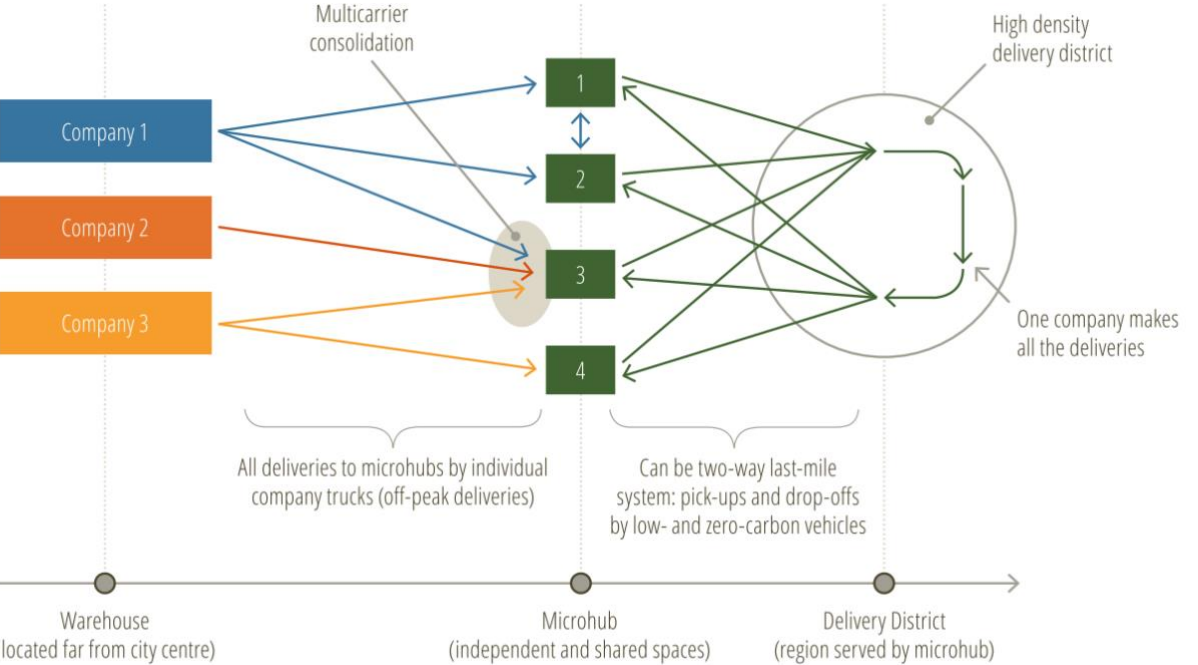


Figure 1112: Gnewt Cargo's operations in Central London use a mixed multi-carrier. (Lee et al., 2019)

De Bok et al., (2024a) explored the impact of large-scale microhub implementation in Rotterdam, with the aim of reducing the number of vehicle kilometers traveled by conventional delivery vans. The study evaluated nine different microhub scenarios based on different design aspects: location, type of vehicles (delivery robots, cargo bikes, or light electric vehicles), and business model (individual or full collaboration). The findings revealed that microhubs, particularly when courier companies collaborate fully, can significantly reduce vehicle kilometers. Sharing microhubs also resulted in reduced demand for scarce urban space by decreasing the number of microhubs.

In Miami, DHL Express partnered with the logistics hub Reef Technology to launch a microhub pilot project. In this initiative, DHL trucks deliver containers to the microhub in Miami, , located right outside the city center, where electric cargo bikes perform the last-mile delivery. DHL anticipates that this project will cut CO2 emissions in Miami by 101,000 kg annually (Katsela et al., 2022b).

In Gothenburg, Sweden, the shopping mall Nordstan and the zero-emission bike company Velove has implemented “City Hub Nordstan”, a microhub located at Nordstan. Smart City Sweden (2019) states that many deliveries does not require heavy motor vehicles, and can instead be delivered by cargo bikes. The hub offers safe areas for parking, traffic management, transshipment, changing rooms, and maintenance and repairs for the cargo bikes. Courier companies such as Pling, Best and DHL Express uses the hub and replaces their delivery vans with Veloves cargo bikes when delivering to central Gothenburg.

4.2.1 Summary Case Study Analysis

A summary of the key achievements from the cities that was analyzed in the case study can be seen below.

BRUSSELS	OSLO	NIJMEGEN	YOKOHAMA
<ul style="list-style-type: none"> • CO2 emissions decreased with 24% • Diesel kilometers traveled per stop reduced from 1,34km to 0,52km. 	<ul style="list-style-type: none"> • Supporting zero-emission goals • Reduced urban noise and congestion. 	<ul style="list-style-type: none"> • Reduced number of trucks and total truck mileage. • CO2 emissions decreased by 40%. 	<ul style="list-style-type: none"> • Number of vehicles reduced from 100 to 29 vehicles • Number of companies managing the microhub reduced from 11 to 1 company.
LONDON	ROTTERDAM	MIAMI	GOTHENBURG
<ul style="list-style-type: none"> • CO2 emissions reduced by 88% per parcel. • Total distance traveled by all vehicles in the city decreased with 52%. 	<ul style="list-style-type: none"> • Full collaboration between courier companies reduced vehicle kilometers. • Increased space efficiency in loading and unloading areas. 	<ul style="list-style-type: none"> • Cut in CO2 emissions by 101,000 kg annually. • Private-public collaboration. 	<ul style="list-style-type: none"> • Integration with sustainable transport modes.

Table 5 Case Study Analysis Summary

4.2.2 Second SWOT-Analysis (Literature + Case Studies)

This part presents the second, refined SWOT-analysis where insights from international case studies is integrated.



Figure 12: SWOT-Analysis of microhubs based on existing literature and case studies

Insights from Case Studies

When comparing the first SWOT analysis, which was based solely on literature, with the second analysis that also incorporated case studies, several changes were observed. The remaining points from the initial SWOT has enough support from the case studies, or was regarded as significant enough from the literature, to still be included in the second SWOT. Some points that were removed is the reduced empty miles driven, improved accessibility, and reduced delivery distance. These were removed due to limited empirical support from the case studies, which led to doubts about the validity in real-life adaptations. Safety issues were not mentioned as a problem in the case studies, as well as lack of knowledge and reduced service level. Opportunities such as real-time navigation and revenue generation was also left out because there was no information about this in case studies.

In contrast, new insights emerged from the case material. The need for coordinated stakeholders is one insight. Cases like Rotterdam require multiple stakeholders to cooperate for success. Another example is the London case, where coordination between clients, the microhub facilities, and Gnewt Cargo themselves is crucial. Further, the importance of private-public partnership models is highlighted, which is shown in the Miami case. DHL and Reef Technology illustrate value in cross-sector collaboration. Another emerging opportunity for microhubs that was found in case studies is the use of existing retail or city infrastructure, where Oslo and Yokohama are two examples. Moreover, resistance from traditional logistics

actors was found as a threat. Traditional logistics firms may resist changes to established processes. There is also an uncertainty regarding long-term funding models. Most of the cases presented in the case study analysis are temporary or pilot projects, waking uncertainties.

4.3 Interviews - Themes and Perspectives from the Logistics Industry

To complement the literature review and SWOT analysis, two interviews were conducted with stakeholders in Swedish logistics and e-commerce. The respondents contributed practical perspectives on the implementation of microhubs in Swedish cities. The analysis of the interview responses was divided into four main themes that reflect the most important aspects of the questions.

Views on Microhubs in a Swedish context

All respondents expressed that microhubs are an effective and relevant concept for future urban logistics in Sweden. One respondent described it as:

"Microhubs have great potential to both reduce costs and carbon emissions in cities. By consolidating goods into a common hub before they are distributed further in the area, the need for multiple parallel transports from different actors is reduced. This means fewer kilometers driven, less congestion and more efficient routes – which in turn leads to lower fuel consumption and thus reduced emissions."

Several interviewees emphasized that the future potential of microhubs is strongly tied to the ability to scale up and integrate the concept within broader sustainable mobility strategies. One respondent pointed out that municipalities should play a coordinating role in this transformation, either by operating the hubs or procuring them from private actors. Another underlined that cooperation between transport companies will be essential:

"I believe microhubs can streamline logistics in larger cities, but for it to be truly effective, transport companies need to collaborate. That requires regulation, and probably new legislation as well."

Some respondents suggested that deliveries within city centres could be restricted for larger vehicles, forcing carriers to use microhubs for last-mile distribution. One described this as a potential way to accelerate the transition, especially if the hubs are served by electric vehicles and coordinated at the municipal level:

"You could prohibit direct deliveries to the city core and have goods from various providers transferred at a microhub. From there, smaller electric vehicles can handle the final leg."

However, one respondent considered that microhubs are still at an early stage in Sweden and that they should be tested and developed in smaller municipalities in order to take the concept to larger cities in the next step. Although several respondents agreed that microhubs in Sweden are still in an early stage development, others highlighted successful pilot projects where microhubs had already shown positive effects. One noted that:

"Our customers hardly noticed the change when we introduced the microhub – except that the area became noticeably quieter. As long as the deliveries are reliable, people are positive."

This reflects a common belief among the respondents: that with the right regulations, incentives, and local adaptation, microhubs can become a key component in more sustainable and citizen-friendly urban freight systems in Sweden.



Figure 1313: Quotes from participants, Views in a Swedish Context

Strengths: Efficiency and Sustainability

Respondents highlighted a range of benefits linked to microhubs, particularly in terms of transport efficiency and environmental sustainability. Both described the concept as a powerful enabler of smarter urban logistics, thanks to the consolidation of goods and the reduced need for parallel delivery routes:

"By collecting heavy transports to a common delivery point instead of them being driven to several different addresses, we reduce both traffic congestion and emissions – something that directly contributes to a better urban environment for everyone in the area."

In addition to fewer delivery vehicles, one respondent emphasized that this reduction is especially visible in sectors such as waste collection and freight, where large trucks have traditionally dominated. This shift has contributed not only to lower emissions, but also to a safer and more pleasant street environment.

"You notice the difference immediately – fewer big vehicles means it's quieter and feels safer to walk or cycle in the area."

Another interviewee stressed that microhubs open up for more flexible delivery windows, especially late in the evening or during the night, which can help ease pressure on the road network during peak hours. They described how fewer delivery vehicles in motion also allows for faster and more predictable delivery operations. Moreover, home delivery operators were said to benefit significantly from microhubs in terms of route optimization and fallback logistics. One respondent explained that:

"With a hub in place, you can deliver several packages to the same point. If a recipient isn't home, you don't need to drive back and try again – you just leave the package at the hub and the customer still gets it in time."

This approach not only enhances the customer experience, but also avoids unnecessary emissions and saves both time and resources for the carrier. Overall, respondents agreed that microhubs can serve as a tool for smarter and more sustainable logistics, with concrete advantages for both operators and urban residents.

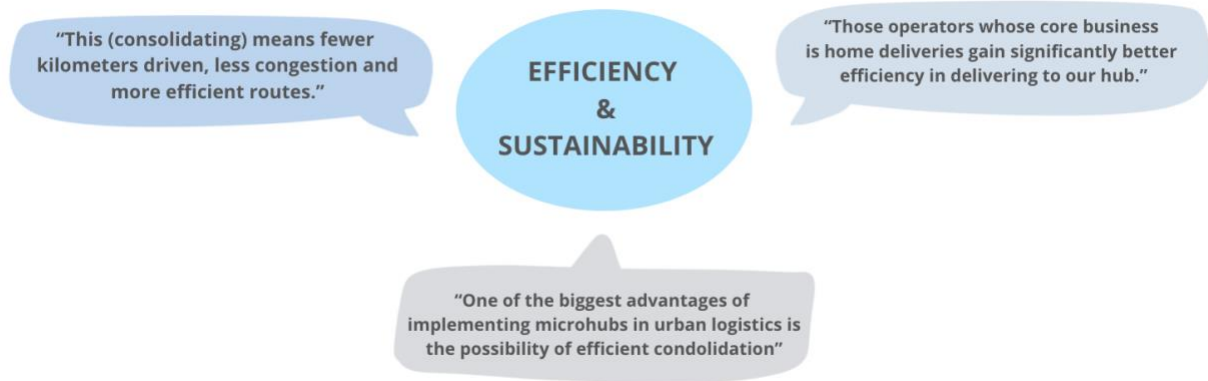


Figure 1414: Quotes from participants, Efficiency & Sustainability

Challenges: Infrastructure, economy and co-operation

Several challenges were identified, particularly related to regulations, lack of space and division of responsibilities:

“Finding space is a huge challenge. It’s crowded in the city and there’s a lot of competition for space.”

Both respondents point to infrastructural challenges to being able to implement microhubs on a larger scale. The first respondent particularly highlights the lack of space as a major obstacle in dense urban environments - finding strategically placed areas for microhubs is difficult but crucial. Technical systems and the need for flexibility in processes are also mentioned as challenges, for example around tracking goods. The other respondent points out that microhubs require a functioning sorting and delivery structure to avoid delays and damage, especially if many transport companies are to be coordinated.

Economic challenges arise mainly around cost and revenue distribution. A respondent explains that there is currently no model for how several transport companies should share costs when delivering to microhubs. The coordination between actors, where some, for example, pay per stop, makes it difficult to justify deliveries to common points if the volumes are not large enough. At the same time, there is a clear potential for savings, where consolidation can lead to fewer kilometres driven, which reduces both emissions and transport costs – something that both respondents see as a positive effect. According to both actors, cooperation is crucial for microhubs to function. Collaboration is needed between municipalities, transport companies, property owners and other stakeholders. One respondent quote:

“Logistics actors don’t want to cooperate because they are competitors. But consumers don’t care who delivers – they just want their package.”

Both respondents agree that regulation and new legislation are likely required to drive cooperation. The municipality is highlighted as a key factor in initiating, procuring and operating microhubs.



Figure 1515: Quotes from participants, Infrastructure, Economy & Co-operation

Future and Possibilities in Sweden

Overall, the respondents expressed a hopeful outlook on the future of microhubs in Sweden. The potential was primarily linked to sustainability, increased efficiency, and collaboration. A recurring suggestion was to implement microhubs in pilot projects to test and adapt the concept to local conditions. Several respondents identified municipalities as potential key actors, either as coordinators or procurers. To enable broader implementation, respondents highlighted the need for clearer regulations, incentives, and cooperation between logistics providers.

"I believe microhubs will play an important role in the logistics of the future – but it is necessary for the cities to be involved and set the framework."

Technological advancements and electrification were also seen as complementary forces that could further strengthen the role of microhubs in future logistics systems.

"We see that electric vehicles, digitalization and microhubs together can create a completely new logistics system – faster, quieter and greener."

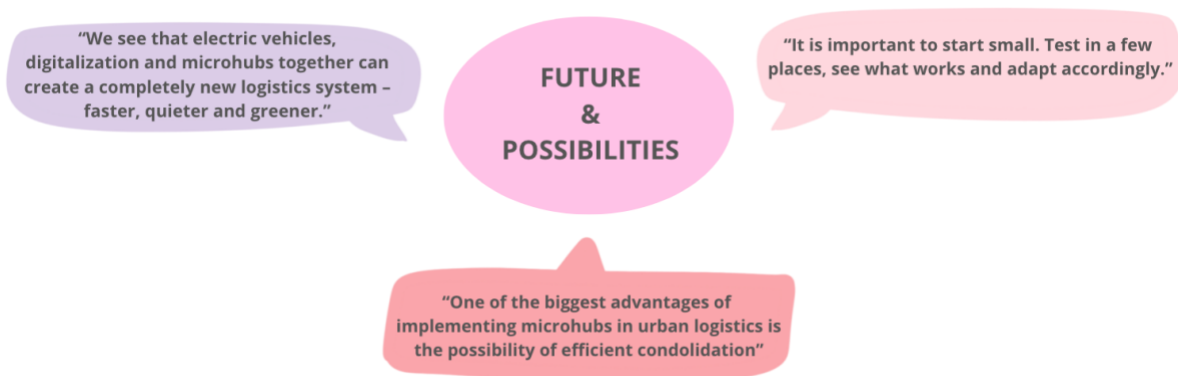


Figure 1616: Quotes from participants, Future & Possibilities

4.3.5 Final SWOT-Analysis (Literature + Case Studies + Interviews)

This part presents the final SWOT-analysis with information literature, case studies and interviews.

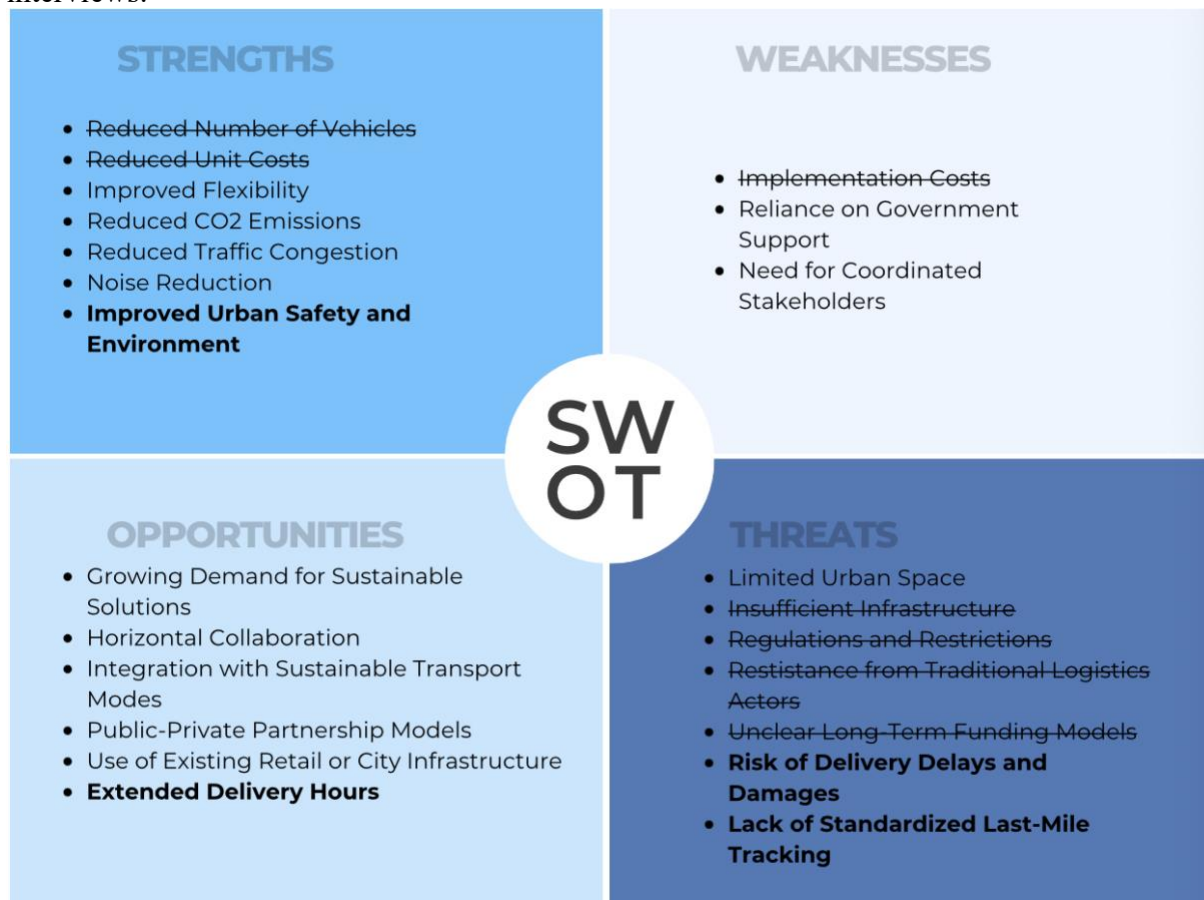


Figure 17: Final SWOT-Analysis based on literature, case studies, and interviews

Strengths

In both the second and final SWOTs, core strengths such as reduced CO2 emissions, traffic congestion, improved flexibility, and noise reduction remain prominent. These were also reinforced during the interviews. However, the final SWOT—shaped by the interview insights—shifts the focus more toward operational benefits for end users. New strengths like local presence and proximity to customers, faster delivery times, and reduced failed deliveries emerged. This shows a new perspective on improved flexibility, with benefits for the last-mile delivery part and end customers. These changes reflect how interviewees emphasized the customer-facing value of microhubs. For instance, Respondent 2 mentioned that the microhub area had become more pleasant and safer due to fewer heavy vehicles, aligning with the new focus on improved urban safety and responsiveness in the final SWOT

Weaknesses

One weakness that is highlighted in both interviews is the strong reliance on government support, as several initiatives depend on municipal involvement to succeed. There is also a need for coordination between multiple stakeholders, mentioned in both interviews. This can be challenging due to differing interests, responsibilities, and operational models. Implementation costs was removed as this was not mentioned in the interviews. Different types of microhubs have different implementation costs, and there is not enough support to show a significant implementation cost. Government support can also reduce implementation cost.

Opportunities

Several key opportunities are highlighted throughout this thesis. The growing demand for sustainable logistics and the potential for horizontal collaboration are opportunities that appeared in all SWOTs and were supported by the interviews. Microhubs can also support the integration of electric and low-emission transport modes, contributing to greener logistics.

The final SWOT expands on the potential in forming public-private partnerships with insights from respondents. Utilizing existing infrastructure such as retail stores is something mentioned in the interviews as well as case studies. Additionally, extended delivery hours are mentioned as an opportunity by Respondent 1, where delivering during off hours enables more flexibility and ease pressure on the road during peak hours.

Threats

Weaknesses identified in the interviews include difficulties in finding suitable space for microhubs in dense urban spaces, which is mentioned by both respondents. The risk of delays or damage due to extra handling at the hub is also mentioned as a weakness by Respondent 1. There is also a lack of a unified tracking system for last-mile deliveries, which reduces transparency. Some threats were removed, such as insufficient infrastructure and regulations and restrictions, as they depend deeply on the context of the microhub, and they were not mentioned by interviewees. Additionally, regulations and restrictions can be complemented by reliance on government support. Resistance from traditional logistics actors emerged after the case studies and lack support from the interviews. Same conclusion was drawn regarding unclear long-term funding models, as this was only concerning case studies.

5. DISCUSSION

This chapter critically examines the findings from the literature review, international case studies, and interviews with Swedish logistics professionals to evaluate the potential, benefits, and challenges of implementing microhubs for last-mile delivery in Swedish cities. It explores differences in definitions, success factors, and practical barriers, providing insights on how microhubs can support more sustainable and efficient urban logistics in Sweden.

5.1 The Concept and Definition of Microhubs

Throughout the literature, the concept of a microhub is presented in various ways, and the term itself lacks a universally accepted definition. This uncertainty became evident early in our research, as we encountered a wide range of expressions referring to similar, yet not identical solutions, such as urban consolidation centers, micro-terminals, city hubs, and micro-depots. While these terms often describe logistics facilities with the goal of facilitating last-mile delivery in urban environments, they differ in aspects such as size, permanence, scope of services, and level of integration with transport modes.

This variation in terminology and design makes it challenging to compare results across case studies. For instance, some microhubs are permanent facilities operated by a single logistics company, while others are temporary or mobile structures shared among several actors. In Oslo, for example, the microhub is built from shipping containers and placed at the port, whereas in Nijmegen, the microhub is run by a neutral third party focusing on receiver-based services. Such differences influence not only operational outcomes but also cost structures, environmental impacts, and stakeholder dynamics.

The lack of a clear and consistent definition also raises questions about how the concept of a microhub should be interpreted in a Swedish context. From the background and theoretical chapters, it is clear that the core purpose of a microhub is to decentralize and consolidate urban deliveries, ideally supporting more sustainable and efficient logistics. However, in practice, a microhub can range from a staffed facility with warehousing capabilities to a simple parcel locker or loading zone.

In our view, a microhub should be understood not only as a physical location, but as a logistics strategy that enables more sustainable and collaborative last-mile delivery. This broader interpretation allows for flexibility in design, but also requires careful consideration of contextual factors such as infrastructure, policy, and stakeholder capacity. As our results suggest, the success of a microhub is not only about where or how it is built—but also about how well it is integrated into the wider logistics system.

5.2 Strengths and Weaknesses of Microhubs (RQ1)

The theoretical framework presented in this thesis highlights a broad range of benefits, challenges, opportunities, and threats linked to the implementation of microhubs. Interviews with two Swedish stakeholders, Respondent 1 and Respondent 2, allow us to compare these academic insights with real-world perceptions and experiences from the logistics sector. Overall, the interview responses largely confirm the theoretical benefits of microhubs but also shed light on additional complexities and practical barriers not fully explored in the literature.

Strengths

The literature suggests that microhubs can significantly increase operational efficiency by enabling consolidation of deliveries, reducing the number of trips, optimizing vehicle use, and shortening delivery distances. These operational gains are closely tied to environmental improvements, particularly reductions in fuel consumption, noise, and CO2 emissions when combined with sustainable transport modes such as cargo bikes and electric vans.

Both respondents supported this view. Respondent 2 described how their initiative was able to reduce traffic and emissions by coordinating deliveries to a single location rather than allowing each transport company to make individual deliveries. This aligns with what is written in the theory about improved efficiency. Consolidating goods leads to less transportation and a smaller number of vehicles required. This in its turn leads to less empty miles driven as well as higher filling grade of vehicles. Respondent 1 highlights how microhub can contribute to more logistical efficiency.

Weaknesses

One of the biggest challenges highlighted in the literature is the additional costs for terminals, new vehicles, administration and new infrastructure. This is something that the respondents do not mention in the interviews, which can be interpreted as costs not having that much of an impact on microhub viability. One can also interpret that this is something that respondent chose not to mention or shed light on in the interviews. However, one respondent mentioned that microhubs can reduce additional costs, but in context of fuel costs.

Another challenge from the literature is that microhubs rely heavily on government support. Both respondents agree with this. Respondent 1 highlights the importance of municipal support, and that new laws and regulations are required for transportation companies to be willing to work together. Respondent 2 also mentions this; that all parties involved need to coordinate and work for the same goal.

One interesting challenge mentioned by Respondent 1 is the lack of willingness among transport companies to collaborate and coordinate. Although the literature discusses horizontal collaboration as a promising strategy for increasing efficiency, it often assumes that such collaboration is straightforward to implement. In practice, Swedish logistics companies are highly brand driven and have successfully positioned themselves directly toward the end customer. As a result, many companies prefer to retain full control over their last-mile deliveries to maintain visibility and customer contact, even if it means duplicating routes or underutilizing vehicles.

This competitive logic conflicts with the collaborative models suggested in the theory. Interestingly, Respondent 1 pointed out that while consumers are often exposed to strong branding from delivery companies, surveys show that most end users do not actually care which company delivers their parcel. They care more about convenience, location, and flexibility in how they receive it. This disconnect between perceived consumer preferences and actual behavior creates a potential opening for shared microhub models. However, realizing this potential would likely require some form of policy intervention or new regulation. This is especially relevant in urban areas where competitive interests currently hinder joint delivery models. Without structural changes to the competitive landscape, whether through regulation, incentives, or new forms of public-private collaboration, shared microhub models will continue to face significant barriers. As a result, the full potential of microhubs as sustainable logistics nodes may remain unfulfilled in Sweden's urban areas.

One respondent mentioned another interesting challenge. This is the distribution of costs and revenues in a shared microhub model. Today, each transport company owns and controls its entire delivery chain, including infrastructure, vehicles, and customer interface. Introducing a shared microhub would fundamentally shift this model. This would raise important questions about who pays for the hub, who manages it, and how revenues are shared. Respondent 1 pointed out that there is currently no established framework for such collaboration, making it unclear how responsibilities and profits should be divided among competing actors.

This aligns with what is said in the theory about lack of knowledge, there is limited understanding of cost structures and revenue streams. This uncertainty could discourage participation and slow down adoption. Without a transparent and equitable financial model, companies may be reluctant to invest or commit to shared microhubs. This is regardless of if such initiative brings collective benefits in terms of efficiency and sustainability. This challenge emphasizes the need for further research and the lack of knowledge that exists in the microhub area.

Opportunities

Several innovative opportunities emerged through the interviews that extend the practical application of the microhub concept. As discussed earlier it is hard to motivate transport companies to commit to share microhub with other companies and collaborate. One opportunity mentioned by Respondent 1 is that individual transport companies would be required to deliver to designated microhubs, from which consolidated last-mile delivery would be carried out using electric vehicles. This would prevent transport companies from delivering directly into city centers.

Another opportunity concerns the municipal ownership or procurement of microhubs, where the city either operates the hubs directly or outsources them through public contracts. This approach is consistent with models seen in cities like Oslo and Yokohama, where local authorities play an active role in hub development and regulation. It reinforces the theoretical argument that public-private collaboration is key to microhubs success. Particularly when space, coordination, and investment are shared responsibilities.

Respondent 1 mentioned another opportunity involving leveraging existing infrastructure by using larger stores such as H&M or Clas Ohlson as microhubs for local distribution. This is something that is not brought up in literature, making this a valuable insight. Residents in the city could get their parcels delivered from the store which could potentially improve speed and flexibility.

One suggestion by Respondent 1 is the potential of integrating postal and newspaper delivery networks into the microhubs system. These actors already operate electric vehicles and bikes, and visit nearly every address on a daily basis. They could efficiently deliver to outdoor parcel lockers as part of their normal routes. This exemplifies the kind of creative, context-specific solutions that may be necessary for microhubs to succeed in the Swedish market. This approach, in our opinion, might not be long term as the electric newspaper is becoming more common. Soon enough people might stop subscribing to physical newspapers which would limit delivery of parcels by these kinds of vehicles.

The concept of microhubs is grounded in clear theoretical principles. These opportunities illustrate that its real-world potential may depend on how creatively it is adapted to existing

infrastructure, policy frameworks, and stakeholder capabilities. Future research and planning may benefit from exploring these models further.

Threats

One of the most frequently mentioned threats is the lack of available space in urban environments. This is a theme that appears in both theory and practice. The literature emphasizes that as cities densify and compete for limited real estate, it becomes increasingly difficult to identify locations that are both logistically strategic and economically feasible for microhub operations. Without dedicated or subsidized urban space for logistics infrastructure, microhubs risk being pushed to the periphery, and thereby reducing their effectiveness for last-mile delivery.

Tied to the issue of space is the threat of regulatory and policy uncertainty. The literature acknowledges that successful microhub implementation often depends on municipal involvement, clear zoning laws, and coordinated urban planning. Cities like Oslo uses zero-emission zones and traffic restrictions to incentivize microhub use. However, both respondents described the lack of clear logistics strategies at the municipal level in Sweden. While cities express interest in sustainable logistics, this rarely translates into concrete support in terms of infrastructure access, traffic regulations, or long-term planning. This gap between intention and action can delay and discourage actors in the logistics sector from committing and investing in microhub operations.

Another operational threat associated with microhub implementation is the risk of delays and damage due to additional handling steps and the need for precise coordination. If microhubs are to serve as the central node of all deliveries within a geographic area, it is crucial that all incoming shipments arrive on time. Once received, the goods must be efficiently sorted and promptly redistributed to ensure smooth and timely last-mile delivery. Any delay in one part of this chain can disrupt the entire process. This could potentially lead to late deliveries, missed time windows, or even service failures. This strongly aligns with what is said in the theory about reduced service levels. Respondent 1 acknowledged this issue and noted that the reliance on third-party handling and transshipment, in this case the microhub operators, adds more steps to the delivery chain.

This introduces more points where parcels can be delayed or damaged, especially if coordination between actors is not well-structured. This concern is echoed in the literature, which identifies increased handling and transshipment as one of the downsides of microhub models. Unlike direct delivery models, where parcels move from depot to customer in one flow, microhubs require an intermediate step. This adds complexity and potential risk, particularly when multiple stakeholders are involved and standardized procedures are lacking. Without strong operational management the microhub could become a bottleneck rather than a facilitator of efficient last-mile delivery.

5.3 Lessons from international case studies (RQ2)

The international case studies show that microhubs can work well in urban environments, under the right conditions. For example, Oslo City Hub and Gnewt Cargo in London showed good results in terms of reduced emissions and streamlined deliveries. An important lesson is that collaboration between different carriers has often been crucial to maximizing the benefits of the microhub.

These experiences are relevant for Swedish cities where competition, fragmented supply chains and tight infrastructure make individual solutions more difficult to implement. Collaborative models and shared microhubs may therefore be a way forward, where the benefits to society justify joint investments.

Successful International Case Studies

The literature review presents several intranational examples of successful microhub implementation, such as in London, Oslo, Rotterdam, and Nijmegen. For instance, Gnewt Cargo in London successfully reduced CO2 emissions by 88% per parcel using electric vans and multi-carrier consolidation. In Oslo, the Oslo City Hub showcases how mobile container-based hubs can be used in cooperation with the city's zero-emission goals, allowing for flexibility and lower investment costs. These examples underline the potential for public-private collaboration, strategic placement, and the importance of aligning microhub initiatives with broader sustainability goals and urban policies.

Lessons Learned: Factors for Success

Common patterns across the case studies suggest several success factors that are highly relevant for Swedish stakeholders. One of the most prominent lessons is the importance of strong policy support and alignment with broader environmental goals. Cities such as Oslo and London have demonstrated that local governments can play a decisive role by implementing emission regulations, incentivizing green logistics, and facilitating space allocation for urban freight solutions. In Oslo, for example, the elimination of private cars in the city center created favorable conditions for zero-emission logistics models supported by microhubs.

Another important success factor is the level of collaboration between stakeholders. Examples from Rotterdam and London highlight how partnerships between logistics providers—either through shared-use depots or coordinated delivery systems—can lead to increased efficiency and reduced environmental impact. In Rotterdam's simulation study, full collaboration between courier companies using shared hubs and vehicles resulted in fewer required facilities and significantly less vehicle traffic. Similarly, Gnewt Cargo's model in London shows that integrating clients' facilities into a consolidated network can reduce costs and emissions without the need for building new infrastructure.

Flexibility in microhub design and operation has emerged as a recurring theme. Oslo's use of temporary, container-based microhubs illustrates how cities can adapt their logistics infrastructure without making large, permanent investments. This approach can be particularly relevant for cities like Gothenburg or Stockholm, where finding long-term, centrally located space is often a challenge. Mobile or modular microhubs also offer scalability, making it possible to pilot small projects and expand based on demand.

Engaging the end recipients of deliveries has also proven beneficial, as seen in the Nijmegen case. By involving shop owners in the planning and operation of the microhub, Binnenstadsservice was able to design a system that met the practical needs of both receivers and logistics providers. This type of user-driven innovation may offer Swedish e-commerce companies an opportunity to build stronger relationships with urban retailers and local businesses, while also improving the efficiency of deliveries.

Overall, the case studies suggest that success is not only a matter of infrastructure or technology, but rather the result of strategic alignment between public policies, private sector

innovation, and urban planning. For Swedish cities, these insights imply that any future implementation of microhubs must be supported by cooperative frameworks and guided by a clear sustainability vision.

Comparing International Contexts to Sweden

Although international case studies offer valuable insights, their direct transferability to the Swedish context is not always straightforward. Cities like London and Oslo benefit from higher population densities, established low-emission zones, and strong public policy support—factors that have played a crucial role in successful microhub implementation. In Sweden, municipal involvement in urban logistics tends to be more limited, and Swedish cities tend to place more of the logistical responsibility on private companies.

This challenge was reflected in the interviews, where Respondent 2 pointed to issues such as limited urban space and the need for better coordination between stakeholders. Unlike in cities where public authorities actively facilitate logistics innovation, Swedish cities may lack the same structural and political enablers.

The smaller scale of Swedish urban areas may make it more difficult to achieve the economies of scale seen in larger international cities. However, pilot projects like City Hub Nordstan in Gothenburg suggest that microhubs can still offer meaningful benefits in a Swedish context. This is especially true when they are based on strong partnerships and designed to be scalable and tailored to local needs and conditions.

5.4 Factors to Consider for Swedish E-Commerce Companies (RQ3)

Implementing microhubs in Swedish urban logistics presents both opportunities and complex challenges. While the potential benefits in terms of emissions reduction, delivery flexibility, and operational efficiency are well-supported by both literature and international case studies, successful implementation depends on adapting these insights to the unique Swedish context. This section synthesizes findings from literature, case studies, and interviews, and offers a more strategic interpretation of what Swedish e-commerce companies need to consider moving forward.

Strategic Location and Urban Space Constraints

A recurring insight is that location is not just important—it's foundational. Proximity to high-demand urban areas and main roads is essential to enable efficient last-mile deliveries via cargo bikes or electric vehicles. However, both literature and interviews show that identifying and securing such locations in dense Swedish cities like Stockholm or Gothenburg is difficult due to limited space, zoning restrictions, and high land prices. Swedish companies must therefore collaborate with municipalities early to secure access to suitable sites, possibly through temporary or modular solutions, as seen in Oslo and Brussels.

Moreover, Swedish cities differ from places like London and Oslo in that municipal involvement in freight logistics has traditionally been weak. For microhubs to function in Sweden, a shift is required in how municipalities prioritize logistics in urban planning. E-commerce companies should not wait passively for policy changes, but instead proactively engage with local governments to create shared goals and drive the agenda for sustainable logistics forward.

Enabling Collaboration and Shared Governance Models

Another key insight is the importance of horizontal collaboration between delivery actors. Shared microhubs can help reduce costs, increase efficiency, and mitigate underutilization. However, as confirmed by Respondent 1, there is resistance to collaboration between competitors in Sweden, often due to unclear governance structures or fear of losing market control. To overcome this, Swedish companies considering microhub adoption must think beyond operational coordination and focus on building trust-based governance models. Clear agreements on cost-sharing, data access, and responsibility allocation are necessary. Pilot projects could benefit from public ownership of the physical infrastructure, allowing private actors to share operations while avoiding disputes over space or investment.

Flexible and Scalable Infrastructure

The success of microhubs internationally often depended on their ability to be flexible and scalable. Examples from Oslo and Brussels showed how using containers or trailers instead of permanent buildings allowed for experimentation and reduced upfront investments. In Sweden, where cities are smaller and investment risk is a concern, companies should adopt a test-and-learn approach. Starting with mobile or pop-up hubs may reduce resistance and increase adaptability over time.

Technology Integration and Service Quality

The integration of sustainable transport and smart technology is another factor with major implications. While electric cargo bikes and EVs are already in use, the interview findings show that operational risks—such as parcel damage or tracking difficulties—remain a concern. Companies must consider how to develop or integrate a standardized tracking system for microhub-based deliveries. As Respondent 1 noted, if different actors use incompatible systems, the transparency and reliability of the entire last-mile chain may be compromised. Technology investments should therefore focus not only on vehicles, but also on coordination platforms that allow multi-carrier parcel visibility. This is especially relevant if Swedish companies move toward shared-hub models.

Creating Economic Value Beyond Delivery

Finally, microhubs should not be seen only as delivery nodes. Literature and interviews highlight the potential for value-adding functions such as warehousing, minor repairs, and waste management. By diversifying the hub's functions, companies can improve its economic viability and appeal to a broader set of stakeholders. In Sweden, where real estate costs are high, combining delivery operations with other services—especially in partnership with retailers or municipalities—could help justify the investment.

6. CONCLUSION

This chapter presents conclusions based on the study's three research questions. It summarizes key insights on the benefits and challenges of microhubs, lessons from international cases, and considerations for Swedish e-commerce companies. The aim is to provide practical guidance and highlight areas for future development.

6.1 RQ1: What are the key advantages, challenges, opportunities, and threats of implementing microhubs for last-mile delivery?

Microhubs present several advantages for last-mile delivery, including reduced CO2 emissions, reduced traffic congestion, noise reduction, and improved urban safety and environment. However, challenges such as reliance on government support and need for coordinated stakeholders pose significant barriers. Opportunities include rising demand for sustainable logistics, horizontal collaboration, and integration with sustainable transport modes. Additionally, public-private partnerships, the use of existing retail or city infrastructure, and extended delivery hours are also presented opportunities. Threats involve limited urban space, the risk of delivery delays and damage, and the lack of standardized last-mile tracking. See Figure 19 for the final SWOT-analysis.



Figure 18: Final SWOT-Analysis

6.2 RQ2: How have microhubs been implemented in other countries, and what lessons can Swedish companies learn from these cases?

International case studies from Brussels, Oslo, London, Rotterdam, and other cities show that microhubs are often implemented as pilot projects, using temporary infrastructure such as containers or trailers. These projects have achieved measurable reductions in emissions and delivery distances. Shared use of hubs between logistics actors increases efficiency, but such collaboration is rare without public sector involvement.

Lessons learned include the importance of location, the use of flexible infrastructure, and the value of public-private partnerships. However, long-term success depends on policy support and clear governance models.

6.3 RQ3: What factors should Swedish e-commerce companies consider when deciding whether to adopt microhubs for last-mile logistics?

Overall, Swedish e-commerce companies should not ask *if* they should adopt microhubs, but rather *how* they can do so in a way that balances operational efficiency, stakeholder coordination, and local adaptation. This means:

- Starting small with pilot hubs using flexible infrastructure
- Collaborating with municipalities to secure space and regulatory support
- Building shared governance structures to enable horizontal collaboration
- Ensuring technological integration to maintain service quality
- Considering additional services to strengthen economic sustainability

The Swedish context may pose specific challenges, but it also offers a unique opportunity to design microhubs that are both sustainable and scalable. Lessons from this study suggest that a long-term, partnership-driven approach is key to making that vision a reality.

6.4 Final Conclusion

There is an urgent need for sustainable last-mile logistics solutions. We believe that microhubs can play a key role in meeting this need, offering a scalable and practical alternative that helps reduce emissions, ease congestion, and relieve pressure on city infrastructure. However, for microhubs to be successfully implemented and scaled, active involvement from government and municipalities is essential. In addition, sharing microhubs among multiple stakeholders is crucial for achieving high utilization and cost efficiency.

7. RECOMMENDATIONS FOR FURTHER RESEARCH

This chapter outlines key directions for future studies that could enhance the scalability, efficiency, and sustainability of microhub-based delivery systems in urban environments. It also gives suggestions and tips for next year's students.

7.1 Areas for Future Research

While this study provides insights into the potential of microhubs and cycle logistics in improving urban last-mile delivery, several areas warrant further investigation. To support more informed decision-making and successful implementation of these solutions, future research should explore the broader systemic impacts, collaborative models, public sector involvement, and infrastructure requirements.

- **Magnitude of impact:** A model analyzing truck traffic volumes under various scenarios (e.g. with and without microhubs and cycle logistics) to understand how different delivery operations will reduce freight traffic.
- **Multi-carrier consolidation:** explore opportunities for businesses to share resources (e.g. shared microhub space) to increase the efficiency of urban delivery operations.
- **Government support:** design financial programs and policies to help businesses implement solutions that improve the efficiency of goods movement in order to reduce freight-related congestion, emissions, and curbside competition.
- **Infrastructure:** determine how roads and cycling infrastructure are best designed and enhanced to allow for the safe integration of cargo cycles with other road users.

7.2 Limitations for This Research

Given the limited availability of prior research on microhubs in the Swedish context, especially concerning their application in e-commerce last-mile deliveries, future research could expand in several directions:

- **Increased number of interviews:** conducting interviews with a broader range of stakeholders, such as municipalities, consumers, property owners, and additional e-commerce companies, would provide a more comprehensive understanding of microhubs operational and societal impacts.
- **Quantitative analysis:** future theses could complement the qualitative insights with quantitative data, such as delivery time improvements, emission reductions, and consumer satisfaction metrics.
- **Pilot studies:** examining real-life pilot projects (e.g. the one PostNord ran in Jakobsberg) in greater depth, potentially including longitudinal studies, would offer empirical insights into effectiveness and scalability.
- **Different geographic contexts:** investigating microhub implementation in rural or mid-sized cities could highlight different challenges and success factors.

Reflection on the Research Approach

Combining a systematic literature review with case studies and interviews has proven to provide a multifaceted perspective. The interviews have contributed practical and context-specific insights, which are often missing from academic literature. It is important to note that the number of interviews was limited, which means that the results cannot be generalized to the entire industry. However, they serve as indicative examples of how the microhub concept is perceived by Swedish actors.

One key observation that emerged as we developed the discussion was the degree of consistency between the interview responses and the SWOT analysis. While some clear overlaps were identified, it also became evident that many of the insights found in the literature were not mentioned by the respondents. This initially led us to conclude that it is unrealistic to expect interviewees to be aware of or articulate every theoretical point covered in academic sources. However, it also raised a critical question: does the absence of these themes in the interviews suggest that certain theoretical insights may be less relevant or applicable in practice?

This discrepancy highlights the gap that can exist between theory and practice. Some of the issues emphasized in the literature may still be in early development stages in the Swedish context and therefore not actively considered by practitioners. It is also possible that these insights reflect idealized or aspirational models presented in academic research, which may not be fully reflected in real-world operations. On the other hand, respondents introduce several practical considerations such as the role of branding, the difficulty of cost-sharing between actors, and the potential of newspaper distribution networks. These insights were largely absent from the theory, yet highly relevant in a Swedish logistics environment.

This suggests that while literature provides important theoretical insights, the interview responses offer a deeper understanding of how things work in practice. By comparing the two, we were able to identify which theoretical assumptions are supported by real-world actors, which ones may be overstated, and which areas might benefit from further research or revision. In this sense, the combination of theory and interviews does not just validate findings, it also challenges and refines them.

7.3 Implications for Government, Municipalities & Companies

As microhubs represent a relatively new and evolving solution within urban logistics, the role of public institutions becomes essential in shaping their successful implementation. This section outlines how government bodies and municipalities can support and facilitate the development of microhubs through policy, planning, and collaboration.

- **Clearer zoning and land-use policies** are needed to facilitate the establishment of microhubs in central locations, especially when they must compete with other urban land uses.
- **Public-private partnerships** can help overcome the initial investment barriers and align objectives between city planning and logistics efficiency.
- **Standardization and coordination** efforts might help avoid fragmented implementations and promote interoperability across platforms and delivery actors.

7.4 Tips for Next Year's Students

Reflecting on the thesis process, several insights emerged that may help future students pursuing similar research. This section highlights practical advice for structuring the project, conducting interviews, and managing common challenges, with the aim of making the thesis journey more effective and rewarding.

- **Plan interviews early:** many companies are slow to respond, so begin the outreach process in parallel with the literature review.
- **Define scope clearly:** the topic of last-mile logistics is broad – decide early whether the focus is environmental, economic, operational, or policy-based.
- **Balance theory and practice:** use both academic literature and real-world examples to support arguments.
- **Stay flexible:** some of your initial assumptions (e.g., feasibility or acceptance of microhubs) may need adjusting as interviews or data suggest alternative perspectives.

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APPENDIX 1 – INTERVIEW QUESTIONS

Interview with a last-mile delivery player (anonymized) Respondent 1:

Date: 2025-04-14

Type of interview: Written, via email

Number of questions: 7

- Question 1: Are microhubs part of your business today? If so, what effects have you observed on efficiency and delivery costs?
- Question 2: What opportunities and strengths do you see with microhubs? Do you think microhubs can improve delivery logistics and efficiency in urban areas? Do you think microhubs can help reduce congestion and emissions? Can microhubs lead to lower delivery costs?
- Question 3: What challenges have you encountered in connection with last-mile deliveries? What logistical challenges can arise when coordinating deliveries?
- Question 4: What potential risks do you identify with the microhub concept? Are there risks linked to delivery reliability, such as delays or damage to goods during transshipment? Can microhubs create new bottlenecks or inefficiencies in the supply chain?
- Question 5: What collaborations do you think are important to tackle the increased transport in cities?
- Question 6: How do you see the future of microhubs in Sweden? Do you think microhubs will become an established part of urban logistics?
- Question 7: Is there anything else you would like to add?

Interview with a last-mile delivery player, Respondent 2:

Date: 2025-04-08

Type of interview: Written, via email

Number of questions: 8

- Question 1: What motivated XXX to engage in the development of microhubs for last-mile deliveries?
- Question 2: What do you think are the biggest benefits of implementing microhubs in urban logistics?
- Question 3: What challenges has XXX encountered or foresees in implementing microhubs?
- Question 4: How do you assess that microhubs can impact both costs and carbon emissions in cities?
- Question 5: What partnerships do you consider important for successfully implementing microhubs?
- Question 6: Do you see any particular trends in e-commerce and logistics that could impact the design and use of microhubs in the future?
- Question 7: How do you think customers experience the transition to microhubs for their deliveries? Have you received any specific feedback from them?
- Question 8: Is there anything else you would like to add?

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