



## **Implementing shared micro-depots in the last-mile logistics in Finland**

Veronika Petrova

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## Abstract

<b>Author(s)</b> Veronika Petrova
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<b>Number of pages and appendix pages</b> 52 + 3
<p>The purpose of this research-based bachelor's thesis is to simplify the transition to shared micro-depots for start-up logistics companies in Finland, based on the understanding of the peculiarities of logistics in the Finnish market. While the aim is to create practical recommendations for those willing who want to switch to a new system. The implementation of the practice of introducing shared micro-depots is another step towards more sustainable and cleaner logistics.</p> <p>The objectives were formulated as a research question: How to make it easier for Finnish start-up logistics companies to switch to shared micro-depots in last-mile logistics? Research objects are last-mile logistics as a final step of the delivery process and micro-depots as a logistics facility. Transportation is a key component of logistics which is investigated in this paper. The companies of a foreign origin are investigated in this paper. Essential recommendations for the Finnish start-up companies which intend to adopt these experimental logistics technologies, are proposed within the framework of this work.</p> <p>This paper uses an empirical type of research, as new data is collected from various scientific literature sources and studies. The research methods of the thesis were a questionnaire and two structured qualitative interviews. Since the paper describes the trend of introducing shared micro-depots into the last-mile logistics, it can be argued that we also have a descriptive study in front of us. Primary research is conducted mainly in Helsinki Region. Target audience - Finnish start-up logistics companies, operating in the last-mile logistics.</p> <p>The results revealed that the initiative of a shared micro-depot's introduction has not only the pitfalls, but a substantial list of benefits, such as provision of environment-friendly and cost-efficient services while implementing sustainable types of modes in the last-mile logistics delivery; growing IT development thrives in Finland, especially in Helsinki and Espoo where research and development centers are located; more and more emerging opportunities and terms for route optimisation.</p> <p>I would like to express my gratitude to a director of operations at DSV and a head of CoDi (Collection &amp; Distribution) at DB Schenker. I prepared a questionnaire for DSV and DB Schenker in advance, utilising a Webropol 3.0 tool in order to conduct company-focused interviews.</p>
<b>Key words</b> Biofuels, Consolidation, Last-mile delivery, Last-mile logistics, Low emission zone, Micro-depot, Start-up company, Urbanisation

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## 1. Introduction

This research-based bachelor thesis in the major specialisation of Supply Chain Management in the Haaga-Helia UAS is a study about relatively recent practice of implementing shared micro-depots in the last-mile logistics on the territory of Finland. Essential recommendations for the Finnish start-up companies which intend to adopt these experimental logistics technologies, are proposed within the framework of this thesis.

I would like to express my gratitude to a director of operations at DSV and a head of CoDi (Collection & Distribution) at DB Schenker. I prepared a questionnaire for DSV and DB Schenker in advance, utilising a Webropol 3.0 tool in order to conduct company-focused interviews.

CEP services (Courier, Express & Parcel services) are undergoing a significant transformation in the new reality: an increased demand for more flexible logistics solutions, sustainable supplies, cost-efficient deliveries, and accurate real-time delivery tracking.

“Last-mile delivery is the final stage in the network of courier, express, and parcel companies.” (Schröder., Heid., Neuhaus., Kässer., Klink and Tatomir 2018). Besides, last-mile delivery is considered as the most expensive and complex part of supply chain due to an extensive list of unexpected expenses.

### 1.1 Background to the topic

This thesis aims to simplify the transition to shared micro-depots for start-up logistics companies in Finland, by creating practical recommendations for those willing who want to switch to a new system.

Since the beginning of the global urbanisation, environmental and social problems have not been so conspicuous. However, a century later, the consequences of this trend have become even more apparent. Today, logistics companies not only should come to smart solutions regarding the challenge of optimisation and rapid delivery, but also make this process more environmentally friendly.

It becomes obvious that urbanisation has led to an increasing lack of space, rivalry for its usage, and capacity bottlenecks in the road network which are more important than ever for the provision of high-quality logistics services. “Road Network is a system of interconnecting lines and points on a map that visualize a system of streets for a certain area” Besides, one can observe several obstacles for logistics providers related to the supply to densely populated urban areas: traffic jams on the

roads, excessive emissions, a shortage of parking spaces as well as large monetary costs due to unforeseen circumstances along the whole supply chain (Hermoso 2022).

Prior to the first attempts to introduce micro-depots into the logistics of the last-mile, logistics companies experienced the aforementioned difficulties. “The micro depot represents a logistics facility in or close by an urban area in which a company has a place to (un)load, sort, store and deliver shipments to their customers and may offer a pick-up point” (EIT Urban Mobility 2020)

Additionally, depending on the tasks set, a micro-depot can be of several types, mobile or stationary. “A mobile micro-depot is usually a shipping container temporarily positioned near the respective delivery area in order to save costs. Alternatively, stationary micro-depots can be set up in unused space on the ground floors of buildings, at train stations, or at off-street parking facilities” (Bürklen 2022).

The use of micro-depots allows operators not only to consolidate cargo, but also to apply more sustainable modes of transport for their delivery (Kirsch 2020).

The goals of establishing a shared micro-depot which can be utilised by several companies are as follows:

1. a change in the types of vehicles used for urban goods distribution (light or heavy vehicles)
2. reducing the total number of trips made by urban vehicles by consolidating or switching to a different mode of transportation
3. increasing vehicle occupancy levels to improve urban freight transport efficiency
4. reducing the environmental effects of cargo vehicle operations by cutting back on trips or switching to more environmentally friendly vehicles
5. reducing of product inventory and logistical activities in the urban context which may increase business volume as a result of the micro-enterprise provision of services with higher added value (Weiss 2019).

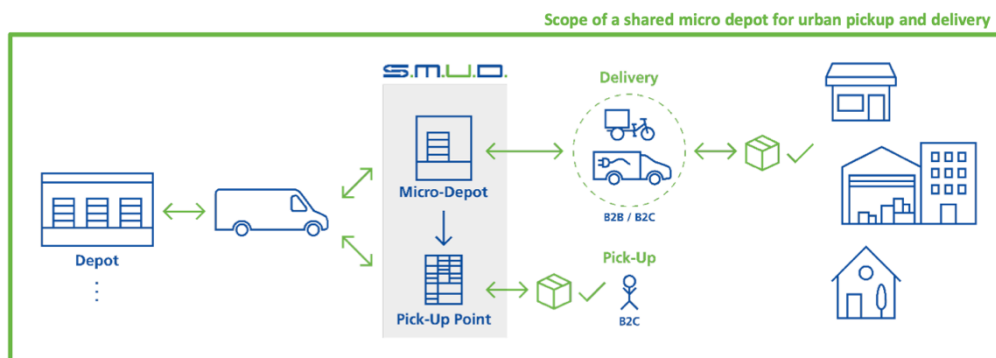


Figure 1. Scope of a shared micro-depot for urban pick-up and delivery (EIT Urban Mobility 2021)

Among the European countries, Germany is a pioneer in the introduction of micro-depots. It is enough just to give an example of an experiment that was conducted in Hamburg already in 2012. Logistics provider UPC, in cooperation with the Hamburg City Administration, launched a project with the introduction of a mobile micro-depot in order to reduce emissions and decrease traffic congestion. It was decided to combine the operation of a micro-depot with electric bicycles, conventional bikes, handcarts, and electric trucks. By the end of this experiment, the company managed to save thousands of kilometers of supply chain, as well as prevent about 40 tons of CO<sub>2</sub> emissions owing to the micro-depot during 2016 (Stodick 2019).

The electric vehicles saved the company 20,015 liters of diesel fuel which also helped to avoid excessive emissions (Stodick 2019). Intending to facilitate last-mile logistics in the city, DB Schenker, in collaboration with other European companies, launched an electric delivery robot in 2021 in Helsinki Jätkäsaari district. The robot, moving at pedestrian speed, was controlled by the operator. During its route, the robot stopped several times to load parcels. When the robot was in proximity, the recipient received a text SMS notification with a code to open one of the 13 robot's cells with parcels. Despite the fact that the experiment lasted only for a few months, the flexible delivery method has not only proved its effectiveness but has also appeared to be environmentally friendly. The usage of an electric delivery robot will help dramatically reduce CO<sub>2</sub> emissions in the long-term perspective (Jokiniemi 2021).

To sum up, shared micro-depots in the city offer more than just last-mile delivery assistance. Currently there is an ongoing search for a functional solution. In addition, many of the present micro-depot solutions are positioned in areas of the public areas that are far from busy city centers and operational hubs, in less obvious and more unexpected locations.

## **1.2 Research question**

The result of this academic research is the set of practical recommendations for those start-up companies who want to switch to a new system. This thesis's objective is how to simplify the transition to shared micro-depots for start-up logistics companies in Finland, based on the understanding of the peculiarities of logistics in the Finnish market. The research question of this thesis runs as follows: How to make it easier for the Finnish start-up logistics companies to switch to shared micro-depots in last-mile logistics.

**RQ: How to make it easier for Finnish start-up logistics companies to switch to shared micro-depots in last-mile logistics?**

The research question is divided into the following IQs:

IQ1: What are the concepts of last-mile logistics and a micro-depot?

IQ2: Why Finnish start-ups have to launch a shared micro-depot?

IQ3: What are the essential regulations of the location and transport means for a shared micro-depot in Finland?

IQ4: What are the essential regulations concerning the design of a shared micro-depot?

IQ5: What practical steps are required in order to launch a shared micro-depot in last-mile logistics in Finland?

Table 1: Overlay matrix

<b>Investigative Questions (IQs)</b>	<b>Theoretical Framework</b>	<b>Methods</b>	<b>Survey Questions</b>	<b>Results</b>
<b>IQ 1.</b>	Searching for information, implementing scientific literature; focusing on the benefits of a shared micro-depot	Secondary Research (Document analysis, national statistics), scientific literature	What are the concepts of last-mile logistics, UCCs and micro-depots? How can one apply micro-depots in the last-mile logistics?	Explanation of the correlation between these concepts. (Chapter 3)
<b>IQ 2.</b>	Searching for information, implementing scientific literature	Secondary Research (Document analysis, national statistics), scientific literature	What is the definition of a start-up company and what are its main features? How suitable is Finnish business environment for start-ups? What are the foreign start-up cases which utilise shared micro-depots? Why is it perspective to implement shared micro-depots in Finland for start-ups?	Explanation of the beneficial use of shared micro-depots for start-up logistics companies.(Chapter 4)
<b>IQ 3.</b>	Identification of types of vehicles that can be used in conjunction with a shared micro-depot	Secondary Research (Document analysis, national statistics)	What is an appropriate location for a shared micro-depot? Describe Urban Access Regulation in Helsinki What is the regulation of transport means for a shared micro-depot?	List of vehicles which can be applied in combination with a shared micro-depot. (Chapter 5)

<b>IQ 4.</b>	Identification of requirements to avoid technical problems while introducing a shared micro-depot	Secondary Research (Document analysis, national statistics)	What are the essential regulations concerning the design of a shared micro-depot?	Practical recommendations in order to follow regulations concerning shared micro-depots and transport means. (Chapter 6)
<b>IQ 5.</b>	Getting practical advice from professionals concerning smart launch of a shared micro-depot	Qualitative Interview, a questionnaire and Secondary Research	What are the required practical steps for launching a shared micro-depot in the last-mile logistics in Finland?	List of the practical steps for launching shared micro-depots in last-mile logistics. (Chapter 8)

### 1.3 Delimitation

This scientific thesis is a research-based project which relies on qualitative research method. The researched location is Finland. Primary research is conducted mainly in Helsinki region. Target audience - Finnish start up logistics companies, operating in the last-mile logistics.

Transportation is a key component of logistics which is investigated in this paper. Research objects are last-mile logistics as a final step of the delivery process and micro-depots as a logistics facility. The companies of a foreign origin are investigated in this paper.

Due to the insufficient scientific research and novelty of this topic, it's complicated to formulate the delimitations for this thesis. However, this new green logistics trend is already well-established in several European countries, including Germany. It should be noted that exactly those companies that already use this practice in G7 countries also have their branches in Finland. The trend of implementation of micro-depots in the last-mile logistics is just beginning to be introduced in Finland. German company DB Schenker has already conducted its experiment on this trend in Finland. DB Schenker and DSV are the target companies for the present thesis. However, the DB Schenker company holds a special place in the scope of this thesis, since it is in cooperation with LMAD (Finnish last-mile autonomous software platform) has already experimented with implementing this new technology in the capital of Finland.

## 1.4 Benefits

CEP (Courier, Express & Parcel Services) providers deliver essential commodities for both sectors, namely for B2B (business-to-business) and B2C (business-to-customer) (Aljohani and Thompson 2020).

This work will help Finnish start-up logistics companies to simplify the transition to shared micro-depots, based on the understanding of the peculiarities of logistics in the Finnish market. Besides, the implementation of the practice of introducing shared micro-depots is another step towards more sustainable and cleaner logistics.

## 1.5 Risks and risk management

Potential risks of the research are:

1. a relatively new topic, hence not much research has been done
2. limited existing contacts to get in touch with possible respondents
3. use of a various methods to approach informants, for instance, meetings, phone calls, messaging, etc.

In order to reduce the risks associated with this research, the author created a detailed plan for its investigation and presentation.

## 1.6 Key concepts

1. Biofuels - "any fuel that is derived from biomass—that is, plant or algae material or animal waste" (Lehman and Selin 2023).
2. Consolidation - "is the process where a carrier or a shipping company combines several smaller shipments into one full container" (EIT Urban Mobility 2021).
3. Last mile delivery - "is the last leg of the supply chain, when the goods (usually small-to-medium packages) move from the transportation hub or warehouse to the actual consumer as their final destination" (Chandrasekharan 2023).
4. Last-mile Logistics - "is a term used for the transportation of merchandise from the nearest distribution hub to the final destination, such as a home or business" (Saloodo 2022).
5. Low emission zone (LeZ) - "is a defined area within a city in which vehicles that do not meet certain emission standards are barred from entering" (Botchwey., Dannenberg and Frumkin 2022).

6. Micro-depot - “a logistics facility usually located inside or close to an urban area, in which a logistics service provider can load or unload, sort, store, and deliver parcels from it to the end-receiver” (BRIA 2022).
7. Start-up company - “is a newly formed business with particular momentum behind it based on perceived demand for its product or service. The intention of a start-up is to grow rapidly as a result of offering something that addresses a particular market gap” (Pratt 2017).
8. Urbanisation - “the increase in the proportion of people living in towns and cities. Urbanisation occurs because people move from rural areas (countryside) to urban areas (towns and cities). This usually occurs when a country is still developing” (Rosenberg., Balouka and Herer 2021).
9. Urban Consolidation Centre (UCC) - “is a logistics facility that is located in the proximity of an urban area, allowing to decouple and bundle inbound freight flows” (Heeswijk., Larsen and Larsen 2019).

## 2. Theoretical Framework

This chapter examines and explores the most advanced and modern technologies and literature data related to last-mile logistics and shared micro-depots technologies. The structure of the theoretical framework is shown in Figure 2.

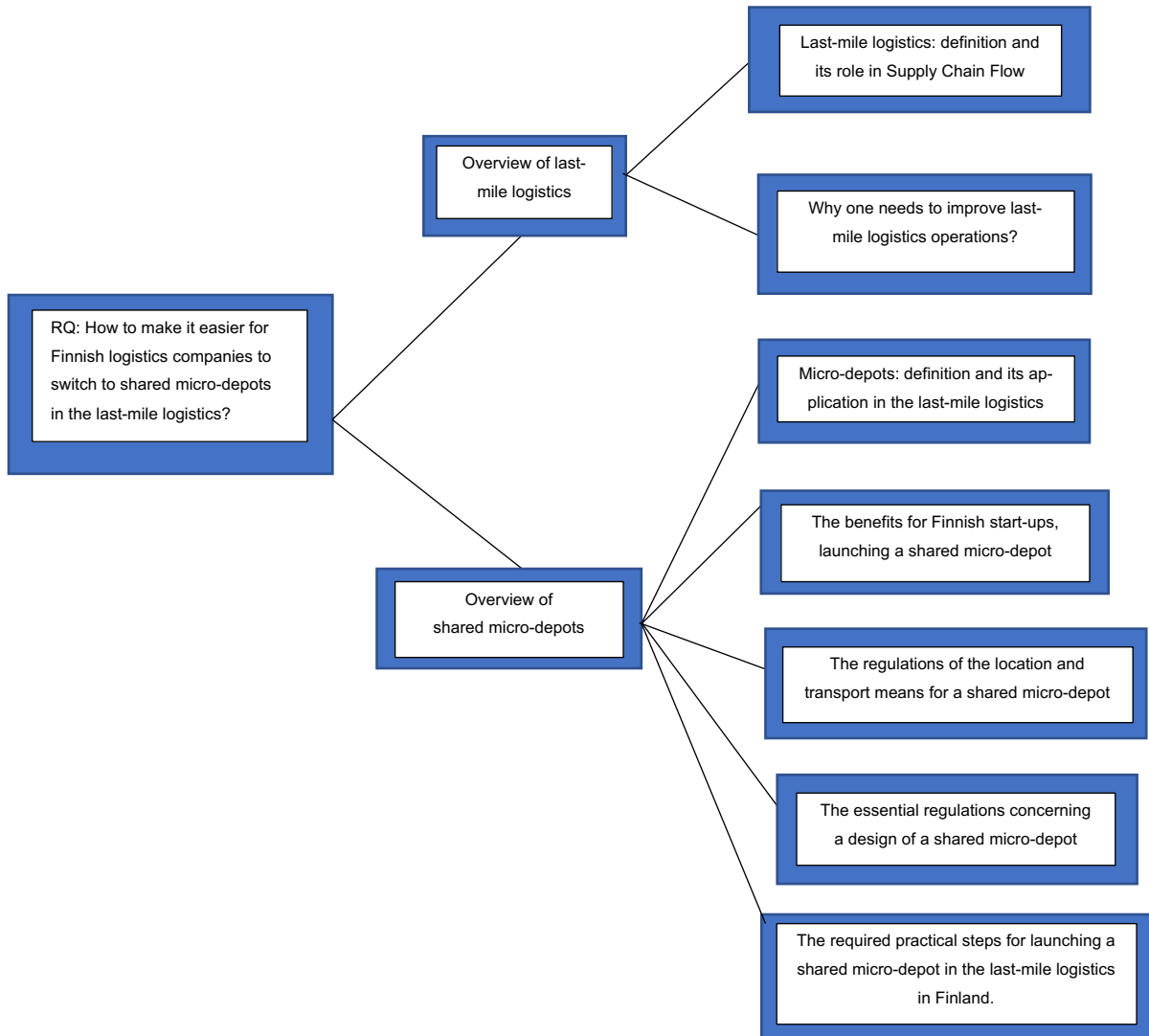


Figure 2. The theoretical framework structure. (Veronika Petrova)

The theoretical framework starts with the wider concepts of last-mile logistics and shared micro-depots (Leerkamp., Holthaus., Kuchhäuser., Thiemermann and Schlott 2021).

The theoretical framework begins with the broader concepts of supply chain management and logistics which entail definitions, close relationships with each other, and reasons for process improvement. The author then delves into identifying several necessary steps to produce a finished product in the form of practical recommendations, including a review of necessary regulations and limitations (DB Station & Service AG 2023).



### 3. The concepts of last-mile logistics and a micro-depot

#### 3.1 The concept of last-mile logistics

Last-mile delivery (LMD) is a term that is used to describe the final link of the entire supply chain. In a nutshell, a last-mile delivery is a shipment of a product from a warehouse or distribution center to a consumer. (B2C or B2B)

Most often a high price for the last-mile logistics is justified by the fact that the addressees are located far enough from each other, especially this trend is noticeable in the countryside. It should be argued that a last-mile delivery in the business-to-customer category is considered more sophisticated in terms of the number of operations and customer loyalty compared to business-to-business. A high percentage of online stores lose their customers and receive undeserved negative reviews about the product due to the fault of logistics providers who failed to provide their client with a high-quality delivery. However, if the companies rely on conscientious last-mile logistics providers, they not only reduce the time for delivery, but also make a delivery more qualitative and customer-oriented (Hamraoui 2020).

The most common last-mile logistics problems, are as follows:

1. unsuccessful attempt to deliver the order from the first time
2. a long waiting time for delivery
3. a lack of route optimization
4. poorly trained delivery service employees
5. traffic jams, traffic congestion and lack of parking spaces
6. improper storage of goods during their transportation
7. an absence or a poor organisation of a reverse logistics

A special place in the last-mile logistics is occupied by the need for a cargo consolidation - it is in turn crucial to minimise the number of kilometers travelled by a vehicle and rapidly increase the number of clients. Cargo consolidation is in a high demand for small-sized modes of freight transport, for which the dimensions of the transported cargo are critical. Thus, by combining several LTL (Less Truck Load) shipments, the company pays only for space occupied by its cargo. Besides, consolidation of freight reduces the risk of customs because the accounting for all shipments is represented in the documents.

### 3.2 The concept of urban consolidation centres

Urban consolidation centers (UCCs) are one of the important links in the smart logistics of the last-mile and they are successfully utilised in many European countries. According to the Figure 3, goods can be delivered from UCC to pick-up points, retail and wholesale stores, parcel lockers etc. In this case, a client can pick up his parcel at any convenient time. Among the outstanding advantages of UCCs are a reduction of carbon dioxide emissions, a better organisation, and optimisation of cargo. There is also the possibility of cooperation with retail and wholesale stores. Nevertheless, like every new technology, UCCs also have certain drawbacks, namely, high costs and lack of financial and intellectual support from the stakeholders and the third parties, as well as the refusal of the government to subsidise and work out legal recommendations for this logistics tool (Grandval., Nimtrakool and Grant 2019).

As for Finland, it can be noted that currently urban consolidation centers are not utilised in this country. Possible reasons for this trend are as follows:

1. a lack of cargo volume in comparison to another EU countries
2. high acquisition costs
3. a decrease of state funds regarding the UCC
4. a distrust of the stakeholders
5. a requirement to develop special road signs to regulate the traffic of UCCs
6. finding a suitable location for UCCs, as they should not be far away from the highways and the city center (Tsiulin., Hilmola and Goryaev 2017).

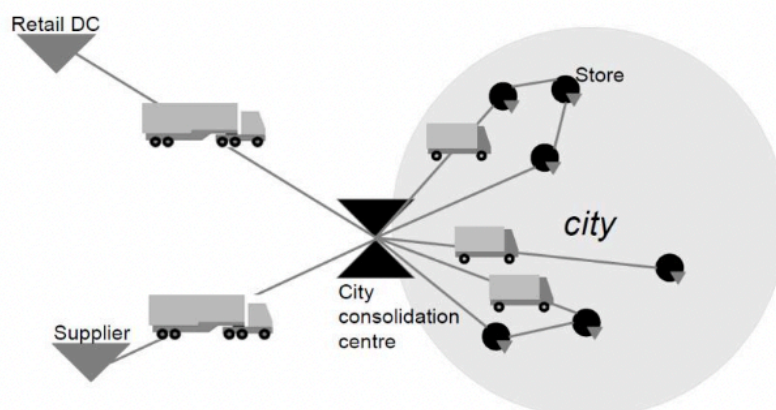


Figure 3. The urban consolidation center (UCC) concept (Quak 2008)

Taking everything into account, consolidation is an effective tool when interdependent resources complement each other, thereby making the logistics process of the last-mile even more efficient for

the end user. For instance, a delivery timeslot, a route planning, and a type of suitable vehicle cannot be considered separately from each other. Thus, it is extremely important for the last-mile logistics that the employees of the cargo companies do not overlook every detail that is closely interconnected with the delivery chain in accordance with the latest updated data in the information system (Hagberg and Hulthén 2022).

### 3.3 The concept of micro-depots and its application in the last-mile logistics

Speaking of a micro-depot as “a logistics facility usually located inside or close to an urban area”, it should be noted that its two key functions are: a consolidation of the received cargo and application of sustainable modes of transport in order to mitigate the consequences of ecological footprint. Moreover, micro-depots should be located in the densely populated areas, where it’s quite complicated to lay a route for the large types of vehicles (BRIA 2022).

Depending on the purposes and financial assets of each company, the company can decide whether it implements its own micro-depot or whether it limits itself to usage of a shared-micro depot where the LSPs may share a micro-depot’s facilities, including warehouse space, dressing rooms for staff etc. (Bürklen 2022).

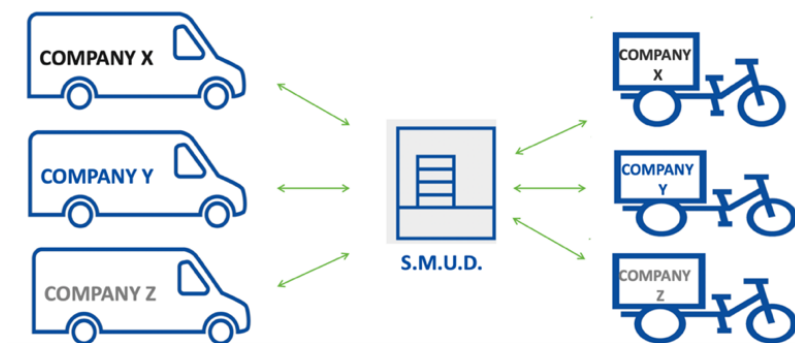


Figure 4. Shared Micro-Depot (EIT Urban Mobility 2020)

Additionally, a win-win scenario assumes that logistics providers rely on a white-label firm which helps the logistic providers to complete a last-mile delivery from a shared micro-depot. “In the logistics sector white-labelling allows you to show your branding on any delivery vehicles, messages or packages that hit the doorstep of your customers. Through white-labelling you can deliver packages and advertise your brand at the same time” (Bringly 2021).

In the best-case scenario bikes and small-sized modes of freight transport perform a movement of cargo under a white label in order to act eco-friendly and cost-efficiently. Furthermore, the issue of

finding parking spaces for these types of vehicles won't be that tough in comparison to implementing large-sized types of vehicles with increased greenhouse gas emissions effect.

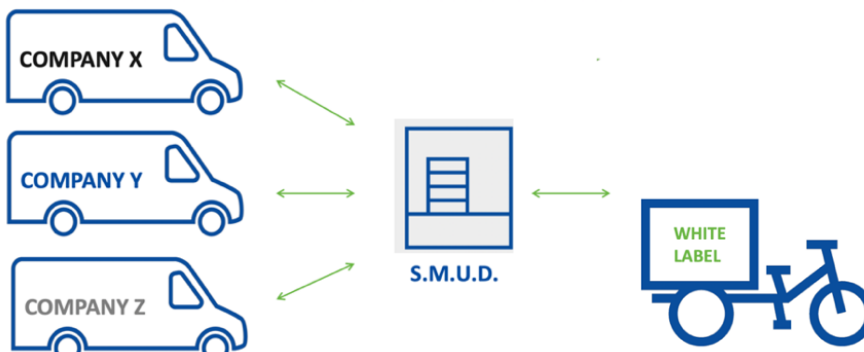


Figure 5. Shared Micro-Depot with implementation of white label (EIT Urban Mobility 2020)

A micro-depot is a new operating model that is different from the usual urban consolidation centre. (UCC) According to Milena Janjevica and Alassane Ballé Ndiaye, a micro-depot is “a facility that is located closer to the delivery area and has a more limited spatial range for delivery than classic UCC” (Janjevic and Ndiaye 2014).

As stated by S.M.U.D. 2021, a logistics service provider has to perform the following obligatory actions in order to implement its first micro-depot:

1. coming up with an idea and find partners in case one aims to operate a shared micro-depot - due to a long waiting time of obtaining various permissions (a building permit, fire licenses, commissioning permit etc.) from authorities this process may last up to a year or more.
2. identification of appropriate location for a micro-depot; starting a project management phase (construction, finding solution for the aspects and possible pitfalls of a project)
3. performing necessary product tests and gradual introduction of operations
4. product evaluation and defining development opportunities - holding an assembly with stakeholders based on the obtained results (EIT Urban Mobility 2021).

The logistics provider should also take into account that if he uses the services of a shared MD rather than his own, then the costs of operations may slightly differ due to the tariffs on rent, facilities, transportation, and salaries of employees. Additionally, a logistics provider has to be aware of the risk of insufficient level of cargo occupancy, as it's possible that delivery services in some regions will not be in great demand and a space of transport mode will be half empty (Glöckner., Pufahl., Franczyk., Weske and Ludwig 2020).

The following ecological aspects while implementing micro-depots should be considered:

1. GHG emissions (stem in greater or lesser degree from utilising fuel or electric vehicles)  
It's worth noting that biogas-powered vehicles are more fuel-efficient than diesel-powered in a long term. Although the price of biogas-fuelled vehicle itself is much higher which is not profitable in a short-term
2. air Pollutants (both GHG emissions and air pollutants are reduced while decline in the number of unsustainable transport modes)
3. noise (can be significantly decreased thanks to a micro-depot and eco-friendly types of vehicles such as cargo bicycle, electric trucks, autonomous robots etc.) (Rosenberg., Balouka and Herer 2021).

In 2020, as part of the S.M.U.D. project, a first experiment was conducted in Helsinki with a shared micro-depot utilising cargo-bikes, vans and trucks which delivered parcels to the customers. The following 5 logistics providers were involved into the new project and functioned separately from one another, utilising two containers and a wooden building to perform the logistics services:

1. a firm which provided around-the-clock parcel locker services
2. a publishing company which had to deliver the magazines to the readers
3. a large logistics service provider using the MD as a transshipment point
4. a start-up offering crowd-sourced deliveries
5. a municipality which managed the operations of MD and was responsible for its maintenance  
(EIT Urban Mobility 2021).

By the end of the experiment, it was revealed that a location, a certain equipment, and facility types of MD, such as place of unloading and warehousing were the main criteria of taking a part in the specific experiment of 5 companies. Moreover, residents pointed out that a micro-depot served as a meeting point for them while picking up their parcels from a MD. Overall, a shared micro-depot implementation has particularly shown its effectiveness in the densely populated areas, as well as the ability of 3PL provider to control other logistics providers in order to standardize and simplify a last-mile delivery process (Rosenberg., Balouka and Herer 2021).

Another example of application of sustainable vehicles is a cooperation of Finnish retail chain, "HOK-Elanto" and Estonian robotics company, "Starship Technologies". They launched a joint project for e-commerce grocery deliveries from Alepa in Espoo region in 2022. Thereby, 60 autonomous robots successfully accomplished delivery tasks during a semi-annual experiment thanks to artificial intelligence which in turn assisted them while moving them around the city full of pedestrian crossing areas and various barriers. Nevertheless, despite the accomplishment of the introduction of autonomous robots in Espoo, specifically in Finland they should be utilised in combination with other modes of transport (cargo bikes, electric trucks, and vans), since they are not able to travel long distances

and do not bypass some obstacles exceeding their dimensions, as well as due to several unpolished technological aspects (Haikonen 2022).

While pursuing the goal to perform fossil-free transportation by the third decade, Posti is planning to utilise 300 electric vans for its last-mile delivery and introduce an innovational “clean vehicle roadmap”. Thus, the area of utilising of electric vehicle modes will extend beyond the Uusimaa region and spread to Turku and Tampere. Besides, electric bikes and scooters play a significant role in the Posti logistics operations by offering mail and other small parcel delivery services. Both electric vans and cargo bicycles are capable to function effectively during the winter cold in Finland (Posti 2023).

In terms of social aspect, micro-depots occupy a significant space (a minimum size of one micro-depot is 15-20 m<sup>2</sup>) which can be also used for socially beneficial purposes such as providing extra parking places, landscaping of surrounding areas, monetary compensation for plastics, glass, and cardboard recycling as a bonus (Bürklen 2022).

The undeniable advantage of introducing micro-depots in terms of last-mile logistics is a reduction in delivery costs since it becomes possible to combine parcels from different micro-depots to consolidate and place them in one vehicle for delivery to the final destination. The success of the micro-depot’s implementation depends on a clear coordinated interaction of transport systems, a vision for the further development of the new project, an effective cooperation with local authorities and partners from the inception of the idea, as well as on reducing carbon footprint through the use of micro-depots. All these aspects create a positive image of micro-depots (Rosenberg., Balouka and Herer 2021).

Based on the examples listed above, one can conclude that there is an increasing interest in the new initiative and the introduction of eco-friendlier modes of transport in Finland. However, in order to fully adapt the given logistics technology, it is necessary to conduct more experiments and collect more data. Nevertheless, we observe that a micro-depot has great chances for full implementation not only in the metropolitan region and it is only a matter of time.

## 4. The benefits for Finnish start-ups, launching a shared micro-depot

### 4.1 Definition and the main features of start-ups

According to Investopedia, a start-up company is “a company in the first stages of operations. Start-ups are founded by one or more entrepreneurs who want to develop a product or service for which they believe there is demand” (Grant 2022).

The start-up companies are considered to expand on a larger scale at a rapid pace in case they hold enough invested funds. Moreover, it is also easier for them to adapt to the new realities of the market than for old pioneer companies and they are full of enthusiasm and desire to develop new ideas.

Silicon Valley is rightfully considered as the most effective startup ecosystem in the world. HP is the first startup in Silicon Valley which appeared already in the 30s of the last centuries. According to the Global Startup Ecosystem Report 2022, Silicon Valley retains its first leading position in the development of new companies and technologies, succeeding in all indicators (performance, market reach, funding etc.) (GSER 2022).

The most striking features of a startup from other types of companies are following:

1. focusing on innovative solutions which will cause a huge stir in the market
2. an uncertainty and risks - in this case it's better to run a limited liability company than a private entrepreneurship as in the event of start-up's bankruptcy, business owners are responsible only for the operations and invested funds; this means that they do not have to pay off the company's debts from their personal pockets
3. a demand for a business idea - in half of the cases, the project collapses due to the unsuccessful strategy of entering the market as was the final product itself
4. a dream team - is one of the main recourses
5. a rapid development of the project - usually within 4 months (Uusitalo 2022).

As Paul Graham (1964), PhD in computer science and a cofounder of significant start-up accelerator, stated that start-ups stagnate in their development when they reach a plateau stage of the S-curve. An accelerator is an organisation which holds master classes and short educational programmes for the development of a company and its employees for the longer term. One can observe in the Figure 6 that an average start-up undergoes the following phases: a slow growth or a temporary freeze of development - a rapid growth - a plateau stage (Yarrow 2012).

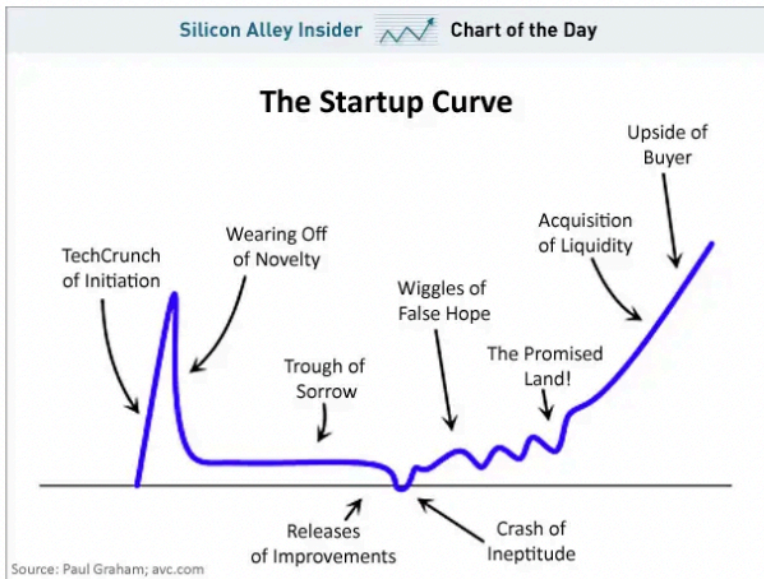


Figure 6. The Start-up Curve

## 4.2 Environment for start-ups in Finland

If one reviews the implementation of a start-up in the context of Finland, one has to take into account that Finland is a transparent and economically stable country with a low corruption level. Finns are proud of their country and culture and are reluctant to adopt the characteristics of other cultures. Thus, we do not observe such an influence of "Americanism" in Finland as in other European countries (Häme University of Applied Sciences 2021).

According to the World Population Review, 5, 544, 452 people legally reside on the territory of Finland in 2023. Approximately, 560 thousand people live in Helsinki which is only 10% of the total population of the country. And about 450 thousand inhabitants reside in the Vantaa and Espoo regions (World Population Review 2023).

Despite a simplicity and safety of launching business in Finland, one has to face a huge redtape, especially if a number of official documents are drawn up either in Finnish or in Swedish. Finns are ready for various business experiments and innovations, but they still have a fear of failure and promotion of an innovative idea. Finns, as a rule, do not have the qualities that are the hallmark of a successful entrepreneur: the ability to present themselves, praising their products and team do not correlate with Finnish modesty and closeness. Modern Finnish start-ups have the nature of nationalism, cultural cohesion, and desire to improve its products and services (Koskinen 2020).



On the report of Hofstede, individualism, uncertainty avoidance and indulgence are the key pillars of Finnish society. In turn, by individualism is meant that Finns focus more on their close circle of family and friends rather than on the entire society. Individualism is also applicable in the work environment, where an employee is hired or fired based on his own achievements and results. Regarding indulgence, it should be noted that Finns are quite tolerate and have optimistic outlook on life (Hofstede Insights 2023).

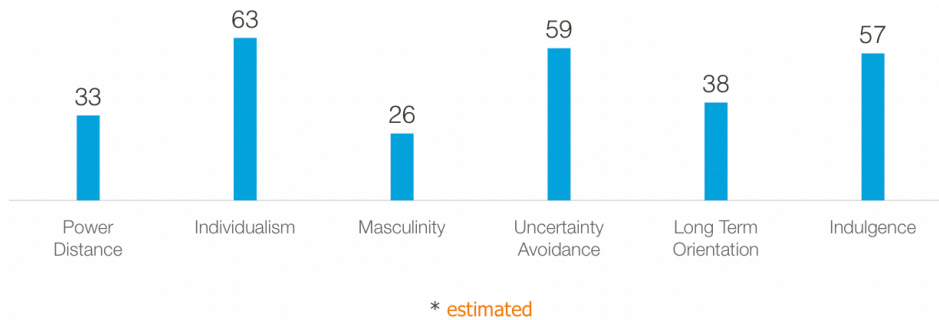


Figure 7. Hofstede Insights. Finland

Finland is frequently underestimated by international scientific community due to unawareness of its late technological progress. Espoo, located near Helsinki (Uusimaa region) is one of the most significant innovative centers in the North Europe, where ecosystem of start-ups, range of scientific research centers, companies of Finnish or international decent and Aalto University are gathered inside of single infrastructure.

Rovio, Basemark, Whim, Wolt, Relex Solutions are those Finnish start-up companies of the twenties which undoubtedly should not go unnoticed on the international market. Unfortunately, it is worth noting that investments in Finnish start-up companies are not on a large scale, especially in the planning phase. Currently, the state-owned company Finnvera which is responsible to the Ministry of Labor and Economy of Finland, is the most accessible source of funding. However, the coverage is not more than 80% of the total cost of the investment. (Finnvera. Official Website).

ELY centres (Business, Transport, Environment Agency) are another state structure which provides consulting and financial services while taking into account a scale and prospective outcomes of the subsidised project (ELY-keskus. Official Website 2023).

Enter Espoo acts as a city business intermediary that attracts international investors, organises various conferences and provides support at various levels, including legal one not only to existing Finnish companies, but also to Finnish start-ups. And no less importantly, Aalto University (ranks 382<sup>nd</sup> worldwide and 2<sup>nd</sup> in Finland in the rating of the best universities in accordance with EduRank

2023 and other research and development centres) cooperate closely with Enter Espoo while supporting and expanding the existing Finnish ecosystem (Podnebesnikova 2021).

Supposedly, Finnish start-ups should refer to the experience of other countries, not necessarily European in order to perform outstanding implementation of shared micro-depots, taking into account Finnish logistics infrastructure. The following international start-up companies can be distinguished which have introduced micro-depots to improve their logistics operations and achieve a greater customer satisfaction:

1. Israeli start-up Fabric (before the rebranding policy was known as CommonSense Robotics), a provider of micro-fulfillment technologies.
2. Hochbahn AG, a German public transport carrier launched a second shared micro-depot in Hamburg in the partnership with start-up companies.

### **4.3 Inspirational foreign start-up cases, utilising shared micro-depots and its analogues.**

#### **Fabric Case**

Fabric, Israeli start-up company started its business activity in the year 2015 aiming to throw down the glove to the last-mile logistics leaders. Nowadays the company has the main offices not only in the Tel Aviv, but also in the United States of America. (New-York, Atlanta) Fabric raised a large capital of \$138 million, attracting investors' interest when their "the world's smallest automated fulfillment center" proved its effectiveness in 2019. A company managed to deliver online purchases to its Israeli customers within one hour in the partnership with Super-Pharm, Israeli beauty and wellness supplier while struggling with slow-paced and high cost last-mile deliveries. Fabric and Super-Pharm work on their projects together already for a couple of years. Over time, Fabric built its micro-fulfillment centers with robotics equipment across the country whose capacity was around 550 m<sup>2</sup> as demand for thousands of online orders with the same-day delivery from Super-Pharm grew every month. Staffs while performing their duties in the automated order fulfillment center, simply scan, put the scanned items in the colored boxes and collect the order. The rest of the operations are executed by a software and robotic machines. Fabric's plans for the future, include expanding its branches in the United States, using a venture capital to introduce new types of fulfillment-centers in different states (Solomon 2021).

Case of Fabric demonstrated us that start-up companies that have developed evolutionary solutions using their unique vision, as a rule, do not go unnoticed by stakeholders. Secondly, the Israeli company, by introducing micro-fulfillment centers was able to significantly reduce the costs and perform same-day deliveries which affected their accounting report and improved a customer focus.

“Micro-fulfillment center is (or MFC) is a small, sometimes highly automated fulfillment center that can fulfill e-commerce orders as well as local store pickups” (Ladd 2022). Micro-fulfillment centers can vary in their scales: from the size of a small store to the size of several football fields. Both, micro-depots, and micro-fulfillment centers are located close to the final recipient’s addresses as opposed to the urban consolidation centers. The overall goal of a micro-depot and a micro-fulfillment center is to reduce costs and waiting time for delivery, whereas their main difference is that micro-fulfillment centers are not adapted to heavy packages, and they are focused more on the specific customized operations. Present micro-depots are not currently flexibly designed to provide extra parking spaces, bonus recycling programs for the clients and meeting place for social activities for the city residents. The concept of micro-fulfillment centers and micro-depots resemble one another. That is the reason why I have decided to illustrate the logistics solution of the start-up company Fabric.

### **Hochbahn Case**

2 years ago, a German public transport carrier Hochbahn constructed a shared micro-depot in Hamburg specifically for start-up companies which was located in the city center, near the main bus station. The main idea of the second shared micro-depot for the city was to reduce traffic congestion and mitigate the consequences of greenhouse gas emissions. This approach, which was applied specifically for start-ups, helped to reach a completely different level in the provision of last-mile services and to experiment with company’s own delivery methods and technologies in the more sustainable logistics environment, while expanding delivery areas to achieve a customer loyalty and satisfaction (Hamburg News 2021).

As it was mentioned earlier in my thesis, for Germany as a whole, the introduction of micro-depots is not an innovative topic as it was one decade ago. Consequently, German logistics providers are trying to expand the implementation of micro-depots in other countries where they have own branches, for example in Finland.

#### **4.4 Perspectives for Finnish start-ups while utilising shared micro-depots.**

According to PostNord study, (E-commerce in Europe) Finland ranks 11th in Europe in terms of customer solvency, ahead of Poland, more than  $\frac{3}{4}$  of Finns purchase their goods in the foreign stores. The logistics of the last mile is on high demand in Finland and the tendency to increase will continue to grow every year. Therefore, the issue of implementing methods of fast, safe, and cost-effective logistics remains relevant to this day (Vahter and Liikkanen 2021).

Finland has made many attempts to introduce micro-depots, some were successful in nature, and some not. Regarding Finnish culture and mindset, we see that some companies' CEOs lack the entrepreneurial streak, but they have the desire and aspiration. We also see that Finnish logistics providers face legal and technical limitations during the experiments with some of their developments. For example, an attempt to introduce widespread the unmanned aerial vehicles (drones) has not been as successful as in Europe, as there are still some existing technical and legal obstacles despite the tests already carried out. Start-ups do not need to utilise drones in combination with a shared micro-depot; they can use cargo bikes, electric vans and trucks which are more predictable and simpler for unsophisticated industry newcomers. However, this is not a reason to abandon the attempt of adoption of robots and drones in the delivery services - these issues and possible solutions should be clearly explained to the local government in order to jointly take measures to promote and improve new technologies. Current start-up companies with a unique vision that lack sufficient funding and experience should not create their own micro-depots. They need to unite with other start-ups to create together a first-class shared micro-depot or they can rent their partners' a shared micro-depot. First, it is worth to start the expanding process regarding the shared micro-depots in the most adapted Finnish cities. (Helsinki, Espoo, Turku, Tampere) After a successful introduction of shared micro-depots in these cities one can conquer with these logistics technologies other areas of Finland.

Undoubtedly, Finnish start-up companies in case of successful implementation of shared micro-depots, will reach another level in the last-mile logistics while:

1. delivering parcels by different methods
2. reducing the distance and shipping costs
3. having an option to rent the necessary spaces and facilities of shared micro-depots, without being responsible for the repair of outdated equipment (in case several start-ups rent a shared micro-depot from a service provider)
4. increasing a loyalty to their brand by using eco-friendly delivery methods and providing the residents with extra parking spaces, special programs, and social activities
5. attracting investors (as a result of successful integration of shared micro-depots in the Finnish infrastructure)
6. promoting Finland to reach a higher international level in the field of logistics.
7. becoming more competitive and keeping a stable plateau stage which is extremely paramount for start-ups to survive in the "red ocean". (Figure 6)
8. acquiring more opportunities to conduct new required experiments and etc.

## **5. The regulations of the location and transport means for a shared micro-depot**

### **5.1 Finding an appropriate location for a shared micro-depot**

The carefully selected location for the implementation of shared micro-depots is the key to the success of the entire last-mile logistics' supply chain, as the right location determines the distance, cost-efficiency (for both parties, providers, and the parcels' receivers) and convenience of delivery to the end consumer. Additionally, the chosen location should not interfere with a transportation city system and a public space; parking spaces for trucks and vans should be in a good availability. The thorough analysis of the existing data (logistical conditions, a transportation and infrastructure city system, land-use regulations etc.) could not be conducted without the assistance of various software tools and competent professionals. Only after well-chosen location for the future shared micro-depots, one can speculate about the design.

When planning the location of shared micro-depots, new city initiatives should also be considered. According to Land use and planning review 2022 of Helsinki city, the construction of the majority of recently designed rail and tram lines is going to be completed by the end of the 2025s. (Jokeri Light Rail, Pasila railway connections, Jätkäsaari tram lines etc.) What is equally important, is a latest update of pedestrian and cycling traffic in Helsinki region. For instance, Baana project which is a 130-km bicycle highway network plan awaits its implementation in the next few years. Besides, the local government in frames of Baana plans not only to launch more well-designed and adapted bike paths, but also to improve the existing ones in Helsinki. Another city initiative concerning the improvement of municipal infrastructure (pedestrian crossings, sidewalks, and one-way bike paths) in the Linnankoskenkatu area will begin to be carried out already this year. Finally, the construction of wider city boulevards will increase not only the number of parking spaces, but the number of offices and apartments. It is expected that this year about 8000 new houses in Helsinki will be waiting for their new inhabitants (City of Helsinki 2022).

Referring to the map of Helsinki, one cannot ignore the fact that a vast list of new initiatives is being put forward for the development of urban infrastructure. Yellow color on the map indicates initiatives related to the transport system, orange indicates pedestrian and bicycle traffic. Thus, the development of cycling, city boulevards, pedestrian areas, and transportation system as whole in Helsinki region gives a flexible opportunity to choose a location for the future shared micro-depots while implementing such delivery modes of transport as cargo bikes, electric trucks, vans, and robots (City of Helsinki 2022).

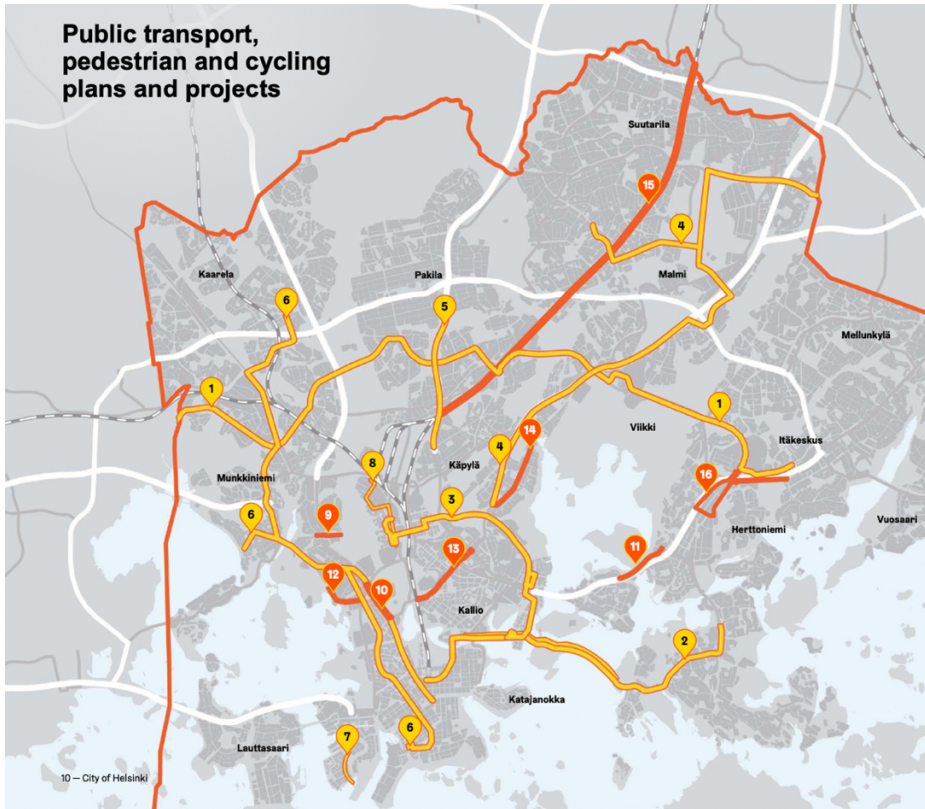


Figure 8. Land use and planning review in Helsinki. 2022

Customers can receive goods from a shared micro-depot both by home delivery and by picking up the orders themselves. Ideally, shared-micro depots should function around-the-clock so that customers who prefer self-delivery to more familiar delivery method could pick up their parcels stored in the secure place without having to go a long distance from home.

As for the expansion of the network of shared micro-depots, it is paramount to take your time and perform actions step by step, taking into account the growing needs of your clients. According to Pete Pättiniemi, the representer of Forum Virium Helsinki, considering the present features of the Helsinki ecosystem, it is possible to introduce only 5 shared micro-depots in the city (EIT Urban Mobility 2021).

Nowadays, only 3 points in Helsinki region are considered as possible advantageous locations: Baana City Hub, ABC Sörnäinen, ABC Mannerheimintie. A shared micro-depot in Baana City Hub was a part of DB Schenker's experiment which was conducted in 2020. Both, ABC Sörnäinen, and ABC Mannerheimintie in Töölö district are Finnish petrol stations, which provide great logistics conditions for the future shared micro-depots. Additionally, ABC Mannerheimintie is located in densely populated area by the standards of Helsinki region, where extra services can be in high demand among the residents (EIT Urban Mobility 2021).



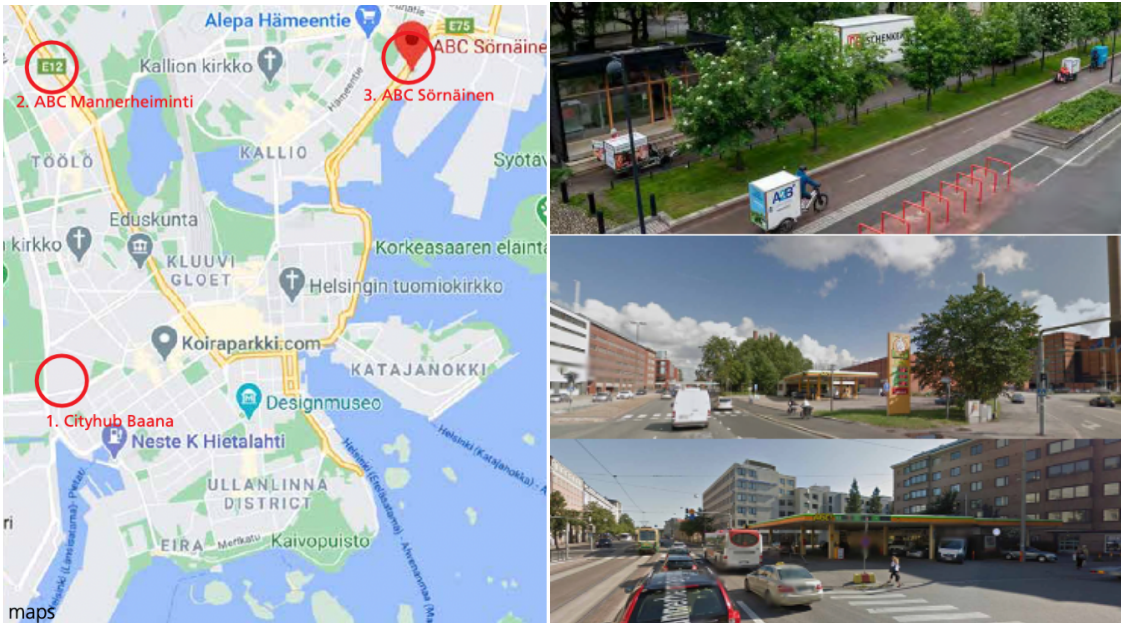


Figure 9. 3 locations for a future shared micro-depot in Helsinki. EIT Urban Mobility. 2020

The expansion of logistics services providers' geolocation is also possible thanks to the combined use of shared micro-depots with already widely used and loved by many consumers, parcel lockers. In case of the first unsuccessful delivery attempt, recipients will be able to get their parcel at any time convenient for them in a nearby parcel locker. Parcels from a shared micro-depot can be delivered to parcel locker via bicycle in support of the green initiative and savings on fuel costs.



(a) A trip from the micro-depot (MD) (circle) to customers, without parcel lockers

(b) A trip reaching the same customers as in Figure 9a, with the addition of parcel lockers (orange) and a new customer (purple)

Figure 10. Adding parcel lockers into a delivery trip from the MD. MDPI. 2021

However, if parcel lockers are not provided in this route chain, then logistics providers should not neglect the individual design of the location of each shared micro-depot; electric trucks and vans will not be able to drive through narrow streets and the parcels will not be successfully delivered by cargo bicycles if the infrastructure of the area does not provide the bike lanes. It is recommended to refer to the local administration in case you wish to share some reflections about the obstacles that

concern you in the area of your delivery zone, for instance, if it is necessary to repair the road or increase the area of a certain object (Rosenberg., Balouka and Herer 2021).

## 5.2 Urban Access Regulations in Helsinki

According to Urban Access Regulations in Europe, there is only one Low emission zone in Finland, and it is located in the capital of Finland, Helsinki. “Low emission zone (LeZ) is a defined area within a city in which vehicles that do not meet certain emission standards are barred from entering” (Botchwey., Dannenberg and Frumkin 2022).

The following types of modes are not allowed to enter this zone (“ympäristövyöhyke” in Finnish), otherwise the drivers have to pay a fine of 100 €:

1. a public bus (M3)
2. a waste collection vehicle (Green Zones in Europe 2010)

Besides, lorries over 12 meters are forbidden in the Lez Zone of Helsinki region which is highlighted on the map. In other cases, the drivers of the lorries over 472,4 inches must get a special permit for them (Urban Access Regulations in Europe 2023).

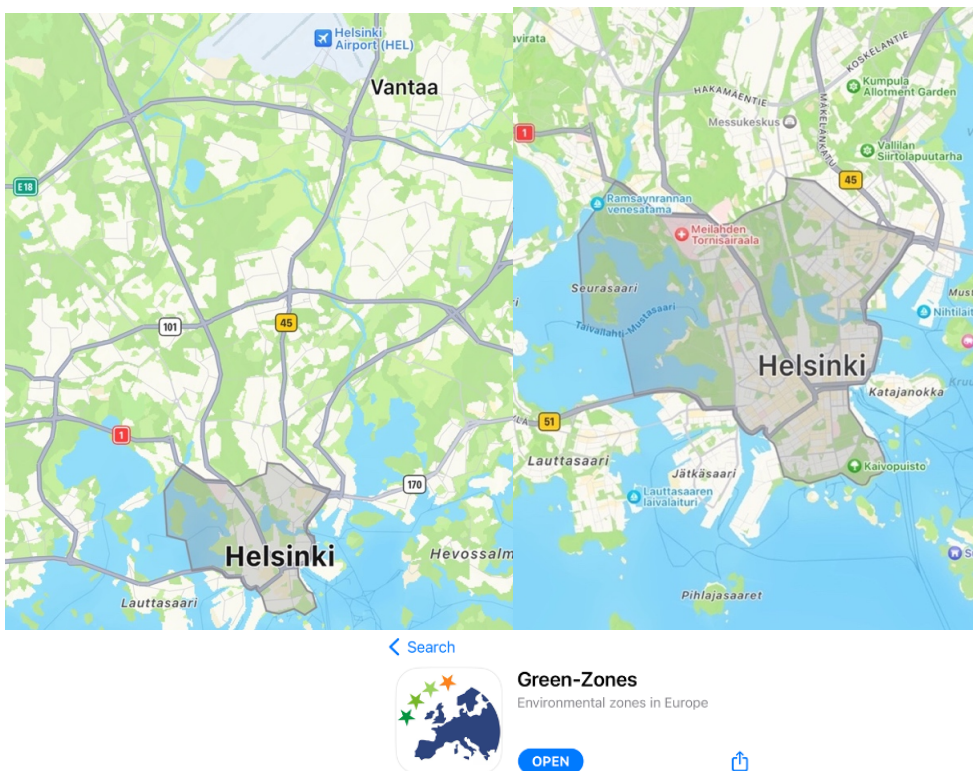


Figure 11. Low Emission Zone in Helsinki. Screenshot from “Green-Zones - Environmental zones in Europe” App



Additionally, The Finnish government has decided to conduct a 3-year experiment to ban studded tires on one of the Helsinki streets, Lönrotinkatu. Unfortunately, this restriction also applies to electric vehicles. Translated from Finnish “Nastarengaskielto” means “Studded Tire Ban”. If this experiment proves its effectiveness and the government issues a decree on the entry into force of this restriction, local logistics providers of the last-mile logistics will have to rethink their strategy. After all, this restriction may even apply to cargo bicycles which also change their tires in winter (Urban Access Regulations in Europe 2023).



Figure 12. Road sign. ” Studded Tire Ban”

### 5.3 Regulations of transport means for a shared micro-depot






Within the scope of this chapter, I will consider only the following types of vehicles: cargo bikes, robots, drones, electric trucks, and vans. As for drones and robots, I would say that these technologies require improvements. Despite a successful project of introducing Aleppo store robots in Espoo, robots as well as drones, cannot be called an absolutely reliable delivery method, at least for today.

#### Cargo bikes

Cargo bikes can easily operate not only on the outskirts of Helsinki, but also in the low emission zone, as these types of modes, as well as robots and drones are emission-free. In addition, the cargo bikes will help to reduce the amount of CO<sub>2</sub> emitted in the overall sustainability indicator of the company. The capacity of the cargo compartment of a cargo bike is up to 250 kilograms. The maximum travel speed for cargo bikes is from 25 up to 45 km/h. However, the speed must not exceed 20 km/h in the residential areas in Finland. As it was mentioned before, within the framework of Baana, the network of bike paths in Helsinki will be expanded by another 9 kilometers, namely from Käpylä to Vantaa (YLE 2023).

Table 3 provides a brief description of cargo bicycles. The cargo bicycles are presented in order of their cargo capacity, from smaller to larger (adapted from Springer 2023).

Table 3: Types of cargo-bikes (self-made table)

Type of cargo bike	What types of parcels can this cargo bike transport?	Approximate price	Image
Courier bike (with 2 wheels)	letters, newspaper etc.	around 1200 €	
Long John (with 2 wheels)	deliveries from cafés, small purchases, clothes etc.	around 2500 €	
Trike (with 3 wheels)	luggage, groceries etc.	around 3500 €	
Long tail (with 2 wheels)	building materials, computer, and household equipment etc.	around 4500 €	
Heavy-duty bicycle (with 3 wheels & more)	furniture etc.	around 7000 €	

## Robots

A particular interest in the use of robots and drones in the last-mile logistics appeared during the Covid-19 pandemic, and Finland was no exception. Indeed, these types of modes still need to be technically refined for a full-scale implementation. Nevertheless, one can already draw conclusions about the effectiveness of this delivery method in a long term (Marr 2020).

In the previously mentioned example of implementing robots in the last-mile logistics, “Starship Technologies” robotics company while operating 60 autonomous robots around the city was responsible for the security on the sidewalks during the experiment. Thanks to the low speed, delivery robots can also move without let or hindrance along the sidewalks (Jokiniemi 2021).

However, the infrastructure conditions and a security awareness are the main issues due to which the local authorities do not want to allow the widespread implementation of delivery robots in Finland. These 2 factors may discourage a desire of the stakeholders to make investments in delivery robots (Muhammed 2022).



Figure 13. Forbes. 2023

The price of a delivery robot varies from 10200 € up to 50000 €, depending on the provided services. However, the capacity of a delivery robot is only up to 50 kilograms. Besides the logistics providers have to pay fees in order to obtain a software, get maintenance services, set mandatory programs etc. This type of vehicle is not capable of covering a distance outside of one city (Chandrasekharan 2023).

## Drones

In regions with insufficiently developed infrastructure, drones will be a true salvation in the last-mile logistics. Drones can deliver not only small parcels, but also food from the local restaurants. Nowadays the main obstacles to the widespread application of drones are the collection, storage and processing of data and distrust on the part of consumers due to the lack of knowledge about the possibilities of the new technology. Drones, like robots, emit carbon dioxide emissions into the atmosphere which amount is significantly lower compared with electric trucks and vans. Speaking about the costs of servicing robots, one should also bear in mind that the costs of operating drones is only 5%, while the rest of the costs go to the salary of the employee who controls the drone remotely through a computer software. In order to offset the costs of drone maintenance, it is necessary to develop technologies to such an extent that one employee (an observer) could control 18 robots at once through a computer software and receiving the same salary. Since the current technological progress allows one observer to control only one drone, and not a group of drones at once (Cornell., Kloss., Presser and Riedel 2023).



Figure 14. Analytics Insight. 2020

## Electric trucks and vans

In a competitive environment, electric vans, and trucks whose purchase price is higher than significantly less eco-friendly diesel-fueled modes of transport, have the potential to displace or complement them. Electric vans, unlike electric trucks, are more designed for transporting cargo over short distances, as well as on narrower streets and yards where it's quite challenging for the e-trucks to drive. Whereas e-trucks can travel long distances not least thanks to the more powerful engine and battery (Haikonen 2022).



Figure 15. Electric truck. Raskas Kalusto. 2022

At especially low temperatures, the battery of electric vehicles has to work in double volume which is an issue of the successful operation of e-trucks and e-vans in the harsh winter. According to the environmental policy of many countries, there is a growing trend of increasing low emission zones, as well as stricter traffic regulations for the vehicles that pollute the air, emitting significant noise and CO2 emissions. Some types of electric vans and trucks also fell under the distribution as the governments of some countries decided to minimize deliveries at night which in turn violates schedules and routes of that last-mile service providers (Haikonen 2022).



Figure 16. Electric van. Neste. 2021

Generally e-trucks and e-vans charge their batteries at night. The battery charger for the e-vehicle is an expensive acquisition, and logistics service providers should be ready to invest in the development of the company. Unfortunately, the network of petrol stations with biogas fuel is not so widespread in Finland. Thus, it will not be possible to fully optimise the route due to the fact that e-vehicles

have to travel a greater distance to refuel. According to U.S. Department of energy: “emissions for 100% biodiesel (B100) are 74% lower than those from petroleum diesel” (U.S. Department of energy 2023).

In 2021, the Finnish factory “Lielahden Autokeskus Oy” with the headquarter in Turku, in collaboration with the stakeholders launched a first conveyor for the manufacture of e-trucks in Finland which was the initial step towards their adoption which currently extended all the way to Santa Claus Village (Karmala 2021).

## 6. The essential regulations concerning a design of a shared micro-depot.

After choosing a suitable location for a shared micro-depot, in terms of optimised and convenient route, one should start thinking about a design of a future shared micro-depot. Bearing in mind still evolving and improving local infrastructure of Helsinki, a special attention should be paid to the following aspects, while performing a preliminary design work on a shared micro-depot: a scale of space; facilities for applied vehicles and their unhindered travelling around the city; development potential of surrounding area; compliance with the requirements and legislation.

As it was mentioned earlier, temporary storage lockers can also be included in the design of a shared micro-depot, inside of which all logistics operations are conducted. Another extraordinary solution would be transformation of familiar to us the parcel collection points into bus stops with sitting places. Also, the location of social facilities, such as snack bars, coffee houses on site will enhance the interest of customers since they will be able to occupy themselves with something while waiting.



Figure 17. Bus stops. EIT Urban Mobility. Gateways Artist impressions. 2020

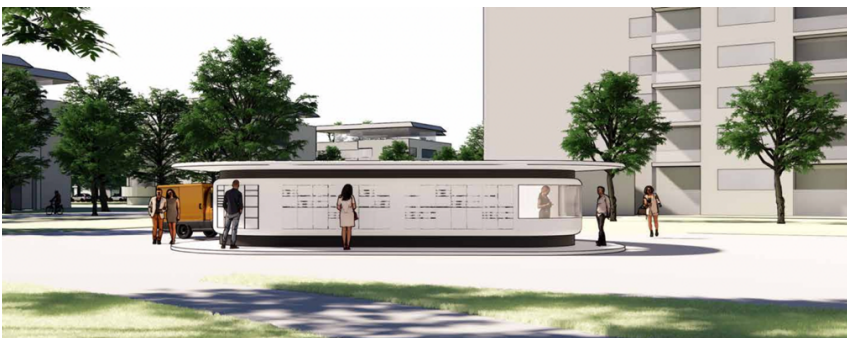


Figure 18. Drive through. EIT Urban Mobility. Gateways Artist impressions. 2020

The local authorities of Helmond (Netherlands) are aiming to build there the most technically advanced European district, where only environmental-friendly vehicles will be allowed to enter. According to the plan, the recent shared micro-depot has to be constructed right next to the Helmond's exceptional district. In most cases only sustainable vehicles under 100 kgs will be able to transport the goods from the Helmond's shared micro-depot. Even at the planning stage of a shared micro-



depot construction, the administration of the city obtained the approval not only from the investors, but also from the local citizens. Despite the fact that construction has not yet been initiated, there are already detailed design schemes (Rosenberg., Balouka and Herer 2021).

Figure 19 demonstrates that Helmond's shared micro-depot can be as high as a 50-storey building. It is also worth paying attention to the fact that all the rooms except rentable space and office, on average do not exceed 40 m<sup>2</sup>. Besides, one also will be able to reach the last floor by an elevator.

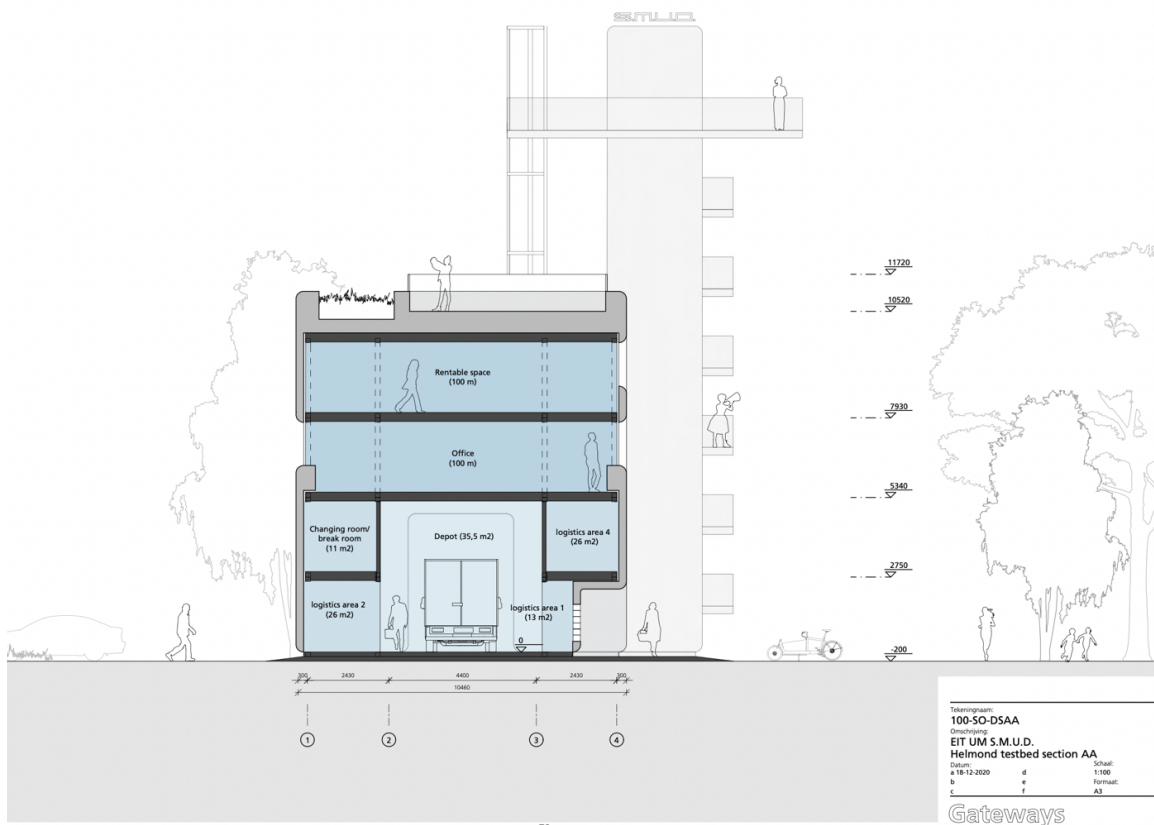


Figure 19. Helmond testbed section AA. EIT Urban Mobility. Gateways Artist impressions. 2020

As it was proposed, 26m<sup>2</sup> kiosk and e-car parking are included in the shared micro-depot plan drawing of Helmond which makes it an attractive logistics object in terms of social aspect. Additionally, there are planted trees and shrubs in the area where the clients can enjoy a cup of coffee or read a magazine while sitting on the bench (see Figure 20).

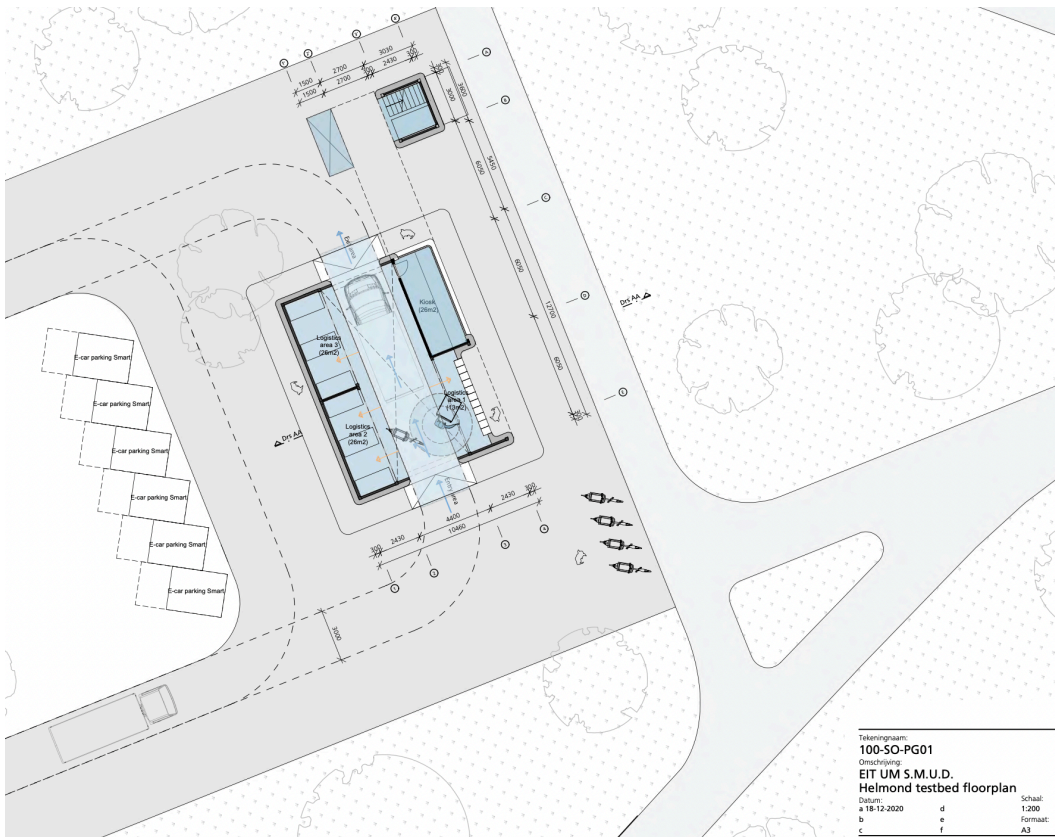


Figure 20. Helmond testbed floorplan. EIT Urban Mobility. Gateways Artist impressions. 2020

In order to consolidate not only cargo, but also “the clients’ actions” one can install the following facilities and special programs for providing a better customer-focused services, showing that *both, the clients and the sustainability matter*:

1. Powerbank stations: for a small fee, the client can borrow a power bank for the necessary time.
2. E-car and bike rental services - a company may rent out their eco-friendly modes of transports to their clients, who want to travel to the outlying districts or is new in the city and doesn't want to waste his time on searching for the routes of local public transport.
3. Temporary storage of household items, including furniture - this function is quite useful when you are moving out of your previous property.
4. Reuse of packaging - it will be cheaper for clients not to throw away the packaging but reuse it again; additionally, one can get bonuses or other rewards for packaging recycling.
5. Changing engine oil - if you run out of engine oil, you can easily request to order it to the nearby shared micro-depot where dedicated staff will help you to change it (EIT Urban Mobility 2020).

It should be noted that utilising the shipping containers (ISO containers) is a standard method of transporting various goods which average lengths are 20 ft. (13.86 m<sup>2</sup> of floor space) and 40 ft. (26.47 m<sup>2</sup> of floor space) By implementing ISO containers in the shared micro-depots environment,



the cargo will be hidden from prying eyes. The ISO containers will help you to consolidate cargo inside of a shared micro-depot, to simplify the process of records management, to ensure cargo safety and its efficient allocation etc. (EIT Urban Mobility 2020).

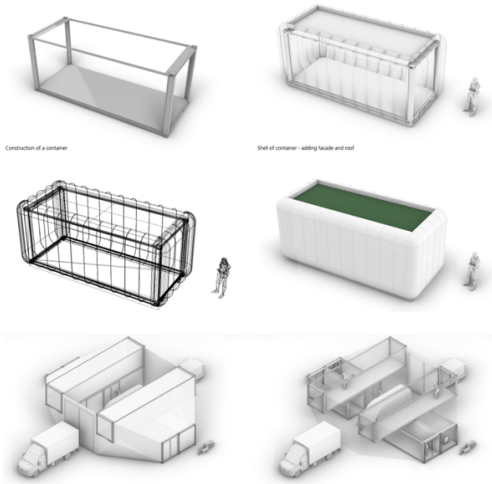


Figure 21. Construction of a container. EIT Urban Mobility. Gateways Artist impressions. 2020

According to the Figure 22, ISO containers are placed in the logistics areas of a shared micro-depot, inside of which e-vehicle will drive and pick-up the required parcels and boxes. It's noticeable that various drive-through zones for some separate logistics areas are included. Besides, electric bikes, trucks, and vans can be utilized in the shared micro-depot (EIT Urban Mobility 2020).

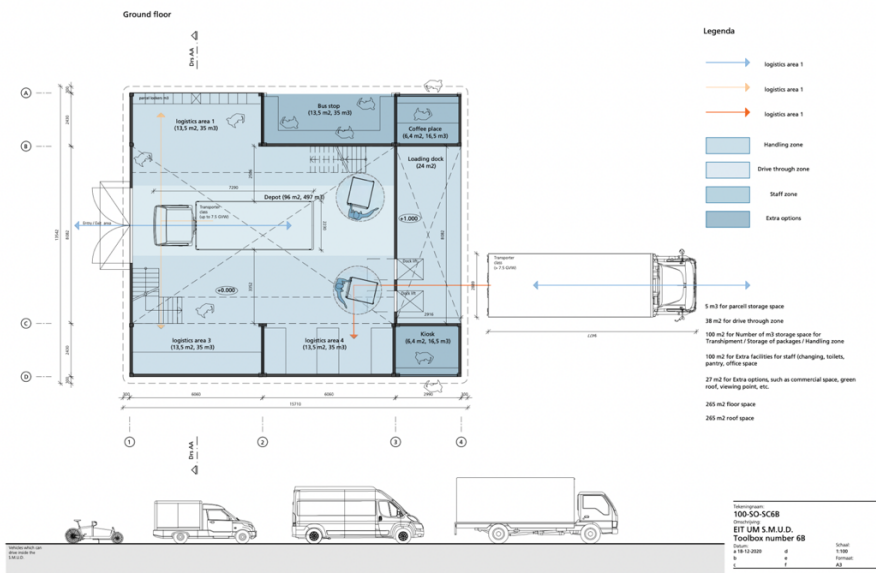


Figure 22. Ground floor of a shared micro-depot. EIT Urban Mobility. Gateways Artist impressions. 2020

## 7. SWOT Analysis of a shared micro-depot in Finland

<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>- a growing IT development (Espoo, Aalto research and development centers in Espoo &amp; Aalto)</li> <li>- an implementation of small-sized types of modes</li> <li>- a provision of environment-friendly and cost-efficient services</li> <li>- an application of optimized routes (for instance, Baana Project Initiative in Helsinki)</li> </ul>	<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>- a load capacity of transport means such as bikes, vans, and small-sized trucks</li> <li>- a bike is the only vehicle which delivery efficiency is directly dependent on the employees' physical abilities</li> <li>- a long period of the necessary permits' obtaining and difficulties with legal documents which are only in Finnish and Swedish</li> <li>- high costs of design, construction, and maintenance of a shared mi-</li> </ul>
<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>- an increase in population of Finland, especially in Helsinki and Espoo region.</li> <li>- an awareness on eco-friendly types of modes and sustainable delivery</li> <li>- a low risk of idea's rejection among the locals</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>- rivals who less take care about the environmental aspect but have an advantage in terms of load capacity</li> <li>- a quick and low-cost delivery are in priority</li> <li>- size, local facilities and infrastructure of the city are paramount aspects on which the success of a shared micro-depot depends</li> </ul>

Figure 8. SWOT (self-made analysis)

## 8. The required practical steps for launching a shared micro-depot in the last-mile logistics in Finland.

1. Inception of the idea and engagement of stakeholder for the successful performance of a shared micro-depot:

- Define your company's values, mission, and vision.
- Don't push away possible stakeholders whose offer isn't suitable for you this time.

Perhaps it will be challenging for you to manage another project without their assistance in the near future.

- One should always act proactively to deliver strong results.

As a shared micro depot is not highly acclaimed logistics facility in Finland one should talk to the local residents, stakeholders and local authorities about its benefits and pitfalls. In order to address the possible issues, start-ups should submit a request to the "Parliament of Finland", "Finnish Government" or "The Finnish Transport Infrastructure Agency" which representatives are in charge of the enactment of laws, improving cities' infrastructure, reform of road signs etc.

- Figure out the location, adjacent area, types of modes, and all the facilities of a shared micro-depot accurately.
- Make sure that you have sufficient time to obtain all necessary permits for planning and construction of a shared micro-depot; a legal process may last up to a year or more.
- Consideration of PESTLE (political, ecological; social; technological; legal and environmental) and SWOT aspects. (Strengths, weaknesses, opportunities, and threats)

2. Creating a clear action plan and a design based on the previously performed analysis and permissions received:

- Continue cooperation with stakeholders throughout the entire process of launching a shared micro-depot.
- Develop a design of a shared micro-depot based on the adjacent area, types of modes, and all the facilities for it. (a quantity of shared micro-depots and locations; roadmap execution; space size; drive through zones, unloading space etc.)
- Select the essential information technology tools to conduct a comprehensive data analysis for a successful operation of a shared micro-depot.
- Analyse current and potential needs of the stakeholders of a shared micro-depot carefully.
- Act according to the requirements and demands of your clients and improve your services.
- Determine limitations and regulations.

3. Initiate the process of logistics services' providing while implementing a shared micro-depot and attempt to standardise the whole process to save financial assets and overall delivery time.
  - Implementation of a shared micro-depot and its facilities, such as containers etc. in the logistics operation process.
  - Graduate enhancement of a shared micro-depot's operations and facilities.
  - Keeping under control the whole process of a shared micro-depot's implementation.
  
4. Summing up and assessment of a shared micro-depot's introduction.
  - Evaluation and summarising of a project and experiments' results.
  - Application of KPIs while evaluation process such as reduction of carbon dioxide emissions and noise; better organisation and optimisation of cargo; decrease in traffic congestion.

**The following goals should be outlined:**

1. The wise exploitation of the city's resources and infrastructure and improvement of last-mile logistics services' provision and road signs system.
2. Introduction of the new initiatives' proposals regarding the local infrastructure and business environment.
3. Achieve a high awareness rate about the new initiative among the locals which introduction is as ever before relevant in circumstances of insufficiently environmentally friendly and cost-effective last-mile logistics services.

## 9. Interviews with DSV and DB Schenker Representatives in Finland

Two structured qualitative interviews with DSV and DB Schenker which in turn are giants and leaders of the global logistics were conducted in the present Bachelor thesis. A director of operations at DSV and a head of CoDi (Collection & Distribution) at DB Schenker answered a questionnaire and gave interviews about implementation of a micro-depot in Finland from the perspective of the companies where they work. I have prepared 6 general topic-related questions with a Webropol 3.0 tool for both logistics companies in advance in the form of a questionnaire. Based on the answers, I prepared questions for the interviews which are more applicable in terms of a logistics company's strategy. (Appendix 1, Appendix 2, and Appendix 3)

### 9.1 Interview with DSV

DSV (De Sammensluttede Vognmænd) is translated from Danish as "The Consolidated Hauliers" "DSV is a Danish global supplier of transport and logistics solutions (road, air, sea and train) which has offices in 80 countries and an international network of partners and agents" (DSV 2023).

In Finland DSV has branch offices in Hämeenlinna, Jyväskylä, Kempele, Kotka, Tampere, Turku, and Vantaa. DSV has not conducted experiments in the field of creating micro-depots in Finland, but it appreciates the possibility of introducing micro-depots in the country. (8 out of 10 scores according to a self-made questionnaire) The company explains the choice by the fact that "Finland is a large country with relatively low volumes."



Figure 9. Driving directions at Trukkikujja, Vantaa. DSV Official Website 2023.

A director of operations at DSV while giving an interview in Teams, highlighted that the company doesn't aim to apply smaller-sized types of vehicles, such as e-cars, cargo bikes, robots, and drones as they don't provide courier services between Finnish cities and are focused more on cargo

consolidation. Thus, utilising an electric small-sized truck is the most common delivery method at DSV. Speaking of a biogas-fuel and diesel fuel, there is no difference in terms of operations. Although, biogas-fuel is a more sustainable type of a liquid fuel, it's very high-priced and is subject to heavy taxes. According to the company's vision, DSV is eager to utilise a shared micro-depot which is founded by state authorities in the future, rather than a co-founded or a self-founded shared micro-depot. DSV doesn't aim to pay rent and maintenance fees to its competitors. Additionally, high costs of design, construction and maintenance are the main pitfalls for introduction of a shared micro-depot for DSV branch in Finland. DSV Representative said that: "Parcels is a very small segment and micro-depots are very expensive to maintain." Installation of the facilities in the shared micro-depot is supported by DSV. Power bank stations; a reuse of packaging; e-car and bike rental services were particularly highlighted by the company. Finally, a director of operations at DSV stated that ABC Sörnäinen should be considered as the best location for implementation of a shared micro-depot for DSV to provide environment-friendly and cost-efficient services. In this case we are talking about 3 possible locations for a shared micro-depot in Helsinki which were already mentioned in the thesis. (ABC Sörnäinen, ABC Mannerheimintie, and Baana City Hub) He explained his choice by the fact that ABC Sörnäinen is a Finnish petrol station which is located near E75, Lahdenväylä motorway; DSV terminals and offices are located near E75 motorway in Vantaa.

## 9.2 Interview with DB Schenker

"DB Schenker is one of the world's leading global logistics providers which supports industry and trade in the global exchange of goods through land transport, worldwide air and ocean freight, contract logistics and supply chain management" (DB Schenker 2023). In Finland DB Schenker has branch offices in Helsinki, Joensuu, Jyväskylä, Kuopio, Lahti, Lieto, Mikkeli, Oulu, Pori, Seinäjoki, Ylivieska and Vantaa. It was mentioned before in the thesis that a shared micro-depot in Baana City Hub was a part of DB Schenker's experiment which was conducted in 2020. Besides, DB Schenker has launched an electric delivery robot in 2021 in Helsinki, Jätkäsaari district.



Figure 10. Viinikkala Land Transport Centre. Vantaa. DB Schenker Official Website 2023.

While visiting DB Schenker's main office in Vantaa personally, I was given a perfect opportunity to conduct an interview with a head of CoDi. (Collection and Distribution) DB Schenker has already conducted several experiments in terms of a shared micro-depot implementation in Finland.

DB Schenker, answering a questionnaire, has highly appreciated the idea of utilising a shared micro-depot in Finland, namely 9 out of 10 scores. DB Schenker representative believes that cargo volumes are increasing, and e-commerce is booming in Finland. Referring to the key incentives for DB Schenker company while utilising a shared micro-depot in Finland, the following aspects were identified: acquiring the awareness on eco-friendly types of modes and sustainable delivery; an opportunity to provide environment-friendly and cost-efficient services; and an application of optimized routes, for instance Baana Initiative in Helsinki. However, the main pitfalls of a shared micro-depot implementation, are as follows: high costs of design, construction, and a maintenance of a shared micro-depot; local facilities and infrastructure of the city are not sufficiently adapted for a shared micro-depot's service needs. Additionally, DB Schenker is more eager to utilise a co-founded or founded by the authorities shared micro-depot in Finland. DB Schenker is not willing to utilise a shared micro-depot which is founded by their company as there are a lot of extra fees and red tape. According to a head of CoDi at DBSchenker, a big truck is the most challenging type of mode to implement it with a shared micro-depot due to lack of parking space in the downtown, narrow streets, and service costs. Considering an eco-fuel, we observe that there is no difference between it and diesel fuel in terms of operations. Besides, eco-fuel is almost 20% more expensive than diesel-fuel. However, there are still clients who are willing to pay more for a sustainable delivery.

DB Schenker representative said the experiment in Jätkäsaari in 2021 with utilising a delivery robot which had lasted for 7 weeks was successful and attracted media attention. The experimental rental of robots was fully justified (a joint project with LMAD) and the volume of cargo wasn't extensive. Recently, DB Schenker has launched the same robots in Kalasatama area for a small parcels' delivery. Furthermore, Kamppi district was chosen as the location for the experiment with introduction of a shared micro-depot because it's a hospitality area with many temporary buildings and opportunities for establishing a network connection. The experiment in the Kamppi district was evaluated as perspective one because DB Schenker received much attention and publicity with positive feedback for the carrying the experiment with a micro-depot for the first time in Finland.

### **9.3 Conclusion**

There is no doubt that DSV and DB Schenker have highly evaluated the idea of introduction of a shared micro-depot in Finland. According to a Webropol 3.0 reporting analysis, DSV is a passive (8 out of 10 scores), and DB Schenker (9 out of 10 scores) is a promoter of the idea. Both companies'

representatives suppose that Finland has relatively low cargo volumes in comparison with other European countries. However, e-commerce is booming in Finland and new opportunities for adapting technological innovations are emerging. One of the key differences between DSV and DB Schenker, is that DSV doesn't seek to implement small-size types of vehicles, such as cargo bikes, robots etc. because DB Schenker as opposed to DSV has entirely different business concept. Both, DSV and DB Schenker concluded that there is no difference between biofuel and diesel fuel in terms of operations. Although, a certain percentage of the clients is willing to pay more for a sustainable delivery. The enterprises also agree that it's quite arduous to implement a shared micro-depot by a company on its own, first and foremost due to the high costs of design, construction, and maintenance.

DSV representative stated that ABC Sörnäinen should be considered as the best location for implementation of a shared micro-depot for DSV as ABC Sörnäinen is a Finnish petrol station which is located near E75, Lahdenväylä motorway; DSV terminals and offices are located near E75 motorway in Vantaa. On the other hand, a head of CoDi at DB Schenker representative expressed a preference to Kamppi district (Baana City Hub) as the location for the experiment with introduction of a shared micro-depot, because it's a hospitality area with many temporary buildings and opportunities for establishing a network connection.



## 10. Research Methods

This chapter covers the steps taken to build the research structure. It supports both the use of particular data gathering and analysis techniques as well as the overall research strategy. The research plan also demonstrates how the interviewing process was carried out.

The present research relies on qualitative research methodology. Table 2 summarises the main characteristics of the qualitative research. (Chawla., Kumar., Naved and Chawla 2023).

Table 2. Qualitative Research Method (Chawla., Kumar., Naved and Chawla 2023).

Research Method	"Qualitative research is defined as a market research method that focuses on obtaining data through open-ended and conversational communication. The qualitative research methods allow for in-depth and further probing and questioning of respondents based on their responses, where the interviewer or researcher also tries to understand their motivation and feelings"
Purpose and Objective	To obtain different but complementary data on the same topic in order gain better understanding of the research problem
Research Design	The results are obtained from scientific literature materials, a face-to-face structured interview, Teams interview, as well as from statistical tables and databases, surveys, and a questionnaire.
Analysis and Interpretation	Collecting, analyzing separately, and comparing qualitative data. Implementing some of the key data in the recommendations. The convergent parallel design is also utilized in this thesis

### 10.1 Data Collection

The research was conducted through structured interviews performed with DB Schenker and DSV. "A structured interview is constructed using the same considerations as mailed and directly administered surveys. The structured interview consists of an interviewer reading the questions, possible answers, and recording the answers" (Newman and McNeil 1998).

The data is collected through face-to-face and Teams interviews, a Webropol 3.0 questionnaire, scientific literature, webpages of international corporations, surveys, legal documents, statistical tables, and databases.

### 10.2 Research Design

This paper uses an empirical type of research, as new data is collected from various scientific literature sources and studies; qualitatively oriented interviews and a Webropol 3.0 questionnaire are also used in the work. Since the paper describes the trend of introducing shared micro-depots into

the last-mile logistics, it can be argued that we also have a descriptive study in front of us. Aiming to characterize the concept of a shared micro-depot implementation through already existing data, models and concepts, the research approach is characterized as a theory-driven (San Miguel 2021).

The study of the topic was divided into three main sources of data collection. At the first stage, the author contacted logistics companies that had already had experience or were preparing shared micro-depot developments, also visiting the office of DB Schenker in Vantaa physically. The information was collected through phone calls, personal interviews, and a Webropol 3.0 questionnaire sent. Secondly, the author contacted local experts of global companies by word of mouth. The approach consisted mainly of a questionnaire, Teams videocall and a face-to-face interview. Finally, the author used already existing data from scientific literature, databases and statistical tables, and legal documents.

The following implementation plan for a Webropol 3.0 questionnaire based on project tasks was designed:

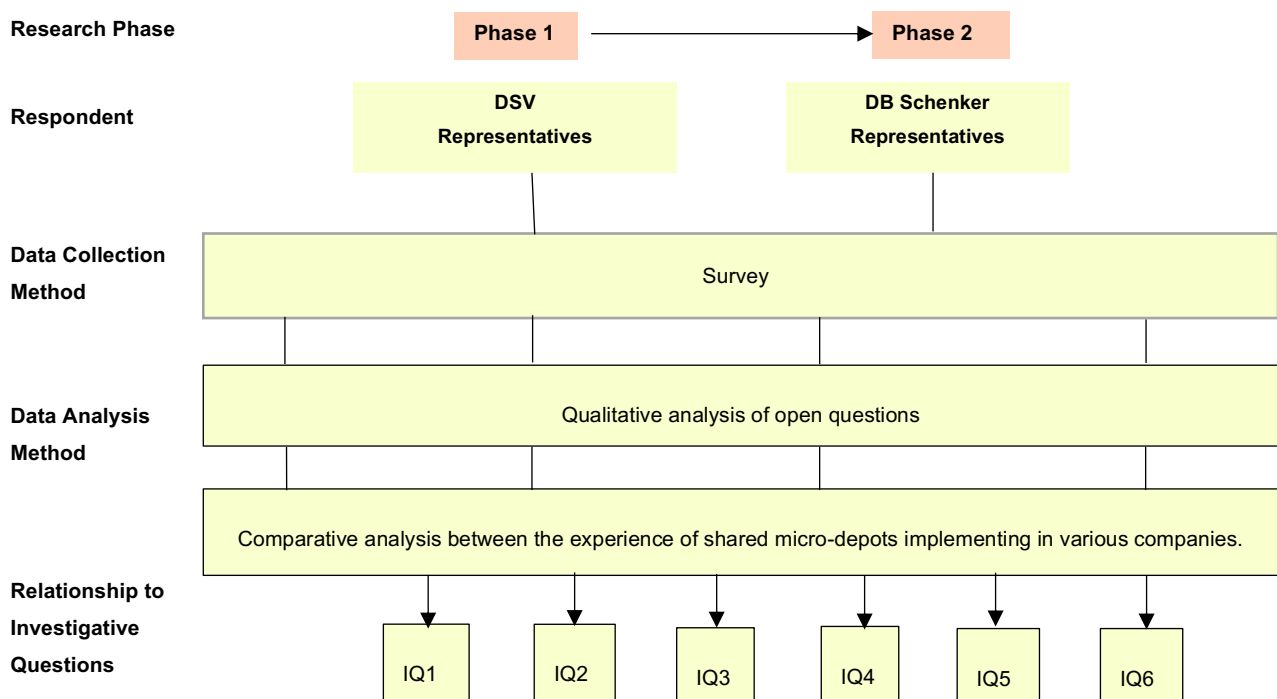


Figure 11. Research design. A questionnaire which was structured in order to prepare for the Interviews (self-made)

**RQ: How to make it easier for Finnish start-up logistics companies to switch to shared micro-depots in last-mile logistics?**

IQ1: Evaluate the idea of creating a shared micro-depot in Finland from 1 to 10

IQ2: Justify your choice (see interview question 1).

IQ3: What are the main pitfalls for introduction of a shared micro-depot In Finland for your company?

IQ4: What are the main incentives for your company while utilising a shared micro-depot in Finland?

IQ5: What type of a micro-depot are you eager to utilise?

IQ6: What types of sustainable vehicles would you prefer to apply in combination with a shared micro-depot?

## 11. Summary

In times of a growing e-commerce in Finland, one can observe a high demand on more sophisticated last-mile delivery methods. As it was mentioned previously: “A mobile micro-depot is usually a shipping container temporarily positioned near the respective delivery area in order to save costs. Alternatively, stationary micro-depots can be set up in unused space on the ground floors of buildings, at train stations, or at off-street parking facilities” (Bürklen 2022).

In the current Bachelor thesis, I discuss how to simplify the transition to shared micro-depots for start-up logistics companies in Finland, by creating practical recommendations for those willing who want to switch to a new system. Finland is a country with a relatively low cargo volume in comparison with other European countries.

Undoubtedly, Finnish start-up companies in case of successful implementation of shared micro-depots, will reach another level in the last-mile logistics while:

1. delivering parcels by different methods while utilising sustainable types of vehicles
2. reducing the distance and shipping costs
3. having an option to rent the necessary spaces and facilities of shared micro-depots, without being responsible for the repair of outdated equipment (in case several start-ups rent a shared micro-depot from a service provider)
4. increasing a loyalty to their brand by using eco-friendly delivery methods and providing the residents with extra parking spaces, special programs, and social activities
5. attracting investors (as a result of successful integration of shared micro-depots in the Finnish infrastructure)
6. promoting Finland to reach a higher international level in the field of logistics.
7. becoming more competitive and keeping a stable plateau stage which is extremely paramount for start-ups to survive in the “red ocean”.
8. acquiring more opportunities to conduct new required experiments and etc.

One can draw a conclusion that if it's quite cost-efficient (due to high costs of design, construction, and maintenance) to launch a shared micro-depot even for such logistics giants, as DSV and DB Schenker, then it's more wisely for Finnish start-ups to join to a shared micro-depot which is founded either by logistics pioneers or by state-authorities. Although, there are some start-ups with a large capital which they need to properly distribute. In my opinion, the most beneficial locations for a shared micro-depot's implementation in Finland should be near the city center in the densely populated area, be adjacent to a motorway and other socially significant objects.

## 12. References

- Aljohani, K., Thompson, R. 2020. An Examination of Last Mile Delivery Practices of Freight Carriers Servicing Business Receivers in Inner-City Areas. MDPI. URL: <https://www.mdpi.com/2071-1050/12/7/2837>. Accessed: 14 September 2022.
- Biodiesel vehicle emissions. 2023. Energy Efficiency & Renewable Energy. U.S. Department of Energy. URL: [https://afdc.energy.gov/vehicles/diesels\\_emissions.html](https://afdc.energy.gov/vehicles/diesels_emissions.html). Accessed: 10 April 2023.
- Botchwey, N., Dannenberg, A., Frumkin, H. 2022. Making Healthy Places, Second Edition: Designing and Building for Well-Being, Equity, and Sustainability. The second edition. Island Press. pp 77.
- Bürklen, A. 2022. Implementing micro-depots in last-mile logistics opportunities and challenges. Israel Public Policy Institute. URL: <https://www.ippi.org.il/implementing-micro-depots-in-last-mile-logistics-opportunities-and-challenges/>. Accessed: 13 March 2023.
- Chandrasekharan, S. 2023. How and why should businesses democratize the last-mile? Forbes. Small Business. URL: <https://www.forbes.com/sites/forbesbusinesscouncil/2023/01/26/how-and-why-should-businesses-democratize-the-last-mile/?sh=604f3f3a40be>. Accessed: 15 February 2023.
- Chawla, P., Kumar, A., Naved, M., Chawla, P. 2023. Blockchain, IoT, and AI Technologies for Supply Chain Management. CRC Press. pp. 5.
- Clausen, U., Hompel, M., Souza, R. Advances in Resilient and Sustainable Transport. 2023. the 6th Interdisciplinary Conference on Production, Logistics and Traffic 2023. Springer. pp. 99.
- Consolidation. 2022. Definition. Saloodo. URL: <https://www.saloodo.com/logistics-dictionary/consolidation/>. Accessed: 14 September 2022.
- Cornell, A., Kloss, B., Presser, D., Riedel, R. 2023. Drones take to the sky, potentially disrupting last-mile delivery. McKinsey & Company. URL: <https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/future-air-mobility-blog/drones-take-to-the-sky-potentially-disrupting-last-mile-delivery#0>. Accessed: 10 April 2023.

DB Schenker. 2023. Official Website. URL: <https://www.dbschenker.com/global/about/profile>. Accessed: 12 May 2023.

Design of micro-depots. 2020. SMUD. EIT Urban Mobility. URL: [https://www.eiturbanmobility.eu/wp-content/uploads/2020/07/CC\\_Design-of-Micro-Depots.pdf](https://www.eiturbanmobility.eu/wp-content/uploads/2020/07/CC_Design-of-Micro-Depots.pdf) Accessed: 22 April 2023.

DSV Official Website. 2023. URL: <https://www.dsv.com/en-nl/about-dsv>. Accessed: 12 May 2023

EduRank. 2023. Aalto University. Rankings. URL: <https://edurank.org/uni/aalto-university/rankings/>. Accessed: 27 March 2023.

ELY-keskus. The official website. <https://www.ely-keskus.fi/en/web/ely-en>. Accessed: 27 March 2023.

Finnvera. The official website. URL: <https://www.finnvera.fi/eng>. Accessed: 27 March 2023.

Glöckner, M., Pufahl, L., Franczyk, B., Weske, M., Ludwig, A. 2020. Conceptualization of a smart service platform for last-mile logistics. 7<sup>th</sup> International Conference on Serviceology. ICServ 2020. Communications in Computer and Information Science. Springer. pp 175-184.

Grandval, S., Nimtrakool, K., Grant, D. 2019. Factors of Adoption Governing the Emergence of Urban Consolidation Centre. Supply Chain Forum. URL: [https://www.researchgate.net/publication/333719329\\_Factors\\_of\\_Adoption\\_Governing\\_the\\_Emergence\\_of\\_Urban\\_Consolidation\\_Centre](https://www.researchgate.net/publication/333719329_Factors_of_Adoption_Governing_the_Emergence_of_Urban_Consolidation_Centre). Accessed: 15 February 2023.

Grant, M. 2022. What a Start-up Is and What's Involved in Getting One Off the Ground. Investopedia. URL: <https://www.investopedia.com/terms/s/startup.asp>. Accessed: 25 March 2023.

Green Zones in Europe. 2010. Low Emission Zones. Helsinki. URL: <https://www.green-zones.eu/en/low-emission-zones/finland/helsinki>. Accessed: 10 April 2023.

Guidebook on possible auxiliary business models. Shared micro depot for urban pickup and delivery. 2020. SMUD. EIT Urban Mobility. URL: [https://eit.europa.eu/sites/default/files/ee\\_guidebook-on-possible-auxiliary-business-models.pdf](https://eit.europa.eu/sites/default/files/ee_guidebook-on-possible-auxiliary-business-models.pdf). Accessed: 22 April 2023.

Hagberg, J., Hulthén, K. 2022. Consolidation through resourcing in last-mile logistics. ScienceDirect. URL: <https://www.sciencedirect.com/science/article/pii/S2210539522000554#s0010>. Accessed: 15 February 2023.

Haikonen, J. 2022. Green last-mile logistics solutions in Finnish cities. Master's thesis in Supply Management. Lappeenranta-Lahti University of Technology. URL: [https://lutpub.lut.fi/bitstream/handle/10024/164982/Mastersthesis\\_Haikonen\\_Johannes.pdf?sequence=1](https://lutpub.lut.fi/bitstream/handle/10024/164982/Mastersthesis_Haikonen_Johannes.pdf?sequence=1). Accessed: 20 March 2023.

Hamraoui, Y. 2020. B TO C E-commerce in Finland, Improving Last mile delivery. Theseus. Haaga-Helia University of Applied Sciences. Bachelor's thesis. URL: [https://www.theseus.fi/bitstream/handle/10024/354979/Hamraoui\\_Yassine.pdf?sequence=2&isAllowed=y](https://www.theseus.fi/bitstream/handle/10024/354979/Hamraoui_Yassine.pdf?sequence=2&isAllowed=y). Accessed: 15 February 2023.

Heeswijk, W., Larsen, R., Larsen, A. 2019. An urban consolidation center in the city of Copenhagen: A simulation study. International Journal of Sustainable Transportation. URL: [https://www.researchgate.net/publication/331291629\\_An\\_urban\\_consolidation\\_center\\_in\\_the\\_city\\_of\\_Copenhagen\\_A\\_simulation\\_study](https://www.researchgate.net/publication/331291629_An_urban_consolidation_center_in_the_city_of_Copenhagen_A_simulation_study). Accessed: 15 February 2023.

Helsinki OKs €30m bike 'baana' to Vantaa. 2023. YLE. URL: <https://yle.fi/a/74-20018285>. Accessed: 10 April 2023.

Hermoso, C. 2022. What is a Good Road Network and Why is it Important? BRIA. URL: <https://www.bria.com.ph/articles/what-is-a-good-road-network-and-why-is-it-important/>. Accessed: 14 September 2022.

Hochbahn to open second micro depot in late May. 2021. Hamburg News. Logistics. URL: <https://www.hamburg-news.hamburg/en/innovation-science/hochbahn-open-second-micro-depot-late-may>. Accessed on 27 March 2023.

Hofstede Insights. Finland. URL: <https://www.hofstede-insights.com/country/finland/>. Accessed: 27 March 2023.

Janjevic, M., Ndiaye, A. 2014. Development and Application of a Transferability Framework for Micro-Consolidation Schemes in Urban Freight Transport. 8th International Conference on City Logistics. Procedia. Social and Behavioral Sciences 125. pp. 284-296. URL:

[https://www.researchgate.net/publication/275543649\\_Development\\_and\\_Application\\_of\\_a\\_Transferability\\_Framework\\_for\\_Micro-consolidation\\_Schemes\\_in\\_Urban\\_Freight\\_Transport](https://www.researchgate.net/publication/275543649_Development_and_Application_of_a_Transferability_Framework_for_Micro-consolidation_Schemes_in_Urban_Freight_Transport). Accessed: 15 February 2023.

Jokiniemi, M. 2021. Autonomous robot delivers packages to residents in Helsinki. Forum Virium Helsinki. URL: <https://forumvirium.fi/en/release/autonomous-robot-delivers-packages-to-residents-in-helsinki/>. Accessed: 31 August 2022.

Karmala, J. 2021. Finland's first electric truck factory creates jobs and reduces emissions from traffic - Development sped up by MySmartLife and eRetrofit projects. Forum Virium Helsinki. URL: <https://forumvirium.fi/en/electric-trucks/>. Accessed: 10 April 2023.

Kirsch, D. 2020. Shared micro depots - from idea to implementation. 2020. SMUD. EIT Urban Mobility. URL: [https://www.eiturbanmobility.eu/wp-content/uploads/2020/07/03\\_Shared-micro-depots-from-idea-to-implementation-Daniela-Kirsch-1.pdf](https://www.eiturbanmobility.eu/wp-content/uploads/2020/07/03_Shared-micro-depots-from-idea-to-implementation-Daniela-Kirsch-1.pdf). Accessed: 31 August 2022.

Koskinen, H. 2020. Domesticating start-up culture in Finland. Sociology Unit. Department of Social Research. University of Turku. European journal of cultural and political sociology. URL: [https://www.researchgate.net/publication/343567532\\_Domesticating\\_startup\\_culture\\_in\\_Finland](https://www.researchgate.net/publication/343567532_Domesticating_startup_culture_in_Finland). Accessed: 27 March 2023.

Kumar, V. Product Delivery in the Sky: How Drones Could be Gaming Changer? 2020. Analytics Insight. URL: <https://www.analyticsinsight.net/product-delivery-sky-drones-gaming-changer/>. Accessed: 10 April 2023.

Ladd, B. 2022. Is Micro-Fulfillment The 'Next Big Thing' In Retail? Forbes. URL: <https://www.forbes.com/sites/forbescommunicationscouncil/2022/07/22/is-micro-fulfillment-the-next-big-thing-in-retail/?sh=65b992ec3f35>. Accessed on 27 March 2023.

Land use and planning review. 2022. City of Helsinki. URL: <https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/julkaisut/julkaisu-20-22-en.pdf>. Accessed: 27 March 2023.

Leerkamp, B., Holthaus, T., Kuchhäuser, J., Thiemermann, A., Schlott, M. 2021. Case Study Research on Urban Logistics and Last Mile Delivery Processes in Germany. GIZ in China. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. URL: [https://transition-china.org/wp-content/uploads/2021/11/20210811\\_BUW-2.pdf](https://transition-china.org/wp-content/uploads/2021/11/20210811_BUW-2.pdf). Accessed: 07 November 2022.



Lehman, C., Selin, N. 2023. Biofuel. Definition. Britannica. URL: <https://www.britannica.com/technology/biofuel>. Accessed: 31 August 2022.

Marr, B. 2020. Demand For These Autonomous Delivery Robots Is Skyrocketing During This Pandemic. Forbes. <https://www.forbes.com/sites/bernardmarr/2020/05/29/demand-for-these-autonomous-delivery-robots-is-skyrocketing-during-this-pandemic/?sh=1ed0768a7f3c>. Accessed: 10 April 2023.

More electric vehicles in use - In addition to Helsinki, electric cars will now also be used in Turku, Tampere, Espoo, and Vantaa to deliver Posti's parcels home. 2023. Posti. URL: <https://www.posti.com/en/media/media-news/2023/more-electric-vehicles-in-use--in-addition-to-helsinki-electric-cars-will-now-also-be-used-in-turku-tampere-espoo-and-vantaa-to-deliver-postis-parcels-home/>. Accessed: 20 March 2023.

Muhamed, A. 2022. Autonomous Delivery Robots for Urban Settings. Bachelor's Thesis. International Business and Logistics. Metropolia University of Applied Sciences. URL: [https://www.theseus.fi/bitstream/handle/10024/753120/Muhumed\\_Abdirahman.pdf?sequence=2](https://www.theseus.fi/bitstream/handle/10024/753120/Muhumed_Abdirahman.pdf?sequence=2). Accessed: 10 April 2023.

Muutosta muutossa - Niemi asensi aurinkopaneelit muuttoautoon. 2022. Raskas Kalusto. URL: <https://www.raskaskalusto.fi/muutosta-muutossa-niemi-asensi-aurinkopaneelit-muuttoautoon/>. Accessed: 10 April 2023.

Neste is piloting its first electric vehicle charging service with Niemi Services - aiming to launch the service in Finland in 2021. Neste. URL: <https://www.neste.com/releases-and-news/transportation/neste-piloting-its-first-electric-vehicle-charging-service-niemi-services-aiming-launch-service>. Accessed: 10 April 2023.

Newman, I., McNeil, K. 1998. Conducting Survey Research in the Social Sciences. University Press of America. pp. 27.

Podnebesnikova, E. 2021. Start-up ecosystems and the role of state and municipal support agencies: Finnish and Israeli. Bachelor's Thesis. Business Administration. Metropolia University of Applied Sciences. URL: [https://www.theseus.fi/bitstream/handle/10024/498246/Podnebesnikova\\_Ekaterina.pdf?sequence=2&isAllowed=y](https://www.theseus.fi/bitstream/handle/10024/498246/Podnebesnikova_Ekaterina.pdf?sequence=2&isAllowed=y). Accessed: 27 March 2023.

Pratt, M. 2017. Start-Up Company. Definition. TechTarget. URL: <https://www.techtarget.com/searchcio/definition/startup>. Accessed: 15 February 2023.

Quak, H. 2008. Sustainability of Urban freight Transport Retail Distribution and Local Regulations in Cities. PhD dissertation, Erasmus University Rotterdam. URL: <http://repub.eur.nl/pub/11990/>. Accessed: 15 February 2023.

Rosenberg, L., Balouka, N., Herer, Y. 2021. Introducing the Shared Micro-Depot Network for Last-Mile Logistics. MDPI. Sustainability. URL: [https://www.researchgate.net/publication/349322495\\_Introducing\\_the\\_Shared\\_Micro-Depot\\_Network\\_for\\_Last-Mile\\_Logistics](https://www.researchgate.net/publication/349322495_Introducing_the_Shared_Micro-Depot_Network_for_Last-Mile_Logistics). Accessed: 31 August 2022.

San Miguel, E. 2021. Course Book Bachelors' Thesis in Theory and Practice. Degree Program in International Business. Haaga-Helia University of Applied Sciences. pp 72-74.

Schröder, J., Heid, B., Neuhaus, F., Kässer, M., Klink, C., Tatomir, S. 2018. Fast forwarding last-mile delivery - implications for the ecosystem. McKinsey & Company. Travel, Transport, and Logistics and Advanced Industries. URL: <https://www.mckinsey.com/~media/mckinsey/industries/travel%20logistics%20and%20infrastructure/our%20insights/technology%20delivered%20implications%20for%20cost%20customers%20and%20competition%20in%20the%20last%20mile%20ecosystem/fast-forwarding-last-mile-delivery-implications-for-the-ecosystem.pdf>. Accessed: 15 February 2023.

Shared micro depot for urban pickup and delivery. Summary of the online stakeholder event on Shared micro depot for urban pickup and delivery. 2020. SMUD. EIT Urban Mobility. URL: [https://eit.europa.eu/sites/default/files/stakeholderevent\\_summary.pdf](https://eit.europa.eu/sites/default/files/stakeholderevent_summary.pdf). Accessed: 31 August 2022.

Shared micro depots for urban pickup and delivery (S.M.U.D.) Compilation of different micro-depots solutions. 2021. EIT Urban Mobility. URL: <https://eit.europa.eu/library/shared-micro-depots-urban-pickup-and-delivery-smud-compilation-different-micro-depot>. Accessed: 31 August 2022.

Smartcity. 2023. DB Station & Service AG. URL: <https://smartcity.db.de/en/micro-depot>. Accessed: 15 February 2023.

Solomon, S. 2021. Super-Pharm looks to expand robotic facilities as online demand booms. The Times of Israel. URL: <https://www.timesofisrael.com/super-pharm-looks-to-expand-robotic-facilities-as-online-demand-booms/>. Accessed on 27 March 2023.

Stodick, K. 2019. Sustainable Parcel Delivery in Urban Areas with Micro Depots. Mobility in a Globalised World. University of Bamberg. pp. 233-244. URL: [https://www.researchgate.net/publication/334784178\\_Sustainable\\_Parcel\\_Delivery\\_in\\_Urban\\_Areas\\_with\\_Micro\\_Depots](https://www.researchgate.net/publication/334784178_Sustainable_Parcel_Delivery_in_Urban_Areas_with_Micro_Depots). Accessed: 15 February 2023.

Summary of the online stakeholder event on shared micro depot for urban pickup and delivery. 2021. EIT Urban Mobility. URL: [https://eit.europa.eu/sites/default/files/stakeholderevent\\_summary.pdf](https://eit.europa.eu/sites/default/files/stakeholderevent_summary.pdf). Accessed: 27 March 2023.

The Global Startup Ecosystem Report. GSER 2022. URL: <https://startupgenome.com/reports/gser2022>. Accessed: 27 March 2023.

Top 5 benefits of white-labelling your last-mile deliveries. 2021. Bringly. URL: <https://www.bringly.nl/post/top-5-benefits-of-white-labelling-your-last-mile-deliveries>. Accessed: 20 March 2023.

Tsiulin, S., Hilmola, O., Goryaev, N. 2017. Barriers towards development of urban consolidation centres and their implementation: literature review. World Review of Intermodal Transportation Research. URL: [https://www.researchgate.net/publication/319072117\\_Barriers\\_towards\\_development\\_of\\_urban\\_consolidation\\_centres\\_and\\_their\\_implementation\\_literature\\_review](https://www.researchgate.net/publication/319072117_Barriers_towards_development_of_urban_consolidation_centres_and_their_implementation_literature_review). Accessed: 15 February 2023.

Urban Access Regulations in Europe. 2023. Finland. URL: <https://urbanaccessregulations.eu/countries-mainmenu-147/finland>. Accessed: 10 April 2023.

Uusitalo, A. 2022. How to Establish a Business in Finland as an Immigrant. Bachelor's Thesis. International Business Degree. Häme University of Applied Sciences. URL: [https://www.theseus.fi/bitstream/handle/10024/755862/Uusitalo\\_Amanjot.pdf?sequence=2&isAllowed=y](https://www.theseus.fi/bitstream/handle/10024/755862/Uusitalo_Amanjot.pdf?sequence=2&isAllowed=y). Accessed: 27 March 2023.

Vahter, M., Liikkanen, L. 2021. Why is Finnish e-commerce lagging behind the rest of Europe?. QVIK. URL: <https://qvik.com/news/why-is-finnish-e-commerce-lagging-behind-the-rest-of-europe/>. Accessed: 08 April 2023.

Weiss, C. 2019. The challenge of sustainable last mile distribution of CEP services in small towns. Transportation Research Procedia. Rostock. URL:

<https://www.researchgate.net/publication/334427443> The challenge of sustainable last mile distribution of CEP services in small towns. Accessed: 31 August 2022.

World Population Review. 2023. Finland Population 2023. URL: <https://worldpopulationreview.com/countries/finland-population>. Accessed: 10 April 2023.

Yarow, J. 2012. Chart of the day: What it's really like doing a start-up. Insider. URL: <https://www.businessinsider.com/chart-of-the-day-the-startup-curve-2012-3>. Accessed: 27 March 2023.

# 13. Appendices

## Appendix 1. Webropol 3.0 questionnaire. Implementation of micro-depots in Finland

### Implementing shared micro-depots in the last-mile logistics in Finland

**i** Mandatory questions are marked with a star (\*)

#### 1. Please enter your contact details

Company name \*

Your name & surname (optional)

Your title (optional)

Mobile (optional)

Email (optional)

*Please kindly answer the following 6 topic-related questions. (Selection, multisections & text fields)*

#### 2. Evaluate the idea of creating a shared micro-depot in Finland from 1 to 10 \*

1 2 3 4 5 6 7 8 9 10  
 unpromising           perspective



A shared micro-depot according to Helmond test model. (SMUD. Gateways Artist impressions 2020).

#### 3. Please justify your choice, see question 1 (optional)

#### 6. What type of a micro-depot are you eager to utilise? (Please choose one or more options or specify you own) \*

- a) a shared micro-depot which is founded by your company, whereas the other firms use the facilities of the shared micro-depot for a determined rent price
- b) a co-founded shared micro-depot in collaboration with logistics service providers
- c) a shared micro-depot which is founded by state authorities in order to lease its facilities to the local logistics providers
- d)
- other

#### 7. What types of sustainable vehicles would you prefer to apply in combination with a shared micro-depot? (Please choose one or more options or specify your own) \*

- a) a cargo bike
- b) an e-van
- c) an electric small-sized truck
- d) a robot
- e) a drone
- f)
- other

#### 4. What are the main pitfalls for introduction of a shared micro-depot in Finland for your company? (Please choose one or more options or specify your own) \*

- a) a load capacity of small-sized types of vehicles
- b) high costs of design, construction, and maintenance of a shared micro-depot
- c) local facilities and infrastructure of the city are not sufficiently adapted for a shared micro-depot service needs
- d)
- other

#### 5. What are the main incentives for your company while utilising a shared micro-depot in Finland? (Please choose one or more options or specify your own) \*

- a) acquiring the awareness on eco-friendly types of modes and sustainable delivery
- b) implementation of small-sized types of modes
- c) opportunity to provide environment-friendly and cost-efficient services
- d) application of optimized routes (for instance, Baana Project Initiative in Helsinki)
- e)
- other



Baana Project in Helsinki, bike and pedestrian corridor (Tripadvisor. Baana 2023).



A cargo-bike (IAA Transportation 2023).



A robot (Forbes 2023). & A drone (Analytics Insight 2020).



An e-van (Neste 2021). & An e-truck (Raskas Kalusto 2022).

Submit

## Appendix 2. DSV. Webropol 3.0 questionnaire's answers

### Implementing shared micro-depots in the last-mile logistics in Finland Copy

**Respondent:**

-

**Response on:**

08.05.2023, 08:58 - 08.05.2023, 09:01

#### 1. Please enter your contact details

Company name	DSV Road
Your name & surname (optional)	Kai Kajal
Your title (optional)	Director Operations
Mobile (optional)	No answers
Email (optional)	No answers

#### 2. Evaluate the idea of creating a shared micro-depot in Finland from 1 to 10 \*

1   2   3   4   5   6   7   8   9   10

unpromising           perspective

#### 3. Please justify your choice, see question 1 (optional)

Finland is a large country with relative low volumes.

#### 4. What are the main pitfalls for introduction of a shared micro-depot in Finland for your company? (Please choose one or more options or specify your own) \*

b) high costs of design, construction, and maintenance of a shared micro-depot

#### 5. What are the main incentives for your company while utilising a shared micro-depot in Finland? (Please choose one or more options or specify your own) \*

c) opportunity to provide environment-friendly and cost-efficient services

#### 6. What type of a micro-depot are you eager to utilise? (Please choose one or more options or specify your own) \*

c) a shared micro-depot which is founded by state authorities in order to lease its facilities to the local logistics providers

#### 7. What types of sustainable vehicles would you prefer to apply in combination with a shared micro-depot? (Please choose one or more options or specify your own) \*

c) an electric small-sized truck



## Appendix 3. DB Schenker. Webropol 3.0 questionnaire's answers.

### Implementing shared micro-depots in the last-mile logistics in Finland Copy

**Respondent:**

-

**Response on:**

11.05.2023, 10:54 - 11.05.2023, 10:57

#### 1. Please enter your contact details

Company name	Schenker Oy
Your name & surname (optional)	Petri Sinkko
Your title (optional)	Head of CoDi
Mobile (optional)	No answers
Email (optional)	petri.sinkko@dbschenker.com

#### 2. Evaluate the idea of creating a shared micro-depot in Finland from 1 to 10 \*

1   2   3   4   5   6   7   8   9   10

unpromising           perspective

#### 3. Please justify your choice, see question 1 (optional)

No answers

#### 4. What are the main pitfalls for introduction of a shared micro-depot in Finland for your company? (Please choose one or more options or specify your own) \*

- b) high costs of design, construction, and maintenance of a shared micro-depot
- c) local facilities and infrastructure of the city are not sufficiently adapted for a shared micro-depot service needs

#### 5. What are the main incentives for your company while utilising a shared micro-depot in Finland? (Please choose one or more options or specify your own) \*

- a) acquiring the awareness on eco-friendly types of modes and sustainable delivery
- c) opportunity to provide environment-friendly and cost-efficient services
- d) application of optimized routes (for instance, Baana Project Initiative in Helsinki)

#### 6. What type of a micro-depot are you eager to utilise? (Please choose one or more options or specify you own) \*

- b) a co-founded shared micro-depot in collaboration with logistics service providers
- c) a shared micro-depot which is founded by state authorities in order to lease its facilities to the local logistics providers

#### 7. What types of sustainable vehicles would you prefer to apply in combination with a shared micro-depot? (Please choose one or more options or specify your own) \*

- a) a cargo bike
- b) an e-van
- c) an electric small-sized truck
- d) a robot
- e) a drone