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Potential for upscaling the use of light electric freight vehicles in sustainable last mile deliveries

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Abstract

The last mile logistics is known to be the most costly and most polluting part of the supply chain. The last mile logistics contribute with high emissions, congestion and safety issues in urban areas. Recently, the number of deliveries in urban areas have increased and it is common for residents to order merchandise online. Hence, new innovations are being tested in different cities around the world such as Light Electric Freight Vehicles (LEFVs). This report tries to identify which type of goods is suitable for delivery using LEFVs and what the driving forces to upscale the use of the LEFVs are. Moreover, the report also addresses how LEFVs will impact the last mile logistics and the supply chain if the use of LEFVs would increase. In order to fulfil the purpose of this report interviews with different actors in the supply chain in relation to LEFVs were conducted. The results showed that LEFVs are suited to be used for a wide range of goods. Furthermore, the results also showed that the driving forces to upscale the use of LEFVs are based in minimizing the last mile logistics problem and meeting environmental requirements. The results also emphasised the importance of hubs and UCC in the city in order to facilitate the use of LEFVs. Lastly, the results showed that there is a need for extended collaboration among stakeholders within urban areas to make it possible to increase the use of environmental effective transport modes.

Keywords: LEFVs, City Logistics, Urban Areas, Supply Chain Management, Urban Consolidation Centres

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Jens Collvin Taima El Elawi

Abbreviations & List of Glossary

ADR- Autonomous Delivery Robots

B2B - Business to Business

B2C - Business to Consumer

GDP- Gross Domestic Product

GIS - Geographical Information Systems

GPS - Geographical Positioning Systems

ITS - Intelligent Transport Systems

ICT - Information and Communication Technology

LEFVs - Light Electric Freight Vehicle

NO_x - Nitrogen Oxide

PM - Particulate Matter

SCM- Supply Chain Management

Temporary Hubs- A movable container placed strategically in relation to the end customer

UCC- Urban Consolidation Centres

VTI - Swedish National Road and Transport Research Institute

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1.0 Introduction

Urbanization has been growing rapidly in the last decades. Browne (2019) states that in the 1960s less than one-third lived in urban areas, while in 2014, 54% of the world's population lived in urban areas. According to the United Nations, two-thirds of the world's population will be living in urban areas by 2050 (EU, 2016). Hence, the trend of increasing urbanization is common in European cities as well. In 2015, three-quarters of Europe's population lived in urban areas, and the growth is continuous in European cities (EU, 2016). However, the continuous increase of inhabitants in urban areas also contributes to problems, especially in the logistics and transport sector (Browne, 2019). With the increased population, the demand for goods and services within urban areas will also increase, leading to external problems such as pollution, noises, congestion and safety issues (Browne, 2019). Mostly, the increased demand for goods and services leads to an increase in vehicles within the city area, other than existing public transport and private vehicles (Browne, 2019). Due to the complexity of urban areas, the logistics process is different from regular logistics activities and is often referred to as city logistics. OECD (2011) define city logistics as following:

"The movement of goods, equipment and waste into, out from and within or through an urban area"

Barceló, Grzybowska and Orozco (2018) state that there is a wide range of goods types delivered within urban areas such as parcel delivery, material collection, home delivery services and waste collection. Moreover, there is a need for daily deliveries to supermarkets and grocery stores containing temperature-controlled products (Browne, 2019). On the other hand, there is also a need for catering supply to offices in the same area, and both types of food products require different handling, making city logistics even more complex (Browne, 2019). The main transport modes to deliver demanded products and services within urban areas are roads (Barceló, Grzybowska and Orozco, 2018). The authors also state that between 15%-20% of the vehicles during rush hours in urban areas correspond to logistics fleets. Moreover, (Van Amstel et al., 2018) states that 80% of freight traffic in urban areas are vans[1], which leaves no space for future growth. Transport vehicles are contributing to congestion and lower quality of life in cities. Therefore, new technology needs to be developed and used, to reduce the negative impact. One of the new innovations and actions that have been taken within urban areas to solve the problems, is the use of Light Electric Freight Vehicles[2], (LEFVs), for the last mile delivery within urban areas. LEFVs are used in a wide range, both for self-employed entrepreneurs but also by logistics service providers (Van Amstel et al., 2018). The size of LEFVs can variety, however, the vehicles are agile, clean and quiet and take up less space than regular vans (Van Amstel et al., 2018). Despite the positive aspects with LEFVs, vehicles are only a small part of city logistics today and vans are continuing to increase.

[1]Non-electric vans with maximum payload of 1.9 ton *(Commission for Integrated Transport, 2010).*

[2]Electric vans with maximum payload of 750 kg *(Moolenburgh et al., 2020).*

Currently, the Nordic countries are in alliance investigating the possibility of upscaling the use of LEFVs with three different test pilots in Fredrikstad, Helsinki and Gothenburg. The purpose of the project is to understand and investigate the possibilities of innovations in urban areas to reduce the negative impact of freight vehicles. Hence, in collaboration with Swedish National Road and Transport Research Institute (VTI), this report will focus on investigating and analysing different segments of commodities within urban areas and how the commodities can be correctly matched with LEFVs. Moreover, this report will investigate how the increased use of LEFVs will affect the last mile logistics and supply chain.

1.2 Problem Analysis

To gain a profound understanding of the subject, it is necessary to understand the underlying problem first. This master's thesis will be a small part of a bigger project conducted by VTI, where the overall scope for the project is to implement innovative sustainable last-mile delivery services.

Over the last decade, there has been a significant rise within e-commerce and it is evident that many of the traditional manufacturers have entered this market segment (Cui and Pan, 2015). The rationale behind this is the great exposure to extensive market shares, reductions in inventories and production time, and in the end, gain better margins. This has been essential for companies entering the e-commerce business but also the fact that it allows companies to understand their customers in a more enhanced way. When the demand for e-commerce rises and at the same time urbanization increases worldwide, demand for freight transportations rises as well (ibid).

With the increasing demand for freight transportations and especially within urban areas, problems arise such as pollution and noises. Not only does it lead to problems, but it also drives the demand for last-mile deliveries within urban areas (Veličković et al., 2017). Last mile deliveries themselves contribute to problems like congestion, greenhouse gas emissions, accidents, noise, and air pollution. These are viewed as external costs i.e. social and economic cost activities caused by one group of people but another group of people has to take the impact from their actions, and the first group are not held accountable for that. One way to deal with this is to let the 'user pay' or 'polluter pay' for their external impact (Gallo, 2010). Last mile deliveries are viewed as the chain where the most emissions are created, inefficient utilization, low filling rates and a costly part of the entire transportation chain. Other issues with last-mile deliveries are the fact that the trend for it is pointing up, i.e. there will be a constant debate about space limitations and competition for space within urban areas. Meaning that to succeed with last mile deliveries, city logistics planning must strike a balance between demands from the cities and the expectations society has on environmentally friendly solutions (Veličković et al., 2017).

The underlying problem for last mile delivery services[3] is then the need to make it more sustainable, by using LEFVs as a mode of transport in cities, there is a potential to reach zero emissions (Quak and Nesterova, 2014). By making last mile deliveries more sustainable, the potential to scale up the use of it is great and one enabler for doing so is the deployment of LEFVs. However, according to Quak and Nesterova (2014), three big obstacles have been identified for an upscale use of LEFVs. First of all, the logistics design that is present today is developed to facilitate conventional vans. Secondly, support from local authorities and municipalities are extremely important to scale up the use of LEFVs. Lastly, Successful implementation of LEFVs requires companies that want to be sustainable. Other issues raised with LEFVs is e.g. the use of public spaces in urban areas and cities. Meaning that different facilities need to be created in urban areas and that could affect public spaces (Quak and Nesterova, 2014). LEFVs cannot carry as much weight as conventional vans, therefore a need for temporary hubs and micro-hubs are presented when speaking about the implementation of LEFVs. Implementing temporary hubs and micro-hubs will affect the whole supply chain, due to the fact it adds another step in the chain.

To upscale the use of LEFVs, there is a need for a deeper understanding of the vehicles themselves. One of the current "grey zones" with LEFVs is to match the vehicles with the right goods and with the right customers and/or businesses in order to benefit from the advantages of LEFVs. Moreover, it is also important to understand how the vehicles will affect the last mile logistics. Hence, this master thesis will investigate which segment of goods and which type of customers and/or businesses can benefit from upscaling the use of LEFVs. Another gap this master thesis tries to address is to investigate how LEFVs will affect the supply chain and last mile logistics in terms of e.g. temporary hubs and micro-hubs.

1.3 Purpose

Given the above analysis of the subject, the purpose of this master's thesis is to conduct a qualitative study/analysis to investigate the relationship between segments of goods and which type of vehicles of LEFVs that are suited for last mile deliveries. More specifically, an investigation and evaluation of the ability to scale up the potential for LEFVs within urban cities for sustainable last mile deliveries. By addressing the above statement, hopefully, this master's thesis will bridge the gap between companies and consumers when it comes to sustainable deliveries within cities. Additionally, the purpose aims at understanding how the increased use of LEFVs could affect route planning, logistics and supply chains within urban areas and cities.

1.4 Research Questions

Connected to the purpose of this master's thesis, research questions have been constructed in order to facilitate and guide the research in its right way. The research questions are connected to each other in ways that might not be clear at first glance. In order to facilitate

[3] *"The last stretch of the supply chain from the last distribution centre to the recipient's preferred destination point" (Olsson, Hellström and Pålsson, 2019).*

the upscaling potential for using LEFVs it is necessary to understand the impact LEFVs will have on last mile logistics. As a result it adds another dimension to the last mile logistics. This is then connected to the understanding of how segments of goods can be matched with LEFVs and different segments of customers. Due to the fact that customers, users and stakeholders could be the ones driving implementation of e.g. hubs.

RQ1: What are the driving forces to upscale the use of LEFVs and which segments of goods are suited to LEFVs?
RQ2: How does the use of LEFVs affect last mile logistics, specifically in relation to having urban hubs?

1.5 Delimitations

In order to deliver a research paper that can be applied and/or used in a near future, some kind of delimitations need to be addressed and pointed out. First of all, the term LEFVs is widely used throughout the research paper, this term refers to electric vehicles considered to be light in terms of their pay-load (see section 2.2) and no other type of vehicles. Focus and aim has been set for the operational engagement and commercial side of LEFVs, since this side is less researched. Another delimitation for the research paper is the scope in terms of geographical location. In terms of utility for the research field, the result could be viewed as applicable across different locations. However, this research paper has a set focus on urban areas and cities in the Nordics and mainly on the city of Gothenburg. In this report the term segments of goods relate to general cargo and will not relate to bulk transports.

1.6 Disposition

The disposition of this report will be organized as shown in Figure 1. Firstly, the report will start with an introduction, in this section the problem analysis, purpose of the report and research questions will be stated to give the reader a clear overview of the research aim and purpose. Secondly, the report will include a literature review with relevant topics to the purpose, which will lay the foundation for the report and give the reader an understanding of the subject. Thirdly, the methodology will be presented, where the reader can follow how this study was conducted. The fourth section of this report will present the results from the study and answers to RQ1 and RQ2. Hence, section five will analyze the results from the study in comparison with literature stated in the literature review. Lastly, the reader will find the conclusions of all sections of the report. Suggestions for future studies will also be presented in the last section.

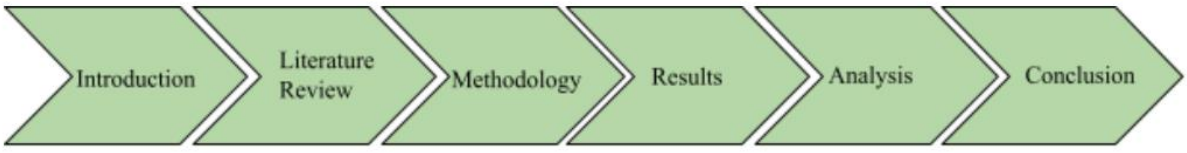

Figure 1. *Overview of the disposition.*

2.0 Literature Review

Within this chapter, a literature review with subgroups is presented to establish the ongoing practice and concepts for city logistics and the deployment of LEFVs. Parts of the literature review will work as the theoretical framework for this master's thesis, see section 2.8, page 27 and Figure 4. Starting with the establishment of city logistics and vehicles within those areas and then moving on to how to match segments of LEFVs to segments of commodities. The next part will deal with the stakeholders and policies and end with temporary hubs and how the use of technology can work as an enabler for LEFVs.

2.1 Challenges with City Logistics

Why/how does the complexity of city logistics require new transport modes?

City logistics is a complex area with a wide range of stakeholders. Furthermore in a city there are a wide range of daily activities and a high diversity of goods (Browne, 2019).
City logistics is an optimization of logistics and transport activities to meet the customer demand within urban areas while still considering the impacts of the movements and activities. Crainic, Ricciardi and Storch, (2009) states that the transport of services and goods is an important factor for most social and economic activities taking place in an urban area. The different stakeholders within an urban area all benefit differently from transports and logistics within the city centre (Crainic, Ricciardi and Storchi, 2009). However, the authors state that there are problems connected to the increased need for transported goods and services in urban areas. The first problem mentioned by the authors is the shared road and space capacity. Today freight vehicles share the infrastructure with public transport and private cars, causing congestions in cities. Moreover, as stated by Van Amstel et al (2018) 80% of freight traffic in urban areas are vans. Dablanc (2018) states when e-commerce first started the expectations from the customer were mainly focusing on lower prices than physical stores. However, technology development has increased the knowledge for the consumers making the power shift from producer to consumer. Consumers today expect fast deliveries, freedom to choose delivery methods, delivery time and smooth return services (Dablanc, 2018; Transport For London, 2019). Hence, the high requirements from the consumers increase the freight trips in cities leading to a negative impact in urban areas in terms of pollution and congestion (Dablanc, 2018). The cost of congestion in Europe is 1% of the annual gross domestic product, (GDP), (Albalate and Fageda, 2019). Moreover, the authors write that congestion will continue to increase and will be one of the most challenging aspects for policymakers and city planners. The movement is not the only space needed for freight vehicles. City logistics also requires storage and loading/unloading which requires even more of the urban spaces (Dablanc, 2007).

The second problem with city logistics connected to the above mentioned congestion issues is the environmental impact of freight vehicles. Anderson, Allen and Browne (2005) writes that freight vehicles in city centres pollute the environment more than regular cars or motorcycles per kilometre travelled. The reasons for high pollution from freight vehicles is, firstly due to

higher fuel consumption and secondly, due to that a large share of the vehicles use diesel as fuel (Anderson, Allen and Browne, 2005). Moreover, the authors state that freight vehicles contribute to a large share of Greenhouse gas Carbon dioxide. Dablanc (2013) also states that freight transport within cities is more polluting than long distance freight transport due to the average age of the vehicles but also the high number of short trips and stops. The competition in city logistics is high with a low margin. This leads to the fact that the fright operators in the city are small and often invest in old trucks and vans causing even higher negative environmental impact (Dablanc, 2013). Other than carbon dioxide, the transport sector is also responsible for emitting Nitrogen oxide (NOx) and Particulate matter, (PM). Both NOx and PM are harmful to the residents in urban areas and European cities and the concentration is increasing. Other Greenhouse gases, NOx, and PM, freight transport also contribute to noise (Dablanc, 2013; Transport For London, 2019). The environmental impact of city logistics activities have a large impact on the residents within the urban area and needs to be identified and reduced (Brown, Allen and Holguin, 2015).

The last problem that will be mentioned in this section is road safety. Dablanc (2013) writes that freight vehicles have a low share of accidents in cities but when the accidents occur the accidents are more serious. Transport For London, (2019) states that 32% of the road accidents causing death includes freight vehicles. Albalate and Fageda (2019) discuss the relationship between congestion and road safety in urban areas. The authors argue that the relationship between the two variables is of great importance for sustainable activities in cities. While considering firstly the high costs of road accidents and secondly, the policymakers' aims to reduce the congestion also have an indirect impact on road safety. 5-10% of the accidents in European cities involve a light truck while 10-15% involve heavy commercial trucks (Dablanc, 2013).

To sum it up, city logistics is an important sector for economic and social activities within a city. Different stakeholders benefit from the logistics activities and transport within a city is needed to fulfil the resident’s needs. Overall city logistics is needed for the city to function and for the residents of the city to have the daily needs of goods and supplies. Hence, the demand for transport is increasing continuously leading to several environmental and social issues. As mentioned before, increased use of freight vehicles leads to high pollutants which have a negative impact on the resident’s health. Moreover, the intense demand for faster transports has reduced the filling rate of freight vehicles leading to a higher number of vehicles in the system causing congestion and safety issues in an urban area. Another factor is the new initiatives and the need to change the logistics layout in order to reach sustainable city logistics.

2.2 Supply Chain Management

This section explores the interaction between LEFVs and the supply chain.

Supply chain management (SCM) is defined by the global supply chain forum as following (Lambert and Cooper, 2000):

" Supply Chain Management is the integration of key business processes from end-user through the original supplier that provides products, services, and information that add value for customers and other stakeholders"

In other words, SCM is a way to improve performance and increase the efficiency of material and information flow through using internal and external capability and technology to create a seamlessly coordinated supply chain and lower the overall costs for the system while still meeting the customer's demand (Lambert and Cooper, 2000; Power, 2005; Paulraj and Chen, 2007; Christopher, 2016). Hence, organizations in the supply chain are linked together through physical flows, information flows, and monetary flows, both upstream and downstream as shown in Figure 2 (Christopher, 2016; Bozarth and Handfield, 2019). The supply chain is now more advanced, complex to manage and the layout is changing (Christopher, 2016; Paulraj and Chen, 2007; Bozarth and Handfield, 2019). Moreover, there are disadvantages with the traditional supply chain such as lack of transparency and information sharing, causing problems for businesses, but at the same time creating new opportunities for different layouts and increased use of technology. (Casey and Wong, 2017).

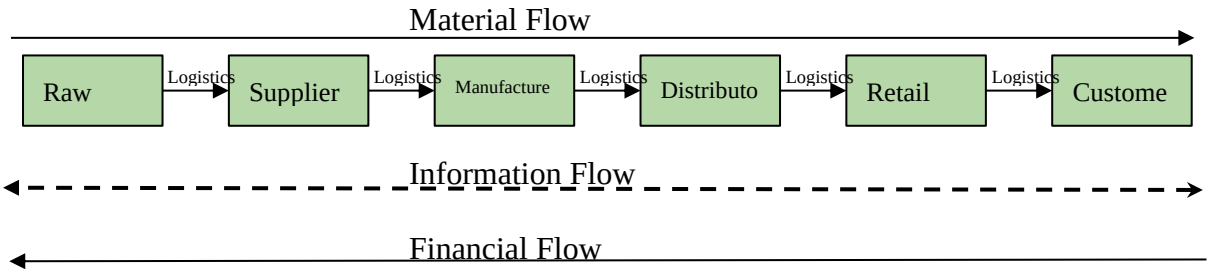

Figure 2. *Traditional supply chain layout.*

The efficiency of the supply chain determines what a firm can do and how competitive it can be in the market (Hugos, 2018). Hence, having an efficient supply chain is important for every existing business. There are five main areas where decisions regarding the supply chain need to be made (Hugos, 2018);

- Production: what product is the market requiring, how much and when?
- Inventory: what inventory should be stocked at each stage?
- Location: Where should the location of the inventories and production be?
- Transportation: How should the physical flow from one step in the supply chain to another be?
- Information: How much data to collect and how to share the information.

It is argued that the sum of these decisions defines the efficiency and capability of a company's supply chain (Hugos, 2018).

A supply chain is a wide area and to remain within the scope of this report, the focus will be on the transportation part of the supply chain. However, it is important to understand the bigger picture and to recognize and analyze how the last mile logistics impact the supply chain network. Section 2.2.1 will discuss the last mile problem in detail.

2.2.1 Last Mile Logistics

There are many different definitions of last mile logistics, however, a common description of the term is stated as following according to (Olsson, Hellström and Pålsson, 2019)

"The last stretch of the supply chain from the last distribution centre to the recipient's preferred destination point"

Hence, last mile logistics is also described as the movement of people and goods from a hub to the end consumer (Laseinde and Mpofu, 2017; Gevaers, Van de Voorde and Vanelslander, 2011;). Last Mile logistics is the last step of the supply chain and it is considered to be one of the most expensive, polluting and inefficient steps in the chain (Gevaers, Van de Voorde and Vanelslander, 2011; Slabinac, 2015). Offering home delivery is a way for companies to increase service rates toward the customers. By offering such services problems from a logistics infrastructure point of view arise where a trade-off between route efficiency and customer convenience arises (Kull, Boyer and Calantone, 2007). Gevaers, Van de Voorde and Vanelslander, (2011) states that there are several reasons for this, such as the not-at-home problem and small delivery vans, which increases the emissions per parcel as well as the costs. Gevaers, Van de Voorde and Vanelslander, (2009) also mentions that offering direct delivery to the end customer also increases the degree of "empty running" for the delivery vans. The authors also mention that 13%-50% of the total supply chain costs are from the last mile logistics operations. The costs are mainly due to inefficiencies and bad environmental performance (Kull, Boyer and Calantone, 2007). Furthermore, the authors state that the customer density is often not high enough to operate at an optimal cost causing the costs to increase for the last mile. Relating to the not-at-home problem Kull, Boyer and Calantone, (2007) writes that if the delivery window is not determined and communicated to the customer the number of not-at-home trips will increase. However, by narrowing down the delivery window the routing process becomes inefficient creating environmental problems within an urban area. Lastly, Customers today have more information available and therefore demand more environmentally efficient transports and low carbon emissions. However, customers are often not willing to choose lower services such as a longer delivery window to have more sustainable last mile deliveries (Kull, Boyer and Calantone, 2007).

The literature in section 2.2.1 stated that different actions were taken by stakeholders to improve the last mile logistics, reduce costs and improve environmental performance. The increase of home deliveries has led to increased use of light goods vehicles as well as other initiatives such as logistics hotels and increased collaboration among the stakeholders in the last step of the supply chain (Allen et al., 2018).

2.3 Segment of Goods in Relation to LEFVs

How do the limitations for LEFVs affect different types of carried goods?

There is extensive literature and research regarding LEFVs, even though the subject is relatively young. However, one important aspect is to find the right match between different segments of goods and at the same time to the different segments of LEFVs. Under this chapter, a review of the different segments of LEFVs and different segments of goods will be conducted, and by doing so, deliver a profound understanding of the subject to the reader.

LEFVs are, as per definition, Light Electric Freight Vehicles used within city centres and dense urban areas to perform the last mile delivery (Moolenburgh et al., 2020). According to Moolenburgh et al., (2020), LEFVs are either a bike, moped or a smaller vehicle equipped with electric assistance or a driveline, made to cope with the distribution of goods in urban areas where movement of people is common and dense. The advantages of LEFVs are that the vehicles produce zero-emission, are agile, get closer to the customer, utilize infrastructure better, don't have to circle for parking, are quiet and do not require as much space as conventional trucks and vans (Arvidsson, 2020). Discussing LEFVs, the common distinguishing is between three different types as seen in Table 1.

Table 1. *Vehicle weight, loading capacity and different types of LEFVs (Moolenburgh et al., 2020).*

	Electric cargo bike	Electric cargo moped	Small electric distribution vehicle
Loading capacity	50 - 350 kg	100 - 599 kg	200 - 750 kg
Vehicle weight	20 - 170 kg	50 - 600 kg	300 - 1000 kg

Table 2. *Vehicle weight, loading capacity and different types of conventional vans (Commission for Integrated Transport, 2010).*

	City vans	Small vans	Medium/Large vans
Loading capacity	400 - 600 kg	600 - 900 kg	900 - 1900 kg
Vehicle weight	Up to 1700 kg	1700 - 2300 kg	1800 - 3500 kg

As displayed in Table 1, the loading capacity and the weight of the different vehicles are shown. *Electric cargo bike:* is an agile but also active way of moving goods within cities with a payload capacity of up to 350 kg. This type of vehicle is mostly used for mail and smaller parcel deliveries where the volumes for the shipments are low, food deliveries and business-to-customer (B2C). However, used at the maximum payload of 350 kg could lead to substantial problems with manoeuvrability and the environmental benefits are hampered (Moolenburgh et al., 2020). *Electric cargo moped:* A vehicle with a payload up to 500 kg making it a solid transportation mode. This type of vehicle is more suited e.g. bulk transports of foods or construction equipment i.e. heavier transportations compared to the electric cargo bikes. By deploying an electric cargo moped, the driver does not need to make any efforts (which is the case for an electric cargo bike). *Small electric distribution vehicle:* A small van that has a payload of up to 750 kg. Usable for all sorts of activities such as street cleaning,

catering, waste collection, bulk transports and parcels, both for B2C and business-to-business (B2B). Compared to the two other segments, bike and moped, the manoeuvrability decreases with the deployment of this vehicle. However, comparing it to conventional vans, manoeuvrability is enhanced and it will cope better in public areas and be easier to park (Moolenburgh et al., 2020). In Table 2, the segmentation of what is perceived as conventional vans are displayed to provide a sense of comparison between the segments of LEFVs and conventional vans.

According to the research project conducted at the University of Applied Science in Amsterdam, there are different categories of goods flow that occur in city logistics which suit the deployment of LEFVs (Ploos van Amstel et al., 2018). These criteria and the enablers/motivator are presented in Table 3.

Table 3. *Criteria and enablers for implementation of LEFVs (Ploos van Amstel et al., 2018).*

Criteria	Enablers
1. Small and light shipments	LEFVs are restricted by their loading capacity
2. Network design: High density of stops located close to each other	LEFVs are restricted by their range but can access parking spots in dense areas easily
3. Time-sensitive shipments	LEFVs can manoeuvre easily in dense areas and are trusted due to the fact congestion doesn't affect them as for conventional vehicles
4. Prospect for innovations and growth	A shift in demand from customers and pressure from competitors allows for innovations such as LEFVs

From the research conducted by Ploos van Amstel et al., (2018) segments of suitable goods were identified that could deploy LEFVs as a mode of transport.

2.3.1 Segmentation of post, parcel and food logistics

Post and parcel logistics holds a huge potential for deploying LEFVs as a mode of transport because the shipments often come in smaller packages and volumes and the operations are conducted at networks with a high density (Ploos van Amstel et al., 2018). It is evident that freight companies such as DHL and Postnord already have implemented the use of LEFVs (cargo, bikes, mopeds and club cars) in their operations (Postnord, 2020) (ibid). One reason for companies such as Postnord and DHL to enter the market segment of parcel deliveries is that post services have declined over the years, hence new markets are being explored. One of these markets is the parcel market which has exploded and that's why companies try to gain more market shares within that area (Ploos van Amstel et al., 2018). However, according to Morganti and Browne (2018), conventional vans are still considered to be the most used modes of transport for last mile deliveries. Even though online shopping and e-commerce have pushed the boundaries to new levels of parcel deliveries in urban areas, there are still

barriers LEFVs have to overcome. Barriers to the adoption of LEFVs are cost competitiveness (both cost for ownership and purchase price), the range is another barrier, but new and better infrastructure are viewed as an enabler for better range. Lastly, aftermarket service, repairs, long charging times and the value of selling used LEFVs are viewed as concerns (Morganti and Browne, 2018).

Even though the above concerns regarding LEFVs exist, another segment of goods that have shown potential for the deployment of LEFVs is the food segment. This is since food deliveries are mostly time sensitive shipments. Another factor is the network design, the design is usually with stops within a short distance from each other, hence LEFVs have an advantage. Home deliveries of food are another sector that has grown, small shipments and time critical, making them perfect for deploying LEFVs (Ploos van Amstel et al., 2018).

2.4 Involved Stakeholders

Which stakeholders could hold an interest in upscaling the use of LEFVs?

City logistics stakeholders can be divided into different categories. The most common categories of city logistics stakeholders in existing literature are the following: local authorities, residents (consumers), shippers, receivers and transport companies (Katsela and Browne, 2019; Kiba-Janiak, 2016). Each of the stakeholders has different interests and objectives when it comes to city logistics (Kiba-Janiak, 2016; Katsela and Browne, 2019). Figure 1 shows the demand and flow between different stakeholders in urban areas.

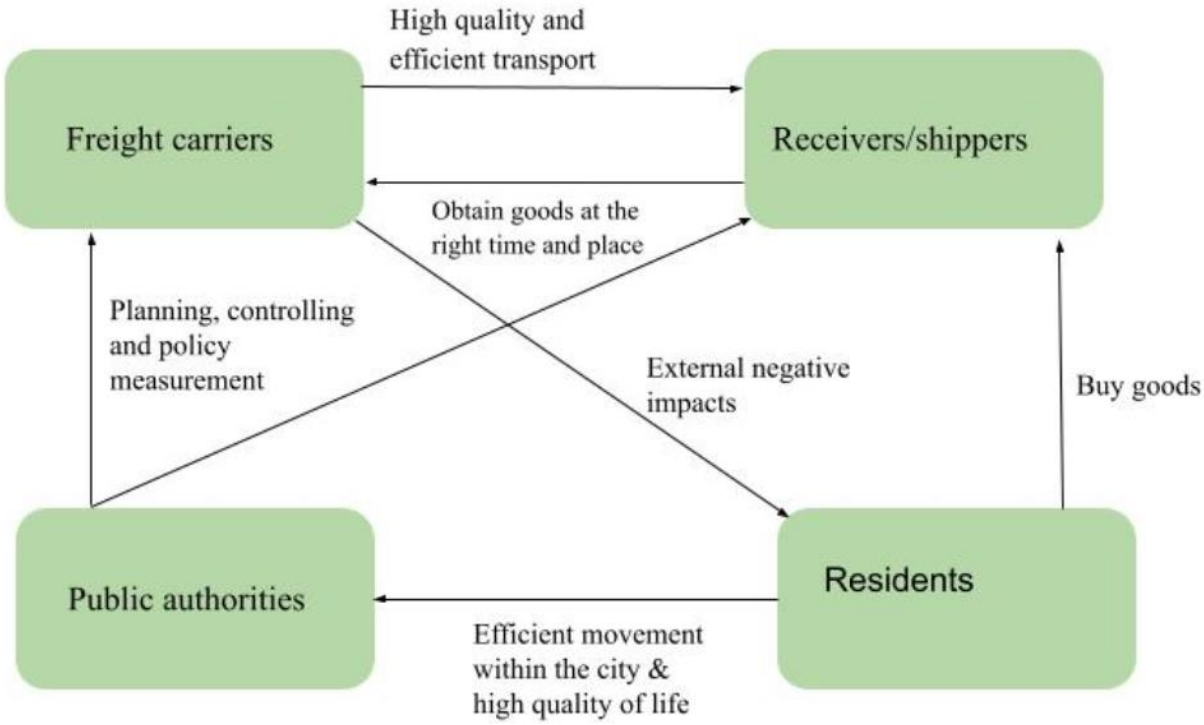

Figure 3. *Stakeholders within urban areas and their demands for last mile deliveries (Kiba-Janiak, 2016).*

Katsela and Browne (2019) mention that each stakeholder plays a different role in city logistics and are after different outcomes. Freight carriers are often interested in business but

also performing cost efficient deliveries. Public authorities on the other hand are interested in reducing the external impact of transport activities and achieving an attractive city for residents. The residents within an urban area are affected by the externalities of transport activities (Katsela and Browne, 2019). City logistics has a diversity of stakeholders all with different points of views and objectives leading to conflicts between stakeholders (Katsela and Browne, 2019). The authors also mention that due to the complexity of city logistics the conflict between stakeholders leads to bad communication between the public and the private sector. To achieve sustainable growth of the city and develop a low impact urban planning and transport system there is a need for collaboration between the stakeholders (Browne, Brettmo and Lindholm, 2019). Moreover, to achieve efficient collaboration the stakeholders need to be analyzed and common goals and motives should be determined (Katsela and Browne, 2019). Tamagawa, Taniguchi and Yamada (2010) also mention the importance of analyzing the stakeholders and understanding the behaviours to achieve efficient collaboration. The study conducted by the author aims to understand the objective of each stakeholder involved in city logistics, to evaluate the criteria. The assumption stated by the authors is that stakeholders work towards achieving their objectives however when a new policy is introduced, the stakeholders change the behaviours.

According to Tamagawa, Taniguchi and Yamada (2010), the objective of a freight carrier is to grow in profit which is also mentioned in the literature by (Katsela and Browne, 2019). To achieve the objective freight carriers focus on reducing transport costs. The goal is to minimize transport costs while maximizing the number of sales (Tamagawa, Taniguchi and Yamada, 2010). The authors write that the objective for shippers is also to grow in profit however, there are different aspects included for this stakeholder compared to the previous one. In conclusion, the objectives for shippers is to minimize cost and maximize profit. When it comes to residents, the objective according to the authors is to ensure a good living environment and for the residents to achieve the objective, there is a need to minimize the external impact from transport activities within urban areas. Lastly, the objectives of public authorities according to the authors are two. First to ensure a society with low environmental impact, secondly to achieve a society with high economic efficiency. To achieve the two objectives the authors state that public authorities focus on achieving environmental standards and efficiently use the infrastructure within urban areas.

Since the stakeholders have different objectives the focus for public authorities and private companies are not the same. According to Browne, Brettmo and Lindholm (2019), transport authorities often focus on the movement of people instead of goods and freight. Furthermore, the authors discuss the difficulties for public authorities to understand and include the wide range of stakeholders in the transport planning process. In fact, the authors also argue that private companies have not been included in the transport planning process until recent years. The authors also stress the importance of including all stakeholders to make changes in city logistics and within urban areas. The engagement of stakeholders was also stressed by Katsela and Browne (2019), where the study presented initiatives taken in Swedish cities where a collaboration between the private and the public sector was conducted. The authors point out the importance of stakeholder collaboration to understand stakeholders behaviour.

Understanding the behaviour of the stakeholders will lead to aligned motives and common goals which will minimize conflicts and increase productivity to implement efficient city logistics solutions (Katsela and Browne, 2019; Tamagawa, Taniguchi and Yamada, 2010). Regulations by public authorities have often aimed for freight transport, where restrictions limiting vehicles in parts of the city to size and time are common (Browne, Brettmo and Lindholm, 2019). Moreover, as mentioned by Tamagawa, Taniguchi and Yamada (2010), one of the objectives for public authorities is to minimize emissions and the negative environmental impact. Hence, regulations to achieve the objectives are often implemented in the city where controlling the fuel type is common (Browne, Brettmo and Lindholm, 2019). The authors discuss that such regulations can lead to conflicts and disagreements between the public and private sector. Moreover, it is argued that such decisions are often taken without considering the upstream supply chain. For instance, if regulations ban large vehicles from entering the city and time restrictions exist during the day. The outcome can be that freight operations instead increase the number of smaller vehicles in the city and vehicle activities to meet the customers' demands (Browne, Brettmo and Lindholm, 2019).

To solve the complications between the different stakeholders there are several initiatives and examples that have been conducted in collaborations between the stakeholders. The study was done by Katsela and Browne, (2019) presents an example in Gothenburg city and Malmö city where collaboration between the different stakeholders have led to efficient city logistics development. In Gothenburg city, the authors presented "Stadsleveransen", which started in 2012. The concept included a consolidation centre located close to the city, where packages arrived from one Scandinavian and international transport provider. The next stage is that the packages are grouped into delivery rounds and delivered by four electric vehicles (Katsela and Browne, 2019). The number of deliveries with stadsleveransen has increased since the start. The authors mention that this initiative has included many different stakeholders such as transport providers, haulage organizations, property owners and public authorities (Katsela and Browne, 2019). The other example in Malmö called the "Samcity" initiative aims to coordinate freight consolidation and distribution systems with logistics services in the city. The initiative will examine if the system is economic and environmentally sustainable. This initiative also included several stakeholders both from the private and public sector with common goals and objectives (Katsela and Browne, 2019).

To sum it up, the diversity of stakeholders in an urban area leads to complexity when planning and developing city logistics initiatives. The literature suggested 6 different categories to divide the stakeholders into, all with different views and objectives. The stakeholders work toward achieving the objective leading to miscommunication between them and conflict of interest. Not until recent years has the collaboration between the public and private sector increased in interest, leading to different new innovative initiatives such as the example in Gothenburg and Malmö. The literature points out the importance of collaboration between stakeholders to achieve efficient and sustainable city logistics. Moreover, the authors also stress the importance of understanding the objectives and behaviours of the stakeholders to have an efficient collaboration.

2.5 Policies as a Driving Force

Are there any policies in place to enhance the use of LEFVs?

Within city logistics and transportations in urban areas, policies have been put in place by decision makers. This has been done to ease and enhance the environmental impacts transportations with conventional vans and trucks contribute to within city centres. Many of these policies were not put in place to enhance the use of LEFVs, but in hindsight, it has worked in favour of electric vehicles. When discussing policies, one usually talks about low emission zones, restrictions for access, charges and incentives, loading zones and night deliveries. In this section, a review of these policies will be conducted and how they can enhance/enable the deployment of LEFVs.

2.5.1 Low Emission Zones

A low emission zone is a selected area where different modes of transport can go through if they meet certain criteria regarding emissions (Browne, Allen and Anderson, 2005). Low emissions zones have been implemented due to bad air qualities within cities, and they have the potential to improve air qualities. According to the literature, low emission zones can be shaped in different ways and be dependent upon, certain times the restrictions are in place, requirements and standards vehicles need to meet in order to enter the zones. In Scandinavian, low emission zones have been in place for several years.

In Sweden, low emission zones were introduced in 1996 in the cities, Stockholm, Malmo and Gothenburg. The rationale behind this was to lower the environmental impact of vehicles, such as emissions and noise disturbance. The aim of the restricted emission zones was to capture all vans and trucks over 3.5 tonnes, which has worked very efficiently. The restriction is put upon the vehicles entering the zones e.g. entering vehicles can't be older than 8 years, otherwise retrofits for equipment that reduces emissions for older vehicles needed to be implemented. Vehicles entering a low emission zone in e.g. Gothenburg and not having the retrofit and being older than 8 years would be subject to disciplinary actions from the law enforcement (Browne, Allen and Anderson, 2005). In Sweden it is evident that vans (3.5 tonnes) have had a steady increase of 1.8% comparing 2019 to 2020, in figures that is 595 580 registered vans. Only 3% of the vans run on renewable fuel which is quite telling (Trafik Analys, 2020).

Even though the literature is scarce on how low emission zones have affected the deployment of LEFVs. It is likely that when more policies like low emission zones are implemented in urban areas and cities, indirectly it will enhance the use and deployment of LEFVs, even though the initial thought was not to do so.

2.5.2 Restricted Areas

Restricted areas are usually dealt with in different ways and forms. Discussing restricted areas often refers to weight, vehicle size, time and width. Meaning that if a vehicle wishes to enter an area with weight restrictions, it must meet the criteria for gross weight. As

mentioned, these restrictions often come in different forms e.g. combination with weight and time. Meaning that urban areas and cities can somewhat make sure that heavy vehicles don't enter city centres during peak hours.

According to Holguín-Veras et al., (2020) areas restricted by weight are usually implemented because of a desire to reduce congestion and/or accidents by larger vans and trucks in urban areas. It is evident that freight operators and carriers seem to be reluctant to incentives like this due to small margins in their operating costs. Leading to an advantage for LEFVs, hence they would then not be subject to incentives like this. However, according to the literature, research has shown that introducing restricted areas for weight and time will lead to more pollution, emissions and poorer quality of life for the areas outside the target area (Holguín-Veras et al., 2020).

2.5.3 Incentives and Charges

There are many different ways of controlling the flow of traffic within and to/from cities. One way to deal with it is to implement incentives and charges. Incentives, compared to charges, could have a stronger effect on society because they are not mandatory. Examples seen from one incentive like this is the one from Sweden during 2009. At this time, if a person bought a vehicle classified as green, they would not have to pay taxes for a time period of 5 years. Resulting in a decrease of 1% emissions from the designated road traffic after just 1 year (Dreblow et al., 2013).

Looking at the charges implemented across the globe, congestion charges are probably the most common ones. A congestion charge is defined by Anderson, Allen and Browne (2005) as a specific scheme of target geographical areas and when the vehicle enters the area during a specific time, they have to pay for that trip. By implementing congestion charges, decision makers aim to reduce the traffic flow within the city and at the same time achieve better air quality with fewer emissions. Another important aspect of congestion charges is the potential revenues public authorities will receive which could be subject to enhancing public transport in the aforementioned cities (Anderson, Allen and Browne, 2005). Congestion charges will affect companies in different ways, some might try to drive and find other routes and ways around the areas affected by the charges. Others might invest in small electric vehicles that don't have to travel long distances in the city but instead can just operate within the city.

2.5.4 Loading Zones

Loading zones have been put in place to eliminate or at least reduce the problem that can occur between different parties using curbsides. At the same time allocating more loading zones to freight vehicles using curbsides. Different solutions are seen across the globe, for instance in London, loading gaps are painted and allocated for loading activities (Holguín-Veras et al., 2020). Other findings that concern LEFVs in a more direct way and loading zones are the implementations of supportive policies. It is argued that if the deployment of LEFVs for last mile deliveries should be scaled up, supportive policies need to be in place. One way to deal with this is to facilitate the use of LEFVs by letting them use non-parking

spaces within cities as a loading zone. Another factor pointed out by the literature is to let LEFVs access pedestrian zones for their operations e.g. loading/unloading, giving them a natural advantage within cities (Quak, Nesterova and van Rooijen, 2016).

2.5.5 Night Deliveries

Another way to ease and facilitate traffic flow in densely populated cities and areas have been to implement deliveries that occur at night time. According to Browne et al., (2008), there are 2 different ways of conducting night deliveries, either the night delivery is performed in an urban area (whole area) or at a targeted location. Problems raised with night deliveries are disturbance that will affect citizens living in urban areas (Browne et al., 2008). However, if night deliveries were to be performed with LEFVs instead, noise disturbance would be eliminated from the vehicles themselves. Loading and unloading operations would still be an aspect to consider even with LEFVs for night deliveries because it would cause noise disturbance.

2.6 Urban Consolidation Centres, Micro-hubs & Temporary-hubs

By increasing the availability of temporary hubs could that upscale the utility of LEFVs?

2.6.1 Urban Consolidation Centres

Browne et al., (2005) write that the Urban consolidation centre (UCC) does not have a common definition in the existing literature. The existing definitions vary between different actors, over time and in different countries. The authors therefore describes UCC as the following:

> *"A logistics facility that is situated in relatively close proximity to the geographic area that it serves be that a city centre, an entire town or a specific site (e.g. shopping centre), from which consolidated deliveries are carried out within that area. A range of other value-added logistics and retail services can also be provided at the UCC."*

In the UCC operators sort goods from different transport companies and deliver the goods to the end customer often in environmentally effective transport alternatives (Browne et al., 2005). According to Allen et al., (2012) having UCC closely located in the city centre will improve the supply chain performance as well as reduce the negative environmental and social impact from freight transports making the concept both internal and external beneficial. It is mentioned by Allen et al., (2014) that if a UCC is used efficiently the total curbside time and the space occupied by vehicles can be reduced as well as congestion. The authors also mention the environmental benefits with efficient use of UCC where reducing the negative impact on local air quality was a factor. UCC will also make it possible to increase the quality of life in urban areas. Noise is one of the current issues with freight in the city centre. Hence, by having UCC the freight operators have the option to use more quiet vehicles for the last mile delivery. Hribernik et al., (2020) write that the process can be divided into two steps. Firstly, the goods arrive from a centre outside the city to the UCC and secondly, the last mile delivery, the delivery from the UCC to the end customer. By Browne

et al., (2005) the advantages and disadvantages of UCC are presented and Table 4 summaries some of the advantages and disadvantages.

Table 4. *Some of the advantages and disadvantages of UCC (Browne et al., 2005).*

Key Advantages	Key Disadvantages
Environmental and social benefits, more efficient and less intuitive transports.	High setup costs
Better planning and implementation of logistics operations	Freight is consolidated internal within companies
Better inventory control, availability and customer services	Additional stage in the supply chain results increased delivery cost
Public relations benefit from UCC	Hard for one centre to handle the amount of goods in urban areas.

2.6.2 Micro & Temporary-hubs

As for the case of UCC, micro and temporary-hubs also lack a common definition in the literature. However, Janjevic and Ndiaye (2014) analyzed 34 implementations of such initiatives in Europe and summarized the common characteristics of temporary and micro-hubs in the following way:

- Firstly, the main aim of all micro-hubs is to reduce total vehicle trips in urban areas. Hence, having micro-hubs close to the end receiver will help.
- Secondly, the activities involving logistics setups in the city centre of an urban area
- Thirdly, micro-hubs delivery small and light parcels
- Lastly, the vehicles used for the last mile logistics are often environmentally effective, such as cargo bikes or LEFVs.

Schodl et al., (2019) describe micro-hubs or temporary-hubs as logistics infrastructure facilities that are used for storage, transhipment and distribution. The hubs are located close to the end customer which will receive the parcels (Schodl et al., 2019). The authors state that the idea with hubs close to the end customer will increase the possibility of environmentally efficient transport alternatives such as LEFVs and pedestrian transport. Hribernik et al., (2020) further state the benefits with temporary hubs are minimized trips and miles but also the option to use environmental effective transports. Moreover, the hub also aims to increase customer services where customers can pick up parcels but also have future customer-oriented service (Schodl et al., 2019; Hribernik et al., 2020). Different studies in European cities have been conducted where the aim is to investigate the temporary hubs and urban consolidation centres. In London a UCC was operated to deliver office supplies (Browne, Allen and Leonardi, 2011). From the UCC to the end customer electric vans and cargo bikes were used. The presented results showed a reduction in vehicle costs such as fuel cost and maintenance costs. On the other hand, the costs increased when employing drivers and

operating the UCC. Moreover, the authors also presented that Co2 emissions per parcel dropped but the frequency of transports increased (Fikar, Hirsch and Gronalt, 2017;Browne, Allen and Leonardi, 2011). Arvidsson and Pazirandeh (2017) presented a study where operating mobile hubs was presented from a sustainable perspective. It is argued by Arvidsson and Pazirandeh (2017) that delivery vans today spend a large share of the time driving from and to the distribution centre which is often located outside the city. Moreover, the authors also state that this scenario often occurs during the morning and in the afternoons when the roads are highly congested. When the van enters the city the van often receives high parking charges due to incorrect parking which is a high internal cost for companies or spends a long time searching for a suitable parking space (Arvidsson and Pazirandeh, 2017).

To sum it up, temporary hubs, micro-hubs and UCC all have benefits from an environmental and social perspective. The literature presents different initiatives taken where positive results were shown. Most importantly, the use of UCC enables transport operators to use more environmentally effective vehicles such as LEFVs.

2.7 Interaction Between Customer and Delivery Operations

Will the use of IT innovations facilitate the use of LEFVs?

With the technology present in today's everyday life, such as smartphones, apps, information systems and the amount of data that people generate, endless opportunities for companies are presenting themselves. Could that be a factor, if being more transparent towards consumers about the transport, be seen as an enabler for the reason to upscale the use of LEFVs? In this section, Intelligent Transport Systems (ITS) will be reviewed in order to understand if it can play a part for LEFVs together with information and communication technology (ICT).

When discussing ICT there is an understanding that by deploying such technologies, sustainable transportation could be achieved. According to van Geenhuizen (2009), ICT technologies are heterogeneous products (hardware and software) that will ease factors such as communication, collecting data, management, guidance through electronics and processing of data in distribution networks. Within a transportation system, ICT could either be really simple solutions like single communication and up to interactive applications like traffic management. One common system used across many industries is geographical position systems (GPS) and geographical information systems (GIS), these systems can provide users with optimized suggestions for route planning. Users could e.g. insert their origin and destination and the system would provide them with the best possible route (van Geenhuizen, 2009). This is a common way of using GPS applications but in freight transports, it has proven to be an important part of everyday operations.

A more complex solution that has been implemented in freight operations as well as in public transport systems are advanced travel information systems. Systems like this could either be attached in public transport services, portable for users or mounted in freight vehicles. This technology uses real-time information, hence it can provide the best possible route dependent

on variables such as congestion, accidents within cities and opening hours for stores (van Geenhuizen, 2009). According to Crainic, Gendreau and Potvin (2009) using ITS technologies and especially technology using position-based data and real-time information has the potential to provide better customer service profoundly. This is since the data extracted from the different sources can enhance productivity in terms of re-routing freight vehicles in real-time and reach more customers and their needs on time but also take on new assignments in a more proficient way.

Summarizing the technology available for freight transportation in general, such as the ITS and ICT, it is clear that applications like this offer new possibilities for all vehicles operating in dense areas. Meaning that it is not unique for LEFVs in that sense. However, because LEFVs are operating first and foremost within city centres, deploying technology like ITS and real-time information of e.g. customers' orders, where they live and how to receive the order. LEFVs could have an upper hand due to the fact that they easily can operate between shorter distances and their manoeuvrability makes them ideal under such conditions.

2.7.1 Autonomous Vehicles

Autonomous vehicles have recently been a large topic and have been used in different sections of the logistics industry such as in ports for container handling and hospital and medicine logistics (Kapser and Abdelrahman, 2020). The authors state that the vehicle is being developed for B2C deliveries where shared infrastructure is used. Taniguchi, Thompson and Qureshi, (2020) states that autonomous vehicles have a promising future and can deliver efficient delivery services in urban areas. The authors write that innovations like autonomous vehicles or autonomous robots can improve efficiency in terms of cost but also reduce the negative environmental impact. Different studies and pilot projects have shown improved results when using innovative solutions like autonomous vehicles and robots. Figliozzi, (2020) describes Autonomous delivery robots, (ADR), as "*Electric powered ground vehicles that can deliver items or packages to customers without the intervention of a delivery person.*" The author mentions that ADR can be divided into two groups. The first sidewalk road autonomous delivery robot which only operates on sidewalks or pedestrian paths. Secondly, simple road autonomous delivery robots which travel on shared roadways with conventional vehicles (Figliozzi, 2020). Kapser and Abdelrahman, (2020) write that the ADR can only deliver small shipments and the robots can be unlocked by the recipients with a one-time code. The robots use sensors and navigation technologies and can therefore drive on roads and sidewalks without human interaction. Hence, the robots have to share the space with existing traffic and vehicles Hoffmann and Prause, (2018) argue that the robots have competitive advantages in suburbs and areas where the traffic density is lower. However, the literature shows that this concept can be promising in the future, even in urban areas.

2.8 Theoretical Framework

The literature review included information that will give the reader a background on the subject and what is currently stated in the literature. Moreover, the literature review included information that is important to have in order to understand the results and analysis of this

study. However, due to the wide scope of the literature review the theoretical framework for this project will only include the subjects shown in Figure 4. There are several reasons for this choice.

- Firstly the chosen subject includes information that will have a direct impact on the results of this project.
- Secondly, the choice of the subject that will be included in the theoretical framework is also based on how the subjects connect.
- Lastly, to have an accurate analysis, the information in each section will be used in relation to the importance and impact on the results.

Section 2.1 includes literature regarding current challenges within city logistics. The challenges will be included in the theoretical framework since the challenges are a driving force to upscale the use of LEFVs. Moreover, the literature included in section 2.1 presents the main challenges of city logistics where LEFVs can be a part of the solution. Since the challenges in city logistics are closely related to the environmental and safety issues, the section will have a direct impact on the results in order to understand if LEFVs will be a part of the future solutions for logistics problems in the city. Supply chain management, (section 2.2), is a wide area with many different stages and parts that needs to connect. However, the most important part of the supply chain in relation to the aim of this project is the last mile logistics. Hence, the theoretical framework will only focus on the last mile logistics from section 2.2. In order to address the RQ2 section the last mile logistics layout is important to include in the framework in order to understand how the current layout affects the use of LEFVs. Section 2.3 will be included in the framework due to the aim of the project. The section presents information regarding the different characteristics of LEVFs, which will be a foundation for RQ1.

Involved stakeholders (section 2.4) includes information regarding the importance of collaboration among the stakeholders, how collaboration can be increased and also the main stakeholders. For this project the focus will be on information regarding the main stakeholders and how the main stakeholders benefit from the deployment of LEVFs. Section 2.5 presents current restrictions and policies in urban areas that can be a driving force and enable the use of LEFVs. Lastly, section 2.6 includes important information regarding UCC, temporary-hubs and micro-hubs. Section 2.6 has a direct impact on the results and is a foundation for RQ2.

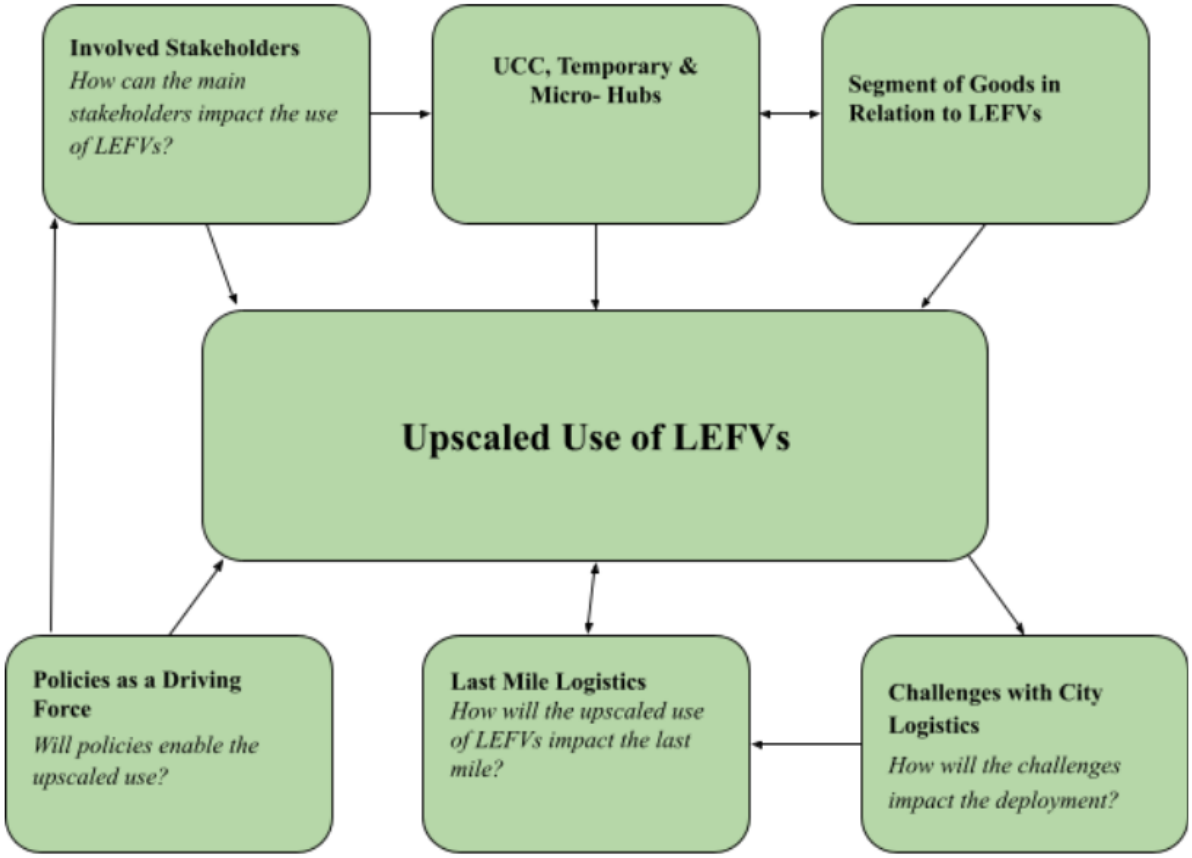

Figure 4. *Overview of theoretical framework.*

3.0 Methodology

Under this section, the authors will present the methodology used to conduct this study and answer the research questions. Moreover, information regarding the type of data collected and how the data was collected will be presented.

3.1 Research Paradigm

Collis and Hussey (2014) explain that there are two types of research paradigm, positivism and interpretivism. According to the authors, positivism is built around the belief that reality is independent of people and the goal is to with empirical research such as observation and experiments discover theories. Moreover, the framework for a positivism paradigm aims to provide logical or mathematical proof for justified statements. Under positivism the research is objective and logical reasoning is always required. Denscombe, (2017,) also describes positivism as an approach that relies on measurements and statistics.

Interpretivism on the other hand is built around the belief that social reality is not objective. Interpretivism is built around subjectivity rather than objectivity, a description more than analysis and agency rather than structure (Denscombe, 2017), (Collis and Hussey, 2014). The paradigm focuses on investigating and exploring the complexity of social phenomena (Collis and Hussey, 2014). By understanding the characteristics of an interpretivism paradigm, one can understand why the paradigm is commonly used in business research where the aim is to understand how people are thinking and behaving (Denscombe, 2017). This paradigm is highly used in qualitative research which emphasizes individual views and personal experiences.

This research aims to answer the following research questions:
RQ1: *What are the driving forces to upscale the use of LEFVs and which segments of goods are suited to LEFVs?*
RQ2: *How does the use of LEFVs affect last mile logistics, specifically in relation to having urban hubs?*

Based on the field that will be investigated and the research questions, the subtle paradigm for this study will be interpretivism. There are two reasons why interpretivism will be the approach for this study. Firstly, the area that is being investigated is new. The concept with LEFVs is being tested in different cities in Europe where the results show improvement to some extent. Hence, the positivism paradigm where statistics and measurements are the core of the paradigm will not be sufficient to apply for this research since numbers and quantitative studies are limited. To understand how innovations, such as LEFVs, will impact the urban logistics, supply chain and also investigate the possibility of increasing LEFVs in different commodity segments, the human view and options need to be included in this study. Secondly, logistics and supply chain is a complex field with a large number of stakeholders involved, hence, the most common approach used in the logistics field is interpretivism.

3.2 Research Approach

Collis and Hussey (2014) state there are two types of research approach, quantitative and qualitative. Moreover, the information collected in quantitative research will be quantified and used for statistical analysis. While for a qualitative study, the data collected is in a nominal form, such as words and images. The data collected for a qualitative study will not be used for statistical analysis. According to the authors, data collected for qualitative research must be highly specific and precise. Furthermore, for a qualitative study, it is essential that the data collected is of high quality and depth. Hence, qualitative research is highly detailed.

To answer the research question and fulfil the purpose of this study, a qualitative research method will be conducted since it is considered more suitable for the purpose of this report. There are two reasons for the choice of a qualitative research method for this study. Firstly, the subject is a new phenomenon where existing research is limited. Secondly, to understand the subject and to answer the research questions there is a requirement of an open approach where data and information can be collected from different points of views within the business area.

The research design and approach is built on three different steps as shown in Figure 5
The first (1) step of the research was to analyse existing studies and literature. Hence, a literature review was conducted to understand the concept of urban logistics and LEFVs. The literature review aims to give the reader background and understanding of urban logistics. Moreover, the reason was to collect and analyze existing literature on the subject to build a foundation for this report. The second (2) step is to apply the research approach and paradigm. Hence, interviews with different stakeholders in the supply chain were conducted in order to answer the research questions. The aim of the interviews is to understand and analyze the opportunity and the obstacles with LEFVs from the business perspective, rather than studies and literature. The last step (3), was to summarize and interpret the results from the interviews. The results from the interviews will be used to answer Q1 and Q2, moreover, the data gathered from interviews will be valid and compared to existing studies in order to have reliable results. The choice of the method will be further explained in sections 3.3.1 and 3.4.

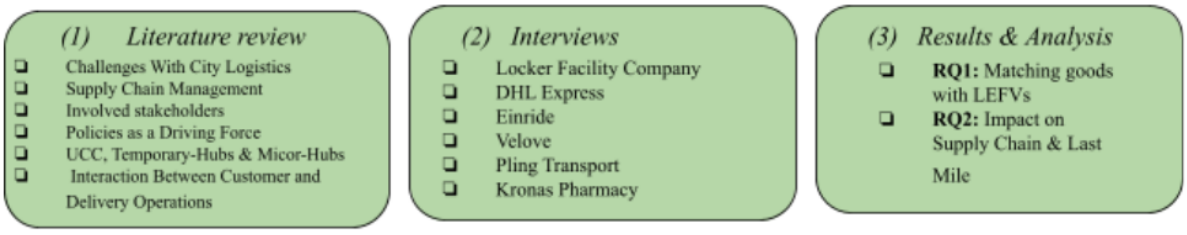

Figure 5. *Overview of the research design.*

3.3 Data Collection

To fulfil the purpose of this study, it is important to determine the type of data to collect, where to collect the data and how to collect it. The method used to collect data is interviews,

literature analysis and observations. According to Collis and Hussey (2014), primary data is data collected from sources, such as interviews, experiments and questionnaire surveys. Meaning that the secondary data for this report will be the analysed literature, this is explained in the section 3.3.2.

3.3.1 Primary Sources

The primary sources for this study will be obtained from interviews within relevant areas, with relevant actors for city logistics and the potential to use LEFVs in a broader context. It was deemed feasible to apply semi-structured interviews to obtain valuable information from professionals within the industry. The reason for using semi-structured interviews lies in the fact that it provides the research with deeper and more profound knowledge about the topic. Compared to structured interviews which provide the research with almost no room for spontaneity from the predetermined questions, semi-structured interviews allow for follow up questions during the interview (Denscombe, 2017). Meaning that the interviews will provide the researcher with good and valuable information.

Table 5. *Overview of interview objects.*

Company	Interviewee	Position	Type	Date	Duration	Language
Locker Facility Company	Respondent 1 (R1)	Production Leader	Online - Zoom	21-02-17	30 Min	Swedish
DHL Express	Respondent 2 (R2)	Cargo Bike Riders	Telephone	21-02-18	30 Min	English
Einride	Per Olof Arnäs - Respondent 3 (R3)	Strategic Logistics Expert	Online - Zoom	21-02-19	45 Min	Swedish
Pling Transport	Respondent 4 (R4)	Member of the Management Team	Online - Zoom	21-03-04	35 Min	Swedish
Velove	Johan Erlandsson - Respondent 5 (R5)	CEO & Co-Founder	Online - Email	21-03-08	Not Applicable	English
Kronans Pharmacy	Dan Adolfsson - Respondent 6 (R6)	Head of Logistics	Online - Zoom	21-03-11	35 Min	Swedish

In Table 5, a list of interview objects that have participated in this research is presented to give an overview of the interviews. They were selected based on the recommendation from the supervisor at VTI, Niklas Arvidsson, in order to achieve a good spread of different actors and points of view. After the recommendations from the supervisor, a snowball effect

developed through to other areas and interesting interview objects deemed feasible for this study. The interviews were either conducted online through applications like Zoom, Teams, Google Meet or a telephone call. The interviews were recorded, granted from the participants and the respondents had the option to be anonymous. Therefore, when the interviews are cited in the result, they will be cited as respondent 1 (R1) and so on. This will be conducted in order to have a consistent result.

3.3.2 Secondary Sources

To gain a profound understanding of the thesis topic, a secondary source for information was deemed feasible to include. The literature review works as the theoretical framework for this master thesis, hence it is the second source for information. The data collected for the literature review has mainly been based on scientific articles and published books regarding the subject. Articles and books have been gathered through different search engines such as the one provided by the University of Gothenburg and by Google Scholar to find suitable data. The literature that has been analyzed is composed of the complexity that city logistics consist of, meaning that case studies, research, pilot projects and actions taken to achieve sustainable logistics within urban areas. This was conducted to achieve a holistic view of the aforementioned topic.

3.4 Interview Structure

Collis and Hussey (2014) state that interviews are used under an interpretivist paradigm to understand different perspectives of the problem and how people within the industry work, feel, think and which different options exist. According to the authors, the most used interview structures for an interpretivist paradigm are unstructured and semi-structured interviews. When conducting an unstructured interview, the questions are not prepared in advance rather developed during the interview. On the other hand, while conducting Semi-structured interviews questions are prepared beforehand to cover the right area and develop new questions during the interview. The authors also state that there are two types of questions, open and closed questions. Open questions require a deeper and more developed answer which cannot be answered with a simple yes or no. However, the answer to a closed question is short and can be answered with a simple yes or no.

The interviews can be conducted in different ways and there are mainly three ways to conduct an interview, face-to-face, telephone and online. Face-to-face interviews can be conducted in any physical place that is suitable for the researcher and the respondent. The disadvantages of conducting face-to-face interviews are that it is time-consuming and can also be expensive if travel is required (Collis and Hussey, 2014). However, the advantage with face-to-face interviews is that the data is more comprehensive which according to the authors can be useful if the researcher has sensitive or complex questions. Telephone interviews are a good alternative if one wants to save costs and time. However, the authors state that it may not be possible to have long interviews as in the case of face-to-face interviews. Lastly, the authors mention online interviews, which can be conducted through an online platform. The authors mention some disadvantages with this type of interviews such as

internet connection, use of software and recording the interview. For this particular study and due to Covid-19, none of the interviews has taken place face-to face. This has not hampered the study, instead it has allowed the authors of this thesis to be flexible and able to adjust quickly for the interview objects.

For this study, semi-structured interviews will be used since it is considered to be suitable to have relevant data for the purpose of this study. The questions will be structured beforehand to give the respondent a lead on the subject. However, the questions will be open which gives the respondent the chance to freely answer the questions and add valuable information. Moreover, due to the current pandemic, the interviews will mostly be conducted online using suitable software for the participants and ensuring the possibility to record the interviews in order to have the right information available.

3.5 Data Analysis

By applying interviews as a method to collect data, the data needs to be analysed before it can be used and presented as a result of this study. First of all, after the interviews were conducted, the authors had to transcribe the collected data. A content analysis of the transcribed data was made and then broken down into smaller parts that were viewed as relevant for this study through a subjective selection of the transcribed interviews. This selection technique was decided upon since all the data obtained during the interviews are not relevant to the study. Meaning that it would allow the authors to choose the data and information viewed as most relevant for the topic (Denscombe, 2017).

To select relevant information from the obtained data through the transcribed interviews, a thematic analysis has been applied. A thematic analysis implies that the collected data should be categorized into different themes through coding. Through the coding, relevant data could be separated and then compiled into the result (Denscombe, 2017). The coding of the transcribed interviews was conducted by both authors and then put together and screened towards the collected literature. This resulted in a document that consisted of the empirical findings for this study. This was completed to reduce and ensure that biases weren't present in the empirical findings and they are presented in Chapter 4 of this study.

3.6 Rationale of the Methodology

To conduct and produce a master thesis that would have some kind of platform to build from, the rationale and research design need to be established. Firstly, the ongoing practice and norm within the research field were determined, as prerequisites to what to expect. This was completed by conducting a literature review and the literature review tries to explain city logistics and how that affects choices of LEFVs, stakeholders, policies and enablers for using LEFVs more. Hence, the literature review supports the ongoing research and is therefore working as a theoretical framework for this master thesis in some ways. Due to the fact that all aspects within the literature review aren’t included in the theoretical framework, see Figure 4 in chapter 2. Secondly, the actual research methodology was decided upon, this was completed to facilitate the research questions. For this master thesis, the authors have decided

to conduct an empirical study by using interviews as the primary source. The interviews were conducted using a semi-structured approach, allowing the authors some freedom of spontaneity. Another aspect for the interviews is that the questionnaire differs from company to company. This is the case because the chosen interview objects have different roles within the industry, hence by asking different questions, different points of views can be identified. Lastly, the result from the collected data through the interviews was used to answer the aforementioned research questions.

The rationale regarding the methodology is that the authors view the subject as quite young and at the same time there are a lot of new investments and actors entering this market segment. Therefore, semi-structured interviews are viewed as the most solid way to obtain profound data from different actors. According to Mangan, Lalwani and Gardner (2004), a common problem when conducting research is that value, norms, judgments, preferences, references and theories are included in a research approach, leading to predetermined stand-points. Hence, the goal of this master thesis and the rationale of the chosen methodology is to achieve a result that hopefully is free from predetermined norms and biases.

3.7 Reliability and Validity

According to Golafshani,(2003), reliability can be defined as the following:

> *"The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable."*

The authors state that reliability in a qualitative study tests the quality of the information. A qualitative study aims to help the reader to understand a situation that otherwise would be hard to understand and generate the purpose (Golafshani, 2003). According to Collis and Hussey (2014), reliability refers to the accuracy and precision of the research. In other words, the differences that occur if the research was conducted again. For a positive study, reliability is often high, while in an interpretivist study the reliability has less importance or can be interpreted in different ways. Moreover, the authors state that in a qualitative study the focus on validity is put on the observations and interpretations and how well it is explained and understood.

Validity refers to the extent that the results of the study reflect the phenomena under study. There are different research errors, such as fault procedures or poor sampling that have an impact on the validity of the research (Collis and Hussey, 2014). Denscombe, (2017) describes three guidelines to measure the accuracy of the information.

- Respondent validation: The researcher can return to the respondents with the findings and check the validity. By doing so, the researcher will confirm the accuracy of the information and get a confirmation on how the respondent's information was interpreted.

- Ground data: One of the benefits of qualitative data is the findings of the study have been grounded on empirical data and existing research in the field. Hence, a solid foundation for the conclusion is provided (Denscombe, 2017).
- Triangulation: The researcher can use contrasting data sources which will increase the validity and identify that the correct data is used.

This report will try to reach and obtain a study that achieves high reliability and validity. Hence, an assessment of this will follow in the analysis chapter after the study is completed.

3.8 Research Ethics and Confidentiality

Research ethics could be referred to as the principle of a code of conduct, according to Collis and Hussey (2014), guidelines conducted by Bell and Bryman (2007) should be followed to obtain ethical researchers. Some of the guidelines mentioned in the book are harm to participants, privacy, confidentiality and anonymity. This research has been conducted with respect to the guidelines provided by Bell and Byramn (2007). In order to respect and follow the guidelines, the respondents and parties included in this research have been informed about the purpose of the research. All participants have got the question if the data collected from them could be used as a result in this report.

Another statement from Collis and Hussey (2014) is that the researchers should offer both anonymity and confidentiality to all participants within a research project. The authors explain that the research should assure that the participants will not be identified, if they wished to stay anonymous. When ensuring anonymity for the participants, it will encourage freedom for the participants of the interview to elaborate on the answers and share information. The authors of this report will provide information to all participants regarding ethics and anonymity. Moreover, the participants will have the option of remaining anonymous during this report.

4.0 Results

In this section of the report, the result of the conducted interviews with companies and stakeholders will be presented, an overview of the interviews can be found in Chapter 3 and Table 5. The result for this study will be presented in an order decided by the authors to provide a clear overview of the collected data. First, the result from the interviewed companies producing LEFVs or would have the expertise to produce such vehicles will be presented from the perspective of LEFVs manufacturers. Secondly, transport operators that have applied LEFVs as a mode of transport will be presented as perspectives from transport operators. Thirdly, identified companies that could benefit from applying LEFVs to their daily operations were interviewed due to certain characteristics and will be presented as perspectives from service users.

In order to present a holistic result, perspective 4 in the results is the manufacturer, transport operators and the service users view on UCC, micro-hubs and temporary hubs, combined to one heading.

4.1 Perspective from LEFVs Manufacturers

From the perspective of manufacturers for LEFVs, there are different driving forces and requirements in order to upscale the use of LEFVs. Different actors have different goals, aims and agendas. For this section of the report, one manufacturer of LEFVs referred to as Respondent 5 (2021) and their answers will be presented. Another manufacturer that produces electric and autonomous freight vehicles referred to as Respondent 3 (2021) were interviewed mainly because of their expertise within the area but also to understand why they have chosen to focus on more conventional sizes of electric freight vehicles.

There are many interesting aspects of why companies decide to produce LEFVs and have chosen to target that segment. The obtained result shows that the goals of manufacturers is to reduce resources and energy available when conducting the delivery operations. By reducing resources and energy it is stated that one goal is to help reach the target of 1.5 degrees lower on the planet (Respondent 5, 2021) in line with IPCC (IPCC, 2019). Another interesting aspect argued for why some companies decide to produce LEFVs is the desire to make cities a better place to spend time in and make them more liveable (Respondent 5, 2021). Meaning that some of the rationales behind producing LEFVs is to reduce congestion, noises and air pollution which often occurs when conventional vans operate for a shorter distance and have to make starts and stop frequently in order to make their deliveries. This can then be connected to the findings in the literature review (section 2.2). According to Respondent 5 (2021), they see potential obstacles to financially scale-up their operations and problems with the electric grid. This is something that also was brought up by Respondent 3 (2021), even though that company isn’t producing LEFVs, they are heavily involved in future transportation operations. One of the biggest obstacles to overcome is the capacity in the Swedish electric grid. The problem doesn't lie in how much electricity Sweden produces per year, because Sweden produces more electricity than what is consumed every year. Meaning

that the electric grid can't handle and carry the number of cargo loads and thus create bottlenecks in the system. If there would be a scale-up of using electric vehicles (not only LEFVs) the electric grid is in urgent need of expansion (Respondent 3, 2021). This fact is applicable in a scenario where all transportations would be transported on electric freight vehicles, not only LEFVs. However, it is important to bear in mind that this shift is about to be realized in a not too distant future and it would cause problems for the upscaling potential for LEFVs as well.

Looking at different types of goods and to what extent the segments of goods can be matched with LEFVs there are some limitations for LEFVs. According to Respondent 5 (2021) and where they see the biggest potential for matching goods with LEFVs (Respondent 5 produces electric cargo bikes) is the segment of B2C within urban areas. The target area has been set for the growing area within e-commerce which has a huge potential for LEFVs and especially when it comes to home deliveries. The growing potential for LEFVs in connection with home deliveries combined with e-commerce orders is because they usually fit the requirements of weight and size. Another dimension to this is the belief shown by the industry. Respondent 5 (2021) emphasized that LEFVs and the product they produce could handle all transports that today goes by conventional vans today, as long as it is within the requirements for size and weight, which are proof of the belief the industry has on these vehicles.

In order to upscale the use of LEFVs within cities and urban areas, there are a few factors according to Respondent 5 (2021) that need to be considered by decision-makers. Factors and support from decision-makers such as facilitating access to bike lanes in cities, better and more infrastructure projects that focus on green transport solutions like enhancing streets e.g. LEFVs. It will not be enough to facilitate the infrastructure in cities, there has to be more and harder policies and regulations towards conventional vans and motor vehicles, lastly financial back-up from decision-makers are required in terms of creating hubs (Respondent 5, 2021). Another aspect obtained from the interviews connected to LEFVs and more especially to electric cargo bikes is how to make them financially viable to implement on a bigger scale. It is evident that the area where they operate needs to be densely populated and that there need to be enough customers' orders per square meter (Respondent 3, 2021).

4.2 Perspective from Transport Operators

As shown in Table 1 section 2.3 there are different sizes of LEFVs available. The sizes and the type of LEFVs is an important factor in order to determine suitable goods and customers in relation to the vehicle. Respondent 2 (2021) and Respondent 4 (2021) both operate using LEFVs in the city of Gothenburg today. Both respondents argue that LEFVs have different advantages compared to regular vans which are attractive for last mile logistics within urban areas. One of the advantages mentioned is the possibility to access small areas in the city where vans are too large. Moreover, the cargo bikes used in Gothenburg today can operate on the regular bicycle path but also pedestrian paths if needed (Respondent 2, 2021). Using cargo bikes in urban areas increases the possibility of flexible transport where the operator can deliver closer to the customer without spending time on finding a parking spot

(Respondent 2, 2021; Respondent 4, 2021). The operators using LEVFs for the deliveries are available to deliver the package directly to the customer's door which leads to shorter time spent walking to the customer. The time to deliver the cargo to the end customer can be from 15 seconds up to 10 minutes depending on the location of the customer (Respondent 2, 2021; Respondent 4). If it is a home-delivered to a private person on the 6th floor, it might take up to 10 minutes to deliver the parcel. However, if the delivery is to a business where the cargo bike can stop directly in front of the door, the package can be dropped within 15 seconds and the operator can continue on the route to the next customer (Respondent 2, 2021). This is not the case while delivering with regular transport vans where the driver needs to spend more time on finding a suitable place to park the van since the van cannot access small areas in the city (Respondent 4, 2021). Another important aspect mentioned by the respondents is the possibility to avoid congestion during peak hours in cities. Respondent 4 (2021) gives the example of delivering a parcel from Gothenburg city to Möndalsvägen where theoretically it would have been faster to deliver with a regular van for this distance. However, since the vans are often stuck in congestion during peak hours, using a cargo bike was in this case faster than a regular van. Hence, using LEFVs for deliveries can be efficient both in terms of the pickups/drop off of the cargo but also during the delivery distance where vans often get stuck in traffic.

The respondents also emphasized the advantages of using LEFVs as shown in Table 6. One of the discussed advantages according to the respondents is the fact that with LEFVs the cargo cyclist has more options for closer accessibility in terms of space. Respondent 4 (2021) discusses that the dimensions of LEFVs make it possible to enter small areas while Respondent 2 (2021) further emphasizes the possibility to access the bicycle and pedestrian path. Since LEFVs can access smaller areas within the city, there is no need for parking the vehicle, which is according to both respondents a big advantage. The respondents also mention that this leads to faster and more efficient deliveries. There are also economic advantages connected to the previously mentioned advantages. The driver can come closer to the endpoint and higher efficiency can be achieved especially when there is construction going on in the city and it is challenging to find parking spots for the regular vans. Moreover, the most discussed advantages with LEFVs according to the respondents are the environmental benefits. LEFVs are energy efficient and air emission is reduced with this type of vehicle (Respondent 2, 2021; Respondent 4, 2021). The emission from deliveries in urban areas is a highly prioritized topic that emphasizes that the plan in the future is to have environmental efficient deliveries especially for last mile deliveries (Respondent 2, 2021). Moreover, the vehicles are small and produce less noise which is beneficial for the residents in urban areas but also the public authorities (Respondent 2, 2021; Respondent 4, 2021). Using LEFVs in urban areas are accepted and appreciated by urban residents (Respondent 2, 2021; Respondent 4, 2021). Both respondents mentioned that during the delivery routes, residents often showed interest in the vehicle and gave positive feedback regarding the use of LEFVs. Respondent 2 (2021) however mentions that some residents have a negative approach regarding the use of LEFVs since sharing the infrastructure with bicycles and pedestrians can be challenging. Respondent 4 (2021) also mentions that the interaction with people in the city is different when delivering using LEVFs compared to regular vans since

the driver is closer to the people passing by and to customers. Hence, with the use of LEFVs, the driver has the possibility to communicate with urban residents during the stops (Respondent 4, 2021).

The results also showed disadvantages with the use of LEFVs as summarized in Table 6. Both respondents mention capacity in terms of weight and dimensions. Both respondents have the capacity to load up to 200 kg on the cargo bikes. There is a possibility to load heavy cargo and the capacity of a pallet if another container is connected (Respondent 4, 2021). However, it can be challenging for the cyclist to have a full load and cycle with the cargo, especially when weather conditions are challenging (Respondent 4, 2021). Another disadvantage mentioned was the fact that the cargo bikes could break down which means that there is a need for a specialist to fix the vehicle (Respondent 2, 2021). The respondent also mentioned that some of the breakdowns can be fixed at the point of the breakdown while other times there is a need to transport back the vehicle to the hub. This can lead to problems such as inefficiency and dissatisfied customers which put high pressure on the driver (Respondent 2, 2021). Moreover, Respondent 2 (2021) mentions that one has to accept that the use of LEFVs is less reliable than regular transport vans since the chance that the vehicle breaks down is higher.

Table 6. *Advantages and disadvantages with LEFVs from the respondents perspective.*

Advantages	Disadvantages
Access to bicycle and pedestrian paths.	Capacity limitations in terms of weight and dimensions.
Environmental benefits.	Challenging to deliver full capacity if the weather conditions are bad.
Possibility to access small areas in the city and deliver to the door.	Requires a hub or a UCC in the city centre.
Positive feedback from urban residents.	An increased collaboration between stakeholders is required.
Spending no time on finding parking spots.	When breakdowns occur there is a need for specialists to fix the cargo bikes which is time consuming.
Fast deliveries and higher efficiency leading to economic benefits.	Less reliable in terms of breakdowns.

According to Respondent 2 (2021) and Respondent 4 (2021), there is a wide range of cargo delivered with LEVFs during the operation. Respondent 2 (2021) mentions that there is a mixture between packages and mail during the respondents delivery route. The respondent mentions that it is common to deliver mail and contracts to law firms and other types of companies. However, there are also many packages delivered within urban areas to residents, shops and cafes. Respondent 2 (2021) mentions that in the case of the type of cargo delivered

during the delivery route 50% of the cargo is mail such as contracts and 50% are packages such as orders to a resident. On the other hand, Respondent 4 (2021) argues that LEFVs are suitable for a wide range of cargo types. Respondent 4 (2021) mentions that the company often delivers lunches to school and offices. The physical appearance of the lunch boxes makes it possible to efficiently use the space in the vehicle since it is possible to stack the boxes on top of each other (Respondent 4, 2021). Moreover, Respondent 4 (2021) argues that using LEFVs for deliveries is possible for most types of cargo where the weight is possible to handle and the dimensions are within the limit. The respondent also mentions that there is an increased interest in the use of LEFVs which has led to more companies choosing to deliver using LEFVs.

Another aspect mentioned by Respondent 2 (2021) is the use of ITS and ICT applications. It is argued that systems like this surely will enhance operations and make deliveries easier to plan and execute, but also to ensure more accurate deliveries. It is also mentioned that the "not at home problem" could be dealt with in a better way using applications like this, thus being able to achieve better and smooth delivery routes. However, as mentioned by Respondent 2 (2021), from a driver's point of view, having a set timeframe can impact the performance negatively since if drivers had to adapt to time frames and time windows instead of going the logical route, it could lead to being less efficient, compared to today's operations. It is also argued that combining this with route planning and time planning most probably would lead to being more efficient, then just looking at applications where customers can choose a time frame and the freight company adjusts to the time (Respondent 2, 2021).

There are however limits with LEFVs as mentioned before. Pre-cooked food or lunch boxes are cargo that can efficiently be delivered with LEFVs both from the weight aspect but also physical appearance (Respondent 4, 2021). However, there is a limitation of transporting temperature controlled food products since the vehicles do not have the option of controlling the temperature with the current battery capacity (Respondent 4, 2021). There are limitations regarding the cargo weight and volume (Respondent 2, 2021; Respondent 4, 2021).

4.3 Perspective from Service Users

As stated in the previous section LEVFs can be used for a wide range of products and retailers. One producer and retailer that has an interest in an upscaled use of LEFVs is Kronans Pharmacy. Respondent 6 (2021) discusses the interest of the company in using LEFVs for deliveries within urban areas. Kronans Pharmacy offers both physical stores and e-retailing where customers can either order online and then collect in the store (click and collect) or order to another suitable location for the customer such as pickup points and home deliveries. Respondent 6 (2021) mentions that the order from the online retailer increased significantly during the last years, especially after the outbreak of the coronavirus. Compared to the e-commerce market which increased by 10% last year, the increase for Kronans pharmacy e-commerce was 180% where the outbreak of coronavirus was one of the reasons (Respondent 6, 2021). The pharmacy products are needed by the customers even during a pandemic which led to an increase in home deliveries for Kronans e-retailing (Respondent 6,

2021). Moreover, Kronans Pharmacy offers both prescription medicines and merchandise which increase the logistics challenges for the pharmacy. One of the current challenges with delivering pharmaceutical products where the prescription is needed is patient safety and how to ensure that the right person receives and picks up the prescription medicines (Respondent 6, 2021). It emphasises that while dealing with the traditional pharmacy operations meaning handling prescription and non-prescription medicines, there is a high focus on quality assurance and patient confidentiality. On the other hand, the merchandise market is a fast developing market that increases the challenges of combining and handling both types of goods in relation to each other (Respondent 6, 2021).

In relation to LEFVs, the respondent argues that there are both advantages and disadvantages of using the vehicles for delivering pharmaceutical products. The respondent also mentions the importance of sustainability for the whole chain within the company and that there is a driving force for having more options regarding sustainable solutions for the end customer (Respondent 6, 2021). Meaning that, if the customer orders a product from Kronans Pharmacy online, there will be an option of choosing more sustainable transport modes for instance LEVFs. By giving the customer several options the demands towards the transport operations will increase regarding sustainable solutions. Today with the demand for fast deliveries increasing the use of LEFVs will enable the delivery of the needed product to the customer faster than a regular van without compromising the environmental aspects (Respondent 6, 2021). As mentioned by both Respondent 2 (2021) and Respondent 4 (2021) there are limitations with using LEFVs for deliveries in terms of volume, weight and physical appearance. Hence, Respondent 6 (2021) discusses the possibility of using LEFVs for Kronans products in terms of volume, weight and physical appearance is accurate. There are however also disadvantages of using LEFVs from the perspective of a pharmacy. As mentioned before, one of the challenges with Kronans pharmacy is that there is a need to handle prescription and non-prescription medicine as well as merchandise (Respondent 6, 2021). According to Respondent 6 (2021), when customers order products from the pharmacy and the order includes both medicines and merchandises, the transport and delivery options are determined by the medicines. As stated and mentioned by the previous respondents one of the limitations with using LEFVs as a transport mode is the ability to handle temperature controlled products. Respondent 6 (2021) discusses the option for delivering medicine is based on the possibility to keep the needed temperature during the whole transportation.

Respondent 1 (2021) mentions that companies usually deliver small lightweight packages which can fit in the locker boxes and could be suitable to deliver with LEFVs. However, the company uses regular delivery vans for transportation and the results received from the respondent is that LEFVs do not have the required equipment. Moreover, since the company usually delivers a large number of packages the physical sizes of LEFVs leads to smaller deliveries which are inefficient in terms of costs and environmental aspects (Respondent 1, 2021).

4.4 Interrelationship between LEFVs and Hubs

In terms of logistics layout, all respondents emphasized the importance of UCC, micro-hubs and temporary hubs as an important element to facilitate and upscale the use of LEFVs. All participants and interviewees discussed and talked about the importance of finding space within cities and urban areas when it comes to UCC, micro-hubs and temporary hubs if there would be a potential to upscale in using LEFVs. UCC, micro-hubs and even temporary hubs could be acquired and take shape in different ways and the result of the interviewees view on this is presented in this section.

4.4.1 UCC and Micro-hubs from all Actors

According to Respondent 5 (2021) UCC, micro-hubs and also temporary hubs plays a vital part if companies, society and authorities wish to facilitate the implementation of LEFVs. Respondent 5 (2021) sees centrally located goods transhipments hubs as a necessity to conduct transport operations in urban areas where distance is shorter and the density of customers and orders are high with LEFVs. Another aspect raised within the subject of hubs in urban areas is the need to collaborate with different actors such as city governments, municipalities and authorities to financially aid and support the development of hubs in urban areas. Respondent 3 (2021), believes that LEFVs could be more effective than conventional transport solutions in cities. If LEFVs take over the transport work at the breakpoint between longer haulage and cities this could be achieved and both LEFVs and more conventional vans could operate efficiently (Respondent 3, 2021). To reach this, transhipment points and hubs in urban areas are required and the importance of that is stressed.

Other actors within the transport industry have a similar argument for why urban hubs are necessary but from another perspective. Respondent 2 (2021) and Respondent 4 (2021) operate from a hub within the city centre or pick up the delivery from one place in the urban area to another place within the possible range using LEFVs. According to respondent 2, the location of the hubs or the place to pick up the goods from is an important aspect in order to enable the use of LEFVs. Currently, there is a need for hubs in the city centre that the operators can use as a starting point. Moreover, Respondent 4 (2021) argues that even if there is a need for a hub in the city centre the size of the hub for LEVFs does not have to be as large as a regular hub for vans or trucks. The respondent argues that the hubs can be placed in the basement of existing facilities. Another issue regarding UCC, micro-hubs and temporary hubs is according to respondent 4 (2021) the collaboration among the different stakeholders. Having a hub requires collaboration between both cargo holders and service operators, the respondents mention that it is challenging to determine how the cargo will be consolidated in terms of ownership and physical flow. Respondent 4 (2021) discusses that in order to have an efficient hub in the city centre where LEFVs can operate from there is a need for increased collaboration among the different stakeholders. One of the stressed collaborations is a collaboration among different cargo holders in order to be able to consolidate different cargos from different companies in one shipment (Respondent 4, 2021). However, the respondent also operates from restaurants to schools and offices meaning that the hub in this case already exists in the city leading to more efficient use of LEVFs (Respondent 4, 2021).

Respondent 1 (2021) argues that temporary hubs in terms of locker facilities will be challenging in terms of infrastructure Respondent 3 (2021) also stresses the challenges that will be put on the electric grid with the increased use of LEFVs which is also applicable for temporary movable hubs. Another aspect regarding temporary hubs that was stressed by respondent 2 is the IT challenges that will arise if a locker facilities company developed temporary movable hubs. Respondent 6 (2021) focused on the physical hubs located in the city centre where LEFVs operators can pick up the cargo and deliver it to the end customer. The respondent explained that a pattern often seen from orders in urban areas is the urgent need for fast deliveries. The customers often expect deliveries within 30 minutes up to a maximum of 2 hours. For that reason, Respondent 6 (2021) explains the introduction of click-and-collect in the physical stores all around Sweden. By introducing this concept, customers are able to pick up the orders within 2 hours (Respondent 6, 2021). Kronans Pharmacy has stores located at strategic places around Sweden and especially within urban areas. With the high demand for fast transports and increased need for home deliveries, the respondent argues that there is a possibility to use the physical stores as hubs in urban areas. By doing so, LEFVs operators have the option of picking up the cargo and delivering the cargo to the end customer (Respondent 6, 2021). The advantages of using the strategically located stores for deliveries with LEVFs according to Respondent 6 (2021) is the possibility for fast deliveries and the increased service levels towards the customers. There are however challenges with using the stores as physical hubs. The respondent argues that there is a need for increased control of inventory and planning in the stores if the stores are used as hubs. Moreover, from a pharmacy perspective there are also challenges regarding temperature control goods and patient safety in terms of prescription medicines and non-prescription medicine in combination with the merchandise. However, there are currently patterns for ordering more merchandise online rather than prescription medicines and non-prescription medicine (Respondent 6, 2021). Table 7 shows the summaries of the possibility for hubs in urban areas and challenges that can arise while considering setting up a hub within urban areas.

Table 7. *Enables and challenges with hubs according to Respondent 1 (2021); Respondent 3 (2021); Respondent 6 (2021).*

Enablers	Challenges
Fast deliveries with environmentally efficient solutions such as LEVFs.	An increased collaboration among the stakeholders is needed in order for the hubs to operate efficiently.
LEVFs are much smaller than regular transport vans meaning that the hubs can be located in a smaller area in existing facilities within the city.	An increased interest from the public authorities regarding setting up the hubs and financial support.
Strategically located physical stores can be used as hubs.	Challenges regarding inventory arise if the physical stores are used as hubs.
Lack of infrastructure when it comes to temporary hubs.	Challenges regarding responsibility for the hub.

5.0 Analysis and Discussion

At this section of the report an analysis and a discussion of the obtained data and the result will be presented. There will also be an analysis and discussion of the chosen method in a subsection. The analysis will first of all take its standpoint from previous research, literature and the theory and then compare that to the main findings from this study to see if they correspond to each other. The discussion and analysis will also be held from the perspective of the RQs. Then the analysis of the method is conducted and pros and cons are analysed and discussed. Lastly, the validity and reliability of the report is assessed and evaluated.

5.1 Empirical Findings

After conducting the interviews and compiling the result in chapter 4 of this study, findings from the study and findings corresponding to the literature review and previous research can be seen in Table 8 for an easy overview.

Table 8. *Overview of main findings from the study compared to the literature.*

Findings from literature	Corresponding to the study	Verified findings in the study
UCC, micro-hubs and temporary hubs usually used by eco-friendly vehicles in cities.	Yes corresponds to the study.	The importance of small transhipment hubs in city centres for LEFVs was stressed by all interviewees.
Collaboration between stakeholders not always aligned → thus very important to improve.	Yes corresponds to the study.	Collaboration between e.g. freight companies and city authorities to find solutions on city logistics problems → favourably for LEFVs.
Policies and incentives such as congestion charges and low emission zones play a part of all future electric vehicles.	Yes corresponds to the study.	If there will be an upscale in using LEFVs, decision-makers need to put harder restrictions on conventional vehicles.
Smaller packages and parcels such as e-commerce orders, food deliveries and letters have great potential for using LEFVs.	Corresponds to the study to some extent.	Result shows that actors within LEFVs don't see any specific segments of goods as a better fit, as long as the restrictions/limitations are met.
ICT and ITS solutions play an important role to enhance delivery operations, especially within cities but it is not unique for LEFVs and the upscaling potential.	Corresponds to the study to some extent.	It is argued that applications and solutions through ICT and ITS are good for delivery operations but should be used in combination and not only by time frames/windows.
N/A	Not mentioned in the literature for Sweden.	It is argued that the infrastructure in Sweden for electric vehicles are not in place and/or ready for a total shift, which could affect the upscaling potential for LEFVs.

It is evident that even though the interview objects were selected through a snowball effect and recommendations from our supervisors, the result and empirical findings from this study is consistent throughout the work and corresponds most of the time with the literature. However, new aspects and factors not dealt with in the literature review for this study is also displayed in Table 8. Examples of this are the infrastructure in Sweden regarding charging electric vehicles, which is not in place if there would be a total shift to electric vehicles. As a result it could hamper the development and implementation of LEFVs in general, this will be discussed and analysed in section 5.2. Problems with electric infrastructure have not been dealt with in the literature review. Overall, findings from the study correspond to the literature but also that the interviewees have discussed and raised the same aspects, problems and issues. Showing that there is consensus among industry actors and issues, problems and solutions is agreed across the industry. However, this subject is relatively young and there are a lot of new and different actors and stakeholders entering this market. Hence, this study might not be representative of the entire industry due to new actors and stakeholders constantly entering and innovating new solutions. But it could explain the current situation and trend and hopefully, it could be used to understand the need of using LEFVs and how to upscale the use of them.

Looking at the findings from Table 8 and connecting them to the RQs it is quite clear that the authors of this study agree upon that they have obtained good and solid answers from different actors within the industry. Such as, investigate driving forces behind the implementation and the potential to upscale the use of LEFVs for sustainable last mile deliveries within urban areas. It is evident that the environmental factor is working as the driving force behind companies and service providers' decisions to ramp up operations with LEFVs. An interesting aspect regarding segments of goods in relation to LEFVs is that the interviewees do not see any segment of goods as better suited, instead the companies see the restrictions and limitations of the vehicles as the limiting factor. However, bulky goods are never ideal for a transport operator but it is an interesting point from the interviewees. Finally, the impact LEFVs will have on the last mile logistics is very interesting, because as mentioned in RQ2, another dimension in terms of distribution such as UCC is required in order to reload cargo to LEFVs. The question of handling this new dimension has been dealt with in the interviews and are analysed and discussed in section 5.3 and 5.3.1 for further assessment.

5.2 Segments of Goods & Constraints on the Current Infrastructure

One focus and aim with this study was to investigate the relationship between different segments of goods and matching them with different LEFVs. In relation to this study, one thought was that this could be matched with different types of customers. Meaning that the right customer would be suited for the use of LEFVs and their packages and parcels were within the limitations and restrictions of the vehicles. From previous research and the literature review, it was evident that some criteria and enablers had been identified for the upscaling use of LEFVs. Criteria such as, time-sensitive shipments, small and light parcels,

prospect for innovations and growth and finally the network design had to be of high density regarding starts and stops (Ploos van Amstel et al., 2018). According to Ploos van Amstel et al., (2018) this would be favourably for LEFVs, the interesting aspect from this study and the actors that have been interviewed are not that specific on what kind of goods that should be right for the upscaling use of LEFVs. Literature and previous research points at segments of goods such as post, parcels and the food sector, due to the nature of the goods and the restrictions and limitations of LEFVs.

The interview objects did not stress goods limitations for LEFVs compared to conventional vans. Instead the interview objects discussed problems and rationale of the vehicles themselves and not cargo. They view the restrictions and limitations as the factor for what they can perform and argue that the vehicles could carry anything that a conventional vehicle could. That might be true but goods that weigh less should be a better fit compared to goods that are very heavy and bulky, because the range of the vehicles will be affected. On the one hand it could be argued that small deliveries such as postal services, letters and contracts are ideal packages from a point of view of the LEFVs. On the other hand, it could be argued that if society wants to upscale the use of LEFVs on a bigger scale, more and better areas of use need to be found and applied to LEFVs. Hence, it will not be enough if one of the underlying driving forces for implementing LEFVs is the environmental aspects, to target a market with letters and contracts. Even though the result pointed out that some of the deliveries within Gothenburg were made to law firms with contracts and agreements. It could be argued that letters, agreements and contracts are a dying market, especially with technology such as blockchain that could handle services like that, without sending a physical letter or even with personal contact.

The authors thought about different actors that could benefit from using LEFVs in their daily operations, in a market that was growing and at the same time fit the spec of the vehicles. One area that stood out was first and foremost the e-commerce, which already is a target market for LEFVs actors, mentioned in the result. However, one area that has grown by 180% the last year, according to the result, is home deliveries of medicines and drugs through e-pharmacies. This growth was for one retail chain involved within pharmacies in Sweden and during the year Covid-19 had its outbreak, which should be acknowledged. Still, this indicates that medicines and merchandise goods (shampoo, make-up etc) have the potential to be transported using LEFVs. This doesn't come trouble free though. First of all, as mentioned by Ploos van Amstel et al., (2018) in the literature, one criterion for deploying LEFVs is the network design. It will not work if there aren't enough stops located close to each other with enough orders within a certain geographical area. This is not the case in Sweden, many cities are not viewed as urban areas and one could argue that it would not be cost efficient for LEFVs operating longer distances with a low order intensity. With that said, in bigger cities e.g. Stockholm. Gothenburg and Malmo, it could make sense to deploy LEFVs and matching goods like pharmaceutical products for home deliveries. These parcels usually have an ideal size and weight, meeting the restrictions and limitations of the vehicles. The problem with home deliveries of pharmaceutical products is that most of them require temperature control which could lead to problems. For instance, if LEFVs were deployed with a system that could

keep the goods cooled how would that affect the battery, hence the range of the vehicles? If the range were tampered with, would LEFVs be as effective as they are and would it be profitable to use them for companies seeking to improve their profit. This study hasn't looked into this particular issue but it could be interesting to continue to research this type of area. Another issue faced with home deliveries of medicine is the fact that many medicines are on prescription and need temperature controlled deliveries.

Constraints on the Current Infrastructure

Even if the right match between LEFVs and segments of goods could be found and identified as a good match, there are other issues with the overall infrastructure that need to be taken into account. In the literature review subjects such as last mile logistics problems and challenges with the city logistics were reviewed. It did not raise issues with the current infrastructure in Sweden, however, issues related to that did come up during the data collection. To complete deliveries in urban and densely populated areas, consumers put a lot of pressure onto delivery companies in terms of price, how fast the delivery arrives and also sustainability factors. It is evident from the literature review that these deliveries contribute to congestion, emissions and accidents (Dablanc, 2018; Dablanc, 2013; Anderson, Allen and Browne, 2005). These issues could be addressed by implementing and upscaling the use of LEFVs. However, aspects that were not raised and mentioned during the literature review are the constraints on the current infrastructure and especially the problem with the electric power grid around Sweden.

If there would be a change in how vehicles operate e.g. electric vehicles were standards in a near future, would the infrastructure have the ability to cope with that? This was an aspect raised in the result, if this would be the case it would lead to problems because the infrastructure for charging the vehicles is not in place. Not only would it be a problem with the charging infrastructure but also with the infrastructure for the power grid overall. Due to the fact it would not be able to manage that amount that would need to go through the power grid, hence the capacity in the power grid is too weak at the moment. Leading to thoughts such as, would that have an impact on the upscaling use of LEFVs. Even though society is not at a stage where all vehicles are run by electricity, it seems not to be in a too distant future. If that would be the case in a few years, will LEFVs and transportations solutions be prioritized compared to cars and if not, a balance between these different modes of transport would be needed. There is a lot of talk about sustainable transportation solutions and LEFVs is one of them but the overall perception is that cars will be prioritized over delivery vehicles if that would be the case in the future.

5.3 Adding an Extra Step in Last Mile logistics

To facilitate the upscaled use of LEFVs there is a discussion regarding the need for a change in the logistics layout, both in the literature and the interviews. Currently, the logistics layout is shaped based on regular vans and larger vans which have a loading capacity between 400-1900 kg (Commission for Integrated Transport, 2010). Compared to LEFVs where the load capacity is between 50-700 kg (Moolenburgh et al., 2020). Based on the numbers, challenges

arise with the current logistics layout when trying to add LEFVs into the system. The most common type of deliveries occurring in the cities today is conducted as shown in Figure 6. Firstly, the cargo is transported from different suppliers or manufacturers into a consolidation centre which is often located outside the city (Arvidsson and Pazirandeh, 2017). Secondly, the cargo is loaded on vans in the most efficient way possible in order to deliver into the city. Most commonly the vans are half empty in order to fulfil the customers demand for fast deliveries (Gevaers, Van de Voorde and Vanelslander, 2009).

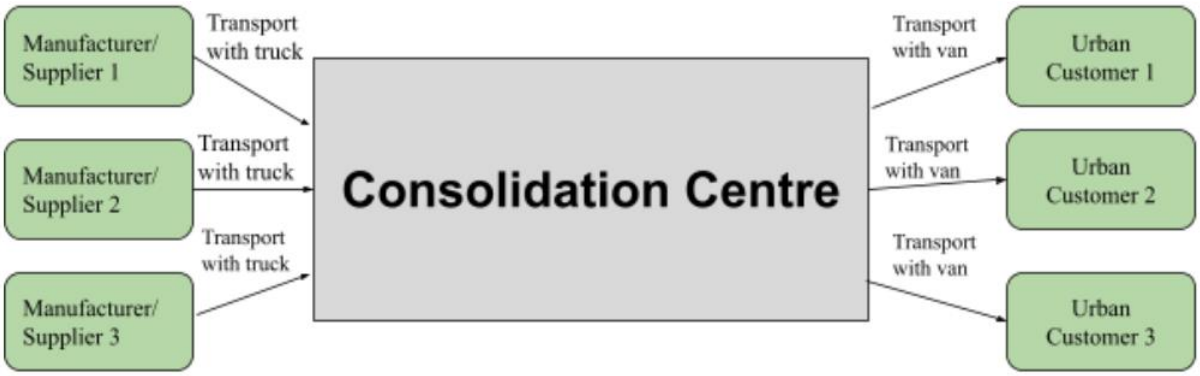

Figure 6. *Traditional logistics layout into urban areas.*

As mentioned by Allen et al., (2012), having a UCC will improve the overall supply chain performance but also increase the possibility of environmental effective transport solutions. Figure 7 shows the possible way that the logistics layout can improve in order to upscale the use of LEFVs.

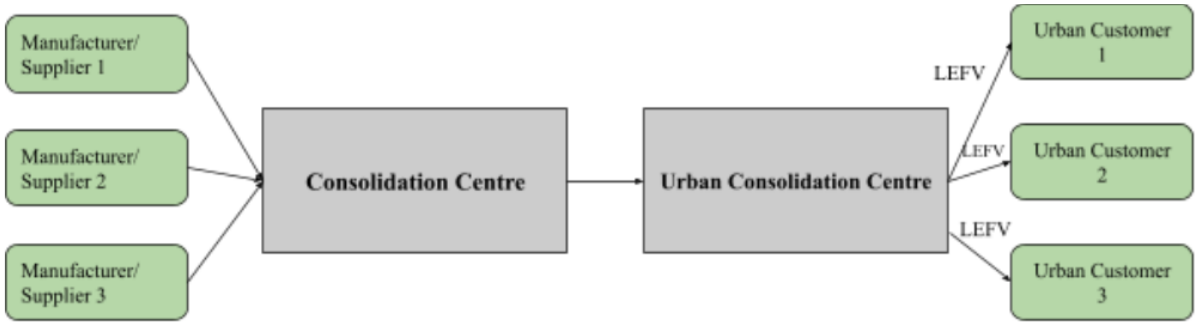

Figure 7. *Example of new logistics layout where LEVFs is a part of the system.*

However, even with the advantages that a UCC adds to the system, there are still disadvantages that need to be taken into consideration as shown in Table 4. One of the most important factors to consider in order to determine the possibility to increase the use of LEFVs and implementation of a new UCC is the costs. During the interviews, the need for a UCC in order to upscale the use of LEFVs was stressed. Respondent 5 (2021) mentioned that the problem with current consolidation centres located outside the city is not only that LEFVs do not have the battery capacity to drive that distance but also the problem of cost efficiency. Using smaller vehicles for transport from the consolidation centre to the end customer will mean increased costs since the loading factor is lower with LEFVs as shown in Table 1. Hence, more vehicles need to be used in order to deliver the same quantity as with a regular van leading to higher costs. However, in order to have cost efficient deliveries with LEFVs

UCC is needed meaning that there will be a need for investments for the facilities. There is a trade-off between cost and environmentally effective solutions when it comes to deliveries within urban areas. The last mile leg is the most inefficient, polluting and costly stretch during the whole supply chain (Gevaers, Van de Voorde and Vanelslander, 2011; Slabinac, 2015). Moreover, the setup cost for a new UCC is high. This means that by upscaling the use of LEFVs, there is a need for an extra step in the last mile logistics as shown in Figure 7. Since the last mile leg is already expensive and complex, arguments regarding the possibility to add an extra step arises from a cost perspective. Today companies and customers have to make a trade-off between costs and environmental effectiveness. Even when the topic regarding environmental effective solutions is an important topic today in all businesses, especially the logistics and transport sector. The costs are often too high and the customers might not be willing to pay extra for more sustainable transport solutions. From a customer's perspective, adding an extra step for the last mile deliveries is not always convenient since it will lead to higher cost for the same end goal, delivering the order to the end customer. However, from a business perspective or a company perspective one can argue that the trade-off between costs and environmentally effective solutions have a different impact. Companies today want to promote the business as green and sustainable. Hence, an argument will be that companies will choose to have green transport solutions even if the costs can be higher when adding an extra step in the last mile logistic chain. Since it can be used to promote the company as sustainable and green.

One of the problems in urban areas is the lack of space (Crainic, Ricciardi and Storchi, 2009). This makes it even more challenging to have and deploy UCC. The space in urban areas today is expensive and in order to make the city a liveable and enjoyable space using the space for UCC might not be prioritized. Respondent 4 (2021) argues on the other hand that having a hub or a UCC for LEFVs will not require as much space as a hub for regular transport vans. Hence, the respondent mentioned that the hub can be underground in already existing facilities in urban areas. Different pilot projects have been tested in different European cities in order to understand the possibility and the need of UCC. In Gothenburg "Stadsleveransen" is a pilot project that began in 2012 (Katsela and Browne, 2019). As mentioned in section 2.4, the initiative included two transport providers, one Scandinavia and one international. The initiative had a UCC located close to the city centre where cargo from the two transport providers arrived in smaller vehicles and grouped in delivery rounds that were performed by four electric vehicles. The UCC was located 1 km from the city centre. The second initiative was also mentioned 2.4 which was conducted in Malmö called "SamCity" which also focused on consolidating goods flow in a UCC in the city (Katsela and Browne, 2019). This initiative shows that stakeholders are willing to work towards finding solutions to have a greener city and the option to choose more environmentally effective transport solutions. Moreover, without hubs in the city centre, upscaling the use of LEFVs will be challenging. This was also stressed by the respondents during the interviews, the UCC is an important part in order to increase the use of environmental effective solutions. Even with the cost-tradeoff and lack of space in cities, the initiative shows that public authorities and other stakeholders within the city are willing to overcome the disadvantages with UCC in order to promote environmental effective transport modes.

Having a UCC will also lead to challenges regarding collaborations, responsibility and the number of goods that needs to be handled in the hub (Browne et al., 2005). Challenges regarding which actor should be responsible for the UCC arises and how the collaboration should be conducted. Connecting back to RQ1, the results from the interviews showed that a wide range of cargo can be transported with LEFVs if it is within the dimensions required from the LEFVs. This means that e-commerce packages such as clothes and cosmetics are suitable but also mail and pre-cooked food. Hence, having an UCC that can handle a wide variety of goods is challenging in terms of logistics investments but also storage and cargo handling. Moreover, several different transport providers are using LEFVs in urban areas today. Considering the limited space in urban areas, having one UCC requires collaboration among the different transport providers but also cargo owners. One can argue that it will be challenging to consolidate cargo in one UCC to different competitors within the transport sector. On the other hand, the transport providers cannot have one UCC for the company due to the lack of space and large investment costs for UCC. It is therefore stressed that increased collaboration among the actors in the transport sector is needed in order to efficiently use UCC (Respondent 4, 2021).

The investment costs for a UCC is high and the space in cities is limited. This has therefore led to discussions regarding using temporary hubs or micro hubs. As shown in the study by Arvidsson and Pazirandeh (2017) one possible way of avoiding high investment costs for UCC is to implement movable temporary hubs. The authors mention that temporary hubs can be in the form of container or deport hub. As mentioned in section 2.6.2 the main aim of the temporary hubs is to be used as storage, transhipment and distribution logistics infrastructure. The hubs are also located close to the customer which makes it possible to use LEFVs as a mode of transport. One idea could then be to use temporary hubs instead of UCC, due to the high investment cost for an UCC. However, problems with temporary hubs could occur such as time contracts, how long could temporary hubs be in one place before it has to move. What if infrastructure is built up in cities and relied on temporary hubs and then they are removed due to short term contracts. That would cause problems for freight companies and other stakeholders using temporary hubs. Using a temporary hub will reduce storage costs but also the overall handling time (Arvidsson and Pazirandeh, 2017).

5.3.1 Physical Stores as Hubs

The UCC or hubs in the urban area is an important factor in order to facilitate the upscaled use of LEFVs. However, as mentioned in section 5.3 there are several aspects that need to be taken into consideration in order to make it possible to implement UCC in city centres. From the results provided the respondents stressed the possibility to use physical stores as hubs for deliveries in urban areas. As mentioned in section 4.0 one of the appropriate types of cargo to be delivered with LEFVs is pharmaceutical products that are not medicine. The most common type of orders online is merchandise rather than medicine. Hence, it would be a possibility for the pharmacy to use LEFVs for deliveries in the city when medicines are not ordered. Another important aspect to consider regarding the pharmacy is that the physical stores are located strategically in the city meaning that it would be possible to use the physical stores as hubs. Hence, deliveries to customers with LEFVs could be completed

within hours from the order has been placed. Using physical stores as hubs will not require new investments for facilities, no extra space in the urban area and the company can control the products ordered and delivered. However, problems arise regarding the need of the store. Firstly, one can argue that the quantities ordered from a specific area in the city can lead to high pressure for order handling in the store. This will require store workers to package and prepare the orders for deliveries. Hence, it can be challenging to keep the same customer services in the store for the store visitors. However, the pharmacy today has a pick-and collect service meaning that the customers can order online and pick in the store within 2-3 hours. Therefore, some stores are not new to the concept of handling online orders which can make it efficient to use the physical stores as hubs. Secondly, the stores are often not large in the city centre which will also lead to challenges regarding handling the orders in the store. Since the current service is to pick-and collect in the store, customers might not feel the need to order online and then pick in the store since the customer is physically going to the store. However, by offering home delivery within 2-3 hours the orders can increase the high number of cargo that needs to be handled. Thirdly, even if the merchandise orders are currently higher than the prescription medication and non-prescription medicine providing medicine is the main aim of the pharmacy. Hence, as the results showed the type of vehicles used for deliveries are determined by the medicine meaning that even if an order includes merchandise and the dimensions of the cargo are suitable to deliver with LEFVs it can be challenging to use LEFVs. Due to the requirements for temperature controlled medicine which currently is a challenge for LEFVs and this is an area that can improve.

5.4 Required Collaboration between Stakeholders

Increased collaboration between stakeholders was stressed both in the literature but also during the interviews. Katsela and Browne (2019) mentioned that different stakeholders have different goals and aims when it comes to city logistics. This was also stressed by Respondent 4 (2021). In both cases, this means that having an increased collaboration can be hard since the end goals are different from one stakeholder to another. As shown in figure 3 the different stakeholders have different relationships with each other and expect different services. The public authority is the one stakeholder that has a higher impact on all the other stakeholders. As mentioned by Katsela and Browne (2019) the goal for public authorities is to have an attractive city for residents where the external impact from the transport sector can be reduced or internalized. Hence, the public authorities have the power to influence the increased use of LEFVs. One of the actions that can be taken is environmental policies and restriction. Respondent 5 (2021) mentions that the public authorities can help with upscaling the use of LEFVs by having stricter policies for vans within the city. Having stricter environmental restrictions will make it challenging for vans to deliver within the urban areas meaning that transport providers and transport receivers will have to find different transport solutions. As mentioned by Browne, Allen and Anderson (2005), low emissions zones is one of the actions that can be taken in order to minimize the external impact from the transport section. LEFVs are designed to have lower environmental impact, restrictions such as low emissions zones will therefore promote the upscale use of LEFVs. Not only does the restriction encourage transport providers to lower the emissions, but also to increase the

overall quality of life in cities. One of the commonly discussed problems with transports in urban areas is the noises and disturbance. The residents require a liveable city without disturbing noises early in the morning or late in the evening. Vans and other types of motor vehicles create noise that makes the city less attractive as a living space. Hence, regulating that will lead to that transport providers will increase the use of less noisy vehicles for deliveries in urban areas such as LEFVs.

As mentioned in section 2.3, page 15, LEFVs have different sizes and appearances which requires less space. The public sector can further promote the use of LEFVs by restricting the loading zones. Quak, Nesterova and van Rooijen (2016) stresses there are benefits with using LEFVs in terms of loading and unloading since LEFVs have the possibility to access smaller areas in the city but also access pedestrian zones. As stressed by Dablanc (2007) the space in cities is limited and having vans conducting the load and unloading operation in cities will require even more space. Hence, having policies that regulate where regular vans can conduct the loading and unloading operation will also help upscale the use of LEFVs. Respondent 4 (2021) and Respondent 2 (2021) also mentioned that LEFVs have the option of coming closer to the end receiver meaning that the delivery operation will take shorter time than regular vans. The public authority has the possibility to increase restrictions for regular vans in order to promote the upscale use of LEFVs. Albalate and Fageda (2019) mentions that the total cost of congestion is 1 % of the GDP and the congestion will continue to increase making it challenging for the public sector and the city logistics planners. Having that in mind, the public sector and the city logistics planners might have an interest in upscaling the use of LEFVs in order to reduce the congestion. Since LEFVs are smaller in size and can access smaller areas in the city, an increased use of the vehicles can reduce the level of the congestion in the city.

Public Authorities Impact on UCC

The public authority plays an important role for the potential to upscale use of LEFVs. As discussed in section 5.3 there is a need for a logistics layout change in order for LEFVs to operate efficiently. In order to facilitate the upscaled use of LEFVs there is a need for UCC in the city centre where cargo can be consolidated. Respondent 5 (2021) mentioned that financial support for hubs and UCC from public authority will enable the possibility to upscale the use of LEFVs. Hence, public authorities have the possibility to invest in UCC but also the possibility to find locations where the UCC can be placed. As shown by the initiatives mentioned before, there have been some pilot tests in Swedish cities where the public authority provides parts of the financial support and facilities. Stadsleveransen is one of the examples that included a UCC 1 km from the city centre in Gothenburg. For a transport provider, it can be challenging to manage the high investment cost required for a UCC. Hence, if the public authority can provide financial support for the UCC the transport providers can contribute in other aspects where the costs are not as high. Respondent 3 (2021) mentioned that other than investment costs, having a UCC will require increased collaboration among all stakeholders including different transport providers. It can be challenging for transport providers to collaborate in terms of competitive advantages. Other aspects that are important to consider is which stakeholder will be responsible for the UCC

and the handling of the different cargo arriving at the hub. An increased collaboration between stakeholders can lead to a conflict of interest since the transport sector is a low margin section. Meaning that even if a UCC investment by the public authorities is made it can still be challenging for collaboration between the different stakeholders.

Logistics Providers and Cargo Owners

Logistics providers want to reach more customers, increase the revenue of the company and be able to market their services as 'green solutions'. Today, customers are well aware of the environmental aspects of the transport sector and the demand for information transparency is increasing. Hence, the residents in urban areas might have an impact on the potential to upscale the use of LEFVs. As mentioned in the results, residents are positive towards LEFVs since it is a new and interesting subject. However, the residents can have a higher impact than that. One action that can help promote the use of LEFVs is to give the customer the choice of selecting that as a transport mode. Customers today demand fast deliveries, liveable cities and home delivers. Hence, increasing the awareness of the potential of LEFVs towards the customers can help the increased use of the vehicles. On the other hand, one can argue that the residents will have a negative opinion towards the vehicles if the use increases due to the reasons that the vehicles have the option to use the pedestrian and the cyclist roads. Increasing the use of LEFVs can shift the road problems to the pedestrians and cyclist roads meaning that it will be challenging for current pedestrians and cyclist roads to handle higher numbers of LEFVs.

It is of greater importance to increase the collaboration between the stakeholders in order to have the option to upscale the use of LEFVs. The public sector plays an important role from a policy perspective but also invests in UCC. The stakeholders need to have aligned goals and objectives in order for LEFVs to increase. Hence, it is important to understand that upscaling the use of LEFVs will benefit the stakeholders from a different perspective. For the public authority, a more attractive city can be achieved, for the residents, the services level can increase but also the living environment in the city can be improved. For the transport providers, it can also be beneficial in terms of faster deliveries, green promotion and less time spent in congestion and alongside curbsides.

5.5 Method Analysis

The authors of this study discussed different methods before the conduction of the work started but the choice of primary data collection was set to be interviews. In combination with interviews, a literature review was conducted in order to set a theoretical framework to base the workaround. By having the theoretical framework and then conducting interviews with relevant actors within the chosen subject, the authors deemed it as most suitable for this study in order to get comprehensive and reliable data and reach the purpose of this study. In hindsight of the conducting study, it would have been beneficial to apply a triangulation of methods. By doing multiple methods it is evident that a study could be "free" from biases such as predetermined views and preferences (Collis and Hussey, 2014). One option could have been to combine interviews with questionnaires sent to a lot more of the concerned

actors within the industry and by doing so this study might have obtained a more covered result that mirrors the industry. It's agreed that a combination of these 2 methods would have provided the study with a better result but at the same time it would have taken too much resources of the entire studies time to conduct such study, hence it would consume a lot of time.

Drawbacks with the chosen method are the limitations from the sample size of the interviewed actors. The aim of this study when choosing different actors to participate in the study was to capture manufacturers of LEFVs, logistics companies using LEFVs in their daily operations and identifying companies/customers that could benefit from having deliveries with LEFVs. A lot of different actors across these segments were contacted and positive responses were obtained but in the end, many of these interviews didn't take place because of time constraints from the different actors. One way to deal with this could have been to only target one of the above groups instead of choosing all of them and that might have provided the study with more accurate data. Hence, the data might have been more representative of that specific targeted population. However, the authors of this study deemed it more feasible to choose different actors from the segments to obtain a good spread and different stand points.

The overall argument for choosing different actors from different segments of LEFVs was to facilitate the research questions, the purpose and the overall aim the authors wished to achieve by conducting this study.

5.5.1 Validity

Since the results of this study were based on interviews from different stakeholders within the business, the data collected can to some extent reflect the real-world aspects regarding LEFVs. The interviews included both users, manufacturers and operators of LEFVs meaning that the results and data collected was from a wide perspective within the business area. However, the choice of interview objects can be discussed. One of the reasons for the choice of the interview objects shown in Table 5 is the possibility to investigate the potential of LEFVs from different stakeholders within the supply chain. Moreover, the interview objects included in the study provide accurate information for Q1 and Q2. Hence, even if different stakeholders would have provided other information, the choices based on the two research questions are relevant. The validity of this study can be improved in terms of interview objectives. One argument is that more business representatives could have been included. During the choice of interview objects, several actors within the business area were contacted for an interview time. However, not all contacted businesses and actors within the sector responded or had the opportunity to contribute in an interview. Moreover, due to the time limitations of this study, the interview objects had to be limited to the current numbers of objectives.

5.5.2 Reliability

As mentioned in section 3.7, reliability is the difference that can occur if the study was conducted again. It is most common that the reliability in qualitative studies is low. Hence, the reliability of this study will be compared to only qualitative research. Hence, the reliability of this study is considered to be high. The information and data collected for this study are reliable since the whole picture is covered. The reliability can differ based on the interview objects, however, as described in section 5.5 the choices of the interview objects are relevant for this study and the researchers' questions. Moreover, the time limit should be considered for the reliability of this study. It can be possible to improve the reliability if the research did not have a strict time limit.

6.0 Conclusion

The purpose of this master thesis was to answer the following research questions:

RQ1: *What are the driving forces to upscale the use of LEFVs and which segments of goods are suited to LEFVs?*
RQ2: *How does the use of LEFVs affect last mile logistics, specifically in relation to having urban hubs?*

Firstly, the results for this study showed that there are a wide range of goods that can be delivered using LEFVs within the limit of the dimensions of LEFVs. Examples given by the respondents are pre-cooked food, merchandise such as cosmetics and clothes but also envelopes and lighter parcels. In other words, general cargo is the most suitable and common type of cargo delivered using LEFVs. This was also mentioned by Ploos van Amstel et al. (2018) where a logistics company with smaller packages and volumes has a large potential in increasing the use of LEFVs. Moreover, the results showed that for the current LEFVs used in Gothenburg and the current operators the weight limit is up to 200 kg. As mentioned by Gevaers, Van de Voorde and Vanelslander (2009) conventional vans delivered in the cities today are not fully loaded due to the demand for fast deliveries to the end customers. Hence, having smaller vehicles, such as LEFVs with lower capacity can still be sufficient for small deliveries within urban areas. Moreover, there are also limits when it comes to the dimensions of the package since the container used is not as large as conventional vans. On the other hand, the results pointed out that it can be challenging to use LEFVs for larger shipments. The challenges can for instance be delivering to grocery stores and other stores in the city that usually have large deliveries on a frequent basis. Hence, as mentioned by Morganti and Browne (2018) conventional vas are still considered to be the most used transport mode for last mile deliveries. The results from the interviews also showed that it can be challenging to deliver temperature controlled goods such as temperature controlled food and medicine. Hence, it can be challenging to point out a specific category of goods that is more suitable to using LEFVs. However, conclusions drawn from the interviews and the literature are that general cargo, such as smaller e-commerce packages, enveloped and pre-cooked food can be considered most suitable for using LEFVs. On the other hand, it can be challenging to deliver temperature controlled products, bulk products and other types of cargo not within the capacity and dimensions of LEFVs, see section 2.3, page 14 and Table 1 .

Secondly, the results for this study also showed that the driving forces for upscaling the use of LEFVs are connected to problems of last mile logistics. The interviewed stakeholders mention that one of the biggest driving forces for upscaling the use of LEFVs are the environmental aspects. The pollution from the transport sector today is a highly discussed issue due to the high environmental impact from deliveries, especially last mile deliveries. This problem was also stressed by Dablanc (2018) in order to understand how to minimize the external impact from freight activities Another important driving force is the demand for fast deliveries. Results showed that customers today demand fast deliveries, in some cases

within 2 hours. Hence, using conventional vans for fast deliveries can be challenging in cities today due to space limitations, time spent finding parking spots and congestion. Which was also stated both by (Dablanc, 2018; Transport For London, 2019). Using LEFVs for fast deliveries in cities can help to meet the delivery time-frame and avoid negative environmental impact, congestion and time spent finding parking spots. This was also shown by the study done in London where the CO2 per parcel decreased using LEFVs (Fikar, Hirsch and Gronalt, 2017;Browne, Allen and Leonardi, 2011). Other important aspects found from the results showed that LEFVs can operate in smaller areas within cities which makes it possible to operate and to get closer to the customers. Hence, the conclusion is that using LEFVs for deliveries in cities can reduce allocated time delivering the orders to the customer.

Lastly, the results of this study also showed that there is a need for a change in the last mile logistics layout in order to facilitate the upscale use of LEFVs. It was discussed both in previous literature and during the interviews that having hubs or UCC in the city is required in order to increase the use of LEFVs. The results showed that it can be due to different factors such as costs meaning that it would not be cost efficient to use LEFVs for deliveries from the consolidation centres located outside the city. Moreover, operating LEFVs from a long distance can be challenging in terms of high costs. Hence, having a hub or a UCC located strategically is almost a requirement. The possibility to use environmentally effective transport modes when having an UCC was also one of the advantages presented by (Browne et al., 2005). Due to that, there is also a need for increased collaboration between all the stakeholders in urban areas. Public authorities have the power to influence and increase use of more environmentally efficient transport solutions in terms of stricter policies for conventional vans regarding emissions and space allocation within cities. Moreover, the public authorities also have the power to invest in new UCC and collaborate with different stakeholders in order to increase the use of LEFVs. This study also showed that there is a need for collaboration between different transport operators in order for the UCC to operate efficiently. Moreover, the results from the interview showed that the residents in urban areas can also have an impact on the transport mode used for deliveries if the residents can have an active choice of choosing a more environmentally effective transport mode. The importance of increased collaboration was also stressed by (Browne, Brettmo and Lindholm, 2019).

To sum it up, the driving forces to upscale the use of LEFVs are based on the mentioned problems connected to last mile deliveries. Moreover, the results for this study showed that having LEFVs as a transport vehicle will benefit the stakeholders from a different perspective. However, there is a need for the stakeholders to have aligned goals and motives in order for the upscale to be possible.

6.1 Continued Research

After concluding this master thesis a few thoughts and insights on the subject of the potential to upscale the use of LEFVs can be drawn and elaborated on and could be subject for future research. The authors of this master thesis recommend continued and future research on the subject of goods in relation to LEFVs. This master thesis aimed to find the match between

different LEFVs and segments of goods, however the result showed that no specific segments were better suited. However, weight and volume restricted goods are preferred. Meaning that continued research on that subject would be interesting due to the fact that the sample size might not be representative of the entire industry and it would be interesting to investigate that further. Another recommendation for future research is to look into the logistics layout and if there is an upscale in using LEFVs one should conclude more research on UCC, micro-hubs and temporary hubs. All interviewees have talked about the importance of this dimension, hence future research on this subject could play a big role if there would be an upscale potential for LEFVs. It would be interesting to see future research of the infrastructure and what implications that might have if it is not prioritized. Another problem identified during the study that future research could look into, is the issue of prescription medicine if it has been ordered directly to a front door. The potential for this kind of segment of goods in combination with LEFVs is viewed by the authors as rather substantial. Lastly, continued research on the effect and role public authority plays in order to upscale the use of LEFVs is recommended. Due to the fact that this master thesis was focused on the operational side of LEFVs, still public authorities have proven to play an important role.

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Respondent 1 (2021). *Locker Facility Company with the Production Leader*. 17 Feb.

Respondent 2 (2021). *DHL Express with Goods Rider*. 18 Feb.

Respondent 3 (2021). *Einride (Per Olof Arnäs) as Strategic Logistics Expert*. 19 Feb.

Respondent 4 (2021). *Pling Transport with Member of the Management Team*. 4 Mar.

Respondent 5 (2021). *Velove (Johan Erlandsson) as CEO and Co-Founder*. 8 Mar.

Respondent 6 (2021). *Kronans Pharmacy (Dan Adolfsson) as Head of Logistics*. 11 Mar.

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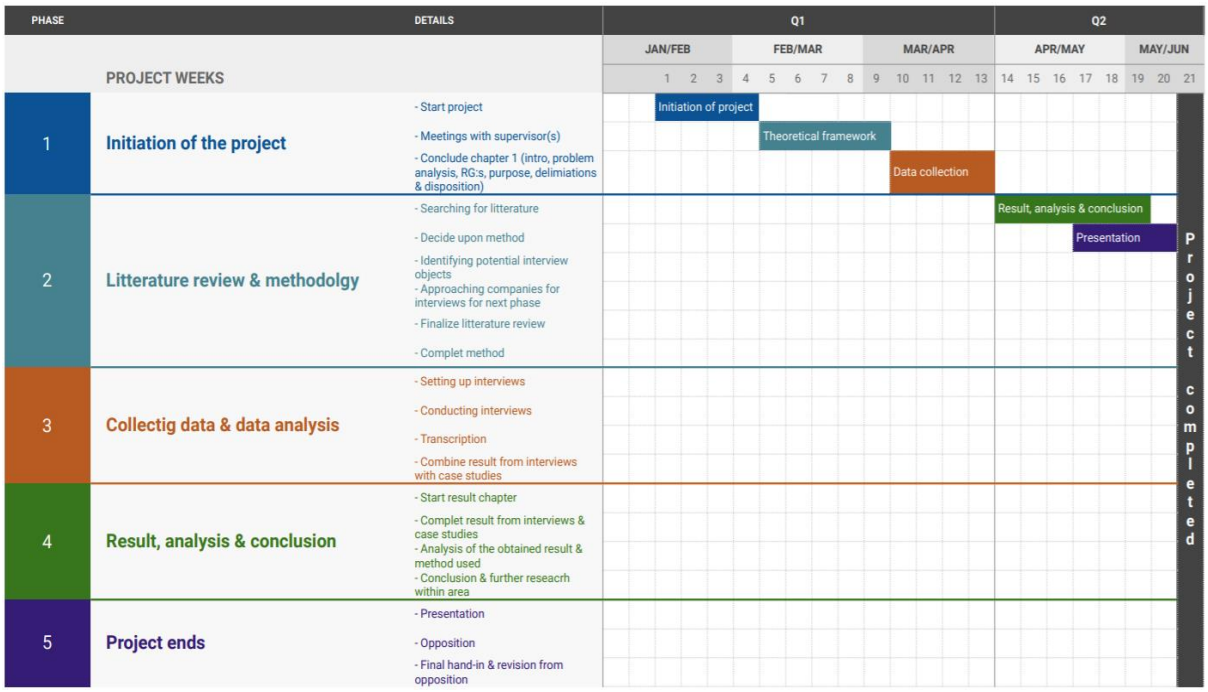
Appendices

Appendix 1 - Timeline of Thesis Project



Appendix 2 - Interview Questions

Locker Facility Company

1. Tell us about your role in the company and how a regular work day looks like for you?
2. What advantages do you see by using a concept like XXX instead of regular deliveries?
3. What drawbacks do you see with the concept XXX? Is there anything the company wants to improve or develop in order to grow?
4. What about autonomous moveable XXX boxes for last mile delivery in the future? Compare Hemglass or Bokbussen, get a text that your parcel is outside for the next x min, etc.
5. What would you as a company require in order to start using LEFVs in your daily operations? What are the restrictions you see at the moment for this segment of vehicles?
6. Do you believe that XXX will be a concept used in the future to reduce unnecessary home deliveries when the customer is not available?
7. How would you say that the overall logistics is affected by deploying a system like XXX? Please elaborate.
8. What opportunities do you see when it comes to last mile logistics, given that XXX is the last step in a supply chain?
9. What does the nr of unpicked up parcels look like?
10. XXX as a company strives to be climate neutral in a few years, but you hold the parcel for 3 days and then it will go in return to your warehouse. Operating like this seems to have a high impact on the climate and lead to unnecessary transports. How do you work around this?

DHL Express

1. How does a regular work day look like for you?
2. Have you been driving regular transport vehicles before this pilot? If so, which are the main differences between the vehicles? From the point of vehicles, does it give you more flexibility to park, load/unload, access the customer easier and get closer to them?
3. How much time do you spend outside (carrying packages to customers) the vehicle and in the vehicle, on average?
4. What is the most common type of commodity that you deliver? → the most common type of commodity is mail, however, do you see potential for other types of commodities?
5. What type of commodities do you find challenging to deliver using LEFVs? According to you, what is the ideal commodity to deliver? From the point of view when LEFVs are used. Do you see any difference in size of the packages you deliver today compared to when you started?
6. How are these vehicles perceived by the public, according to you?
7. What are the biggest general issue you meet using LEFVs as a transport mode

8. As a driver, what advantages do you find with the use of LEFVs?
9. Do you see a potential to use LEFVs in a broader context, compared to how it is being used right now?
10. Do you see a pattern to which type of customers the deliveries are made to?
11. Have you experienced any negative experiences with the use of LEFVs?
12. Ask about their view on the findings in the literature
    → The not-at-home problem is highly stressed in the literature. Do you feel that it is the same case for deliveries in Gothenburg? Does it occur often that the customer is not able to receive the parcel?
    → If so, do you believe that ITS will minimize the problem?
13. (If employed before the introduction of LEFVs) How do you assess the process around the introduction of LEFVs in your company?
14. What is your thought of LEFVs in last mile distribution?
15. What about health and safety issues driving these vehicles?

Einride

1. Tell us about your new position at Einride and what you do there?
2. Why have you decided to focus on the segment of electrified autonomous vehicles? Please elaborate.
3. Given Einrides area of expertise (electric & autonomous vehicles) do you see a potential to enter new market segments?
4. What would you say are the biggest obstacles to you at the moment?
5. Einride makes a lot of different sizes for their vehicles, are there any specific reasons why Einride hasn't produced LEFVs?
6. What about autonomous moveable insta boxes for last mile delivery in the future? Compare Hemglass or bokbussen, get a text that your parcel is outside for the next x min, etc.
7. As a logistics expert, what up/downsides do you see with last mile deliveries? If there are any, do you think they have played a part in why Einride focuses on larger vehicles?
8. Today you are active in terminal operations, due to its secluded nature, with clear boundaries and not so much potential risks of accidents. Do you see a future where you would enter the highway before entering the city (less speed but more obstacles to navigate).
9. Given your expertise within logistics, do you think LEFVs will be one of the solutions to solve urban logistics/last mile logistics problems? If so, could Einride play a part in that solution?
10. From a logistics perspective, what do you think are required to upscale the use of electrified vehicles in general?
11. Do you think that the policies regarding emissions etc from the public sector will drive the use of more electrified vehicles? Please Elaborate.

Pling Transport

1. How does a regular work day look like for you?
2. Have you been driving regular transport vehicles? If so, which are the main differences between the vehicles? From the point of vehicles, does it give you more flexibility to park, load/unload, access the customer easier and get closer to them?
3. How much time do you spend outside (carrying packages to customers) the vehicle and in the vehicle, on average?
4. Pling is a small company, compared to DHL. What was the driving force to enter a market where the idea is to deliver goods using LEFVs?
5. Which are the main advantages using LEFVs, both from a cyclist perspective but also from a management team perspective.
6. What are the biggest general issues/disadvantages you come across using LEFVs? (from both perspectives)
7. What is the most common type of commodity that you deliver? → the most common type of commodity is mail, however, do you see potential for other types of commodities?
8. In your website, one of the services you offer is to transport food (which needs to be temperature controlled), do you see a potential where LEFVs can be used to deliver other types of temperature controlled commodities, considering the energy needed and the current battery capacities.
9. Do you see a pattern to which type of customers the deliveries are made to?
10. Do you also see a pattern to which type of commodities that you usually deliver?
11. As a part of the management team, which driving forces do you believe will help the increased use of LEFVs?
12. Since LEFVs is a new area, do you believe that a close collaboration with policy makers (or other stakeholders) will help you to increase the use of LEFVs?
13. Since there is a need for hubs/terminals near the city in order to deliver with LEFVs. Do you believe that the hubs/terminals is one of the reasons why LEFVs are not used on a higher level today?
14. If yes, how can stakeholders collaborate to have more hubs/terminals i cities in order to achieve a more sustainable last mile transports

Velove

1. Why have you decided to focus on the segment of LEFVs? Please elaborate.
2. What do you see as the biggest advantage with LEFVs?
3. What would you say are the biggest obstacles to Velove at the moment?
4. Considering that you are a "producer" of LEFVs, which type of goods are the vehicles aimed for?
5. Other than weight restrictions, size and temperature -controlled goods, are there more limits on which type of goods that can be transported using your LEFVs?
6. Do you see a potential in the future, where LEFVs can be used to a larger extent?

7. If yes, do you believe that there is a need for a change in the logistics layout, meaning would there be a need for more UCC, micro hubs and temporary hubs within cities? please elaborate.
8. If so, how can stakeholders collaborate in order to provide space for hubs, UCC and temporary hubs in cities?
9. Do you see the potential of using physical stores as "hubs"? If so, would it promote the upscale use of LEFVs or would it be too complicated from a logistics and transportation point of view?
10. What would you say is needed to upscale the use of LEFVs within urban areas? Policies, layout, infrastructure etc?
11. The battery capacity & the range for the vehicles, what is the "limit" on how far the hub can be located?
12. Do you see a growing interest from cities to implement the use of your LEFVs in daily deliveries? (Saw that you have open up operations in Copenhagen)
13. Do you think that the policies regarding emissions etc from the public sector will drive the use of more electrified vehicles? Please elaborate.
14. Given your expertise within logistics, do you think LEFVs will be one of the solutions to solve urban logistics/last mile logistics problems?
15. As a logistics expert, what up/downsides do you see with last mile deliveries?

Kronans Pharmacy

1. Tell us about your role in the company and how a regular work day looks like for you?
2. What are the major challenges you face today as a logistics manager at Kronans?
3. Do you have a high density of orders from your "hub" to city centres?
4. As for today, how do you typically deliver your orders? (if outsourced, do you consider the vehicle type used to deliver your packages?)
5. Do you believe that an upscale use of LEVFs will increase the customer service for your company, meaning that the deliveries will be faster, more sustainable etc.
6. Kronans offers many different types of products, in different sizes and shapes. However, the orders are often not that large meaning that the packages are not heavy etc. From this perspective, do you believe that LEVFs is a subtitle vehicle for transporting pharmacy orders within city centres?
7. If question 6 is a yes. Do you believe that Kronans will be a part of driving development and deployment of LEVFs since it can mean great competitive advantages in terms of fast deliveries and sustainable deliveries (promoting yourself as a green company).
8. Do you see any obstacles using LEVFs for Kronans deliveries?
9. Kronans has physical stores at strategic places across Sweden, do you see a potential to use them as micro-hubs for customer orders within urban areas?
10. Do you see any potential drawbacks or advantages with it?
11. If so, would electric vehicles be an option for Kronans and maybe LEFVs as well?

12. Which are the most common orders you receive from customers, meaning, does customers usually order “temperature controlled” prescription-medicine or is it more common that you deliver regular orders?
13. Is it challenging to make home deliveries with temperature controlled products? Or is it even possible to do so?
14. If LEFVs is an option for delivering pharmaceutical products, in your opinion, what would be the advantages and what would be the challenges?
15. Finally, do you think this is the new way of operating/running a pharmacy? Combining conventional stores with home deliveries.