THE FUTURE OF URBAN LAST MILE DELIVERIES

– NOT A PIECE OF CAKE

A case study of customer demands, innovations, and sustainability within urban last mile deliveries of bakery ingredients

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Abstract

Urban last mile delivery has become an increasingly relevant topic in this day and age, where the urban population is growing at the same time as climate change forces nations to limit emissions. The demand for fast and flexible deliveries in urban areas accelerates, which further escalates the need to optimize these last mile deliveries since they are the most polluting part of the supply chain. Previous research on the topic is scarce, and has mostly focused on the Business-to-Consumer (B2C) perspective. As there are not just residents, but also many businesses operating in urban areas, it is also interesting to look at the Business-to-Business (B2B) deliveries that take place in cities.

In this single case study, the last mile delivery from a B2B perspective is examined in Stockholm, Sweden. The purpose is to examine how the case company should improve its distribution and last mile delivery setup in Stockholm to better meet the customers' expectations and needs, and at the same time consider costs and externalities. The analysis included mapping the customers' general expectations to identify gaps between this and the current last mile delivery setup of the case company.

The study showed that business customers demand frequent, reliable and flexible deliveries, but they also value sustainable deliveries highly and will toughen their demands on sustainable deliveries in the coming 5–10 years. The Swedish policy makers will likewise increase their sustainability demands on the transport sector in the coming years. Customer willingness to pay for more sustainable choices is however very low, and it is therefore hard for companies to see such investments as financially viable. Although in order to stay relevant on the market, it will be necessary for the company to make such investments, as well as implementing additional solutions to increase the flexibility and transparency of deliveries. It was furthermore found that the best way forward for the case company was to outsource the urban last mile delivery operations in Stockholm to a 3PL provider with more knowledge and resources in the area.

Contribution: This thesis has been a complete elaboration between the two authors. Each author has been involved in every part of the process and contributed equally.

Keywords: Urban last mile delivery, customer demands, sustainability, outsourcing

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List of Abbreviations

3PL – Third Party Logistics
B2B – Business-to-Business
B2C – Business-to-Consumer
CO2 – Carbon dioxide
CTP – Collaborative Transport Planning
EFV – Electric Freight Vehicle
FCEV – Fuel Cell Electric Vehicles
GHG – Greenhouse gas
HVO – Hydrotreated Vegetable Oil
ICT – Information and Communication Technology
IoT – Internet of Things
LSP – Logistic Service Provider
LU – Load unit
RQ – Research Question
SEV – Small sized electrical vehicles
UCC – Urban Consolidation Centers
UDC – Urban Distribution Centers
UMC – Urban Micro-Consolidation Centers

1 INTRODUCTION

This chapter covers the background of the thesis, provides an introduction of the case company, and presents the research questions that will be answered. Finally, the focus of the thesis and delimitations are presented.

1.1 Background

Last mile delivery has become an increasingly relevant topic within both research and industry. Lal and Narayanswamy (2022) mean that evolving market demand has resulted in a need for a more effective delivery service, and consumers in Business-to-Consumer (B2C) relationships now expect deliveries on the same or the next day. These expectations on deliveries have also spilled over to the Business-to-Business (B2B) side, since buyers are expecting the same experience as they are used to as consumers (ibid).

Last mile delivery is the most polluting and expensive part of the supply chain (Bosona, 2020), and it should therefore be in every company's interest to optimize it. Urban last mile delivery is especially relevant to look at since the European Commission (2013) expects urbanization to rise to more than 90 % in some European countries such as Sweden by 2050. Due to the increased urbanization, a larger quantity and diversity of goods will be bought by urban customers (Slabinac, 2015). The transportation of urban freight is crucial both for a better urban environment and for economic growth (Taniguchi, 2014). The need for innovative solutions and new technology is therefore evident, considering that the European Commission's White Paper (2011) states that the usage of all conventionally fueled vehicles should be halved by 2030 and completely banned in city centers by 2050. In Stockholm, the municipal board has agreed to introduce stricter requirements on vehicles that wish to enter certain parts of the inner city already in 2024 (Heick, 2022). The stricter requirements would mean that only vehicles running on electricity or gas are allowed to enter these restricted areas, such as the Gamla Stan (ibid). However, this agreement is still under investigation and is not yet implemented.

According to a number of authors (Ranieri et al., 2018; Demir and Syntetos, 2022; Slabinac, 2015; Bosona, 2020), there are many externalities that arise due to last mile delivery. Ranieri et al. (2018) define an externality as "when the social or economic activities of one group of persons have an impact on another group and when that impact is not fully accounted, or compensated for, by the first group". The same authors state that the main externalities of road transport are air pollution, noise pollution, climate change, congestion, accidents, and infrastructure wear and tear (Ranieri et al., 2018). There are a number of EU regulations aiming to decrease these externalities in urban areas, and several EU projects on sustainable city logistics and clean last mile transport to reach the goals of the regulations.

Since last mile deliveries are the final part of the supply chain, it is greatly influenced by customer requirements and needs. Kolasinska-Morawska et al. (2022) state that in the end, it is the customers who influence how the supply chain develops. Demir and Syntetos (2022) conclude that the need for innovation in sustainable transport systems is greater now than ever, in this era where customers ask for fast and reliable last mile deliveries. They say that this has become more relevant since the vulnerability of supply chains became visible during the pandemic and has shifted the focus from cutting costs to also taking reliability and environmental sustainability into account (ibid). However, Kolasinska-Morawska et al. (2022) emphasize that it can be hard to obtain information from customers regarding their satisfaction, expectations, and future requirements.

There is a lot of research available on the topic of the last mile delivery in the B2C context, however, there is not much research on the last mile delivery for B2B and the business customers' expectations of the delivery. To understand and bridge the gap, the demands of a number of predefined B2B customers in an urban area will be explored. In this thesis, we want to understand the customer's expectations and needs in connection to urban last mile delivery while considering costs and externalities in order for a company to stay competitive.

1.2 The case company

The case company, hereby referred to as The Company due to anonymization, is Sweden's leading supplier of bakery ingredients and accessories to business customers, which includes bakeries, patisseries, and the bakery industry. The case company is part of a large company group within the food industry, hereby referred to as The Company Group. Through the extensive amount of sister companies in The Company Group, The Company has access to a very broad range of products. The Company sources products internationally and is one of Scandinavia's leading importers and wholesalers of spices, nuts, raisins, and coconut.

The Company does not only provide its customers with bakery ingredients and accessories. The employees also possess specialist expertise in several additional areas and can help customers with everything from recipes and practical advice to marketing materials and sales-boosting activities. The Company has a center for innovations where they develop new products and recipes and evaluate the market potential for new products. Customers are free to ask questions about anything from the baking process to recipe development and packaging. The Company has also developed an online recipe system, where recipes are collected along with ingredient declarations and nutritional calculations. It is also possible for the customers to place orders on The Company's e-commerce website.

Distribution and logistics are also an important part of the customer offer for The Company. On the website, it is highlighted that delivering "the right goods at the right time" is important, as well as for the goods to be easy to handle when they arrive. The Company commits to reliable deliveries

with customized packaging and also offers free delivery on orders over 5000 SEK that are delivered on normal working days.

1.3 Problem description

Changing customer demands, rising costs, and a wish to increase sustainability in the supply chain prompted The Company to take a deeper look into their last mile deliveries. In order to stay competitive and be able to attract new customers, The Company experienced a need to better adapt their deliveries to the customers' wants and needs. The management team also found that the technical development in the area of last mile deliveries has been so quick in recent years that they have not been able to keep up and adapt their distribution network at the same speed. Although The Company has supply chain expertise in-house, the work has historically been more focused on solving current problems than looking for future possibilities. However, the business is growing, and The Company is now interested in looking into what innovations and new technologies there are on the market that have the potential to improve customer satisfaction while minimizing costs and externalities.

1.4 Research purpose and questions

The purpose of this thesis article is to examine how the case company should improve their distribution and last mile delivery setup in Stockholm to better meet the customers' expectations and needs, and at the same time consider costs and externalities. Thereby we aim to answer the following research questions:

RQ1: How can business customers' expectations and needs be met for urban last mile delivery of bakery ingredients, potentially using innovations and new technologies?

RQ2: What factors could hinder or enable the implementation of sustainable urban last mile deliveries?

RQ3: What advantages and disadvantages could a company get from outsourcing the urban last mile delivery?

1.5 Focus and delimitations

We have chosen to limit this thesis to study last mile deliveries in an urban environment in Sweden. From the case at The Company, data will be analyzed regarding their distribution in Stockholm. The study is further limited to the distribution of food, where consideration must be given to the temperature requirements and shelf-life of the products. This also entails limitations in what transportation modes can be used due to the requirements of handling food and keeping the cold chain. Furthermore, The Company delivers to other businesses (B2B) which entails bigger order

volumes than deliveries to consumers. This also limits the possible modes of transport and design of the distribution network. Since the focus of this work is a food company's last step of the delivery chain, the last mile in this thesis project refers to the final delivery to the business customer and not the end consumer.

The work will focus on the future of sustainable deliveries, but the time horizon for the implementation of the proposals is limited to 5–10 years in the future. We will therefore not investigate technologies that are too innovative and far into the future, instead, they should be feasible for a medium-sized food company to implement within 5–10 years. The fact that the company is medium-sized will limit the study in several ways since it limits the size of the distribution network. Today, The Company has a network of about 500 customers in the Stockholm area. The results of the study will therefore be most relevant to companies of approximately the same size and within similar industries.

1.6 Report outline

Chapter 1 Introduction: Covers the background of the thesis, provides an introduction of the case company, and presents the research questions that will be answered. Finally, the focus of the thesis and delimitations are presented.

Chapter 2 Methodology: Describes the research approach and methodological choices made to fulfill the purpose of the thesis as well as to answer the research questions. It provides a description of how the data collection is done and how the data will be analyzed. Lastly, the quality of the research is presented, and how measures will be taken to strengthen it.

Chapter 3 Literature Review: Gives an overview of the academic foundation related to the research area and begins by describing the definitions of urban logistics. Furthermore, the literature review is divided into urban logistics, innovative vehicles used for last mile delivery, technologies and urban logistics concepts, customer demands of urban logistics, externalities, urban fright plans and mobility strategies, and finally, transportation of food.

Chapter 4 Empirics: Presents the result of the data collection. It begins by covering general information about the case company and then goes through the supply chain process of the company. The data collected from interviews with customers regarding their demands are presented, and finally, future opportunities and challenges in Stockholm are described. The information has been collected through several interviews with employees from different departments, as well as observations from the warehouse in southern Sweden, from two distribution rounds in the Skåne region, and visits to customers and the distribution center in Stockholm.

Chapter 5 Analysis of Customer Demands for Urban Last Mile Delivery: Analyzes the customer demands and expectations for urban last mile delivery. Challenges are identified both from the aggregate results from customer interviews, and from the survey. Furthermore, gaps within the last mile delivery are identified and possible solutions to close these gaps are discussed.

Chapter 6 Analysis of Challenges and Opportunities with Sustainable Last Mile Deliveries: Analyzes the challenges and opportunities that come with the implementation of sustainable urban last mile deliveries. In Chapter 6.1 an overview is given of the identified opportunities and challenges, which then are analyzed further in Chapter 6.2 through 6.3.

Chapter 7 Analysis of Advantages and Disadvantages of Outsourcing Last Mile Deliveries: Analyzes the implications both for handling the urban last mile distribution in-house and for outsourcing it.

Chapter 8 Conclusion: Concludes the study and answers the research questions. It also provides the case company with recommendations for future implementation, and describes areas to be further researched by both the academia and the case company.

2 METHODOLOGY

This chapter describes the research approach and methodological choices made to fulfill the purpose of the thesis as well as to answer the research questions. It provides a description of how the data collection is done and how the data will be analyzed. Lastly, the quality of the research is presented, and the measures that will be taken to strengthen it.

2.1 Research approach

Saunders et al. (2007) state that there are two main research approaches: deductive and inductive research. The inductive approach is when you collect data and develop a theory from the analysis of the data. The deductive approach, on the other hand, is when you develop a hypothesis from theory, and then design a research strategy to test the hypothesis. Deductive research is often thought of as scientific research since the hypothesis is put through a rigorous test to see if it holds or if the theory must be modified. In deductive research, the methodology used must be highly structured to facilitate replication, and facts must be possible to measure quantitatively to ensure reliability. In inductive research, on the other hand, the goal is often to understand the context in which certain events are taking place (Saunders et al., 2007). It is therefore appropriate to study a small sample of subjects rather than a large number as with the deductive approach. Inductive research is also often more suitable if you are interested in understanding "why" questions rather than describing "what" questions for deductive research. For inductive research, the theory follows from data rather than the other way around and is often used if the research topic is relatively new or if there is little existing literature on the topic. It is also possible to combine the two research approaches (Saunders et al., 2007).

The research approach for this thesis work is inductive research since there are not many research articles written on the topic of last mile delivery, especially not in the B2B context, and it is therefore not possible for us to develop a hypothesis from theory. We rather have to collect our own data to be able to develop a theory that can be applied to the challenges at The Company.

2.2 Research methodology

According to Yin (2018) there are five social science research methods, and these are: case studies, surveys, experiments, archival analyses, and histories. Three conditions are used to decide when to use the different methods and these depend on what kind of research questions will be posed if it requires that the researcher has control over behavioral events and if it focuses on contemporary events (Yin, 2018).

If the focus on research questions is mainly "what" questions, there are two possibilities. Some "what" questions are exploratory and are suitable for an exploratory study, exploratory experiment, or exploratory case study. The second type of "what" questions could be seen as a form of "how

much", "how many" or "to what extent" questions where a survey or archival methods are preferred over the other methods. Survey methods and analysis of archival data are also suitable for research questions focusing on "who" and "where" questions. When the goal of the research is to track specific outcomes or describe the incidence of an event these two methods are advantageous. On the contrary, "how" and "why" research questions are more prone to use the methods of case study, experiment, or history. This is because these questions focus on the operational processes over time instead of single events (Yin, 2018).

If the focus of the study will be "how" and "why" questions, the remaining methods to choose from will be a research case study, an experiment, and history. History has no control over behavioral events as it deals with the past and is limited to direct observations. Case studies on the other hand are used when some contemporary event or set of events are being studied and where it is not possible to manipulate the relevant behaviors. The case study consists of both direct observations of events and interviews with people who are or have been involved in these events. Lastly, experiments require an investigator to manipulate behavior both directly and systematically. It can either be conducted in a laboratory environment or a field setting (Yin, 2018).

Case studies are suitable when the research questions are formulated as "how" and "why" questions, no control of behavioral events is needed and there is a focus on contemporary events. Yin (2018) further defines the case study as an empirical method that examines a contemporary phenomenon thoroughly and within its real-world context. This applies especially if the boundaries are not clearly visible between the phenomenon and context (Yin, 2018). We have therefore chosen to use an exploratory case study as the research methodology of this thesis, since we will not have control of the behavioral events, and a few "how"-questions will be studied that will be answered with a case study based on The Company in this thesis.

There are four different ways to design a case study, which depend on the number of cases used and the number of units of analysis used for the case study. This results in four types: single case holistic, single embedded, multiple-case holistic, and multiple case embedded. Common for all the designs is that they aim to study the contextual conditions in relation to the case. Single-case designs are suitable to use when the case is unusual, common, critical, revelatory, or longitudinal (Yin, 2018) and are appropriate for analyzing a phenomenon that few have studied before (Saunders et al., 2007). Furthermore, the unit of analysis could either be holistic or embedded, where the holistic approach focuses on the organization as a whole. The embedded case study, on the other hand, is done by studying a number of sub-units within the organization which could be for example teams or departments of the organization (Saunders et al., 2007). In this master thesis project, a single case study will be used on the case company since the phenomenon of last mile delivery in an urban area of food products has seldom been investigated before. The study will have multiple units of analysis through analysis of the different departments and stakeholders at

the case company and thus the study will be a single case embedded study. The overall unit of analysis will be The Company.

2.3 Data collection

Yin (2018) describes that there are six sources of data that could be used to collect data for case studies. These are documentation, interviews, direct observations, participant observation, archival records, and physical artifacts. The sources of data have different strengths and weaknesses which are illustrated in Table 2.1 below.

Table 2.1: The six sources of data's characteristics and field of application. Source: Yin, 2018

Source of data	Examples	Used to
Documents	Letters, emails, administrative documents, studies, event reports and news articles	Verify and build upon evidence from other sources
Interviews	Unstructured interview, survey interview	Create exhaustive understanding of participants' view-points, and key events
Direct observations	Observe events in real-world setting	Provide additional information regarding the topic
Participant observation	Researcher is an active observer and participates in the studied action	Provide inside information and perspective
Archival records	Public governmental data, budget, maps, survey data produced by others	Verify and build upon evidence from other sources
Physical artifacts	Physical evidence, instruments, tools, technological device	Develop broader perspective and provide additional information

In this thesis internal documents such as Excel-sheets, emails and studies from The Company have been used to collect both qualitative and quantitative data. Furthermore, a literature review, interviews, observation, surveys and a focus group have been conducted which will be further explained in the following sections.

2.3.1 Literature review

Documentation can be very important in any data collection when conducting a case study as it has several benefits and allows the researcher to augment evidence with help from other sources. A search on the internet can offer essential information used for preparation and orientation before conducting fieldwork. It is important to do systematic searches of relevant documentation when collecting data (Yin, 2018).

A literature review is done by reviewing already existing literature to establish what is already known and identifying gaps in the current knowledge. There are two styles of reviewing which Jesson et al. (2011) describe as traditional literature review and systematic review. The materials used for the traditional review are often based on what the authors consider to be important while the systematic review is more neutral and has a standardized process. The literature review made for this thesis project will be a traditional literature review following the reviewing types conceptual and scoping as described by Jesson et al. (2011). The conceptual review aims to combine different areas of theoretical knowledge to better understand the problem. The purpose of the scoping review is to determine the gaps in current knowledge within the research area which can be used for future research (Jesson et al., 2011). In this master thesis, a literature review will be conducted to understand the challenges of urban last mile logistics and gain insights into possible technologies to be used for distribution. Sources used for this thesis are books and articles gathered from search engines such as LubSearch, Web of Science and Google Scholar. The primary search words were “last mile delivery”, “last mile logistics”, “urban logistics”, “urban distribution” and “city logistics”. In combination with these primary search words, the search words “innovative”, “vehicles”, “cost” and “sustainability” were used to narrow the search to include these specific topics. The articles that were included in the literature review mainly covered European cases to increase their relevance to this case study.

2.3.2 Interviews

Trustworthy and accurate data that are suitable for the study’s research question can be gathered through interviews. There are different types of interviews which can either be unstructured and casual conversations or highly structured and formal where every respondent gets standardized questions (Saunders et al., 2007). Interviews are usually categorized as unstructured/in-depth, semi-structured, or structured interviews (ibid).

The unstructured interviews are informal and are used to investigate a general area of interest in depth. Saunders et al. (2007) state that no list of questions is prepared beforehand, instead the researcher only has an idea of the aspects that should be explored and the interviewee gets to speak freely about the topic area. Semi-structured interviews are when the researcher develops a list of questions and areas that should be covered in the interview. The questions and areas may however vary from interview to interview and the order of asking the questions might be varied depending on the dialogue (ibid). Some questions might be added or excluded in particular interviews, given the interviewees' roles. Data from the interviews can be collected either by taking notes or by recording the audio. In structured interviews, the questions are decided upon before the interview and are standardized for all interviews according to Saunders et al. (2007). After asking the interviewee a question the response is noted on a standardized schedule. The questions should be asked exactly as stated and without changes in tone that could create a bias (ibid).

The semi-structured interviews can be part of the case study strategy to gather data which usually is analyzed qualitatively. The data from this type of interview can be used to understand the "how", the "what" and the "why" (Saunders et al., 2007). This master thesis will be conducting semi-structured interviews to be able to vary the questions and allow follow-up questions on interesting areas. The time limit for each interview was one hour, and the interviews were not recorded due to confidentiality. Instead, one of the authors took extensive notes during the interview and then both authors sat down and reviewed the notes directly after, to ensure that nothing was missed or misinterpreted. The interviews and their purpose are stated in Table 2.2.

Table 2.2: Interviewee summary and purpose of interview, with people working at The Company stated above the bold line

Interviewee	Purpose
Quality & Sustainability Manager	Regulations and laws for transportation of fresh food and general sustainability work for the company
Transport Coordinator	Distribution network, vehicle fleet, outsourcing activities, and improvement potential
Sales Manager Artisan bakeries	Customers' expectations and demands and improvement potential
Chief Digital Officer & Head of Warehouse and Distribution	Digital logistics tools and future implementations
Chief Operations Officer	Strategic plans for the future of transport operations
Driver	Understand the company's own transportation process
Warehouse manager in southern Sweden & foreman of the warehouse in central Sweden	Internal transports and sustainability
Transport planner 3PL	Urban distribution and planning
Bakery Manager, Artisan Bakery Customer 1	First-hand perspective on customer expectation and demand
Vice President and Quality & Sustainability Manager, Industry Customer 1	
Purchasing Manager, Industry Customer 2	
Store Manager, Retail Customer 1	

From the theoretical foundation and several interviews within the case company and the Third Party Logistics (3PL) provider regarding the general themes found in Appendix 1, an interview guide was developed (see Appendix 2), to support the data collection of customer demands through

interviews. The names of the companies are encrypted and named after which customer segment they belong to.

2.3.3 Observations

Observations will be used in this master thesis to understand the current distribution process of the company and to gain insights into everyday operations. According to Saunders et al. (2007), there are two types of observations: participant observation and structured observation. The participant observation is examining qualitative aspects and is when the researcher tries to be an active participant in the activity which is being studied. The structured observation on the other hand has a structure that is decided upon in advance and is systematically performed. The goal of structured observation is to quantify and determine the frequency of events or behavior rather than answer why something is happening (Saunders et al., 2007). The observations made in the project will not be structured since it will not be possible to determine what is going to be observed beforehand. Participant observation will be conducted to get an in-depth understanding of the last-mile delivery and why certain events are carried out the way they are today. In Table 2.3 the observations made for the project are summarized, and their purposes.

Table 2.3: Summary of observations and the respective purpose

Observation	Purpose
Tour of the warehouse	Gain insights into the assortments and how products are stored and handled
Distribution round 1 & 2	Understand the distribution process and find areas of improvement
Operations of the third-party logistics provider	Gain insights into urban consolidation and distribution

2.3.4 Surveys

Surveys support a cost-effective collection of great amounts of data, which is generally obtained through a questionnaire. This allows the collected data to be standardized and facilitates the comparability of the answers (Saunders et al., 2007). In a questionnaire, every person answers the same set of questions, and can be performed both with an interviewer present and without. The questionnaire needs to be designed so that validity and reliability are maximized, which can be achieved by making a clear design of the form and carefully choosing the questions (Saunders et al., 2007).

There are two types of questionnaires, self-administered and interviewer-administered. Usually, the respondents complete the self-administered questionnaires themselves which can either be distributed by Internet, by post, or delivered by hand to the respondents. In the interviewer-administered questionnaires the answers are recorded by the interviewer and can be done either as a telephone questionnaire or as a structured interview (Saunders et al., 2007). A survey will be

used in this thesis project to collect input from customers about their expectations and needs regarding the deliveries and will be conducted through a self-administered questionnaire which is distributed via email and answered in a form on the Internet. Since surveys facilitate the collection of multiple customers' opinions, it allows for more quantitative analysis than interviews which are more qualitative (ibid). The questions used in the questionnaire are presented in Appendix 3.

The survey developed in this thesis was sent out to approximately 100 customers located in the Stockholm area after the interview round. The questions in the questionnaire were based on the same areas covered in the one hour semi-structured interviews with the customers. The purpose of the survey was to broaden the customer perspective to see if the topics discussed in the interviews were specific to the interviewees or experienced by many customers. The survey also served the purpose to get customers to rank different aspects of the last mile delivery, in order to see if there was a consensus regarding the importance of a number of factors affecting the delivery. It was distributed by email from The Company, and a total of eight customers answered the survey.

2.3.5 Focus group

In a focus group, a topic that is clearly defined is discussed by a number of participants, usually between four and eight people (Saunders et al., 2007). An audio recording or two interviewers can be used during the focus group in order to gather all the generated ideas (ibid). This master thesis project used a focus group at a late stage of the project to discuss and evaluate the potential future solutions within urban last mile delivery. The focus group was held when the results from the interviews and survey were being analyzed and possible solutions were being developed. The focus group was performed at the office in south Sweden, with some participants over Microsoft Teams. The participants of the focus group are presented in the list below.

- Chief Operations Officer
- Project consultant
- Sales Director Industrial and Artisan customers
- Sales Director Retail
- Sales Manager Artisan bakeries
- Sales Manager Industrial customers
- Sales Manager Retail customers
- Supply and Demand Manager

Possible implementations were presented to the focus group and the project's advantages and disadvantages for the company were discussed. Furthermore, the feasibility and alternative solutions were discussed.

2.4 Data analysis

According to Yin (2018), there are five types of analytic techniques that are typical for case studies. These are; pattern matching, explanation building, time-series, logic models, and cross-case synthesis. Pattern matching is a technique where two patterns are compared to see if they match. One pattern has been observed empirically, while the other is a hypothesis based on literature. Through a comparative analysis of whether the patterns match or not, conclusions can be drawn. Explanation building can be said to be a sort of pattern matching that is commonly used in exploratory case studies. Explanations of how and why something is happening within the case are then gradually built from data analysis. In a time-series analysis, there may only be one dependent or independent variable to analyze. If changes are traced in detail over time, a trend can be observed empirically and matched with a theoretical trend. Logic models can be described as pattern matching in sequences, where events are analyzed in a repeated cause-effect pattern. Cross-case synthesis is specifically used in multiple case studies to compare and aggregate findings over a number of case studies.

In this thesis, the main data analysis technique used is explanation building, since the research questions are of exploratory nature. Through a number of interviews with employees in different parts of the company, an explanation of the case company's current operations was gradually built. A gap analysis was used to analyze the gaps between the case company's current operations and customers' requirements found in the interviews and the survey. Recommendations were then made based on the gaps found in the gap analysis, and opportunities for improvement found in the literature review that are deemed reasonable for the case company to implement based on the analysis of the company's current operations.

In addition to the qualitative data analysis described above, some quantitative data analysis is included in the report. The main quantitative data analysis is a part of the gap analysis and concerns what products should be stored closer to the Stockholm market. This quantitative data analysis was based on sales data in Excel, and a detailed description of how the analysis was conducted can be found in Appendix 4.

2.5 Quality of research

There are four tests that could be used to determine the quality of a case study research which are called construct validity, internal validity, external validity, and reliability (Yin, 2018). These will be discussed in the following subsections.

2.5.1 Construct validity

Validity is about if the research's findings truly are about what they appear to be about (Saunders et al., 2007). In order to increase the construct validity of a case study, multiple sources of evidence should be used to support convergent lines of investigation which are relevant when gathering

data. Another tactic for construct validity is to get key informants to review the draft of the case study report and to create a chain of evidence (Yin, 2018). A focus group can be used to minimize a potential lack of validity (Saunders et al., 2007). For this master thesis project, several interviews will be held with different people at The Company to ensure multiple sources of evidence are collected, and a focus group is used to verify the interpretation of the results.

2.5.2 Internal validity

Internal validity is the extent to which the findings in a study can be attributed to the interventions rather than any flaws in the research design (Saunders et al., 2007). The test of internal validity has mostly been used in experimental research and is an issue for an explanatory case study where the researcher attempts to understand and explain why one event led to another. For case studies, this extends to the larger issue of drawing conclusions which occurs whenever it is not possible to observe an event directly. There are four tactics that can be used to increase the internal validity during the analytical stage of the case study which are pattern matching, using logical models, explanation building, and addressing rival explanations (Yin, 2018). In this thesis, explanation building is used to gradually get an understanding of different factors that affect the outcome of the analysis. Different perspectives are analyzed through interviews with different stakeholders to increase the internal validity of the results.

2.5.3 External validity

Can also be referred to as generalizability, which means that the results of the research could possibly be useful in other study contexts. Saunders et al. (2007) state that this could be an issue if case study research is done in one single organization, then the purpose will not be to create a generalizable theory that could be applied to all populations. Instead, the task will be to explain what is happening in the particular research setting (Saunders et al., 2007). The external validity can be affected by how the research questions are posed in the case study, where it may be harder to reach a general analytic conclusion for "what" questions. Therefore, the research questions need to be decided during the research design phase of the case study to allow methods seeking external validity. To address the external validity of the case study, theory should be used for single case studies (Yin, 2018). This thesis is a single case study, which makes the issue of external validity crucial to address. The research questions have been formulated in a general way, since the analyzed topics are interesting for companies in other industries than the bakery industry. However, the fact that the data has primarily been collected from actors within the bakery industry, makes external validity an issue. To increase external validity, the literature review has included research on the topic from a broader perspective, not only connected to the bakery industry. Data has also been collected and analyzed from a third-party logistics provider, which transports goods from multiple companies in various industries. This broadens the applicability of the results to other industries, but more data from other industries would have to have been included in order to increase external validity even further.

2.5.4 Reliability

The goal of reliability is to make sure that if the research is conducted again with the same case and procedures it will result in the same findings and conclusions. Reliability aims to reduce the study's possible errors and biases. Yin (2018) states that historically there has been a lack of documentation of case studies and therefore a case study protocol should be used to ensure the reliability of the study. To increase the reliability, the different steps of the research should be as clear as possible and the chain of evidence should be kept (Yin, 2018). According to Saunders et al. (2007), there are four threats to the reliability of research findings, which are: subject or participant error, subject or participant bias, observer error, and observer bias. The first threat of participant error is regarding if the results differ, for example depending on what day and time the research was conducted. If research is conducted at a company the interviewees can feel pressure to answer what their bosses want to hear, which is a threat to the participant bias. This can be avoided by ensuring the anonymity of the respondents. Furthermore, observer error can happen when different observers ask the questions in different ways and by this receives different answers. Finally, observer bias is regarding how the observer interprets the interviewees' replies (Saunders et al., 2007). To ensure the reliability of the case study supervisors at LTH and The Company will review the research to minimize any potential errors and biases. The two authors of the thesis will also review all collected data both together and individually to further reduce the risk of bias.

3 LITERATURE REVIEW

This chapter gives an overview of the academic foundation related to the research area and begins by describing the concept of urban logistics. Furthermore, the literature review is divided into innovative vehicles used for last mile delivery, technologies and urban logistics concepts, customer demands of urban logistics, externalities, urban fright plans and mobility strategies, and finally, transportation of food.

3.1 Urban logistics

With increased urbanization, the concept of urban logistics has been facing an increased interest in recent years, when it has become evident that the living environment in cities has become unsustainable due to externalities. The increasing demand for goods due to a larger population in cities has led to greater importance of urban freight transportation to be able to support a better urban environment and a better life for the people in the cities (Taniguchi, 2014). Urban economies are also quickly changing to become more dependent on more frequent and customized deliveries. The inventory levels of stores located in urban areas have shrunk and businesses are increasingly relying on just-in-time delivery of supplies (Rodrigue et al., 2013). To ensure a city's competitiveness and a high standard of living compared to other cities, an efficient transport system is essential. Also, with a rising number of freight vehicles in cities, problems linked to congestion, pollution, and increased logistics costs arise (Fancello et al., 2017). Recurring problems of congestion start to happen in a city once a threshold of about one million inhabitants is reached, according to Rodrigue et al. (2013). At the same time, from a market perspective, it is easier to serve a higher concentration of people (Rodrigue et al., 2013).

The concept of urban logistics has therefore recently started to be studied by many researchers, although mostly in a B2C context since it is the growing e-commerce and demand for home deliveries that are commonly seen as the primary driver of increased urban freight flows (Bosona, 2020). In this thesis, urban logistics is studied from a B2B context. The flow of goods to cities is described in Figure 3.1 below. The focus of this work is on the second part of the flow, where the goods have reached the City Terminal and are distributed from there to the business customers within the city.

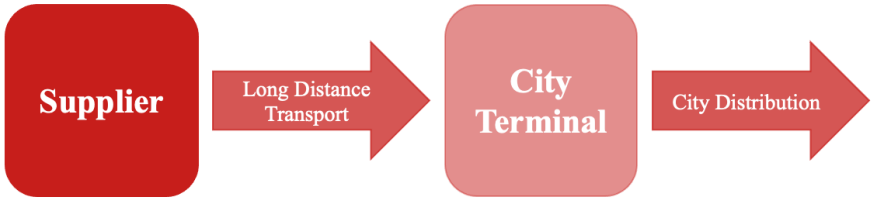


Figure 3.1: Flows within city logistics. Adapted from: Kungl. Ingenjörsvetenskapsakademien, 2019

Since the topic of urban logistics is rather new in research, there are several definitions and terms that are used to describe the concept. No clear consensus has been reached on what terms to use to describe the different aspects, however, Cardenas et al. (2017) have developed a framework of classifications that are presented below.

3.1.1 Three levels of urban logistics

According to Cardenas et al. (2017), the concept of urban logistics can be divided into three domains: city logistics, urban goods distribution, and last mile delivery. City logistics can be described as the macro level, urban goods distribution as the meso level and last mile delivery as the micro level. This is illustrated in Figure 3.2 below.

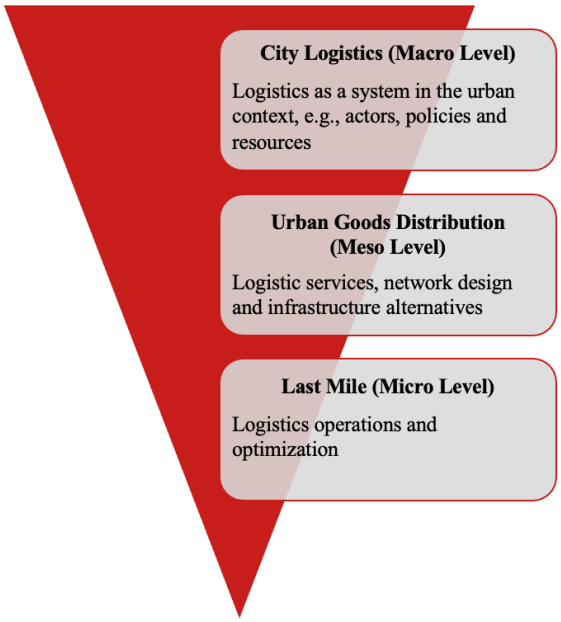


Figure 3.2: The three domains of city logistics. Source: Cardenas et al., 2017

City logistics

City logistics is the broadest concept of urban logistics according to Cardenas et al. (2017). It takes both economic and social issues of the city environment into consideration (Taniguchi 2014). The focus is on the stakeholders and policymakers in the city, and their interactions and interrelationships. The goal is to improve citizens' quality of life and mainly focuses on long-term policy outcomes for areas such as land use, emission reduction, and livability (Cardenas et al., 2017).

Urban goods distribution

Urban goods distribution looks at the interaction between transports and logistics systems, by considering transportation modes, facility locations, and economic, social, and environmental performance (Cardenas et al., 2017). Some of the key challenges in this area are logistics

infrastructure, consolidation schemes, externalities, and freight transport policy performance. On this level, it is common to find case studies, network design studies, and innovative solutions for urban goods distribution (ibid).

Last mile delivery

Last mile delivery has a more operational focus regarding the goods distribution process and focuses on a small geographical location such as a city center. Efficiency regarding for instance time, distance, costs, and the number of vehicles is of great importance, and the main goal is cost efficiency. Optimization of routing problems is often the focus, and environmental variables tend to be seen as byproducts of such optimizations (Cardenas et al., 2017).

3.1.2 Definitions used in this thesis

Since the scope of this thesis is the delivery of goods in a B2B context, the definitions according to Cardenas et al. (2017) above are not fully applicable. As research on deliveries in a B2B context is scarce, there are no established definitions to use. In this thesis, the deliveries to the business customers are referred to as last mile deliveries, because it is the last part of the supply chain for the goods-selling company. However, as the receiving companies in turn often have deliveries of their own to the end consumers, the B2B last mile deliveries fall more under the category of urban goods distribution according to the definitions above. Therefore, the terms "urban last mile delivery" and "urban goods distribution" are used interchangeably in this thesis.

3.1.3 Stakeholders in urban logistics

There are many stakeholders involved in urban last mile delivery, and they all have different objectives, see Table 3.1. The objectives of the stakeholders may differ between cities, where some authorities focus on reaching different targets than others (Balm et al., 2014). This makes urban last mile delivery operations complicated to optimize.

Table 3.1: The stakeholders of urban last mile delivery and their objectives. Adapted from Balm et al., 2014

Stakeholder	Objectives
Senders of goods	Want to offer their customers a high service level
Receivers of goods	Want reliable delivery times
Logistic service provider	Is concerned with the efficiency of transport operations
Citizens	Want a livable environment
Local authority	Wants a safe, clean, and attractive city

The Logistic Service Provider (LSP) or a 3PL provider is a company that possesses knowledge of logistics and how to coordinate economic resources. Traditionally, 3PL meant contracting with an outside company to handle logistics activities such as transportation and warehousing. Often several activities are outsourced to a 3PL provider as a strategic choice by a company. Nemoto and Tezuka (2002) present some advantages and disadvantages of using a 3PL provider. According to them, one advantage of using a 3PL provider is the possibility to reach economies of scale and benefit from their warehouses and large truck fleets. Another advantage of outsourcing logistics activities is the reduction of financial risk by saving capital investments. However, Nemoto and Tezuka (2002) state that one disadvantage is that it is hard to establish a trustworthy and cost-effective partnership between the 3PL provider and the contracting company.

Since there are many stakeholders affected by an inefficient transport system, it is very hard to identify an owner of the problem. It is widely debated if the problems should be dealt with by the public or the private sector, according to Balm et al. (2014). On one hand, it is the public authority that should look after the citizens and create the best possible environment for all stakeholders. On the other hand, restrictions and legislation can have a negative effect on efficiency and economic prosperity for companies. Furthermore, public funding is often not sufficient when it comes to investments in innovative solutions. There is a need for the private sector to create and invest in its own solutions. However, the goal of the private sector is to generate revenue, and investments in improved transportation systems do not have a clear connection to the revenue of a single company. It is not enough for only a few companies to make these types of investments to create change, and the benefits of the investments could to a large extent be said to be for the citizens and society instead of the specific companies (Balm et al., 2014). This makes urban logistics a very complex issue to address, and many perspectives must be taken into consideration.

3.2 Innovative vehicles used for last mile delivery

Last mile delivery done by traditional types of delivery vehicles in urban areas is considered very ineffective from an ecological point of view, according to Slabinac (2015). Therefore, there is a need to introduce innovative types of delivery vehicles that both reduce the negative ecological and social impact of urban transportation and improve competitiveness and business results.

3.2.1 Bicycles and cargo bikes

Delivery companies often use smaller vehicles for their last mile distribution in order to avoid traffic restrictions and reduce congestion (Oliviera et al., 2017). These types of vehicles appeared to have several benefits such as reduced fuel consumption, delivery time, and air and noise emissions, as well as a lower impact on the city and a lower need for parking spaces (Ranieri et al., 2018). They are also unaffected by congestion and policies that make it more expensive to drive and park in the city (Schliwa et al., 2015). However, it is a logistical challenge to decrease the size of the vehicles used for urban last mile delivery when the regional freight transport uses

larger vehicles with higher capacity. Because of this, there is a need to combine the smaller vehicles with consolidation centers close to the urban areas (Oliviera et al., 2017). Another limitation is that they can only transport parcels and not pallets, which only makes them usable in certain types of businesses (Melo et al., 2014).

Cargo bikes have been developed in recent years, with electric traction that has allowed an increase in their capacity. Now, this new generation of cycles is almost equal to traditional vehicles (Ranieri et al., 2018). Cargo bikes are suitable for deliveries within short distances, around 2.5–3.5 km, and light goods transport of 80–200 kg (Slabinac, 2015). This means that cargo bikes are suitable when the delivery area is in close proximity to the distribution center, there is a high density of customers, and low delivery volume per stop. When the delivery area and the volume per stop is large, delivery trucks are more cost-effective (Bosona, 2020).

3.2.2 Electric vehicles

Electric vehicles are an energy-efficient alternative to conventionally fueled vehicles in urban logistics (Foltyński, 2014). The interest in electric vehicles for urban freight transport has increased with the increasing number of restrictions on freight vehicle traffic, as well as fees and taxes charged by local governments (Andaloro et al., 2015). There are several kinds of electric vehicles, as described in Table 3.1 below.

Table 3.2: Types of electric vehicles. Adapted from Foltyński, 2014

Acronym	Description
EV or BEV	All-electric or battery electric vehicles. They are only powered by electric motors and store electricity in batteries. They consume no fossil fuels and produce no tailpipe emissions.
PHEVs	Plug-in hybrid electric vehicles. Are powered by both an electric and a combustion engine (or other types of propulsion). Stores electricity in batteries.
HEVs	Hybrid electric vehicles. Are also powered by both an electric and a combustion engine (or other types of propulsion). They rely on fossil (or other types of) fuel for power to charge the batteries and are not plugged in to charge.

Benefits and limitations of electric freight vehicles

Electric-powered vehicles are beneficial in the sense that they could reduce the environmental impact and dependency on oil in last mile distribution (Oliviera et al., 2017). They also require less maintenance than combustion engine vehicles since they have fewer moving parts and do not need regular oil changes (Quak et al., 2016). The cost savings of using electricity instead of diesel can be considerable, sometimes up to 80 %, according to Quak et al. (2016). Many cities use different instruments to promote the uptake of Electric Freight Vehicles (EFVs), such as favorable taxation schemes like no parking fee, no congestion charge, and no road tax (ibid). Quak et al. (2016) state that there could also be supportive policies such as being allowed to use bus lanes,

park at non-loading areas, enter pedestrian zones, and have wider time access to restricted areas. This is to make the business case to invest in EFVs more attractive. Quak et al. (2016) mean that these measures have proven to have a positive effect on the logistics operation in terms of time savings, and thereby cost savings. It has also proven to lead to a better work environment for truck drivers, as they experience better performance, fewer mistakes, and less stress because of for example the free parking exemption. The drivers are generally not concerned with range issues if they have a stable and predictable daily delivery environment that they know the vehicles will be able to handle. However, if the delivery environment in terms of distance, routes, number of stops, and the weather is very variable, the battery range can be a cause of anxiety for the drivers, says Quak et al. (2016).

There are also limitations to using electric vehicles, such as the need for a charging network infrastructure, long charging times, and the limited distance it can travel before the vehicle needs recharging. The purchase cost for commercial electrical vehicles is higher than for conventional diesel trucks, but the operating cost is lower (Ranieri et al., 2018). For smaller vans up to 3.5 tonnes, the purchase price is approximately two times higher, and for larger vans, the price could be two to five times higher than conventional vans (Quak et al., 2016). The high purchase cost is identified as a major obstacle to the widespread implementation of electric trucks, and their operational competitiveness is dependent on the price to fall (Melo et al., 2014; Kin et al., 2021). Even though the need for maintenance is lower, the repair cost if the vehicle does break, is very high (Quak et al., 2016). There is also an insufficient charging network for EFVs. The deployment of EFVs is slow and has not yet seen a large-scale take-off (Kin et al., 2021). The reason why the transition from fossil-powered vehicles to electric vehicles has not yet happened is due to insufficient technology maturity and that the business case is not yet proven, according to Quak et al. (2016).

The insufficient charging network is not the only issue when it comes to charging electric freight vehicles, Quak et al. (2016) say that it could also be that the existing power grid is insufficient. The majority of commercial electric vehicles are charged overnight at the company facilities, and if many vehicles must be charged at the same time it can become necessary to upgrade the power grid. Such upgrades are expensive, and it can be unclear who the investor should be. For example, in the UK, it is the end user who must pay for these kinds of upgrades even though it is the power-network company that owns the network (Quak et al., 2016).

Lebeau et al. (2015b) have developed a total cost of ownership model and used it to assess the competitiveness of light commercial freight vehicles. They compared 7 battery electric vehicles, 5 diesel vehicles, and 3 petrol vehicles. The result showed that in 2015, battery electric vehicles had a better competitive position than petrol vehicles, but not compared to diesel vehicles. The model was based on the Belgian situation, which affects the results in a number of ways. The model i.a., considers 40 % financial support from regional subsidies, which is what the Brussels-Capital

Region offered small firms for the investment cost of electric commercial vehicles at the time of the study. However, some general conclusions can be drawn, such as that an electric freight vehicle becomes more competitive when the number of driven kilometers per year is high because of the low operating cost compared to petrol and diesel vehicles (Lebeau et al., 2015b). Scorrano et al. (2021) have also conducted a more recent total cost of ownership analysis of electric light commercial vehicles and found similar results. According to their calculations, electric light commercial vehicles had on average a higher cost per kilometer, however, most models only used in urban driving and only charged at the depot were cost competitive compared to their diesel and petrol counterparts.

The total cost of ownership is to a large extent dependent on the batteries according to Lebeau et al. (2016) since they are expensive and are at risk of having to be replaced because of age or breakdowns. The evolution of battery technology is ongoing, and they are becoming cheaper and cheaper. The price of batteries has declined a lot from 2013 to 2020, and is expected to drop even further to only 40 % of the 2020 price in 2030 (Kin et al., 2021). Because of this, electric freight vehicles are becoming more cost-effective. The rapid development might make customers reluctant to buy BEVs today since they would prefer to wait for the next generation to hit the market. On the other hand, it has been observed that companies that operate BEVs in the early stage are securing a leading position in the market and are considered innovators and pioneers in new technologies (Lebeau et al., 2016). Batteries have a limited lifetime and must be replaced once they reach 80 % of their initial energy capacity according to Lebeau et al. (2015b). Their lifetime can vary a lot depending on many factors such as the charging method, operating temperature, and depth of discharge. Since the battery cost makes up a relatively large share of the total cost of ownership for an electric freight vehicle, different business models are being proposed by manufacturers regarding these costs. There is the “battery ownership model”, where the customer purchases the battery together with the vehicle and thus takes over the risks of replacement costs once the warranty period is over. Then there is the “battery leasing model”, where the battery is owned by the manufacturer and the cost is spread monthly for the customer through a renting system. The battery leasing model makes the investment in an electric freight vehicle more competitive from a total cost of ownership point of view (Lebeau et al., 2015b).

Conceptual vehicles and projects

FREUVE is a European FP7 project, co-funded by the European Commission, that demonstrates the use of EFVs in eight European cities – one of them being Stockholm. Many learnings can be made from the implementation of EFVs in these cities, according to Quak et al. (2016). One of them is that it is possible to directly replace traditional fossil-powered vehicles with electric vehicles, however, the use of EFVs often requires more intelligent planning. A direct replacement would mean that the routes would still be designed for the traditional vehicles, and limitations of EFVs such as limited range without charging are not considered. Loading and unloading

operations at the warehouses could also be affected and must be planned around the charging of the vehicle if there is not enough idle time for a full charging cycle.

Andaloro et al. (2015) explain the characteristics of a new concept of an electric vehicle that has been developed for last mile transportation. The vehicle has elements of higher technological innovation and design than the vehicles that are currently on the market. The characteristics include a flexible chassis that allows integration with different electric propulsion systems, and the possibility to install different types of upper bodies. The vehicle also has a mobile platform to facilitate the loading and unloading of goods and an information mobility system that collects, processes, and transmits positioning and operational data to a service center in real-time. These characteristics, along with the fact that the vehicle can carry a greater payload than vehicles in the same category, facilitate freight transport of different kinds of goods (ibid). Another innovative electric freight vehicle is the so-called V-Feather vehicle, presented by Slabinac (2015). It is modular and can be composed of multiple building modules of various sizes and types. This makes the vehicle adaptive for carrying various types of goods, e.g., refrigerated goods. The modules can also be dropped off and recharged at different locations.

There are several projects directed toward solving the problem of charging electric vehicles. One of them is conducted by Siemens, which has invested in electric road systems that are being tested in the US and Europe. Sweden is one of the countries where the ERS is tested, on a 2 km stretch of highway north of Stockholm (International Energy Agency, 2017). Sweden, together with Germany, are world leaders when it comes to real-world studies on electric roads (Kihlström, 2021). The main target for these initiatives is long haulage heavy transport, where charging stations along the road may not be enough. The world's first wireless e-road was built on Gotland in 2020, and the Swedish government has commissioned the Swedish Transport Administration to develop a plan for how to electrify 2000 km of the busiest roads in the country by 2030 (ibid).

The Swedish market for electric freight vehicles

In Sweden, there were 13 433 electric light vans registered at the beginning of 2023 (Power Circle, 2023) and a total of 608 871 light vans registered at the end of 2022 (Trafikanalys, 2023). This means that electric light vans correspond to 2.2 % of the light vans in Sweden today. Melander et al. (2022) have researched the adoption of EFVs in Stockholm and have found that the adoption is very slow even though Sweden has set tough goals for the transition to fossil-free freight transport and is providing monetary incentives in many forms to reach those goals. Melander et al. (2022) studied five freight transport firms in Stockholm, out of which three of them delivered food to restaurants and other companies (B2B) and one delivered food to homes (B2C). Out of these four companies' total fleets, only 3 of the 918 vehicles were electric. However, all firms pointed out that it was in their own interest to become more sustainable, and the management teams were all pushing for the use of EFVs. Despite the clear goals and future targets, the firms experienced some uncertainty regarding political willingness to facilitate the transition towards electrification and

wanted to see long-term commitments and clear communications about tax changes, subsidies, and regulations. The main drivers and barriers these Stockholm firms experienced are presented in the table below.

Table 3.3: Drivers and barriers for the adoption of EFVs in Stockholm. Adapted from Melander et al., 2022

Level	Drivers	Barriers
Internal	The firm's own engagements in sustainability Branding Cost reduction Learning opportunities before demand from customers and new regulations	Limitations of charging infrastructure and grid capacity problems Costs Load capacity Limited range of EVs New ways to manage distribution
External	Customer demands and expectations Stakeholders Environment	Limitations in charging infrastructure Problematic to charge outside of premises Few options on the market Alternative sustainable solutions
Governmental	Regulations and laws Taxes and subsidies Environmental zones	Changing political directives

3.2.3 Vehicles with alternative fuels

Electricity is not the only way forward for more environmentally friendly freight transportation. Other alternatives, such as hydrogen and biofuels, are sometimes seen as more convenient since they require little or no change in behavior as they can be implemented in the firm's current operations (Melander et al., 2022).

Biofuels

There are a number of biofuels that have the potential to reduce the demand for fossil fuels, and that are compatible with the existing vehicle fleets and fuel distribution infrastructure according to Mulholland et al. (2018). The production process for these fuels is mature, and all major original equipment manufacturers have heavy-duty vehicles suitable for their use available on the market. Two such biofuels are biodiesel and Hydrotreated Vegetable Oil (HVO). Biodiesel is produced from feedstocks and is commonly used in blends with traditional diesel, often with a blend below

20 % of biodiesel. A blend below 20 % can be used in diesel engines without any modification. Higher blends and pure biodiesel can also be used, but that requires technical modifications to the freight vehicles. HVO, also known as renewable diesel, is produced in a similar way as biodiesel. However, it can be used unblended (called HVO100) without any modifications to heavy-duty diesel engines. Mulholland et al. (2018) say that the main barrier to biofuel adoption is their long-term economic competitiveness compared to oil prices. There is also a different side to the sustainability perspective, where there is only a limited volume of feedstock that can be used for fuel to not compromise food, land, water, and soil resource availability. According to Melander et al. (2022), it has been said that the EU's promotion of biofuels has resulted in significant deforestation, which makes the sustainability of biofuels questionable. Biodiesel and HVO can however also be produced from waste and residue feedstocks, which further reduce their life cycle emissions (International Energy Agency, 2017). Additional benefits of biofuels are security-of-supply since they can be produced from domestically produced crop feedstock and therefore offset the need for imports of petroleum products. That will also support the demand for agricultural crops and the economic development in this area (ibid).

Natural gas and biogas

Natural gas can be used as fuel in engines manufactured to run solely on methane (Mulholland et al., 2018). However, the potential of mitigating greenhouse gas (GHG) emissions by switching from diesel to natural gas is limited to about 20 % (ibid). To further reduce emissions, biogas can be used. Björner Brauer and Khan (2021) explain that biogas is a renewable biofuel that is produced from the anaerobic digestion of organic material, such as sewage water or household waste. In its upgraded form of biomethane, it has the same properties as natural gas and therefore works as a substitute. Biogas exists on the market in both compressed and liquid form and is mainly used in buses and to some extent in private cars today. There are technologies on the market to introduce these fuels in freight transport, but it has not been done to a large extent yet (ibid).

Fuel cell electric vehicles

Fuel Cell Electric Vehicles (FCEVs) are vehicles that run on hydrogen. In comparison with electrical vehicles, they have a shorter charging time and high autonomy, meaning they can run approximately 600–700 km without recharging compared to around 150 km for electrical vehicles (Ranieri et al., 2018). FCEVs have a great potential to decrease carbon emissions in freight transport, however, the reduction depends heavily on the carbon intensity of the hydrogen production (International Energy Agency, 2017). In FCEVs, hydrogen is stored in a pressurized tank and the vehicle is equipped with a fuel cell for onboard power generation. Hydrogen is therefore an alternative to batteries when it comes to energy storage. Hydrogen has a much higher energy density than batteries in relation to its volume and weight (ibid). FCEVs are hybrids, as energy from braking is recaptured and stored in a battery. That way, benefits from both technologies can be utilized.

The fueling network infrastructure for hydrogen is even less developed than for electrical vehicles (Ranieri et al., 2018). The time to start up new hydrogen refueling stations is also considerable, taking approximately two years (International Energy Agency, 2017). Both the refueling process and the storage of hydrogen are complex and must be done according to standards and protocols. The adoption of hydrogen in the freight market is relatively new, and pilot projects on medium- and heavy-duty vehicles have been conducted since 2015. High costs of both fuel cells and the storage of hydrogen are hindering the adoption of the technology, although technical development is expected to bring down the price in the coming years (ibid).

The use of alternative fuels in Sweden

In Sweden, biofuels accounted for around 22 % of all fuels used for road transport in 2021 (Swedish Energy Agency, 2023). Out of the biofuels, 83 % was biodiesel, 6 % ethanol, and 11 % biogas (ibid). However, the same trend cannot be seen in freight transport. In 2020, around 95 % of all heavy trucks and 90 % of lighter trucks in Sweden were diesel trucks (Björner Brauer and Khan, 2021). Out of the newly registered trucks in 2019, only around 5 % were gas driven and 1.8 % electric (ibid).

From a case study in Sweden, Björner Brauer and Khan (2021) concluded that Swedish transport companies, transport purchasers, and vehicle manufacturers were positive about biogas as a fuel in the freight transport sector and that they believe that the adoption will increase. However, the conditions for this to happen must be right, and there are obstacles that must be overcome. Such obstacles are both connected to fueling infrastructure, high investment costs, low trade-in value, higher costs for service and maintenance, and volatile fuel prices (ibid). Regulations and policies were identified as having a major impact on the transport companies' operations and their ability to transition to renewable fuels according to Björner Brauer and Khan (2021).

3.2.4 Autonomous vehicles

Autonomous vehicles are considered to be one of the most attractive technologies for the future of transportation, according to Ranieri et al. (2018). Many companies are investing in this technology to be used specifically for freight transport. However, both semi- and fully autonomous vehicles are still in the testing phase today. There are many potential benefits of automated trucks. Case studies from the US and the Netherlands have shown that 60–80 % of the total cost of delivery comes from labor costs, which means that autonomous vehicles have very big cost-reducing potential (Polydoropoulou et al., 2022). Since there is no driver, there are no regulations on maximum driving hours to consider, and the truck can even drive during the night which leads to better utilization of highway infrastructure and reduces congestion during the daytime (International Energy Agency, 2017).

According to the International Energy Agency (2017), autonomous vehicles have been demonstrated to be technically viable in the near future on highways, where the driving

environment is relatively stable and predictable. However, introducing vehicle autonomy in urban areas is a lot more complex than on highways. There is also an issue with vehicle and software certification, liability, security, and privacy that must be addressed, as well as social concerns such as that the profession of a truck driver will be eliminated (ibid).

3.2.5 Connected vehicles

Connected vehicles, or "intelligent vehicles", is an emerging concept where technology will be used to create an intelligent transportation system. A connected vehicle can be defined as the presence of devices that connect devices within the vehicle with devices, networks, and services outside the vehicle (Jadaan et al., 2017). This wireless connectivity can be vehicle-to-vehicle or vehicle-to-infrastructure. There are two approaches to the future of connected vehicles; the fully automated approach where autonomous vehicles utilize connectivity to drive themselves, and the manual approach where vehicles are still driven manually but utilize continuous real-time connectivity amongst other vehicles and infrastructure (ibid).

Connected vehicles have the potential to increase capacity and safety on roads through radars and sensors that can maintain a consistent gap to the vehicle in front and detect and avoid hazards, says Jadaan et al. (2017). This can improve the capacity of the existing transportation network. Drivers can get real-time information on the traffic situation, and the system can also help the driver make more environmentally friendly choices. The collected data can be used by stakeholders, e.g., the local government who can analyze road use patterns and plan maintenance work and future improvements accordingly. When transportation is made by connected vehicles it could be possible for the city to control transportation through geofencing. Geofencing could set requirements for a specific geographical area so for example a hybrid vehicle switches to electric mode when entering an environmental zone (Stockholm Stad, 2018). There are also challenges with connected vehicles, especially when it comes to the privacy and security of data, the cost of deploying the system, and governance and ownership of data (Jadaan et al., 2017).

3.2.6 A combination of technologies

As discussed, there are a lot of possible vehicle technologies that can be used in a delivery fleet. There is no need to limit the fleet to just one technology, it can rather be an advantage to mix different technologies according to Lebeau et al. (2015a). Through a case study of an urban distribution center, based on a vehicle routing problem, the authors have identified the optimal solution by composing a fleet with the lowest total cost. The result showed that a fleet with a mix of technologies reduced the cost of distribution. Electric vehicles were shown to be the most competitive technology in the segment of quadricycles and small vans, while diesel remained the most financially viable solution for large vans. Hybrid vehicles were the most competitive in the segment of trucks since they have lower running costs and fixed costs than diesel trucks.

Andersson and Börjesson (2021) found through a life cycle assessment that the lowest GHG impact for vehicles is reached when combining electrification and renewable fuels. According to their research, both HEVs and PHEVs reach lower life cycle CO2 emissions than BEVs when fueled by either one of the biofuels ethanol (E85, 85 % ethanol, and 15 % gasoline) or biodiesel (HVO). The same results were not evident when fueling HEVs and PHEVs with gasoline, then BEVs had lower life cycle emissions. The research done by Andersson and Börjesson (2021) also made it clear that the life cycle emissions of battery-powered vehicles, PHEVs, and BEVs, were strongly influenced by the electricity mix used to charge the batteries.

3.3 Technologies and urban logistics concepts

Not only innovative vehicles but also other technological solutions could improve sustainability and efficiency in urban last mile distribution. To generalize, innovative vehicles do not change the number of driven truck kilometers in the city, but they minimize the negative impacts these kilometers cause. Other technological solutions, such as information and communication technologies (ICT), can reduce the number of kilometers driven in urban areas and decrease the negative impacts that way (Quak, 2012). Such solutions and concepts will be discussed in this chapter.

3.3.1 Collaborative networks

Through collaborations between businesses, LSPs, citizens, and the public sector, the existing infrastructure can be utilized in the best way and externalities can be minimized. Multiple stakeholders can increase their efficiency by sharing resources such as vehicles, cargo consolidation or distribution centers, and last-mile delivery services (Cleophas et al., 2018). Through freight carriers cooperating by consolidating goods, the efficiency of the distribution can be increased while the negative environmental impacts are reduced (Taniguchi, 2014). However, collaboration is challenging since it requires additional efforts of planning and control (Cleophas et al., 2018).

Today, freight carriers experience a need to improve profitability, but it is difficult for them to further reduce operational costs. Collaboration is a possible solution to this problem, according to Wang and Kopfer (2014). There are several collaborative concepts aiming to increase the efficiency of urban goods distribution. One such concept is joint delivery systems where freight carriers cooperate to jointly deliver goods to customers (Taniguchi, 2014). In a network collaboration, carriers work together to bundle their shipments in order to reach a higher drop density and load factor in urban areas. Only a few, big carriers are large enough to be able to create their own network covering an entire country according to Quak (2012). Smaller carriers need to create a network with other carriers, and this can be done with or without a central hub. Without a central hub, shipments must be directly exchanged between partners in the network.

This type of coalition requires strategic, tactical, and operational decisions from the partner companies, according to Clophas et al. (2018). Strategically, they must decide what companies to partner up with. Tactically, they need to agree on how to share costs and benefits. Operationally, they must decide how to split the shipments between them. Clophas et al. (2018) also present some challenges with collaborative networks. They state that there is a risk that problems will occur if the coalition turns into "co-opetition" if the partner companies are competitors in one market and cooperate in another. If so, the partners do not want to be fully transparent and share all information. The splitting of shipments becomes a challenge if not all partners are willing to pool all requests. Also, no individual player will accept a result that is less profitable than what they could achieve on their own. The dilemma is then that these types of collaborations should be more profitable than the individual companies could be on their own, while at the same time having less information to base decisions on (Clophas et al., 2018). Another dilemma is that there could be concerns about the responsibility of transportation if the goods are damaged or the vehicles are delayed, and the delivery times could become less flexible (Taniguchi, 2014).

There are many examples of these types of collaborative networks in the Netherlands, where carriers work together on all less-than-truckload deliveries. These networks have shown positive results on both sustainability and efficiency, according to Quak (2012). One of them, called Distri-XL, saw a kilometer reduction of 11 % and an increase in volume for all partners of 25 %, and others have seen similar results (ibid). The higher load factor means that fewer vehicles enter the cities, which results in lower emissions, better air quality, less noise nuisance, and better traffic safety. Other environmental benefits from collaboration between shippers can be seen due to the increased possibility of backhauling, states the International Energy Agency (2017). Backhauling refers to the practice of delivering cargo on return trips. This leads to improved vehicle utilization and a reduced need for other trips.

Collaborative transport planning (CTP) is a tool that can be used to improve the operational efficiency of members in a collaborative network. Wang and Kopfer (2014) describe that CTP allows the members to keep their sensitive information about customer payments and cost structures unexposed, while at the same time improving the planning situation. The goal of CTP is to reallocate requests among carriers and create routes so that the total fulfillment costs are smaller than the sum of the carrier's individual costs without collaboration. The joint benefit will then be shared by the members in a way that all carriers will improve their profitability (ibid).

Digital freight matching

Digital freight matching can be described as taking collaborative networks one step further and revolutionizing the function of LSPs and 3PLs. In digital freight matching, online platforms and mobile apps are used to match cargo and vehicles, thereby reducing shipment costs and increasing shipment efficiency (International Energy Agency, 2017). In recent years, many new market entrants have developed software and services to take this business model to market. Analogies

are often made to how Uber revolutionized urban passenger transport, however, it is clear that the same homogenous service offering is not feasible for the transportation of goods. International Energy Agency (2017) states that the relationship between shipper and carrier must be well established and based on trust and reputation, and knowledge of product-specific supply chains is accumulated over time. There is also a great heterogeneity in cargo types and requirements, such as maintaining a cold chain. Road freight also requires trained and certified drivers, who are prohibited from driving more than a certain number of hours each day (International Energy Agency, 2017).

3.3.2 Urban consolidation centers

Browne et al. (2007) describe that the key purpose of an Urban Consolidation Center (UCC) is to avoid the need for goods vehicles to deliver part loads into urban areas. This can be done by providing facilities in, or close to, the urban area where deliveries can be consolidated and loaded on more appropriate vehicles with a higher level of load utilization. The function of a UCC is portrayed in Figure 3.3. Other value-adding services can also be provided at UCCs, such as pre-retailing operations (Browne et al., 2007). The benefits of using UCCs are that logistic costs, environmental and social impact can be reduced (Taniguchi, 2014). Moreover, the ones receiving goods from a UCC get the benefits of better delivery reliability, and they will be spending less time on receiving deliveries due to fewer but larger deliveries (Browne et al., 2011; Browne et al., 2007). However, the disadvantages of UCCs include loss of direct contact between the supplier and customer and concerns about responsibility in case of loss or damage of the goods during the final delivery made by the third party (Browne et al., 2007).

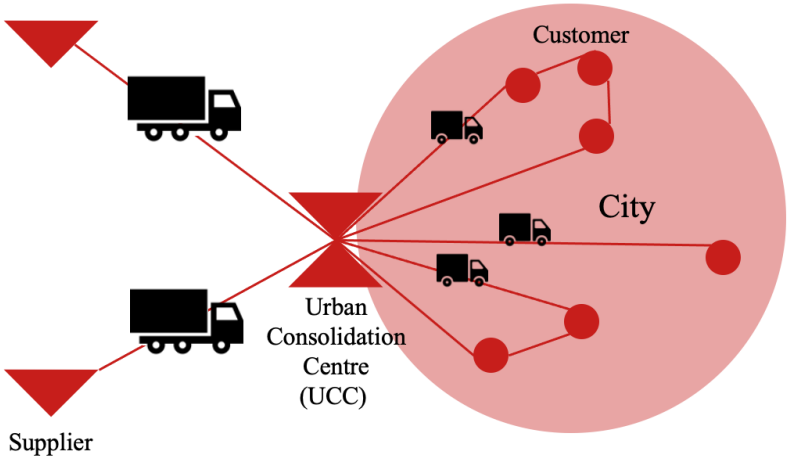


Figure 3.3: Urban Consolidation Centre. Adapted from: Quak, 2008

The location of the UCC is important to consider, according to Browne et al. (2007). If it is not located in direct proximity to the urban area, it could also be used to effectively serve customers outside of the city. Browne et al. (2007) state that the area must also be able to support increased

traffic from both inbound and outbound goods movement. The UCC should also be able to handle return loads efficiently, such as unsold goods, waste, and damaged materials.

Lessons learned from existing and attempted UCCs have been collected by Browne et al. (2007). Due to challenges in data collection and analysis, and the fact that one solution does not fit all urban areas in the world, it is hard to evaluate the effects of UCCs. However, case studies have been made, where one showed that UCCs led to a 61 % reduction in the number of trucks doing the same work (ibid). Browne et al. (2007) found that local authorities have a big impact on whether the concept of UCCs will be successful or not. The authors state that this is because the process leading to the establishment of a UCC requires many parties to be involved, both from the private and public sectors. Local authorities should promote UCC-friendly urban policies, aid with funding, and bring together parties with an interest in UCCs. The early success of a UCC is unlikely and the operation needs to be continuously adapted to meet the needs of all clients (ibid). Initial funding could therefore be crucial for a new establishment to be possible. However, Browne et al. (2007) conclude that UCCs must be financially viable on their own in the long run, they cannot be dependent on subsidies.

3.3.3 Urban micro-consolidation centers

Urban Micro-Consolidation Centers (UMCs) are another concept that Arrieta-Prieto et al. (2021) defined as on-street or off-street spaces where deliveries are dropped and reconsolidated to be delivered by more sustainable last-leg modes such as bikes or light electric vans. Their purpose is to mitigate negative externalities such as pollution and congestion. They do not require a specific physical infrastructure, as their sole purpose is to provide an area for delivery trucks to unload their goods, reconsolidate them, and transfer them into more sustainable modes of delivery (ibid). UMCs can thus be said to be a simpler, less structured concept of a UCC, see Figure 3.4.

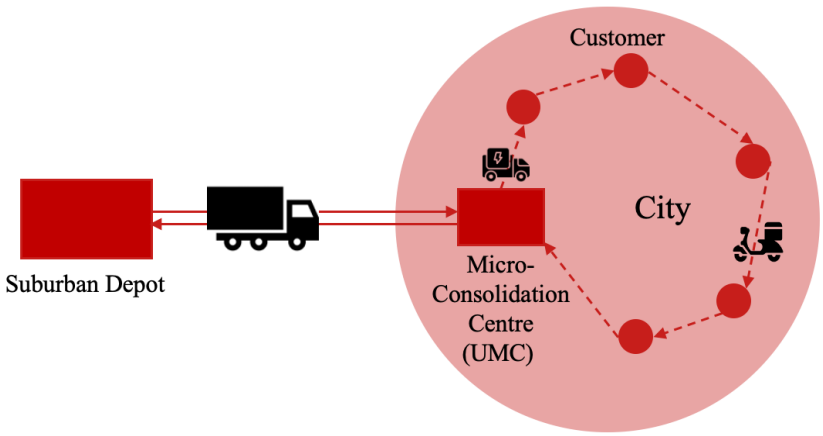


Figure 3.4: Urban Micro-Consolidation Centre. Adapted from: Browne et al., 2011

Arrieta-Prieto et al. (2021) conclude that there is a clear potential for UMCs to increase the sustainability of urban logistics, based on a case in Manhattan, New York. Other successful

implementations have been observed in Paris and in London. The concept has also been tested in other European cities but under different names, such as “micro-hubs” and “micro depots” in Hamburg and Frankfurt. In Frankfurt, the UMC was estimated to decrease annual carbon dioxide (CO2) emissions by 25.5 metric tons in 300 operating days (ibid). In Hamburg, four UMCs have been estimated to reduce vehicle usage by 18 000–24 000 km per year (ibid).

The Freight bus and Delivery van

Dell’ Amico and Hadjidimitriou (2012) present an EU project called CityLog where a type of UMC was tested in three cities in 2012. The project suggests using an Eurocargo truck (called Freight bus) and a small van (called Delivery van) to deliver goods in urban areas. The idea is that the Freight bus should be loaded at the depot with three load units (LUs) that can carry generic parcels, and then these load units can replace the body of a Delivery van. The LUs can be moved from the bus to the van and attached to the van with twist locks. The Freight buses transport the LUs to an intermediate transshipment area close to the inner city, where the LUs can be stored until a Delivery van arrives and loads one. The Delivery vans are small vehicles, possibly fully electric, and are suitable for deliveries in inner cities. By using a high-capacity truck to and from the border of the city, and smaller vans to ensure final delivery inside the city center, congestion and pollutant emissions can be reduced for urban freight transport (Quak et al., 2012). For the solution to be financially viable, the transshipment operation cannot require too much time and handling. The reduction of miles traveled is visualized in Figure 3.5 below, where the traditional urban logistics system is portrayed on the left and the CityLog system on the right.

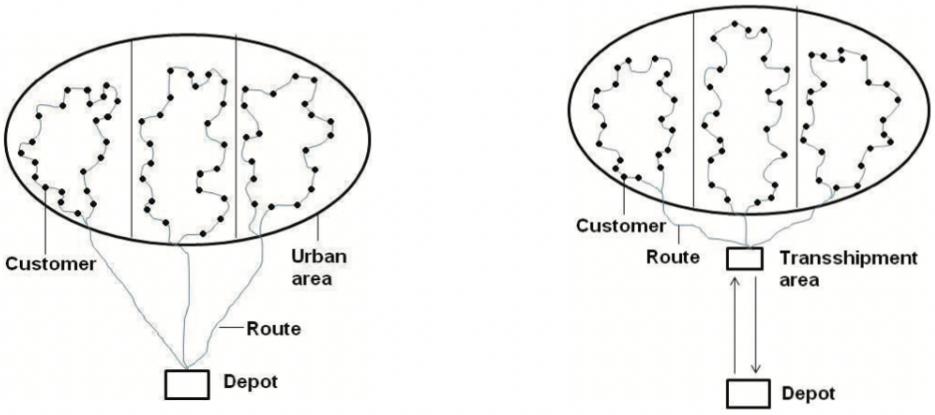


Figure 3.5: Traditional vs. innovative urban logistics system. Source: Dell’ Amico and Hadjidimitriou, 2012

For this setup to work, Dell’ Amico and Hadjidimitriou (2012) state that it must be possible to find space at a reasonable price in order to create a transshipment area. The vehicle fleet must also be completely renewed in order to make this modular way of delivering work. Although the CityLog pilots showed a positive impact on operational efficiency and externalities, it was clear that the

value proposition toward the customer was not directly improved (Quak et al., 2012). That means that the revenue streams are not expected to compensate for the increased cost of the investment.

Quak et al. (2012) conclude that the challenge in city logistics is not to find operationally or technically feasible solutions, it is to find financially viable solutions. They state that for investments in new solutions to be viable, it requires finding incentives for stakeholders that are not strictly financial.

3.3.4 Information and communication technologies

"Smart logistics" and "intelligent logistics" are terms that have grown in recent years, and the meaning is essentially technology-based logistics (Kolasinska-Morawska et al., 2022). It refers to the automation of logistics processes through innovative solutions regarding the use of technology. Kolasinska-Morawska et al. (2022) explain that the strategy is to use Internet of Things (IoT) to enable collaboration and reduce time and costs at the same time as customer satisfaction is increased. Building a network of connections within the supply chain using AI and integrated logistics systems leads to increased collaboration. Another term that often is used is "e-logistics", where the core is the Internet, IT systems, and computer networks where virtual resource planning and coordination are used for automation and improvement (ibid). All of these concepts come together in the concept of the "smart city", which is an emerging idea where information and communication technologies (ICT), Industry 4.0, and new mobility systems and services together will facilitate efficient and sustainable use of resources (Ranieri et al., 2018).

Demir and Syntetos (2022) state that digitalization, automation, and robotic systems will aid in creating a more efficient last mile operation. They declare that information sharing in real-time and IoT can be used to optimize last mile deliveries, and AI can be used to create optimal vehicle routes and schedules. Also, Gevaers et al. (2009) highlight the importance of ICT when it comes to optimal routing and real-time information sharing. Ranieri et al. (2018) explain that ICT and Industry 4.0 can be applied to infrastructure as well as vehicles, which allows for a different approach to mobility. The use of ICT and Industry 4.0 allows municipal authorities to manage traffic systems in real-time and can also be used to reduce externalities. Many cities use time windows to reduce externalities, by allowing vehicles to enter the city only during specific hours. Urban pricing areas and mobility credits are other ways for cities to reduce the number of vehicles in the city center or in a specific zone. The cost can be dependent on daily access, every crossing into the restricted area, or related to the distance traveled in the restricted area (ibid). The use of geographic information systems in combination with real-time routing data is estimated to enable time and fuel savings between 5–10 % inside cities (International Energy Agency, 2017).

ICT is a powerful tool, especially as it can be used to collect and elaborate on data in a smart way through IoT and big data tools. To be able to access data, it is necessary to have sensors installed in the systems (Ranieri et al., 2018). In recent years, sensors have become very cheap which

facilitates the collection of data. Sensors can be applied to several data collection points, such as fuel consumption or the temperature of the goods. All this data can be used to optimize environmental, economic, and social performance. Together with algorithms, the data can be processed in real-time and enable dynamic route planning and fleet management (ibid).

3.3.5 Off-peak deliveries

Off-peak deliveries are deliveries that are made during times when there is little traffic on the roads, such as during the night. A project in Sweden was conducted to investigate off-peak deliveries during the night to a restaurant in Stockholm. The results showed a time saving of 30 % for the transporter compared to making the delivery during rush hours, while the receiver (i.e., the customer) and the seller of the goods had almost no efficiency gains (Andersson, 2022). The receivers would then be required to have staff ready to receive the delivery during the off-peak hours (Holguín-Veras et al., 2005). However, off-peak deliveries could also be made to an unmanned receiver, but in order for it to work there needs to be a contract between the carrier and the receiver stating the terms of delivery (Andersson, 2022).

Two conditions are needed for off-peak deliveries to be successful, according to Holguín-Veras et al. (2005). These are that both the shippers and receivers must get benefits from the participation and that the carrier company needs to have economies of scale in their off-peak operations. The receivers are the ones being served by the carriers and their interests are therefore the primary focus of any off-peak delivery initiative. If the customer does not want to get off-peak deliveries, these cannot be made by the carriers. The willingness of receivers to get off-peak deliveries is therefore crucial for an off-peak delivery program to be successful. There also needs to be a considerable number of customers requesting off-peak deliveries from the supplier (ibid).

The viability of off-peak delivery projects and benefits for the stakeholders are related to the impacts on transport efficiency, which includes fuel consumption, driving time, and delivery reliability. Generally, Stockholm has heavy congestion during the morning and afternoon peak hours, which Fu and Jenelius (2018) found when analyzing the driving speed in the inner city of Stockholm, visualized in Figure 3.6.

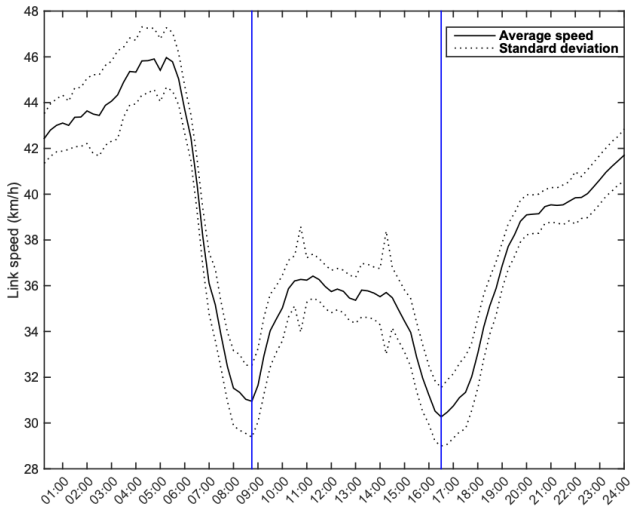


Figure 3.6: The average driving speed (km/h) in the inner city of Stockholm during the day. Source: Fu and Jenelius, 2018

An off-peak goods delivery project in the City of Stockholm showed that both the driving efficiency and reliability as well as the energy efficiency in general improved for night-time deliveries (Fu and Jenelius, 2018). Also, the driving speed was shown to be 31 % higher compared to driving the same delivery route in the morning peak (ibid). However, there are some regulations for heavy vehicles in Stockholm hindering off-peak deliveries due to the risk of being noisy and disturbing the sleeping residents (Andersson, 2022).

3.3.6 Acceptance of new technologies

As discussed, there are many new concepts and technologies in last mile delivery and vehicle automation that are expected to bring many benefits to urban areas. However, their success is strongly dependent on public acceptance and willingness to use these new technologies in their delivery experience. Public acceptance is often low of a new technology at an early stage since the public has not yet had the time to form an opinion about it (Polydoropoulou et al., 2022). New technological solutions that require many changes across the whole supply chain are also typically regarded with skepticism by all stakeholders (ibid).

Technological innovations are generally ahead of social and political change, according to Demir and Syntetos (2022). They state that for most technological innovations, there are regulatory barriers and negative public perceptions of change for five to ten years after the technology is in place. Mathematical modeling and optimization are often needed as evidence before implementation and can help promote technologies by providing quantitative justification (ibid). Also, information sharing has the potential to increase the awareness and receptivity of innovations (Polydoropoulou et al., 2022).

Ploos van Amstel and Balm (2016) have identified seven conditions that must be fulfilled for initiatives regarding innovative vehicles and logistics concepts to be successful:

1. The logistics concepts must be based on the logistics demands of the shippers.
2. LSPs must be willing and able to switch to the new initiative.
3. The recipients of the goods must be aware and accepting of the new initiative.
4. The technical requirements must be fulfilled, such as capacity, temperature requirements, range, and cost.
5. There must be supporting infrastructure, such as charging stations, transshipment facilities, and roads.
6. There must be a supporting ICT backbone, facilitating data sharing and planning.
7. Local authorities must facilitate, coordinate, stimulate, and regulate the development of new logistics concepts.

3.4 Customer demands of last mile delivery

When it comes to delivering goods, every stage of the logistics process is important. However, many argue that last mile delivery is the most important step with regard to the customer experience (Lal and Narayanswamy, 2022). Lal and Narayanswamy (2022) state that the evolving market demand has resulted in a need for more effective delivery service and there are many factors that customers look for in last mile delivery. These factors include speed, timeliness, accuracy, and precision of deliveries. Increasing consumer demands have led to expectations of the same or next-day deliveries in B2C, and the expectations on the B2B side are also rising with buyers expecting the same experience as they are used to as consumers (ibid). According to Slabinac (2015), customers typically look to minimize their costs and maximize their gains when it comes to deliveries. Since the vulnerability of supply chains was made visible during the pandemic, Demir and Syntetos (2022) have found that reliable deliveries have become an increasing focus for customers.

In a survey performed by Quak et al. (2016), customers said that they see “green delivery” as one of the factors they assess when choosing a delivery company, and they generally have a positive attitude towards deliveries with electric freight vehicles. However, only about 25 % of the customers said that they were willing to pay extra for having their goods delivered by an electric vehicle (ibid). Quak et al. (2016) found that although customers care about the environment, the most important factors for them are still price and on-time deliveries.

Slabinac (2015) states that the obtained customer service level directly influences the efficiency, cost, and environmental impact of last mile deliveries. This is because the customer service level is related to delivery time windows, maximum lead times, and frequency of delivery (Slabinac, 2015). Looking specifically at the food supply chain, businesses belonging to the hotel, restaurants, and catering sector require delivery of goods within specific time windows, and they are increasingly demanding fixed delivery times and just-in-time services (Fancello et al., 2017).

3.4.1 Costs related to customer demands

Gevaers et al. (2009) declare that it is common for deliveries to be subject to time windows, which makes the routing process very inefficient. This, in turn, means a rise in driven kilometers and costs, since a so-called "ping-pong" effect can appear when the routes must be built with regards to delivery times instead of optimized based on distance. Boyer et al. (2009) have studied this dilemma from a cost perspective and found that the length of time windows has a statistically significant and substantial effect on route efficiency and cost. Their results show that offering a 3-hour window increases the delivery cost by 45 % compared to offering no window at all, and offering a 1.5-hour window increases the delivery cost by an additional 13 % (ibid). To offer no time window means that the delivery can be made at any time during the day. This is a dilemma for delivery companies since research also shows that offering shorter time windows is a powerful incitement to attracting customers (ibid).

Boyer et al. (2009) also found that the cost per delivery has a direct connection to the customer density in the delivery area. Since the cost decreases with increasing customer density, a company could lower the delivery time window without increasing the costs if the customer density increases. Boyer et al. (2009) describe that companies could offer incentives for their customers to concentrate the deliveries by day of the week and area in order to shape the demand curve and be able to lower the delivery cost. The incentives could be either time-based, e.g., by providing a tighter delivery window on certain days, or financial, e.g., offering a discount for deliveries on certain days. Furthermore, different customer segments can have different logistic desires and customizing logistic programs accordingly would improve efficiency and effectiveness (Mentzer et al., 2001).

3.4.2 Customer relationship

Mentzer et al. (2001) describe that logistics excellence can be seen as a company's source of competitive advantage, where customer satisfaction can be created through the quality of a company's logistics service performance. Mentzer et al. (2001) state that there are three vital components of a customer's perception of the logistics service quality, and these are timeliness, quality, and availability. Interactions between the people who are handling and delivering orders and the customer could impact what they think about the overall logistics services (ibid). Bode et al. (2011) describe that the customers' only face-to-face interaction with the supplier might be through the delivery workers. Therefore, the behavior of the delivery personnel could influence how satisfied the customer is with the supplier firm based on service quality (ibid). Usually, the delivery process starts with the arrival of the truck driver at the agreed time at the customer's facility. Then the truck driver helps to unload the freight, processes the receipts, and then leaves to the next client. The delivery person thus gets to interact directly with one or several employees at the customer's firm. The customer's satisfaction with the service delivery goes beyond the technical aspects and depends on the actions and qualities of the service employee (ibid).

Bode et al. (2011) researched how the customers' purchase behavior could be influenced by the delivery personnel delivering B2B. They found a favorable relationship between sales and personal contact quality. The size of the customer firm also matters since larger firms have an incoming goods department where the employees are not part of the purchasing decisions. Bode et al. (2011) found that the personal contact quality was larger for smaller firms, where decision-makers could notice the service of the delivery person and were likely to take this into account when making decisions about the purchase. Furthermore, the delivery person is especially important at the beginning of a customer-supplier relationship and if a customer frequently interacts with the same delivery person, they could expect certain behavior from the delivery person when delivering the goods (ibid). The customer can also get used to a certain quality level of personal contact. Bode et al. (2011) further mean that this could be a risk for the supplier company as the customer's purchase behavior may be adversely affected by a driver's failure to deliver as usual.

These aspects should be taken into consideration when deciding whether to outsource parts of the physical distribution services. Bode et al. (2011) state that industrial firms are increasingly relying on LSPs to both improve service levels and reduce costs while the firm itself focuses on its core competencies. The LSPs can generally offer both better service quality and lower costs because of economies of scale, but the outsourcing decision also needs to include the crucial part of people in the physical distribution services (ibid). Bode et al. (2011) mean that the direct interaction between the customer and the supplier's employees is crucial for fostering a long-lasting relationship and thus generating robust sales. Having an LSP taking over the service encounter, it is not sure that the customer will relate the positive interaction back to the supplier (ibid).

3.5 Externalities

Globalization and the rise of online sales have led to exponential growth in transport, according to Ranieri et al. (2018). The number of delivery vehicles is expected to increase by 36 % from 2019 to 2030 (Ha et al., 2021). Most of the goods are delivered to urban areas, which causes many problems for citizens in these areas. The transport sector is one of the main causes of external costs, and externalities, which means that the negative impact the transport sector has on the citizens is not fully accounted for or compensated for by the transport sector (Ranieri et al., 2018). Examples of externalities are air pollution, noise pollution, climate change, congestion, accidents, and infrastructure wear and tear (ibid).

Urban last mile delivery is characterized by uncertain and dynamic conditions where conflicting interests of actors such as city councils, citizens, carriers, and suppliers are common (Bosona, 2020). Due to the dynamic nature of the urban environment and economic activities, increasing the sustainability of these transports is not easy. The fact that every city is different is also a challenge since there is no "one size fits all" solution that can be replicated everywhere (ibid). When it comes to last mile delivery, even a small reduction in emissions per distribution round

leads to a large reduction in the long run, since the deliveries are repeated every day (Dell' Amico and Hadjidimitriou, 2012).

3.5.1 Different types of externalities

There are different types of externalities linked to urban last mile delivery which will be further described below.

Air pollution

The impacts that air pollutant emissions have on humans and the ecosystem are determined by evaluating human health diseases and environmental damages in relation to the concentration of pollutants. Examples of illnesses that can be caused by air pollutants are allergies, respiratory diseases, and cardiovascular diseases. Studies have shown that the most important air pollutants in urban areas are Particulate Matter (PM), Nitrogen Oxides (NOx), Carbon Monoxide (CO), aliphatic and aromatic hydrocarbons, Sulfur Dioxide (SO2), and heavy metal (Ranieri et al., 2018). City logistics is responsible for 30–50 % of the transport-related air pollution of particles in Europe (Ploos van Amstel and Balm, 2016).

Noise pollution

Noise pollution is a big problem in residential areas and studies show that issues such as sleep disorders, discomfort, and hypertension are caused by noise pollution (Ranieri et al., 2018). Noise pollution can be caused by a high number of vehicles in circulation in these areas, and by conventional engines (ibid). City logistics is responsible for a large amount of ambient noise in cities, which inconveniences both residents and workers in the city (Ploos van Amstel and Balm, 2016).

Climate change

The main cause of climate change is emissions of GHG into the atmosphere. On a global level, the transport sector is responsible for about 20–25 % of GHG emissions – and the emissions are expected to grow rather than decrease (Ranieri et al., 2018). City logistics is responsible for 25 % of transport-related CO2 emissions (Ploos van Amstel and Balm, 2016). According to Ha et al. (2021), emissions of CO2 are expected to increase by 32 % from 2019 to 2030.

Congestion

A higher number of vehicles in the city causes congestion which further leads to an increase in driving time. This in turn leads to higher fuel consumption and also causes lower public transportation efficiency and delays (Ranieri et al., 2018). The average commute time is expected to increase by 21 % in cities from 2019 to 2030 (Ha et al., 2021). The decrease in mobility leads to lower accessibility and therefore lower attractiveness of urban areas (Melo et al., 2014). Congestion also leads to lower fuel efficiency and higher emissions (ibid).

Accidents

Another externality caused by more vehicles in the city is accidents. Accidents can cause reduced health conditions or loss of human life. This has a big economic impact on both the individual and the society, with increased medical and material costs, loss of income, and increased expenses (Ranieri et al., 2018). Even though there are fewer freight vehicles compared to other types of vehicles on the roads, they are relatively more often involved in accidents with pedestrians and bicyclists (Ploos van Amstel and Balm, 2016).

Infrastructure wear and tear

The increased trip frequency and number of vehicles in circulation in the transport infrastructure leads to infrastructure wear and tear, where the effect is even bigger from heavy vehicles (Ranieri et al., 2018). The need for freight transports to park and transit also leads to greater space occupation in cities. Furthermore, air pollutants do not only cause several illnesses for humans and damage the ecosystem, but they can also influence building surfaces and historical landmarks which can be degraded due to emissions of such pollutants and fine dust (Ranieri et al., 2018).

3.5.2 Costs related to externalities

Transport activities are very important from both economic and social aspects and are strongly connected to economic growth. The freight transport volume trend has followed the evolution of the gross domestic product (GDP) during the last 20 years (Ranieri et al., 2018). However, there are also many negative aspects of transportation. Last mile delivery in urban areas is often fragmented and uncoordinated since shippers often engage different LSPs and carriers for these types of deliveries. This leads to a low load factor of vehicles, a large number of routes, high externalities, and wide system costs (ibid). Last mile logistics is known to be the least efficient stage of the supply chain (ibid), however, there is no consensus in the literature on exactly how inefficient it is. According to Ranieri et al. (2018), last mile logistics account for up to 28 % of the total delivery cost, while Ha et al. (2021) suggest 13–51 % of the total supply chain cost.

Customers typically want companies to be more environmentally friendly, but they have historically not wanted to pay more nor accept longer service times for green deliveries (Gevaers et al., 2009). This has caused companies to make a trade-off between fast deliveries with narrow time windows and the level of environmental friendliness they want to obtain (ibid). However, since the pandemic, the focus has shifted a bit since the vulnerability of supply chains then was made visible (Demir and Syntetos, 2022). Before, the focus for companies was more on cutting costs while bettering customer service. Now, both customers and companies have a rising interest in environmental sustainability in transport, since it has become evident that there is a need to make the best use of the available resources to ensure a sustainable future for all (ibid).

3.5.3 How to reduce externalities

Ploos van Amstel and Balm (2016) state that externalities can be reduced in two ways and preferably in combination; less freight (achieved by efficient city logistics operations) and clean freight (achieved with clean vehicle technology). Demir and Syntetos (2022) suggest that better and more efficient transport planning and vehicle routing is the key to reduced emissions. The main goal of green vehicle routing is to optimize the routes based on fuel consumption. However, there are many factors that influence emissions from vehicles, including age, vehicle occupancy, fuel type, engine temperature, vehicle speed, and load (ibid).

A crucial success factor for city logistics is to find and establish coordination and consolidation opportunities between stakeholders. Freight volume should be consolidated outside the city and moved into the city with cleaner, alternative vehicle technologies (Demir and Syntetos, 2022). Another way to reduce pollutants in cities is to shift to off-hour or night-time deliveries. A complete shift to off-hours has been shown to decrease pollutants by 45–67 % in cities such as New York, Bogota, and Sao Paulo (International Energy Agency, 2017). Fuel and CO2 emission savings can also be seen in the range of 10–15 % (ibid).

The main challenge in reducing externalities is the conflicting objectives in the supply chain network, where the minimization of emissions and costs often does not go hand in hand (Demir and Syntetos, 2022). It is very hard for companies to evaluate the value of investments in solutions to reduce externalities since the benefits of the investment do not have to be connected to increased revenues or profit (Balm et al., 2014). In many cases it is not clear that it is the transport companies that will receive the benefits of the investment, but rather the society at large (ibid).

As discussed before, electric vehicles and vehicles run on alternative fuels have the potential to reduce externalities in terms of air pollution, noise pollution, and GHG emissions. The main reduction can be seen in the use phase since biofuels and electricity often have less climate impact than fossil fuels (Andersson and Börjesson, 2021). However, when comparing different types of vehicles based on their contribution to externalities, it is not only the use phase that is relevant to consider but also the manufacturing of the vehicles. Marmiroli et al. (2020) have performed a comparative life cycle assessment of three types of vehicles: electric, compressed natural gas, and diesel operated to transport goods in an urban environment. The results showed that the electric vehicle performed better than the two internal combustion engine vehicles in four out of the eight categories – the four that are most connected to the use phase of the vehicles. Marmiroli et al. (2020) stated that it was the case even in Italy, where the energy production is dominated by fossil fuels. However, for the other four categories dominated by the production phase, the electric vehicle performed worse. According to Marmiroli et al. (2020), it is the production of batteries that is the main challenge, and it is unclear whether the benefits obtained in the use phase compensate fully for the impact of the batteries.

3.6 Urban freight plans and mobility strategies

Urban freight movement can be made more sustainable either by company-driven change or by change implemented by governing bodies (Anderson et al, 2005). The change driven by the company can come from benefits derived from a more efficient freight operation. Governing bodies on the other hand can implement policies that force companies to change their actions to be more socially and/or environmentally efficient. To be able to develop a sustainable urban freight system there is a need for both initiatives from the company and government policies (ibid).

There are several policy measures that could affect the urban distribution operation such as low emission zones, weight restrictions, time restrictions, and congestion charging (Anderson et al, 2005), see Table 3.3. When introducing a congestion tax some users will choose to use alternative modes of transport or to use the road at another time which minimizes the overall pressure on the road network (Stockholm Stad, 2012).

Table 3.4: Policy measures affecting urban distribution. Adapted from: Anderson et al., 2005

Policy	Purpose
Low emission zones	Permit high-polluting vehicles and encourage the use of modern vehicles to improve the air quality.
Weight restrictions	Prohibit heavy vehicles to make deliveries within a specific geographical area to reduce noise, pollution, vibration and increase the safety of other road users.
Time restrictions	Regulate during what hours deliveries can be made in an area to reduce noise, pollution, vibration and increase the safety of other road users.
Congestion charging	A charge a driver must pay to be able to enter a specific area at a particular time. The goal is to lower the traffic levels on the roads in urban areas and also reduce emissions.

3.6.1 Current transportation regulations in Stockholm

From 2020, it is possible for municipalities in Sweden to implement environmental zones in their municipality with the goal of improving an area's air quality (Transportstyrelsen, 2023a). Transportstyrelsen (2023a) states that there are three environmental zone classifications, where class 1 regulates the operations of heavy trucks and class 2 includes light trucks and passenger cars. The last classification, environmental zone class 3, has the strictest regulations, where only gas, electrical, or fuel cell vehicles are allowed within the zone no matter their weights (ibid).

A congestion tax was introduced in Stockholm in August 2007 after a six-month trial in 2006 (Stockholm Stad, 2012). The trial showed a decline of 18–20 % in average traffic levels due to the congestion tax compared to the same period in 2005. From 2005 to 2012 when Stockholm Stad released the Urban mobility strategy, the average traffic volumes had been more or less stable since the introduction of the congestion tax, even if the population had increased (ibid). A congestion tax is charged at fixed times during the day for driving into and out of the inner city of Stockholm and is also dependent on if it is high or low season (Transportstyrelsen 2023b), see Figure 3.7. There is also a congestion tax for vehicles driving on Essingeleden and there is a cap on how much a vehicle can be charged per day, which is 135 SEK during high season and 105 SEK for low season (ibid).

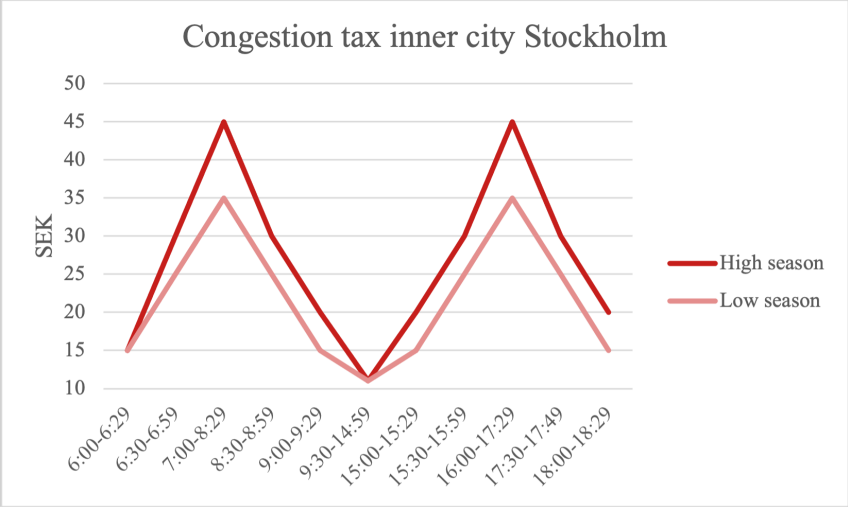


Figure 3.7: Congestion tax in SEK in the inner city of Stockholm. Adapted from: Transportstyrelsen, 2023b

In Gamla Stan, transportation is strictly regulated and all the streets are classified as pedestrian streets which means that vehicles cannot drive faster than walking pace. Stockholm Stad (2022) states that transports made by motor vehicles in Gamla Stan are only allowed between 06:00–11:00 every day of the week and parking is prohibited around the clock. The size of the vehicles is also restricted, and a maximum height of 3.5 meters and a maximum length of 8 meters is allowed (ibid). The municipal board has agreed to introduce an environmental zone class 3 in Gamla Stan and certain other parts of the inner city in 2024 (Heick, 2022). There is already an environmental zone class 1 covering almost the whole inner city of Stockholm, see Figure 3.8. Within the environmental zone, heavy trucks must meet the environmental requirements to be able to operate in the city (Stockholm Stad, 2023).

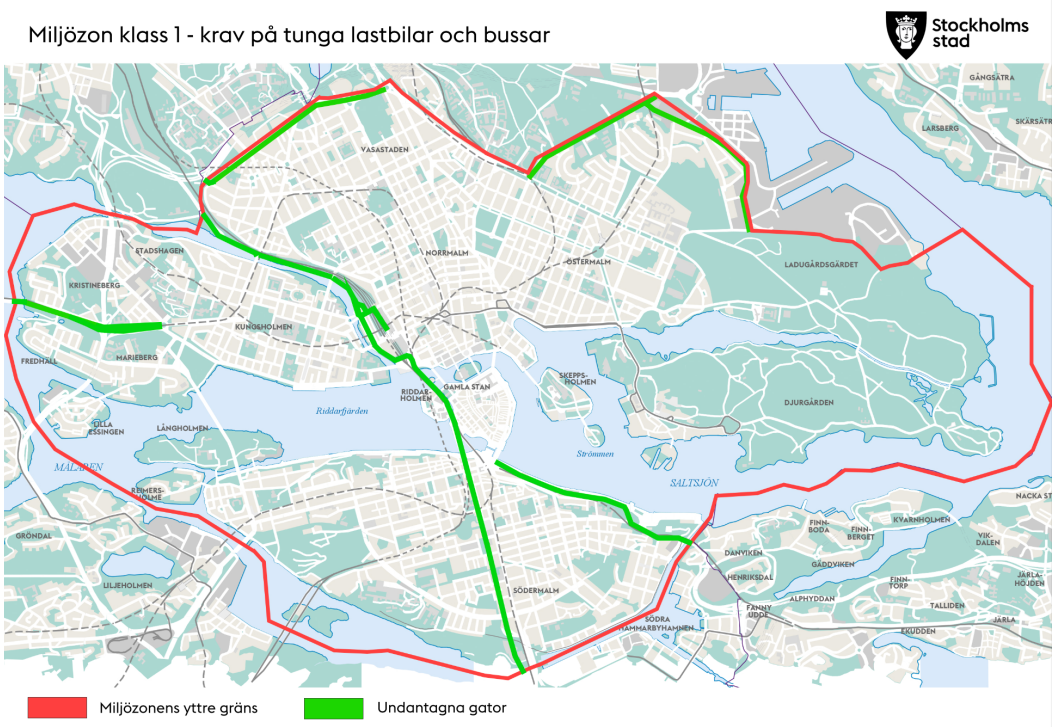


Figure 3.8: The environmental zone of Stockholm Stad. Source: Stockholm Stad, n.d.

3.6.2 Future strategy of Stockholm

Sweden's largest consumer market is the City of Stockholm which had a population of 950 000 inhabitants in 2018 and is estimated to reach about 1.3 million by 2040 (Stockholm Stad, 2018). Freight arrives in the Stockholm region by rail, sea, air, and road, where the last part of the distribution usually is conducted by truck from a freight terminal situated outside the city (ibid). Stockholm Stad (2018) states that the increase in population will put more pressure on the region's infrastructure, especially in the inner city where the majority of the current road infrastructure will remain the same in the future. With more vehicles on the roads, the risk of congestion will increase which reduces urban mobility and further makes freight deliveries more inefficient. Congestion also leads to more noise and poorer air quality. The future of commercial freight transport is therefore in need of innovative ideas and solutions to become more efficient. Furthermore, about a third of the GHG emissions in Sweden are caused by domestic freight deliveries and the transport sector must decrease its emissions by 70 % between 2010 and 2030 to meet the goals set by the Swedish climate policy framework in 2017 (ibid).

By 2040, the City of Stockholm has the goal of becoming fossil fuel-free which calls for more energy-efficient vehicles, renewable energy, and minimization of transportation (Stockholm Stad, 2018). The city's action plan also states that parking charges should be raised and that goods vehicles should have increased capacity utilization. The City of Stockholm has several opportunities to use laws and regulations to affect how freight is transported through the city. The

municipality has the possibility to implement traffic regulations on individual streets or the whole municipality, and can regulate what types of vehicles are allowed and at what hours (Stockholm Stad, 2018).

3.7 Transportation of food

Food products are usually divided into three groups depending on how the product must be stored and transported. The three groups are dry, refrigerated, and frozen. Frozen food products are usually handled separately from dry and refrigerated food products since they need vehicles adapted for keeping the products frozen during transportation. The possibility of coordinating these products is therefore limited and in addition, fresh products require fast deliveries before they deteriorate (Kungl. Ingenjörsvetenskapsakademien, 2019).

The transportation of food accounts for a large portion of the number of transports in Sweden. According to Kungl. Ingenjörsvetenskapsakademien (2019), food products made up 16 % when looking at the number of kilometers driven by trucks within the country in 2017. As much as 95 % of the food transports are made by truck in Sweden due to the food products largely being fresh, refrigerated, or frozen and requiring fast transportation or special vehicles (ibid). The goods can further be transported on standardized pallets called EU-pallets for deliveries of heavier products, such as flour and sugar.

There are two key figures to measure transport efficiency, which are utilization in terms of volume or weight and utilization in terms of time. The utilization in terms of volume or weight can be measured as a percentage of the available loading capacity or maximum weight. The utilization in terms of time is how much the vehicle is used during the available time and can for example be measured by how many hours the truck is actually driving and not being stuck in a queue. There are several challenges with achieving a high utilization in terms of volume or weight such as customers demanding quick and just-in-time deliveries, which leads to smaller deliveries for each shipment. According to Kungl. Ingenjörsvetenskapsakademien (2019), a study in Sweden showed that dry products had a relatively high utilization of volume or weight compared to the transportation of refrigerated and frozen goods.

3.7.1 City food distribution projects

Most of the city logistics projects focus on non-food products due to requirements of cold chain technology, specific handling procedures, short lead times, and legal issues for fresh products. These requirements increase the operational costs of delivery services, making it hard to get the economic viability of city logistics for fresh products (Morganti and Gonzalez-Feliu, 2014).

Fancello et al. (2017) conducted a study of last mile food deliveries for the hotel, restaurants, and catering sector to identify the characteristics of food delivery demand in the city center of Cagliari.

It was found that fresh food deliveries account for a large part of the urban freight transport and these deliveries have high requirements of delivery time and frequency (ibid). The sizes of the deliveries were small and had a high frequency which makes the last food mile delivery system hard to manage. Furthermore, to preserve the food, a cold chain needs to be kept which entails higher costs for the delivery of fresh food (ibid). Morganti and Gonzalez-Feliu (2014) studied the Parma project which implemented an Urban Distribution Center (UDC) dedicated to fresh food products. They found that the degree of consolidation was low for last mile deliveries of fresh products compared to other types of goods. Therefore, they concluded that there is great potential to improve the logistics for fresh products. However, it is hard to implement city logistics projects for fresh products due to their hygiene standards, the need to keep the cold chain, and the lack of free space for refrigerated platforms which all increase the cost of delivery (ibid).

3.7.2 Regulations regarding the transportation of food in Sweden

In Sweden there are laws and regulations addressing for example the handling and distribution of food, which are known as Livsmedelslagen (2006:804) and Livsmedelsförordningen (2006:813) (Rådet för kyl- och fryskedjan, 2021). These laws are based on regulations and directives set by the European Parliament and the Council of Europe (ibid).

The safety and quality of food are affected by physical, chemical, and biochemical changes during the handling, storing, and transportation of refrigerated or frozen food products. The safety of refrigerated foods is also affected by microbial changes. All these changes are dependent on the temperature, where a lower temperature results in slower changes. The changes lead to poorer nutritional quality and food safety. Therefore, the handling, storage, and transportation of refrigerated or frozen food products must be done at a temperature that ensures that they will not pose a health risk (Rådet för kyl- och fryskedjan, 2021). To ensure this, a temperature reserve can be used, which is when the product is cooled or frozen to a lower temperature than required, and is necessary when co-storing, handling, or co-loading when the temperature might rise (ibid). Rådet för kyl- och fryskedjan argues that there needs to be at least a 2 °C temperature reserve for cooled food products during the whole supply chain. The temperature for frozen products is required to be below -18 °C during the whole distribution, handling, storing, and transportation of them. For frozen products, the temperature reserve should therefore be from 2–7 °C, which means that these products should be kept at a temperature between -20 to -25 °C (ibid). There are also strictly legislated temperature requirements for refrigerated foods that are of animal origin which need to be maintained during the whole distribution chain (Rådet för kyl- och fryskedjan, 2021).

4 EMPIRICS

This chapter will present the result of the data collection. It begins by covering general information about the case company and then goes through the supply chain process of the company, including the city distribution process made by the 3PL in Stockholm. The data collected from interviews with customers regarding their demands are presented, and finally, future opportunities and challenges in Stockholm are described. The information has been collected through several interviews with employees from different departments, as well as observations from the warehouse in southern Sweden, from two distribution rounds in the Skåne region, and visits to customers and the distribution center in Stockholm.

4.1 Description of the case company

The Company's main operations in Sweden are located at the headquarters in southern Sweden and a warehouse in central Sweden. In southern Sweden, The Company has both an office, an innovations lab, and a warehouse. The office is where all main functions such as customer service, purchasing, sales and operations planning, marketing, quality, and product development are located. The management team is also working from the headquarters in southern Sweden. The Innovations lab is where recipes and new products are developed. Because of its location in southern Sweden, the warehouse in southern Sweden is where the majority of the goods are received. From the warehouse, goods are distributed directly to the customers in the southern part of Sweden, as well as being shipped to the warehouse in central Sweden. The warehouse in central Sweden also receives goods directly from suppliers and is the hub from which customers in the central and northern parts of Sweden are served. There is also a small office in central Sweden where a warehouse operations team and a small sales team work.

The two central warehouses in southern and central Sweden are supported by two smaller, additional warehouses which are not owned by The Company. The smaller warehouses are needed because the two central warehouses are becoming more and more full, and their utilization is sometimes exceeding the target of 85 %. The smaller warehouses mainly work as safety stocks, where goods are stored and then transported to the central warehouses for picking when needed. Some large customers also order full pallets of goods, which can be stored at the smaller warehouses before being distributed. The additional warehouse in southern Sweden also has the capability of unloading goods delivered in containers, which is not possible at the main warehouse.

The Company does not produce any of its products itself, instead, all the products are purchased from different suppliers and then delivered to one of The Company's warehouses, or in some cases directly to The Company's customers. In the product range, The Company has several products with its own label. These are products that the company has developed together with a supplier. The Company gathers information from their customers about their product needs and wants, and

if they identify a gap in the market, they have the resources to develop this product in-house in collaboration with a supplier.

4.1.1 Strategy

The Company is first and foremost a bakery company and has historically had a narrow focus on this core competency. Other functions, such as logistics and deliveries, have been seen as something that "should just work" – and as long as the goods have reached the customers in a reasonable manner, no changes have been made. This way of thinking has evolved and changed as these other functions around the core business have become of increasing importance to be able to keep and increase market shares. Today, there is a very rapid development when it comes to B2C deliveries, and customer needs and requirements in the B2B setting have evolved along with this development. However, the B2B deliveries have lagged behind, even though customers have become used to better service from their personal purchases. The management team at The Company has therefore identified a need for strategic actions in the distribution process, to keep up with customer requirements and stay competitive in the market.

According to the COO, The Company is too small of a company for it to be reasonable to handle transport operations in-house. The operations become too vulnerable since they have few drivers and vehicles. If there is a disruption, e.g. if a vehicle breaks down or a driver gets sick, the operations can come to a halt which is not reasonable. Therefore, the COO thinks that the transport operations should be handled by external parties who have the resources and expertise to run a supply chain operation effectively. The COO has identified flexibility and accessibility as two main improvement areas, and he believes that outsourcing transportation is the only way to improve them. Stockholm, for example, is a very consolidated market with a lot of transport service providers who are experts in the city. He says that the service providers there have resources and knowledge that The Company can never have, and it would therefore never be financially viable for The Company to run its own transport operations in Stockholm. The same thing cannot be seen clearly in other parts of Sweden, but it is still clear to the COO that outsourcing is the only way forward.

There are also strategic decisions that can be made to change or influence customer behaviors. When the fuel prices skyrocketed in 2022, The Company introduced a variable fuel cost that was added to each order. Previously, the delivery cost had always been included in the price at The Company, but in order to be transparent with the customers regarding the increasing costs they chose to visualize this cost by adding it to the orders separately. In actual money, the difference for the customers was very small. On a single order, the added delivery cost could amount to 149 SEK, while the value of the goods in the order could amount to around 20 000 SEK. However, the visualization of the delivery cost drastically changed customer behavior. Customers who had previously ordered goods 2–3 times per week consolidated their orders to once per week. This was

very beneficial for The Company since each stop in a distribution round is costly. This proved that small strategic decisions can have large financial impacts.

Another strategic question the management team at The Company is looking into is the collection and utilization of data. The COO sees a clear need to exploit the data they have in order to capitalize on it and improve their offerings and operations. Therefore, they have started a new team at The Company which works on transitioning the corporation into making more data-driven decisions. Even though The Company is a bakery company, most of its new hires are engineers since they see that data and digitalization are the future. The COO thinks that the next big step for The Company is to invest in building a transport administration system to capture and utilize all relevant logistics data, even if the transport operation itself is outsourced.

Collaboration and strategic partnerships are other possibilities for The Company to further investigate. Much has happened in recent years when it comes to B2C deliveries, where many transportation and delivery companies have entered the market and have revolutionized the way deliveries are made. Home deliveries of food have also increased in popularity, with different recipe box companies and food stores offering home deliveries. There are delivery companies on the market which have specialized in delivering food, and they mainly deliver during the evenings when people are home from work and ready to receive the goods. The Company, whose customers wish to get deliveries early in the morning, sees a potential partnership here that could be beneficial for both parties.

4.1.2 Customers

The Company has divided its customers into three segments: artisan, industrial, and retail, see Figure 4.1. In general, the artisan bakery customers are smaller bakeries, often family-owned. Industrial customers are customers who in turn produce goods and deliver them to bakeries or grocery stores to be sold. Retail customers are bakeries within grocery stores. The share of sales in SEK between the three customer segments are approximately as follows, according to sales data from 2022:

- Artisan bakery customers: 45 %
- Industrial customers: 30 %
- Retail customers: 25 %

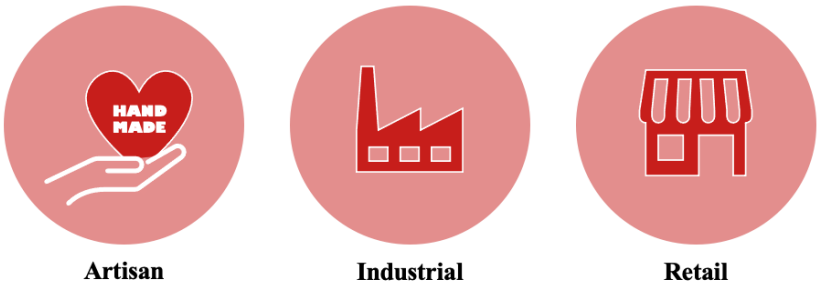


Figure 4.1: Customer segments of The Company

The three customer segments are very different, and thus have different needs and requirements. One difference is how good they are at planning their operations, and thus their orders of goods. Retail stores and industrial customers are generally very good at planning their orders, which means that they are able to place orders a longer time in advance than artisan bakeries can. Artisan bakeries are often family-owned and are sometimes described more as artists than business-minded people, which means that they can lack efficient processes and structures when it comes to ordering goods. The customers' differences and needs are discussed further in section 4.3.

4.1.3 Market and competition

Since The Company has three different customer segments, it can be said that they operate in three markets: bakeries, grocery stores, and industrial food producers. There is an opportunity for The Company to increase its market share in all three of these markets. Especially in urban areas such as Stockholm, there is a big opportunity to acquire new bakery customers since there are so many of them. Out of all bakeries on the Swedish market, around 75 % are artisan bakeries with a turnover under 10 million SEK per year. The bakery market is considered by The Company to be stable even though the external environment is unstable with increased inflation and high electricity prices. The Swedish people have previously been proven to treat themselves with a fika, even during rough times.

There are several competitors on the market offering roughly the same products as The Company to customers in Stockholm. The biggest competitor can make two deliveries a day, six days a week, which makes it hard to compete with their offered delivery times and flexibility. They also offer free deliveries on every order, no matter the size. This competitor is focused on the artisan customers in the Stockholm market and makes deliveries with their own vehicles and drivers. The product range includes products from external suppliers, but also in-house manufactured products with their own brand. Their turnover in 2021 was around 260 million SEK, which can be compared to The Company's turnover of around 1 billion SEK in 2021.

Another competitor, who is a wholesaler to the bakery and confectionary market, has been transitioning to fossil-free fuel for most of their transports. They also have their headquarters and

a warehouse in close proximity to the Stockholm market, however, this competitor is not as established in Stockholm as in the southern parts of Sweden. This competitor used to have the same limit as The Company on the purchase orders for free delivery but has recently increased the purchasing limit by 40 % for the customers to get free delivery. Their turnover in 2021 was around 480 million SEK.

A third competitor is a restaurant wholesaler that has a large market share of the B2B deliveries of ingredients to restaurants. As of today, this competitor does not have any specific competence within the bakery market and is therefore not a direct competitor in the bakery ingredient market. However, most of the bakeries in Stockholm have started to increase their offering of food in addition to bakery goods and are therefore often also receiving deliveries from this competitor. The sales team at The Company has noted that some customers expect to be able to put the delivery late in the evening and get it delivered the morning after since that is how it works at the restaurant wholesalers. Today, The Company has a time limit where orders cannot be changed less than around 24 hours before delivery. This could become a threat in the future if the competitor acquires competence in bakery goods and becomes a new one-stop shop with more flexibility for the bakery customers.

4.1.4 Sustainability

The Company belongs to a big corporate group, which has central sustainability goals and an overall structure for sustainability reporting. The Company collects data and registers this to The Company Group yearly to be included in their sustainability report. Things that are being measured include the usage of water, electricity consumption, and diesel consumption. The Company Group is evaluated on its sustainability work by the organization Sustainable Brand Index and is continuously working towards reducing its climate impact. The Company Group has set up several goals to be reached by 2025, by all of The Company Group's subsidiaries. However, The Company feels like they are relatively small on the whole and are rather driven by customers' demands than central sustainability efforts. Sustainability work has not been the focus of The Company in recent years and the everyday work of the Quality and Sustainability manager is much more focused on quality than sustainability. The Company does not, as of today, have a structured way of measuring its emissions in its supply chain. Some of The Company Group's goals are further not applicable to The Company's business as they are working B2B and not B2C.

One of The Company Group's goals is to have sustainable raw materials, and today The Company offers for example eggs from both free-range hens and cage hens, or ecological and non-ecological products. Sustainable products can be considerably more expensive and there is not a clear demand from The Company's customers today to purchase ecological products since the end consumers of the baked goods generally do not care if their bun is ecological or not. This is a challenge according to The Company since they do not have the possibility to market the origin of their products to the end consumers as they sell their products B2B. In the end, the customers must be willing to pay

more for the ingredients to be sustainable, and in the current economic situation, it is not reasonable to increase the prices even more.

The Quality and Sustainability manager thinks that the best way forward is to develop the company's sustainability work together with the customers. As with sustainable products, it is hard to market the value with sustainable deliveries to the customers. The Quality and Sustainability manager says that some customers value sustainable deliveries, but the majority will still consider the price to be the most important factor when placing an order. For The Company to choose to have sustainable deliveries today would therefore have to be a strategic decision. If the demand from the market for sustainable products or transport increases in the future, The Company will adapt to this, since its primary focus will always be to keep their customers happy. Today, the warehouse manager in southern Sweden and the foreman of the warehouse in central Sweden do not experience any requirements from the customers regarding sustainable deliveries. The only thing that affects the choice of vehicles today is the government's regulations regarding Euro 6 motors in inner city environments. The Company's own trucks have the latest combustion engines that are required by the law and the warehouse and distribution managers do not think that there are any better combustion engines on the market at the moment. The warehouse manager and the foreman have, however, gotten a few requests for deliveries to be made by electrical trucks. They find it difficult to offer deliveries by electrical vehicles since the customers do not want to pay the extra costs that come with such an investment.

The warehouse manager in southern Sweden and the foreman of the warehouse in central Sweden think that old customers do not care about sustainable deliveries, while newer customers are valuing the environmental aspects higher. They also think that the requirements for sustainability will increase, from both the customer and the government. The interviewees think that the government will legislate sustainable deliveries before the customers start demanding them. In the future, the warehouse manager in southern Sweden and the foreman of the warehouse in central Sweden think that The Company will need to purchase electrical trucks or buy the service from a company that already has electrical vehicles. The interviewees at The Company think it would be possible for them to put additional requirements on the 3PL provider in Stockholm regarding the last mile deliveries, but with increased demands, they will likely also require more payment. The general perception at The Company is that in the end, it is the customers that will have to pay for their demands regarding transportation. Electrical trucks also come with challenges. The longest distance for The Company's deliveries is 500 kilometers and the distribution extends over long distances. For it to be possible to use electric vehicles, there needs to be charging stations along the way or a possibility to drive and charge at the same time.

4.2 Supply chain process

In this chapter, the supply chain process at The Company is presented. First, the process of purchasing and storage of products is presented, followed by the transportation process, and lastly

the city distribution process. Both The Company's internal transports and the transports that are outsourced to the 3PL provider are described.

4.2.1 Purchasing and storage of products

The majority of The Company's products are purchased within Sweden, with a concentration around the southern parts of the country. The remaining volumes are purchased mainly from Europe, and some commodity and packaging products from the US, South America, and China. Around a third of the goods purchased from outside of Sweden are delivered directly to the customers from the vendor. Most of the goods arrive via the southern part of Sweden before reaching The Company. Only around 20 % of the purchased volumes originate closer to the warehouse in central Sweden than the warehouse in southern Sweden, but the majority of delivery volumes are distributed from the warehouse in central Sweden. This means that a majority of the shipments from southern Sweden are goods shipped to the warehouse in central Sweden.

The majority of the sold products are dry goods, about a quarter of the goods are refrigerated and a small part is frozen. Dry goods include both food and non-food products such as marketing material, packaging, and utensils. All of the products that The Company sell are packaged, they do not sell any "open foods" (i.e., food not wrapped in a container, such as vegetables or fruit). This simplifies product handling, since there are a lot of requirements for handling open foods that The Company does not have to consider. The risk of contamination is also reduced as all foods are packaged. All of The Company's products are registered in a Product Information Management system where the quality department has to approve the articles and make sure that information such as the barcode, weight, and dimensions are available. The supplier needs to fill in information about the expiration date and how the products should be stored and handled since both the temperature and humidity affect the shelf life of the product.

The Company's warehouse is divided into three temperature zones: dry, refrigerated, and frozen goods. From the moment that orders are picked, however, they are only handled in two temperature zones: refrigerated and frozen. When a customer places an order, the dry and the refrigerated goods are picked and put together on the load carrier of choice. Then the load carrier is put in a refrigerated storage room where the order is waiting to be picked up by the delivery truck. Once in the truck, the goods are also stored in a refrigerated environment. This means that the dry goods are kept in a refrigerated area from the moment it is picked until it reaches the customer, thus keeping a cold chain. The frozen goods are handled in a different chain throughout storage and delivery. If the customers order frozen goods, they are picked and stored separately until the delivery truck arrives. The frozen goods are then transferred to a separate freezer area of the truck.

4.2.2 Transportation

To ensure that the products sent from The Company keep high quality, the temperature is the most crucial factor. Generally, the products have a rather long shelf life, but it is dependent on whether

they have been stored at the right temperature during transport. The trucks are designed to transport both refrigerated and frozen products, but the layout of the trucks differs between vehicles. In The Company's own vehicles, there are cooling and freezer units mounted on the walls of the trucks, and the freezer unit is blocked off by an additional wall inside. This dividing wall is modular and can be expanded to fit the right number of frozen pallets that will be transported. It is possible to check the temperature in the truck's cargo area when driving. The temperature during the transportation is recorded and can be accessed afterward if the customer has any questions or complaints. Before delivery, the temperature in the truck can be printed on a receipt. That way the receiver of the goods can see what temperature was kept before the cold chain was broken when the truck was opened. The Company follows the EU regulation 178/2002 and Swedish laws about frozen food products. Broadly speaking, this means that they are ensuring that the right temperature is kept and recorded during transportation and that products that could be contaminated by each other are not loaded together.

The majority of the faults in delivery are due to products being damaged. Product damage often occurs due to the way the products have been placed on the load carrier. When picking goods in the warehouse, there is an algorithm that tells the picker what order to pick the products in order to place the heavy products at the bottom and the more delicate products at the top. Cling film is then wrapped around the pallets to keep the products in place. If something fails at this stage, such as that delicate products have not been placed at the very top or if the cling film has not been able to keep the products firmly in place, there is a risk that the products will be damaged during transportation. One of the drivers at The Company points out that some products need to be handled with more care than others. As an example, the bags of salt are so big that they are hanging over the sides of the EU-pallet and thus cannot be placed in the truck in the same direction as the other pallets. If something runs into the bags they can break and therefore it is important to load the truck carefully. All cases of quality issues are reported by the customers to The Company, and these are then compiled in an Excel worksheet. From the data, it is possible to see some patterns, such as that cake crust is a product that often gets damaged in transport. The data can then be utilized by the transport department to take action against such "problem products" and change the way of working to avoid similar issues in the future.

Deliveries are made Mondays to Fridays between 05:00–14:30 to the customers. Generally, there are fewer deliveries made on a Monday since it is hard for the bakeries to predict the Friday before what they will need after the weekend. The Company needs to receive the order from the customer on Friday if they are going to get the delivery on Monday. It is also common for customers to order bigger volumes at the end of the week to stock up for the weekend.

The Company's own fleet

The Company has 12 own trucks, which are used to make deliveries to customers located close to the warehouses in southern and central Sweden, while external trucks serve customers farther

away. These trucks have set schedules with deliveries on specific days, and the drivers are responsible for deliveries to certain areas. The interaction between the driver and the customer acts as a sales meeting. For the internal transports, the transported volume is quite similar week to week, but the daily volume varies.

One of the case company's drivers sees several perks with The Company having their own drivers such as the personal relationship it creates between the customer and the company. He explains that the drivers act as the face of The Company, and small acts of service can go a long way in building a good relationship. Such acts can be to take the time to make small talk with the customers, or to help with unloading the goods even though it is not stated in the contract. The driver also points out that it is important how he as a driver acts against the customer if something is wrong. He has been a driver for The Company for many years and thereby knows the customers he is making deliveries for. As an example, he tells a story about how a couple of years ago, the trucks were not loaded by their drivers and somebody had put 50 kg of yeast for delivery to a small bakery which normally ordered only 5 kg. If he would have loaded the truck himself, he would have noticed straight away that something was odd with the order, but in this case, he arrived at the customer with way more than they could receive and had to bring it back. Today, it is the drivers that load the trucks early in the morning, and they can therefore act proactively if something is wrong. On the other hand, another interviewee said that just a few weeks ago he got an angry phone call from a customer who had received his delivery from another driver than usual. According to the customer, the driver had no idea what he was doing. That driver was one of The Company's longest employed drivers with over 20 years of experience who had covered for another driver who was sick that day. So the personal relationship that is created seems to be created more with the drivers themselves than with The Company as a business.

There are no time windows for the deliveries that are made by The Company's own trucks. However, some customers have limitations on when deliveries can be made. One example is a bakery in the inner city of Lund, which is located in the middle of a residential area. There, the residents were complaining about the noise when deliveries were made early in the morning, so now it is agreed that deliveries cannot be made to this address before 07:30. Another customer that has a limitation in delivery time is a school outside Lund, where no staff can receive the goods before 07:00. Other than these special cases, the driver has noted that most of the small artisan bakeries want to receive their orders as early in the morning as possible while the larger customers generally do not care when the orders arrive. Limitations in delivery times are a challenge for The Company since it makes it harder to optimize routes. Such limitations mean that some customers that naturally would be served first in an optimized route may be passed to meet the demands of others. Furthermore, the driver finds it hard to find a place to unload the goods inside the cities in the southern part of Sweden. It often happens that other cars are illegally parked in the loading zone dedicated to trucks, which complicates the unloading.

For The Company's own trucks, there is a return flow on certain routes and days, where the drivers pick up other products on the way back to the warehouse. For example, the driver picks up different kinds of jam from a factory in southern Sweden. There is also always a return flow of the empty load carriers. In recent years, load carriers such as EU pallets have become very expensive, and they are therefore no longer sold along with the goods. Instead, they are rented and have to be returned to The Company which in turn can return them to their suppliers.

4.2.3 City distribution process

The highest concentration of delivered weight is to the big city areas. In 2020–2021, the share of delivered weight between the three biggest cities was around 20 % to Stockholm, 17 % to Malmö, and 8 % to Gothenburg. The Company's total number of customers is around 2500, out of which around 500 are located in Stockholm. Stockholm and Gothenburg are served by external trucks, while Malmö is served by internal trucks. In total, 56 % of all deliveries are made with external trucks and 44 % with internal trucks. There is however one exception from the rule that Stockholm is served by external trucks – there is one specific customer that The Company is delivering to with internal trucks in the Stockholm region. The rest of the distribution is made from a 3PL provider. The case company has chosen to serve this specific customer with internal trucks since it is a very large and sensitive customer and previous outsourcing attempts failed due to late deliveries and failure to keep the cold chain. The Company, therefore, decided to take back the distribution to this customer in-house, and now they have a dedicated truck driver who transports the goods from the warehouse in central Sweden.

Deliveries in big city areas are different from deliveries in other parts of the country for many reasons, but mainly due to traffic. If a truck is late when leaving the terminal, it will get even more delayed due to being stuck in rush hour queues on the way into the city. A delay of only one hour from the terminal can make the delivery three hours late to the customer in Stockholm, where this effect is much more prominent than in other parts of the country.

The use of 3PL in Stockholm

As mentioned before, Stockholm and Gothenburg are served by a 3PL provider. In Stockholm, The Company has outsourced their last mile deliveries to a 3PL provider located 30 km away from Stockholm. The large majority of customer orders for customers in Stockholm are packed and transported from the warehouse in central Sweden. Some are shipped from the warehouse in southern Sweden since the capacity of trucks between the warehouse in central Sweden and the 3PL provider has begun to reach the limit. These shipments from The Company's warehouses to the 3PL warehouse are also handled by external trucks but from other distribution companies. The goods arrive at the 3PL warehouse during the evening and the night and are then distributed the following morning on weekdays. When the goods arrive, the 3PL provider's responsibility as the distributor takes over. They control that the temperature requirements are met and that the right amount of goods have been received. The information is then sent to the team who plans the

transports. Since the deliveries are already packed for a specific customer, there is no handling of individual products apart from the fact that one customer can have ordered both dry, refrigerated, and frozen goods. Just like at The Company's own warehouses, the dry and refrigerated goods are handled in one chain and the frozen goods in another, since the frozen goods must be stored in a freezer. The 3PL provider is responsible for delivering the right frozen goods together with the refrigerated pallets. The whole flow through the 3PL provider from The Company's two warehouses is illustrated in Figure 4.2 below.

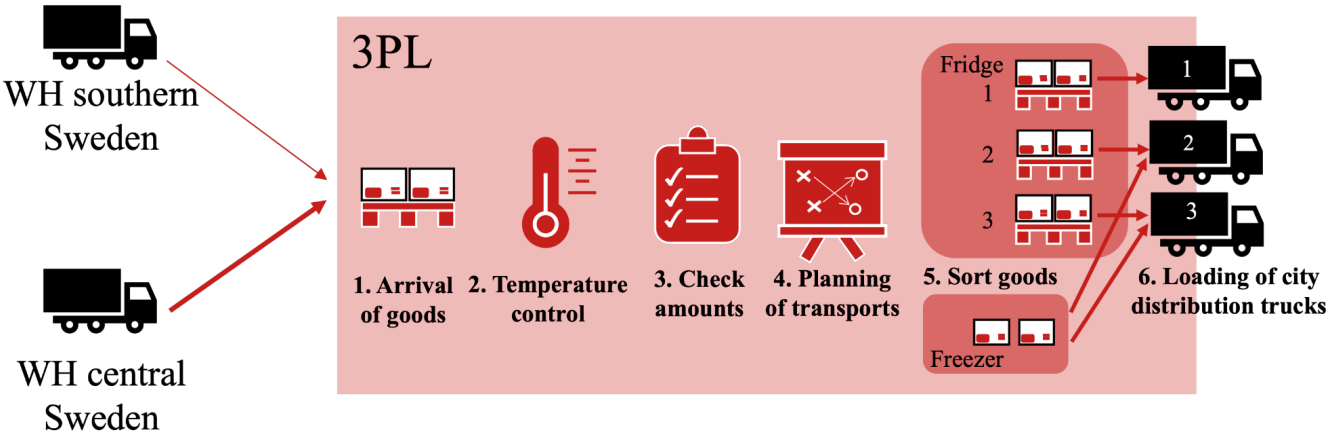


Figure 4.2: Flow of goods through the 3PL provider

Even though the 3PL provider has a system for transport planning and route optimization, the planning is done manually. The system is hard to use in the urban area where the traffic is so irregular and it has difficulties taking into account time windows or delivery addresses that the 3PL provider knows from experience are more problematic than others. Sometimes the unloading zones are far away from the customer facilities. Other restricting factors include weight limits, time windows for deliveries, height restrictions for garages, complicated addresses, and the Stockholm traffic. The routes are quite similar for a specific weekday compared to the same day the week after, and the 3PL provider aims for the drivers to deliver to the same customers. The traffic planner believes that the driver then becomes more comfortable and will make the deliveries quicker over time. The driver makes about 10–15 deliveries per distribution round. The trucks are installed with a GPS-tracker, but they do not follow a fixed route inside the city. This is due to the very varying traffic, which can make it necessary for the driver to change the route on the go. The traffic controller points out that it is not possible to set a fixed route in the inner city area since different roads are closed on different days, and accidents or other unplannable events can quickly create queues. They have to replan the route a couple of times a day due to the incredibly changing traffic in Stockholm.

The first truck leaves the 3PL warehouse around 05:00 in the morning. If it would leave even earlier, the driver would have very limited working hours as driving before 05:00 is classified as a night shift. The driver then has to stop working at 13:30, even if there are deliveries left to be made. However, the 3PL provider also makes deliveries for other companies to restaurants to

which they have a key and can therefore make the deliveries even earlier than 05:00 in the morning. For these customers, the same drivers have been delivering the goods for a couple of years and have been building up a relationship of trust. In the 3PL provider's experience, trust is crucial for customers to be willing to leave a key to the driver since the customer then relinquishes the possibility of being able to verify and accept the delivery. The legal responsibility of the goods is transferred to the receiving company as soon as it has been left at their premises, which is why most customers want to verify the goods at the time of delivery. Today, only a small part of The Company's customers have given the 3PL provider tags and keys to their building, but that is mostly to make the deliveries more time-efficient and not to be able to deliver outside of opening hours.

The 3PL provider does not only consolidate and deliver goods, but they also offer additional services within warehousing. They offer both short-term and long-term storage of goods. They also offer picking and packing services, where they pack and deliver goods directly to the end consumers. They have a refrigerated and frozen part of their warehouse where The Company's goods, among others, are stored and prepared for delivery. The Company does however not utilize the possibility to store goods for a longer time at the warehouse, it is only stored for a few hours before it is picked up for distribution. The cost of storing goods at the 3PL provider is based on how many pallets the company wants to store at the warehouse, and the most common type of pricing is a cost per pallet. For companies who want to store pallets only for a few days, the cost is threefold; one cost for taking in the pallet, one cost for storing the pallet (depending on how many days it is stored), and one cost for removing the pallet. Other types of pricing can be relevant if a company wants to store goods for a longer period of time. From the stored goods, the 3PL provider can pick and pack orders and deliver them straight to The Company's customers when an order is placed. The price for picking and packing is set per order and is usually under 100 SEK per order.

These additional services make it possible for the 3PL provider to profit from many different activities. When looking at the flow of deliveries per day from the 3PL provider, The Company is one of their biggest customers, but when considering revenue The Company is a rather small part of their total turnover. The 3PL provider handles many pallets each day, but the flows vary a lot throughout the year. The amount of goods is affected by holidays and seasons. Around Christmas, New Year's, Easter, and Midsummer the volumes increase a lot. Their staffing is flexible, both for people working in the terminal and for the drivers, and thus they can adapt to the high and low seasons. They can also adapt fast to sudden changes in demand and can complete delivery assignments in one to two hours. For the larger flows, such as for The Company's flow of goods, they do however need the bookings one day in advance in order to plan the transports.

The 3PL provider has three larger delivery vans allocated to deliver The Company's goods, each having the capacity to carry 18–19 pallets. They also have smaller delivery vans in which they can

transport The Company's goods if there is a need, e.g., because the delivery does not fit the route of the bigger vans, or if there is a need for more capacity. They can also be used if it is needed in order to deliver all goods within the agreed time window. The fill rate of the trucks is close to 100 %. The heavy trucks are operated by the same three drivers, but the operation of the lighter trucks can vary between four or five different drivers. The requirement from the 3PL provider is that the driver must know the flow that they are going to deliver to. The heavy trucks have cooling units, and frozen goods are separated by a wall. The smaller trucks do not have a freezer compartment, instead, they use freezer boxes on wheels that can keep the freezing temperature while making the delivery to the customer. The freezing boxes must be kept in a refrigerated area to be able to keep the temperature.

Today, the trucks from the 3PL provider are powered by HVO100, but the corporation is considering investing in electrical or gas-powered trucks in the future. However, the traffic controller explains that these solutions are extremely expensive, and the availability is poor. Furthermore, the 3PL provider finds it difficult to get the limited number of kilometers of a gas or electricity-powered truck to fit their distribution rounds, but also the costs. HVO100 is seen as a good alternative so far, and the traffic controller has not seen any indications that it is going to be prohibited in Stockholm even with increasing regulations. There are, however, going to be zones where heavy traffic will be forbidden, which affects the 3PL provider's distribution. The majority of the 3PL provider's delivery fleet is heavy trucks with a weight of over 3.5 tonnes.

When something goes wrong, the driver will call the transport department at the 3PL company which then contacts The Company's sales team who in turn calls the affected customer, see Figure 4.3. The day-to-day problems are mostly regarding issues with unloading or failed deliveries. If an error is known in advance, the 3PL provider will notify The Company as early as they can in order for The Company to contact their customers. The Company will then have time to prepare the customers for a late delivery instead of having concerned customers calling about their orders. The traffic controller at the 3PL provider has a lot of contact with the sales team, transport coordinator, and supply chain manager at The Company. He points out that there are some areas of improvement that can be done with the chain of communication. Today, it is very time-consuming, and the customers are expecting fast answers.

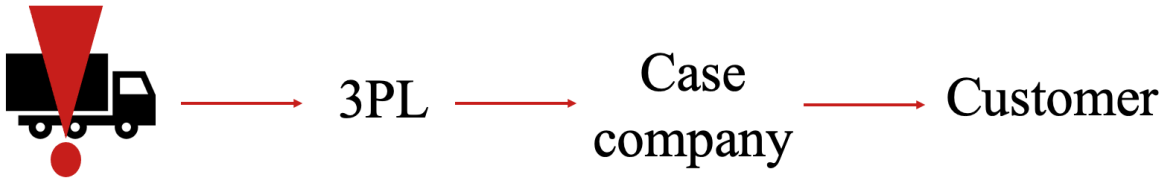


Figure 4.3: The flow of information when something goes wrong with the delivery

The price of transport services has been increasing in recent years. The transport planner of the 3PL provider describes that it is tricky to come up with an attractive offer that is also economically

sustainable for them as a service provider. When new customers are looking for a transporter, different 3PL providers are usually involved in a bidding war. For some individual transport agreements, this bidding war can result in a business loss. However, in the long-term, they can win in terms of customer relationships by agreeing to such low individual transport prices. The transport planner also says that they also can be profitable on other parts of their service offerings such as their warehouse. The sales manager at The Company describes that as a customer of transport services, the cheapest transport solution can be the most expensive one since bad service can cost The Company their customers. There are many things that contribute to the total cost of delivery, not just the transport price.

4.3 Challenges with the current distribution process

From the interviews, a number of challenges have been identified with the current distribution process. These are illustrated in Figure 4.4 and further presented in this chapter.

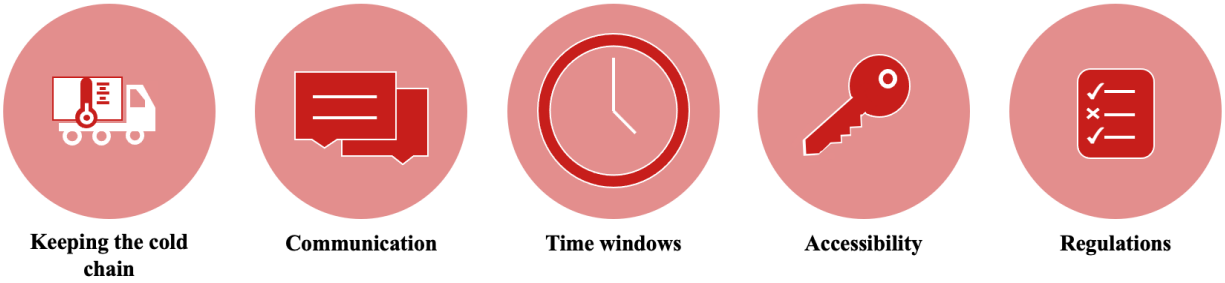


Figure 4.4: Challenges with the current distribution process

Keeping the cold chain

The Company sees transportation of frozen and refrigerated goods as a challenge since they require special handling for the cold chain to be kept. The employees see that different drivers handle frozen goods differently, and the trucks that are used also differ when it comes to solutions for handling frozen goods. Some trucks have walls that can be moved inside the truck, and some have specific corridors where the freezer unit is placed. When outsourcing transportation, The Company worries that the transport provider will not be able to keep the cold chain. Within The Company, there is a belief that their own drivers and their own vehicles are better equipped to handle frozen and refrigerated food, and that there are fewer deviations from the cold chain on internal transports.

Communication between customers, The Company, and the carrier

Today there is no direct contact between the customers and the driver who is delivering the goods. This means that if a problem occurs, there are several intermediates that must forward the information before it reaches the recipient. In areas where The Company delivers with their own trucks, the intermediates are the sales team and the transport planning team within The Company. In areas where the deliveries are outsourced to a 3PL provider, the information must also go through the transport planning department at the 3PL provider. For example, if a delivery is late

in Stockholm, the customer will call their sales contact within The Company and ask where the goods are. The sales representative in turn has to contact the transport planning department at the 3PL provider, who in turn has to contact the specific driver to get information about the delivery. Then the information has to follow the same path back to the customer. It is not uncommon for this flow of information to be so slow that when the customer gets a call back from the sales representative about the location of the goods, they have already been delivered and the problem no longer exists.

The Company emphasizes how important communication is with their external carriers. They expect the carriers to communicate quickly if something goes wrong, for example, if a driver becomes sick or a van breaks down so that The Company can notify the customer well in advance. However, this line of communication can also become ineffective since problems in the operations at the 3PL provider can occur before the start of the working day for the sales representatives at The Company, as many of the deliveries are done very early in the morning. This means that the information can reach the customers too late even if the communication between the 3PL provider and The Company is done in time. To solve this problem, The Company has started investigating the possibility of using an app that can tell the customers how far away the goods are and the estimated time of delivery in real-time, similar to what is sometimes offered when a private customer orders a package online. The Company thinks this would save both themselves and the 3PL provider a lot of time, and at the same time lead to less stress and worry for the customer.

Time windows

From a cost and transport planning point of view, it is problematic to use time windows on deliveries. Many artisan customers, especially in Stockholm, request a narrow time window for their deliveries. The majority of the artisan customers want to receive their deliveries early in the morning. Especially in Stockholm, many customers have very small storage spaces and are therefore dependent on the ingredients to be delivered on the same day as they will be used. Their whole baking process can come to a halt if the delivery gets delayed. However, from the carrier's point of view, time windows are complex. If the windows are too narrow, it is impossible for a single truck to make all deliveries in time. Instead, the load would have to be shared over multiple trucks, which would lower the load factor and increase costs and externalities in terms of staffing, driven kilometers, pollution, etc.

Accessibility

Specifically in Stockholm, accessibility is a big challenge when it comes to supply chain operations within the city. Stockholm has only two large highways leading in and out of the city and therefore, extensive traffic is very common. This does not only affect deliveries to the inner city but also accessibility to get from e.g. the northern to the southern suburbs. However, the challenge is most prominent in the city center where there are many factors affecting accessibility. There are for example restrictions on the weight and height of vehicles in many areas. Weight restrictions are

placed on certain roads that lead into areas where heavy trucks are not allowed. Height restrictions are mainly in garages where many bakeries in the city center have their goods receptions. Certain customers are located on so-called “complicated addresses”, where several factors make it difficult to make deliveries. There are also sporadic issues that can impact the accessibility to certain addresses, such as when the unloading area is blocked by a wrongly parked vehicle.

In winter, weather conditions limit accessibility immensely. To be able to move the pallets, which often weigh around 700 kg, electric trucks must be used which in turn also weigh around 700 kg. These electric trucks, with a total weight of around 1.5 tonnes with cargo on, cannot be moved an inch if there is snow on the ground. This is a challenge since it involves an additional party – the municipality. It is neither the carrier’s nor the customer’s responsibility to make sure that the public streets are cleared from snow.

Regulations

Regulations from the municipality pose a challenge, often because they impact the accessibility of certain areas in the city. In Stockholm, there are different environmental zones that impact delivery operations. In Gamla Stan, for example, all deliveries must be made between 06:00 and 11:00, and vehicle traffic is forbidden at all other hours of the day. There are also regulations regarding the size of the vehicles that are allowed to enter Gamla Stan. All such regulations are complicating factors in transport and route planning. Likewise, environmental zones are challenging as they affect the type of vehicles that can be used for deliveries. In the coming years, when the regulations regarding environmental zones are expected to become even more restrictive, it can become necessary for transportation companies to invest in a new fleet. The municipality is also a strong advocate for the electrification of vehicles and is using regulations to increase the incentives for companies to invest in an electric fleet. However, it can become an issue if these regulations force companies to make such investments even though they are not economically viable.

4.4 Customer demands

Customer requirements and demands have been collected through interviews and a survey, and are presented in this chapter. Five common themes have been identified, and the input from the three different customer segments is presented under each of the five themes. The five themes are; general supplier requirements, delivery time requirements, the customer view on supplier relationships, digital solutions, and sustainability.

4.4.1 Interviewed customers and survey respondents

Interviews were held with four different customers – one artisan bakery customer, two industrial customers, and one retail customer. The interviewed artisan bakery is a bakery chain with around 20 bakeries in Stockholm. Their bakery is located in the inner city of Stockholm, and from there both the baked goods are distributed out to their cafes by their own cars. For this customer, the

interviewee was the bakery manager. The first industrial customer, from here on called Industrial customer 1, is a large manufacturer of baked goods and desserts. They sell their products to corporate customers within food services, such as cafes, restaurants, and hotels – not directly to consumers. At Industrial customer 1, the interview was held with the vice president and the quality and sustainability manager. The other industrial customer, from here on called Industrial customer 2, is a large manufacturer of pastries. They sell pastries and cakes to both businesses and directly to the consumer. At Industrial customer 2, the purchasing manager was interviewed. Lastly, the retail customer is one of the biggest grocery stores in the inner city of Stockholm. Here, the store manager was interviewed.

Figure 4.5: The interviewed customers within every segment and their titles

In addition to the interviews, a survey was sent out to a number of additional customers within the three segments in Stockholm. Eight customers responded to the survey, out of which six were artisan bakeries, one an industrial customer, and one a retail customer.

4.4.2 General supplier requirements

The basic requirements the interviewed artisan bakery has on all of its suppliers are; good service, sustainable operations, and IP certification regarding food safety. When it comes to choosing suppliers, they do not only base the decision on what price the suppliers offer. Since they value a long-term partnership, they rather look at the whole picture of the offering. The bakery manager compared this to a cinnamon bun – what is the most important part of a cinnamon bun? Is it the bun, or the filling? It is impossible to say since it is the total result that matters. However, price is undoubtedly an important factor, and it cannot be too high in order for the bakery to see an opportunity for a long-term partnership. The bakery manager would also consider switching to a new supplier if there is a bigger actor on the market that has a better proposition and if the bakery

feels like they can have a more long-term relationship where they get better additional services such as help with recipes.

Industrial customer 1 works primarily with three suppliers, which they describe as the main suppliers of bakery ingredients in Sweden. They also have some smaller suppliers for special ingredients. The suppliers are chosen on a yearly basis, and the main factors that decisions are based on are the price and quality of the products. Other factors are also taken into account, such as transport reliability, cost, service, and accessibility. They want to be sure that they receive the right goods at the right time, as an absent delivery can affect their whole production plan. They also value fast deliveries, flexible solutions, and transparency. Especially in the last couple of years when the situation with transportation and accessibility of goods has been challenging, they have valued transparent conversations with their suppliers.

The purchasing manager of Industrial customer 2 describes that the company makes a supplier assessment of all their suppliers. They have a template of requirements that their suppliers must fulfill which work as the basis for supplier selection. Delivery reliability is the most important factor for Industrial customer 2. Just like for Industrial customer 1, a late or absent delivery can cause ripple effects in their production which is planned according to the deliveries. The company wishes that the suppliers were to offer more support and work together with the company regarding product development, and thinks this would add value to the business. They also value a supplier that is available, and always base decisions on what is going to benefit the business in the long term. Reasons for changing a supplier according to the purchasing manager of Industrial customer 2 are if the delivery security is poor or if the quality of products deviates from the agreement.

The store manager at the retail customer said that their requirements are simple – they want their goods delivered within the agreed time window, to the agreed price, and within the general requirements regarding the transportation of food. In general, the store manager thinks that the deliveries today are handled well. However, quality and price are two very important factors and if a supplier fails to deliver on them, the store would consider changing suppliers. Other factors that would prompt the store manager to look for alternative suppliers are if he loses the trust in the supplier, if the relationship with the sales representative is bad, or if the supplier fails to deliver the goods on time. The store manager also sees a clear potential for the smaller suppliers in their network to consolidate their deliveries to save both time and money. As of today, the store receives around 30–50 trucks with deliveries each day. If the smaller suppliers, such as The Company, would coordinate their deliveries, he thinks there is potential to reduce the number of trucks per day by a third.

4.4.3 Delivery time requirements

Today, the artisan bakery wants to have its goods delivered between 05:00 and 06:00 in the morning. They do not have any staff available earlier than 05:00 and are too busy to receive the

delivery later than 06:00. They want to receive deliveries every day since the bakery is filled to the brim from just the daily operations. However, later this spring the bakery will move into much more spacious premises and their delivery requirements will then change when it comes to time and frequency. In the new bakery, they wish to receive the goods between 06:00 and 07:00, and only one or two times per week. They want to have the goods delivered within a one-hour time window and within 24 hours from when they place the order. In order to lower the environmental impact, the bakery would consider accepting deliveries during the night from 01:00–06:00 when no personnel is at the bakery. They have given keys to smaller suppliers before to do off-peak deliveries, but it has not worked well since they noticed that products disappeared. However, they have great trust and confidence in The Company and would consider offering them a key.

Industrial customer 1 does not have any specific time requirements for deliveries. Today they accept deliveries between 06:00–15:00. They are going to expand their warehouse in the coming years and predict that they will become even more flexible when it comes to deliveries then. As the situation is today, they think that it is reasonable to keep the delivery frequency at two times per week, but they are willing to consider reducing the frequency if it would be beneficial for them. They are also willing to investigate the possibility of receiving deliveries at other times during the day, but they do not believe that it would be possible for them to leave a key to their suppliers and let them deliver the goods when no one from the company is at the site. This is due to safety and regulatory reasons – they do not think that their certifications allow them to have unauthorized personnel at the premises when their own staff is not around. Compared to its other suppliers, The Company has longer delivery times and more infrequent deliveries. This reduces flexibility as the deliveries must be planned more in advance, and there is less room to make last-minute changes. Since they do not have a lot of storage space, they sometimes become dependent on last-minute deliveries if something unexpected happens. Industrial customer 1 would like to have a bit more flexibility, which they receive from their other suppliers who have warehouses in the Stockholm area.

Industrial customer 2 gets deliveries once a week from The Company, always on the same day, and is satisfied with that setup. They make the order one week in advance and do not have any time windows for the deliveries. They would consider off-peak deliveries or deliveries at other times than today if it would be beneficial somehow, but it is not something they have looked into. According to the purchasing manager, it is not good if all of their deliveries for a specific day arrive at the same time and thus they are considering giving each supplier a specific slot time for their deliveries in the future. The purchasing manager believes that in 5–10 years they will work with tighter delivery windows.

The retail customer has staff ready to receive the goods the whole day between 06:00–17:00, and multiple loading docks where three vans can unload goods at the same time. Today, no deliveries are made outside of these hours except if there are temporary disruptions. The store manager thinks

it will continue like this in the near future due to regulations regarding working hours and extra fees for working outside normal working hours. It does not matter when during the day the deliveries arrive, but the store manager emphasizes that it is important that deliveries are made on the agreed delivery days. They are dependent on just-in-time deliveries, as they have almost no safety stock at the store. If a delivery gets delayed, it directly affects their sales and the store's customers as that means that the shelf will be empty. The store manager explains that the lack of safety stock is a result of the high cost of storage, which is especially high in the inner city. The delivery time window is affected by the regulations from Stockholm Stad regarding what times trucks are allowed to drive in the inner city.

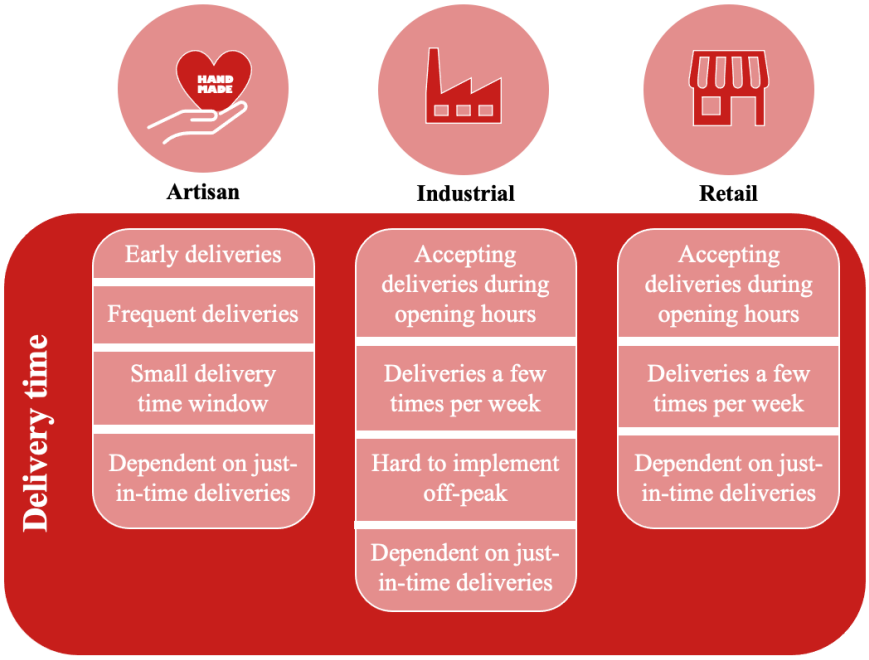


Figure 4.6: Summary of delivery time requirements per customer segment

4.4.4 The customer view on supplier relationships

The artisan customer wants to have nice and friendly drivers delivering the goods. In the past, they have experienced issues with unpleasant drivers and took action against their suppliers to have them changed. The bakery manager says that the relationship with the driver is the most important one for their impression of The Company, as it is the driver they meet every day and create a relationship with. It is therefore the driver that becomes the face of The Company in the eyes of the bakery. The relationship with the sales representative at The Company is also important, but that contact is much more infrequent than the one with the driver. For the relationship with the sales representative, the bakery manager values a long-term approach where not only the price is in focus but also a conversation about knowledge exchange, product development ideas, ideas regarding deliveries, and other questions.

In general, both Industrial customer 1 and Industrial customer 2 say that they value a long-term relationship with their suppliers. Industrial customer 1 wants to have a good contact person at the supplier whom they can trust and who solves potential problems that arise. In the eyes of the industrial customers, it is the sales representative at the supplier who matters the most for the collaboration and relationship. The impression the driver leaves when delivering the goods also matters, but as long as they are agreeable and do not cause any trouble, the interaction with the driver is not something they think much of. The history the company has with its suppliers matters a great deal when they are deciding what suppliers to use for the coming yearly contracts. If they have a supplier which has delivered goods on time and with good quality, they would be reluctant to change that supplier even if someone else would offer a better price. Industrial customer 1 highly values product quality. Since they are a large customer, they also sometimes co-create products together with their suppliers, such as cake mixes. Then it also becomes hard to switch suppliers. For some products, such as sugar, the quality of the goods do not differ from supplier to supplier. Then the price is the deciding factor, and there is no point for Industrial customer 1 to stay with the same supplier if someone else offers a better price.

For the retail customer, it is important to build long-term relationships with the suppliers in order to create a good collaboration. From the store manager's point of view, both the sales representative and the driver of the trucks represent the supplier. Both of their actions matter for the total image of the supplier, and one is not more important than the other.

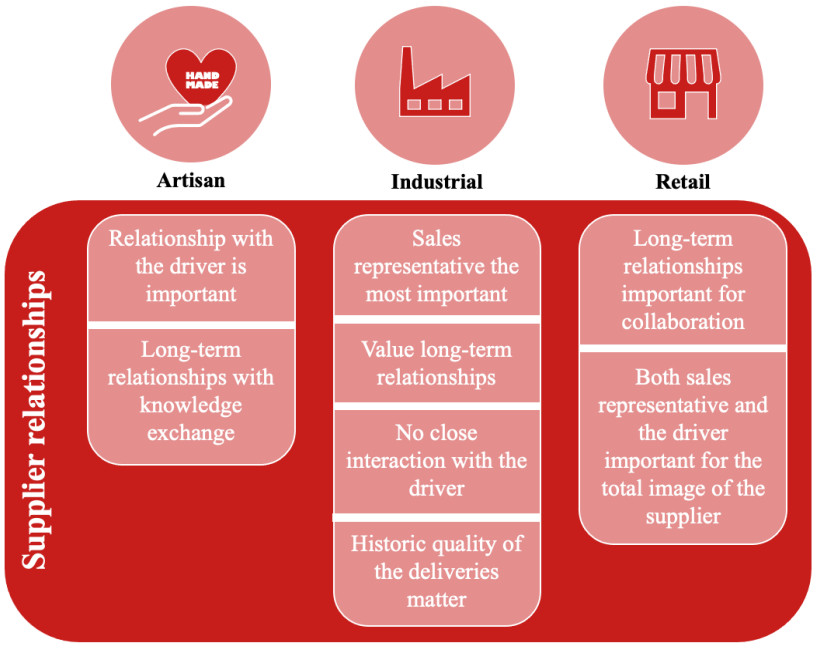


Figure 4.7: Summary of view on supplier relationship per customer segment

4.4.5 Digital solutions

A big part of good service, according to the bakery manager, is to get notified in advance if the delivery is delayed. The artisan customer would prefer to have an app where they could follow the delivery van and see for themselves how far away the goods are. The manager emphasizes that he wants this to be smooth – he does not want to have to log into a website to track the van, and he wants to be able to see it directly on his phone at his own convenience. Such an additional service is not something the artisan customer would be willing to pay extra for, since it is a natural development on the market according to the bakery manager. If competitors come up with a better offering in the future without demanding monetary compensation, he says that it would be easy for them to switch suppliers if they cannot come to a similar agreement with their existing suppliers.

If there would be a way to track the deliveries, it would be appreciated by both of the industrial customers. If something goes wrong and the goods have not been delivered in time, they could then easily get information about the delay and plan their production accordingly. As it is today, the flow of information is extremely slow and dependent on phone calls, which is described as time-consuming. They want to receive a notification if the delivery is going to be delayed, they do not want to have to log into a system themselves and look for the information.

For the retail customer, there is no need to be notified in advance about when a delivery is expected to arrive since they receive such a large number of deliveries each day. They had a system previously where they got notifications about delivery times, but it took more time to try to optimize this than just letting the trucks drive to one of the available unloading docks or wait for one to become free. Notifications or delivery tracking is therefore not something they would be interested in.

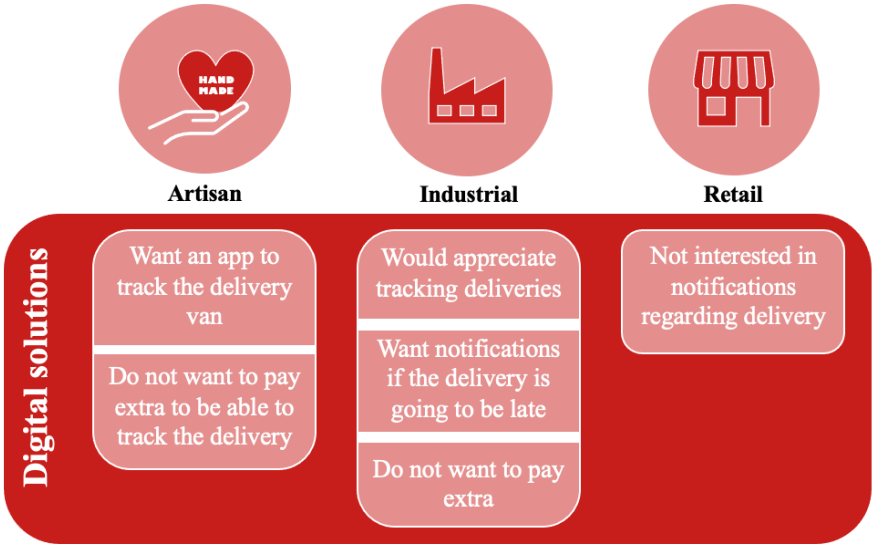


Figure 4.8: Summary of view on digital solutions per customer segment

4.4.6 Sustainability

According to the artisan customer, sustainability is vital for the business. They work a lot themselves to minimize the business' food waste. When choosing suppliers, they do however not always look at how sustainable they are. Sometimes the bakery is offered a quick deal where they can for example get two pallets of sugar for a very low price, and then they can accept that without investigating the supplier's sustainability work. However, when it comes to big suppliers it is very important that they have a sustainable business, and the bakery takes that aspect into account. For the bakery manager, an electric fleet is a clear way to go in order to make deliveries sustainable. The bakery has looked into buying electrical cars themselves to make deliveries from the bakery out to their cafes in Stockholm. The bakery manager says that when they invest in electric vehicles for their own deliveries, they will likely set the same requirements for their suppliers. That will likely not happen in the next few years, but further down the line. The bakery manager also thinks that green deliveries should not increase the price of the delivery and believes that sustainability should be a matter of course. If another supplier would offer green deliveries to the bakery and The Company would charge extra for the service, the bakery manager says that they would consider only working with the other supplier.

Sustainability is also an important topic for the industrial customers. When Industrial customer 1 is choosing suppliers, they only consider working with suppliers who have sustainability certifications and comply with all legal requirements. For their larger suppliers, they expect them to be at the forefront of sustainable solutions within the industry. Some of the Industrial customer's own customers work very extensively with sustainability as it is a large part of their brand. In the future, they think that their customers may increase their sustainability demands, which means that they in turn will have to increase their sustainability requirements on their suppliers. If that is the case, Industrial customer 1 would also be willing to pay their suppliers extra, but only if they require something more than what the supplier must legally do. From what they see today, all suppliers have different sustainability initiatives where they e.g. are investing in new fleets. This is something that is necessary to stay relevant in the market according to Industrial customer 1, and they think that the evolution naturally will lead to more sustainable transport solutions without them as customers having to pay extra.

For Industrial customer 2, sustainability is included as a factor in their supplier evaluation, where the suppliers need to have certain certifications or other sustainability initiatives to be considered as an option. They would like to have sustainable deliveries made to them, however, it is a balance between the cost and advantages that can be achieved. The purchasing manager thinks it can be an alternative to pay extra for sustainable deliveries if it could contribute to them reaching their sustainability goals.

Also, the retail customer states that sustainability is an important topic for the company. They require that their suppliers comply with laws and regulations, but they do not put any additional sustainability requirements on them. The company does not have any demands on sustainable deliveries, except that they should be within the legal requirements. The store manager states that increasing demands on sustainable deliveries is something that the distribution companies will have to adapt to, they expect to continue getting the goods at the right time and in the right amount, and how that is done is not their business.

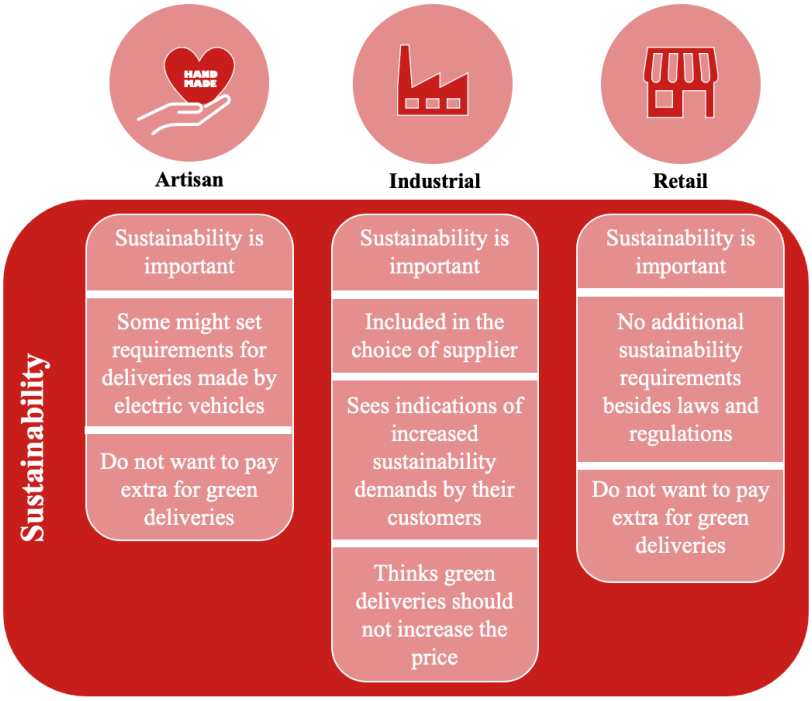


Figure 4.9: Summary of view on sustainability per customer segment

4.4.7 Takeaways from the survey

In the survey, the respondents were asked to rank the importance of five factors when it comes to deliveries of goods on a scale from 1 to 10, where a 10 is the most important. The five factors to rank were; price, delivery reliability, sustainability, relationship with the sales representative, and relationship with the driver. It was clear that all respondents valued delivery reliability the most out of all factors, with an average score of 9. Next in line came price and sustainability, for which the respondents gave an equally high score of 8 on average. All customers but one also stated that sustainability is an important question for them as a company. The relationship with the sales representative was given a score of 7, while the relationship with the driver scored 6.5 on average.

When asked if their requirements on suppliers are met today, and if they are happy with today's setup of deliveries, the customers gave an average score of 6 indicating that they are neither dissatisfied nor completely satisfied. The same result was observed on the question regarding if

they are ready to switch suppliers fast if someone else comes with a better offer, or if they value long-term relationships. When asked what would make deliveries better, the customers listed; more frequent deliveries, deliveries on other days, lower cost for deliveries, nicer drivers, and deliveries made by the supplier's own cars. They also mentioned that in the last 1.5 years, there has been a shortage of some goods and that the price has increased a lot.

Regarding delivery times, most customers requested deliveries in the morning to mid-day, and the majority requested a time window of two hours. The demand for frequency of delivery differed between the different customers, from one to five times per week. When asked if there is any service they are missing from their suppliers, some customers mentioned flexibility when it comes to deliveries, more frequent deliveries made by own cars, that a sales representative comes and visits the customer, and that the supplier is not out of goods.

In the survey, customer demand for a delivery tracking service was also examined. There seemed to be a clear demand for such a service, as all but one customer expressed an interest in receiving notifications about the expected delivery time. However, the majority only wanted notifications if the delivery was delayed. The customers also had differing views on how they wanted to receive notifications, where the majority wanted them via text message, while some wanted them via email or via phone.

4.4.8 Key takeaways from customers

From the customer interviews it is clear that the three different segments have different demands and expectations on the deliveries. When asked what the general expectations of the deliveries are, the customers answered that they want reliable, but also flexible and responsive deliveries. Common for all three segments is that they expect goods to have a high quality, availability, and reasonable price. All customers speak about long-term relationships with their suppliers and cooperation such as product development and exchange of knowledge. The customers are unified regarding what factors would make them change suppliers as well. If a competitor would offer the same products but at a lower price or with higher quality it would be a compelling case to change the supplier. Other reasons include if the price of goods is increased without a reason, or if another supplier offers better service or collaboration. The customers would also consider changing the supplier if a competitor can offer more frequent deliveries or higher delivery reliability. One customer also mentioned that a reason to change the supplier would be if another supplier offered deliveries made by own vehicles. The general expectations as well as reasons to change a supplier are the same for all segments and are summarized in Figure 4.10 below.

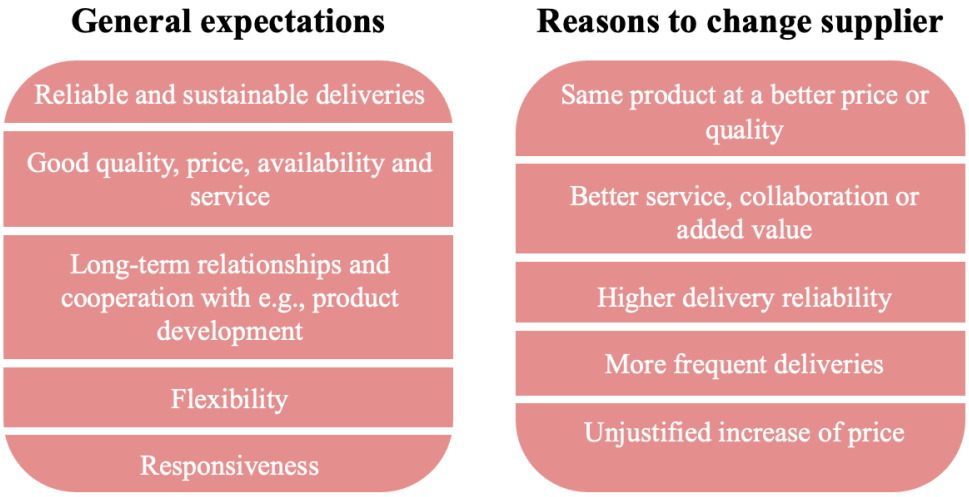


Figure 4.10: General expectations on suppliers regarding delivery and reasons to change supplier

Furthermore, the different segments' opinions on delivery time, supplier relationship, digital solutions, and sustainability are summarized in Figure 4.11.

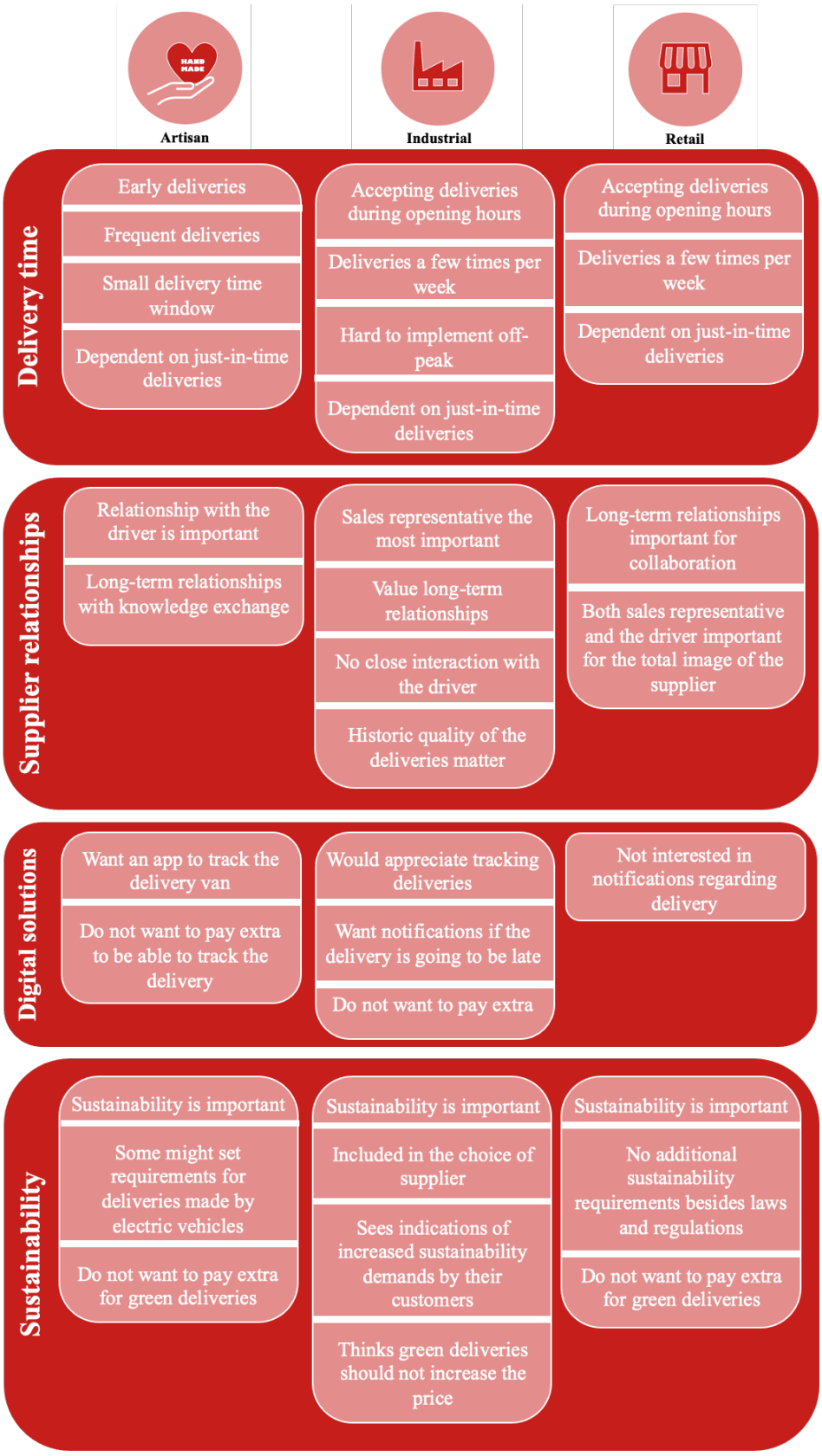


Figure 4.11: Summary of customer demands

5 ANALYSIS OF CUSTOMER DEMANDS FOR URBAN LAST MILE DELIVERY

This chapter will analyze the customer demands and expectations for urban last mile delivery. First, some common themes and conclusions from customer interviews and from the survey will be discussed. Then, four gaps between customer demands and current operations are identified and possible solutions to close these gaps are analyzed.

5.1 Customer expectations

The customer expectations are analyzed below based on five common themes; differences between customer segments, the importance of reliable deliveries, attitude towards innovative solutions, attitude towards sustainability, and the importance of a good relationship.

5.1.1 Differences between customer segments

As The Company described, the customer demands in Stockholm are extensive. The distribution situation in Stockholm is like no other place in Sweden, mainly because of two things; the volatile traffic situation and the high cost of storage. This means that customers demand fast, flexible, and reliable deliveries. They also value long-term relationships with their suppliers and transparent conversations when something does not go as planned. However, one key takeaway from the interviews is that other than this, the three different customer segments have very different needs and requirements when it comes to deliveries. There is no "one size fits all" solution that will generate satisfied customers in the whole of Stockholm city, instead, there is a need to adapt the deliveries to fit the three customer segments.

In general, the larger customer segments – industrial and retail – are rather similar in many aspects, while artisan customer demands differ more. When it comes to frequency of delivery and delivery times, the larger customer segments have lower demands than artisan customers because of their larger storage spaces and large organizations. They are however all dependent on just-in-time deliveries, as even the larger storage spaces are not large enough to keep much of a safety stock. Because of the vulnerability in the artisan customers' operation, due to non-existing safety stock, they bring up flexibility and frequency of deliveries as the most important aspects of delivery while the larger customer segments to a larger extent talk about price. Also in the survey, the retail and industrial customers valued the prices of the goods higher than the artisan customers, which indicates that artisan customers are not as price sensitive. All agree however that delivery reliability and sustainability are two of the most important factors when it comes to deliveries.

The three customer segments have differing views regarding the role of the truck driver. In general, the smaller the customers' organization is, the more important the relationship with the truck driver seems to become – which goes in line with the research done by Bode et al. (2011). This

observation seems logical considering that all interviews were held with people with managerial positions, and at larger corporations, the managers become further detached from the physical operations such as goods reception. The retail customer and one of the industrial customers said that they do not have much insight into the goods reception process and that they do not hear anything from the employees working there unless there is an issue that needs to be addressed by a manager. The bakery manager at the artisan bakery, on the other hand, was very involved in the whole delivery process and was personally interested in developing it to become more optimized. Nice drivers were also something one of the artisan customers from the survey brought up as something that could make the deliveries better. For the smaller artisan customers it therefore seems more important to build and maintain a good relationship between the truck drivers and the personnel, while the bigger customers just want the deliveries to go smoothly without any unresolved issues.

5.1.2 The importance of reliable deliveries

Out of all factors regarding deliveries of goods, delivery reliability was clearly considered the most important by all respondents to the survey. Also from the interviews, delivery reliability was brought up as the most important factor by all segments, and to an even larger extent by artisan customers. This goes in line with the conclusions made by Lal and Narayanswamy (2022), who highlight that important factors of last mile delivery are timeliness, accuracy, speed, and precision of deliveries. Fancello et al. (2017) also state that fresh food deliveries have high requirements for both delivery time and frequency. Due to low safety stock, delivery reliability is the customers' first and foremost priority, and if there is a slight deviation from the usual delivery scheme they generally want to know it right away and not wait until the delivery is already delayed.

5.1.3 Attitude towards innovative solutions

All the interviewed customers seemed to have a flexible mindset when it comes to implementing innovative ideas for the future, such as night-time deliveries. Deliveries outside of their normal opening hours were not something any of the customers had investigated further by themselves today, but a few were open to having a discussion about it to see if it would be beneficial for all parties. In general, the Stockholm customers seemed very aware of the challenges that come with their location, and most of them saw it as a challenge that they and their suppliers must work on together to find a sustainable way forward. An observation was that the retail customer seemed to be the least interested in how the deliveries were made possible – they just stated that it was up to the suppliers to make sure to get the goods delivered on time. The other customers were more conscious about the operating landscape for companies making deliveries, possibly because they all had their own delivery operations to get their baked goods out to their own customers. The understanding of the complexity from a business point of view therefore differed, which impacted their attitude towards deliveries in general.

When it came to off-peak deliveries, opinions differed. For artisan bakeries who are dependent on having the goods available early in the morning, night-time deliveries seemed to be an option they could consider. That was however not an option for retail customers, as they only saw challenges and no gain with receiving deliveries outside of working hours. The main challenges that were brought up regarding night-time deliveries were that it requires extensive trust in the driver to be willing to give away a key and that there are uncertainties regarding safety regulations. Therefore, in order for these types of deliveries to work, it seems to be important to have clear structures and agreements, and to make sure that there are no regulations that are being broken.

5.1.4 Attitude towards sustainability

Regarding sustainability, all interviewed customers stated that sustainability is an important issue for them as a company. They all work to reduce their environmental impact in different ways, but none of them has included their incoming deliveries in their sustainability goals yet. When asked what they believe is the sustainable way forward for freight delivery, they all brought up electric vehicles as the most promising future technology. Other vehicle technologies such as alternative fuels were not as widely known by the interviewees. Regarding sustainable deliveries, both internal goals and external requirements from customers as well as regulators were brought up as reasons for the customers to increase their sustainability demands on suppliers. However, opinions were split when it came to the willingness to pay more for more sustainable deliveries. Quak et al. (2016) found the same results in their survey, where only about 25 % of the respondents were willing to pay extra for getting deliveries by an electric vehicle. Some of the interviewees said that they think that the market as a whole will develop in a sustainable direction and that it therefore will become the new normal way of operating. All agreed that they were not willing to pay more for a service that other suppliers offer for free. However, some recognized that they might require even more sustainable transportation of goods than what is market standard in the future and that they then will have to be able to pay more for such additional service.

The fact that artisan bakeries generally want small and frequent orders becomes contradictory given that they also care about reducing the environmental impact. It would be much more environmentally friendly to receive large orders infrequently. However, that is often not possible in the Stockholm area since storage spaces are so limited. Although from the interviews, we found that two of the customers are currently investing in expanding their warehouses which would enable larger and more infrequent deliveries. Further, the effect of the variable fuel cost showed that small economic incentives can go a long way in influencing customer behavior.

5.1.5 The importance of a good relationship

Another takeaway is that the relationship between The Company and the customers is very important and should be a key focus point to maintain current customers and attract new ones. All interviewed customers said that they value long-term relationships with their suppliers, but it was most evident that it was actually the case for the customers who have co-developed their business

together with The Company in some way. The co-development could be in terms of product development of special mixes, or recipe development. These elements of the relationship were highly appreciated by the artisan and industrial customers. One of the industrial customers said that they wish to have closer collaboration with their suppliers in these aspects, which is a business opportunity for The Company. There are several potential suppliers of bakery ingredients in the Stockholm market, and since the customers choose suppliers based on a number of different factors, they compete with each other on several levels apart from price. The whole offering, as well as past experiences with the supplier, are said to be very important for the customers' choice. This is even more evident for smaller customers, who have co-developed their business to a larger extent with their suppliers. For the bigger customers, the price seems to be of higher importance in relation to other aspects of the offering. They also have a larger purchasing power and can more easily use that to play different suppliers against each other, so in the end it comes down to the price they can offer rather than anything else.

From the survey, the respondents also mentioned long-term relationships and collaboration as two things they value with a supplier. However, they also indicated that it would be rather easy for them to switch suppliers if someone else comes with a better offer. That is something The Company needs to take into consideration when developing their business together with a customer. In order to keep the customers long-term, The Company should try to find areas where they can co-develop e.g. a product with the customers so that it becomes less easy for them to switch suppliers. Such development projects can become beneficial for both parties as it provides stability and the possibility to plan operations with a longer time horizon.

5.2 Gaps to close

Four gaps have been identified between the customer demands and expectations, and the current last mile delivery setup. These four are visualized in Figure 5.1 and further discussed below, along with possible solutions.

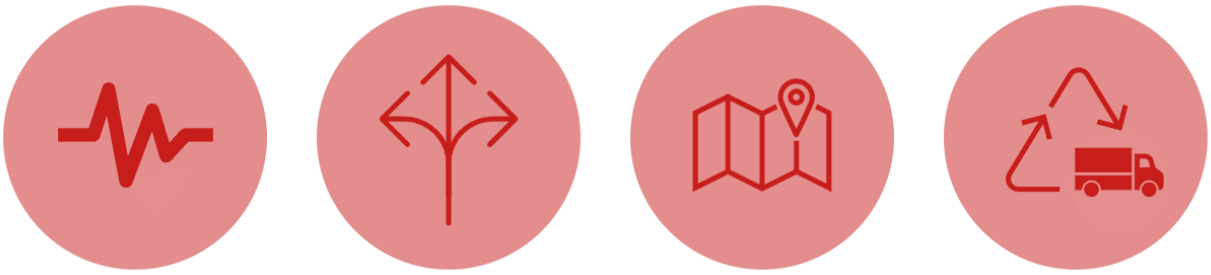


Figure 5.1: The four gaps between customer demands and expectations, and the current last mile delivery setup

5.2.1 Frequency of delivery

One thing that could be noted from the survey was that a number of artisan bakeries wanted more deliveries per week than what they currently get from The Company. This is also something that has been noted by the sales manager for artisan bakeries, who sees this as a trend among artisan bakeries in Stockholm. This goes hand in hand with the customers' limited storage space, which increases the demand for frequent deliveries. It is also interesting to consider the effect that the variable fuel cost had on purchasing behavior, where many customers chose to order fewer times per week to avoid the extra cost of transport. From both an economical and a sustainable point of view, a lower frequency of delivery is preferred by The Company. The demand for frequent deliveries makes it challenging for The Company to get the transportation operation to be economically sustainable, especially since many of the customers also demand small delivery time windows. Boyer et al. (2009) showed in their research that the cost increases by 45 % if deliveries are offered within a three-hour time window. Every stop on a distribution round costs money, both in terms of labor and fuel costs. It is therefore much more economical for The Company to deliver large orders a few times a week than to deliver small orders more frequently. Therefore, we can say that there is a gap between the frequency of delivery that The Company offers and what the customers want.

Solutions

Since it would be both uneconomical and bad for the environment to increase the frequency of delivery, the better option would be to create incentives that influence the customers' view on how many times per week they need to get deliveries. Boyer et al. (2009) showed in their research that the cost per delivery decreases with customer density, and propose that delivery companies should offer incentives for customers to concentrate their deliveries by day of week and area in order to shape the demand curve and lower the delivery cost. If the decision to order fewer times per week comes from the customers themselves and not from limitations placed by The Company, it will not be perceived as a gap. Such incentives could be for example a price reduction when consolidating orders, which goes hand in hand with the financial incentive proposal by Boyer et al. (2009). The price reduction could be set to reflect the cost savings The Company makes when the number of stops on a route is decreased. Another option would be to introduce a fixed price for transportation, similar to the variable fuel cost but instead in the form of a fixed cost. However, it is risky to add such a cost as that could be something that drives customers to switch suppliers. One customer said that unmotivated price increases are something that would make them consider switching suppliers, so if an additional cost or price increase were to be introduced, the reason for it would have to be communicated very clearly to the customers. On the other hand, it was also evident from the survey and the interviews that customers value transparency, and disclosing the transport cost separately from the product cost could be seen as increasing transparency. Regardless of what type of incentive is chosen, its effect should be evaluated thoroughly before a large-scale implementation is decided upon, so that it does not have undesired side effects such as loss of customers.

5.2.2 Flexibility

A recurring theme in the interviews and from the survey is that customers request more flexibility when it comes to ordering and delivery of goods. Many of the customers state that they experience greater flexibility with the suppliers that have storage and distribution centers in Stockholm and that The Company generally has longer lead times. They request flexibility in terms of being able to place or change an order closer to the delivery and more flexible delivery schedules where it would be possible to add an extra delivery one week if needed. The customers highly value that deliveries are made when they need them and might look for alternatives if The Company cannot offer deliveries on the desired day. However, increasing flexibility would be costly for The Company since it would require additional capacity and decrease the possibility to plan and optimize operations. Neither of the customers said that they would be willing to pay extra for more flexible distribution solutions. Some of them stated however that low flexibility might encourage them to switch the supplier to one they feel have more flexible solutions, which means that it can become a matter of loss of market share if The Company falls too far behind the competitors' offerings.

Solutions

In order to stay competitive in the Stockholm market, and to be able to gain more market share, it seems evident that The Company must be located closer to the market. In order to be able to offer better service in terms of flexibility to the customers, the goods must be stored in closer proximity to Stockholm. The Company could either invest in a warehouse just outside Stockholm on its own or rent storage space at the 3PL warehouse. If the plan is to keep using the same 3PL provider in the coming years, a good starting point would be to increase the business and collaboration with them to also include storage of goods. An additional warehouse would just be one additional step in the supply chain and decrease the efficiency further. It would also require investment in both facilities and staff. A good idea would be to start placing fast-moving goods and goods that often are requested on short notice at the 3PL warehouse for storage. That way, the lead time is decreased on these important articles and the customers will experience increased flexibility when ordering goods. Since the 3PL provider charges their customers per pallet for storing goods, it can be a good idea to start storing some pallets for a few months and then evaluate the results.

Based on analysis of sales data for all customer segments, the eight products to the left in Table 5.1 below were identified as the most relevant products to store closer to the market in the first step. These eight products were among the top 20 most sold products based on price and quantity, as well as the top 20 canceled orders and extra deliveries. A more detailed explanation of the data analysis is provided in Appendix 4. The reason for cross-checking the sales data with canceled orders and extra deliveries was to identify products that often are ordered outside of the normal ordering schedule, as well as orders that are canceled possibly because the products could be found with a shorter lead time at one of the competitors. In Table 5.1, 12 additional products are also

presented as proposed products to add in a later stage if the storage should be expanded. These 12 products are among the top 50 most sold products based on both price and quantity.

Table 5.1: Products to store closer to the market for all customers

Products to start with	Products to add if expanding the storage
• Flour • Sugar • Vanilla cream • Marzipan • Almond pulp • Muffin mix (neutral) • Grated coconut • Whipped cream	• Yeast for bread • Raspberry puree • Liquid whole eggs • Cake bases • Rolled oats (gluten-free) • Whipped cream (lactose-free) • Rapeseed oil • Frozen blueberries • Shrimps (hand-peeled) • Butter • Eggs (free range) • Sunflower seeds

When subtracting all orders from industrial customers, who often place very big orders that are delivered directly from the producers and do not go via The Company's flow of goods, the list slightly changed. Analysis of the top 20 most sold products for artisan and retail customers with regards to both price and quantity gave the six products presented to the left in Table 5.2 below. These were also among the top 20 extra deliveries, and the majority among the top 20 canceled orders. To the right in Table 5.2 are eleven additional products that are among the top 50 most sold products based on both price and quality for artisan and retail customers.

Table 5.2: Products to store closer to the market for retail and artisan customers

Products to start with	Products to add if expanding the storage
• Flour • Sugar • Vanilla cream • Marzipan • Almond pulp • Whipped cream	• Butter • Shrimps (hand-peeled) • Raspberry jam • Whipped cream (lactose-free) • Yeast for bread • Eggs (free range) • Cake bases • Rapeseed oil • Raspberry puree • Frozen blueberries • Milk with 3 % fat (lactose-free)

When also subtracting all orders from retail customers, the list changed again. The reason for subtracting retail customers is that they generally are good at planning their orders a long time in advance and rarely require extra deliveries. Analysis of the top 20 most sold products with regards to price and quantity for only artisan customers gave the eight products presented to the left in Table 5.3 below. To the right in the same table are 12 additional products, which are among the top 50 most sold products for artisan bakeries regarding both price and quality.

Table 5.3: Products to store closer to the market for artisan customers

Products to start with	Products to add if expanding the storage
• Flour • Sugar • Vanilla cream • Marzipan • Almond pulp • Whipped cream • Shrimps (hand-peeled) • Milk with 3 % fat (lactose-free)	• Butter (lactose-free) • Eggs (free range) • Walnuts • Whipped cream (lactose-free) • Yeast for bread • Raspberry puree • Replacement product for whipped cream • Marzipan for figurines • Egg yolks • Durum wheat flour • Liquid whole eggs

Considering that artisan customers make up around 45 % of The Company's sales and that the main competitors in Stockholm have focused their offering to artisan customers, it seems like a good idea to start with storing the eight products to the left in Table 5.3 at the 3PL warehouse. However, aspects such as the perishability of goods must also be taken into account, and it must be evaluated if products such as whipped cream and milk are feasible to keep in extra stock. It can be noted that six of the products are among the top 20 sold for all of the three combinations of customer segments, and these products should thus be considered staple products for bakeries. The six products are; flour, sugar, vanilla cream, marzipan, almond pulp, and whipped cream. Providing these staple products with shorter lead times to customers could therefore be something that would increase the feeling of flexibility for customers across all segments.

More flexible delivery schedules are a more complex request since more frequent deliveries are not desirable as discussed above. However, it might be possible to utilize the benefits of having a 3PL provider and not have fixed delivery days for each customer. Since the 3PL provider can consolidate deliveries with goods from other companies as well, it is easier for them than it would be for The Company alone to find reasonable routes with flexible delivery schedules. However, it would make transport planning more complex and volatile. A compromise between strict delivery

days and full flexibility could be to offer alternative delivery days, e.g., two or three days per week so that the customers feel that they have the flexibility to choose but within reasonable limits for The Company and the 3PL provider to be able to plan and optimize routes.

Another possibility for The Company to decrease the perceived gap regarding flexibility is to offer their customers support when it comes to forecasting their need for goods. This especially applies to artisan customers, who generally do not have set structures and processes for forecasting and ordering goods. To reduce the problem of the bakeries not knowing on Friday what they will need the Monday after the weekend, and thus feeling the need to be able to order goods with shorter lead time or to change the order with short notice, The Company could offer support such as a forecasting tool. The tool could be based on historic ordering data for the specific customer, and calculate from that what the customer will need in the coming weeks. Such a tool could also create incentives for customers to consolidate their orders, e.g., if it can be seen that they have placed additional orders of a specific product in the past few weeks. Then the tool could suggest that they buy more of that product in their original order, to reduce the need for extra deliveries. Creating such structures is not only beneficial for the customers, but also for the case company since a reduced need for extra deliveries would decrease costs for The Company. It would also be an extra service that differentiates The Company from the competitors on the market and could possibly lead to a gain of market share.

5.2.3 Delivery tracking

Artisan bakeries expressed a clear demand for reliable deliveries, and the interviewed bakery manager said that traceability and transparency were something he valued highly when it comes to deliveries. A technical solution such as an app where the customers can track their deliveries would be highly requested by the bakery manager. Retail customers, on the other hand, have less interest in tracking their deliveries, instead, the interviewed retail customer said they would find it annoying to receive notifications about them. As long as the deliveries reach the retail customers within the opening hours of their goods reception, they are content. Industry customers also value delivery reliability highly, as their production process also can be dependent on same-day deliveries. Thus, they also have an interest in delivery tracking, which is something that The Company does not offer today. Delivery tracking is a challenge when the distribution is outsourced to a 3PL provider, as there are more actors involved and it is not The Company that owns the data. On the other hand, as the long line of communication is a challenge for both The Company and the 3PL provider today, both parties should be interested in a technical solution that would decrease the need for manual communication. Such a technical solution can be programmed to handle all communication digitally and autonomously between all stakeholders.

Solutions

The implementation of a delivery tracking system is something that has already been initiated at The Company. Given the different requirements of the different customer segments, the technical

solution must be customizable to fit them all. Customers within the same segment also have differing views on how and how many times they want to get notified about their deliveries. Some want notifications via text message, some via mail, and some directly in an app. Some want to be notified when the delivery is on its way, some only want to be notified if the delivery is late, and some want to be able to track the delivery in real-time and not necessarily get any notifications at all. One customer states that it can easily become a source of irritation if they receive more notifications than they want. Therefore, it is important that the solution must be customizable on a customer level, not only on a customer segment level.

The challenging part of offering notifications regarding the delivery to customers in the inner city of Stockholm is that the 3PL provider does not know exactly when the delivery will take place since the routes are constantly changing. The trucks can be traced with the installed GPS, but do not follow a fixed route. Therefore, it could be confusing rather than helpful for customers to see where the truck is located in real-time, and can possibly cause irritation if they see that the truck has been close by but not yet delivered goods. One option could be to implement an easy way for the customers to be directly notified about delays, e.g., because of major breakdowns, heavy traffic, or changed delivery routes. If this information could be made visible in a digital solution by direct input from the truck driver or the 3PL provider without having to go through intermediaries, the flow of information would be much less time-consuming than today. From the interviews and the survey, it became evident that the majority of customers regardless of segment want to be notified only if the delivery is delayed, so that feature is the most important aspect of a delivery tracking service.

5.2.4 Sustainable deliveries

All interviewed customers and all but one respondent to the survey stated that sustainability is important for them as a company. They also stated that it is important for them that their suppliers are sustainable, where the respondents in the survey on average gave a score of 8 on a scale where 0 is “not important” and 10 is “very important” with regards to having sustainable suppliers. When asked if it is important for the customers that the goods are delivered in a sustainable way, the score was slightly lower which indicates that there are other things the customers might value higher within sustainability. However, the score for sustainable deliveries still reached 7 on the same scale as previously described, meaning that it is still considered important. From the interviews with the industrial customers, it became clear that they might include their suppliers more in their sustainability work going forward, and that having sustainable suppliers then becomes even more important. Electrical vehicles were also something that was brought up as desirable for the suppliers to have by the interviewees.

The Company is today lacking in sustainability work. The daily work of the Quality and Sustainability manager is much more focused on quality rather than sustainability, and the sustainability work seems to have fallen between the cracks. One of the biggest competitors is

profiling itself as the more sustainable alternative, with fossil-free deliveries. The deliveries in Stockholm made by the 3PL provider are today also fossil-free since the vehicles are powered by HVO100 – however, this is not something that is advertised by The Company to the customers.

Solutions

In order to compete in the market of sustainable deliveries, it is important for The Company to start focusing more on sustainability – both on advertising the work that is already being done within the company, creating clearer processes, and allocating assets to work with driving the sustainability question going forward. The Company should also continuously follow up on the development of the market regarding sustainability, as this might become an order qualifier for some customers in the future. Sustainable changes in the distribution cannot be made overnight and lagging behind could make The Company lose customers in the future.

One practical idea when it comes to sustainability initiatives is to look into climate compensation of the deliveries. The customers can be given the possibility to choose themselves if they want their transports to be climate compensated or not. This could be done by adding a button at the checkout on the e-commerce website, where the cost for climate compensation is stated and optional to add. Adding that feature on the website would also be interesting for The Company, since it shows how many of their customers are willing to choose the sustainable alternative when there is a cost involved. That is interesting data to collect and use in future sustainability initiatives, to see if there is a possibility to put some of the cost on the customers.

Electric vehicles have been brought up in many interviews as the way to go forward – both by customers, The Company's employees, and the 3PL provider. Some customers have started looking into investing in electrical vehicles themselves, and some are already using electrical vehicles for their own transportation today. One of the interviewed customers said that they expect the same from their suppliers as what they are doing themselves, so when they have decided to switch to a fully electric fleet, they will expect the same from The Company. At the 3PL provider, they are continuously evaluating alternatives such as vehicles run on electricity or on gas. However, as their vehicles are powered by HVO100 which meets all environmental requirements today and for the foreseeable future, they do not see any reason to switch. As electrical vehicles still are around twice as expensive as diesel trucks, they are not yet considered economically sustainable by the 3PL provider, and the same conclusion was made by The Company's own transport department. However, considering that technical development moves fast and that customer requirements move even faster, there will be increasing incentives both for The Company and in turn the 3PL provider to invest in new vehicle technologies in order to stay relevant in the market. This transition will likely happen in the next 5–10 years given that it has already started for some of the customers today.

The fact that all last mile deliveries in Stockholm are outsourced to a 3PL provider makes the sustainability work more complex since The Company cannot control all factors. The Company does not have the possibility to market that the deliveries in Stockholm are fossil-free today, since that is not stated in the contract with the 3PL provider. The Company also has little impact on the 3PL provider's decision to invest in an electric fleet in the future. What the case company instead must focus on are the factors they can control, such as the sustainability work and standards that are set in-house and communicated out to all suppliers, service providers, and customers.

6 ANALYSIS OF OPPORTUNITIES AND CHALLENGES WITH IMPLEMENTING SUSTAINABLE LAST MILE DELIVERIES

This chapter will analyze the challenges and opportunities that come with the implementation of sustainable urban last mile deliveries. In Chapter 6.1 we give an overview of the identified opportunities and challenges, which then are analyzed further in Chapter 6.2 and 6.3.

6.1 Overview of opportunities and challenges

As discussed before, sustainability is considered important by the customers. The implementation of sustainable last mile deliveries entails both opportunities and challenges, which are summarized in Figure 6.1.

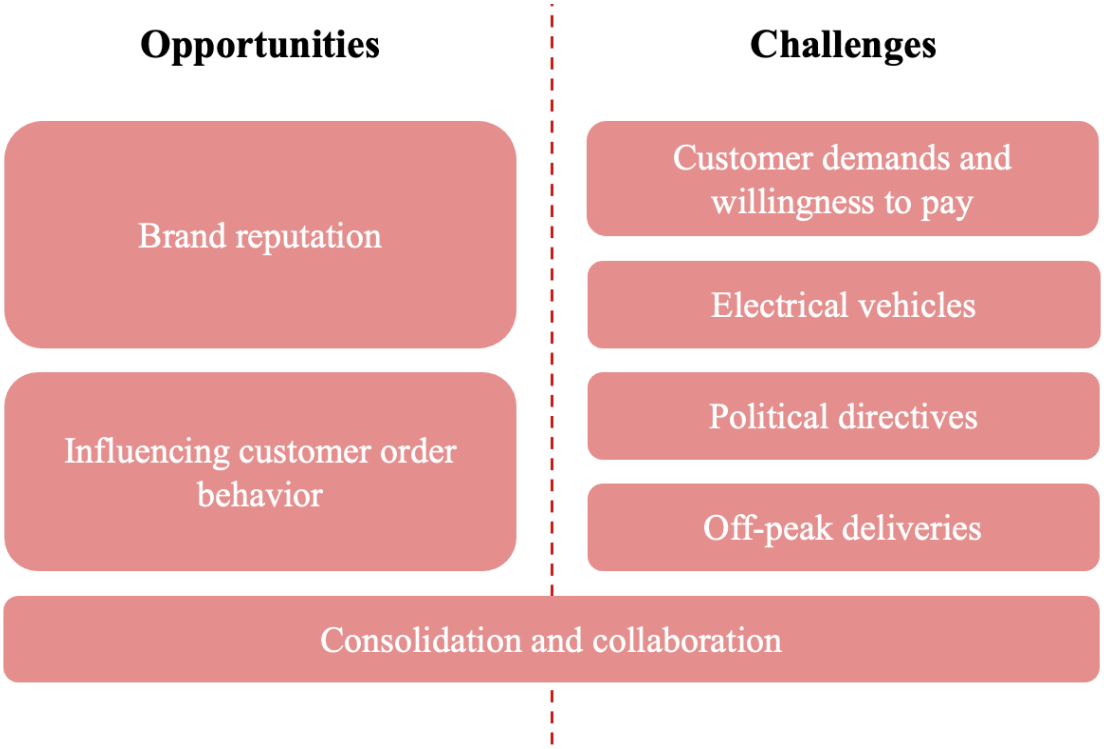


Figure 6.1: Opportunities and challenges with implementing sustainable last mile deliveries

6.2 Opportunities to implement sustainable last mile deliveries

Three opportunities to implement sustainable last mile deliveries have been identified through interviews both at The Company and with the customers. These are brand reputation, influencing customer order behavior, and consolidation and cooperation – and are further analyzed below.

6.2.1 Brand reputation

Since the customers see sustainability as one of the most important factors when it comes to deliveries, it is of great importance for The Company to have a sustainable brand. Considering that sustainable operations may become an order qualifier in the future, there is a risk of losing customers if the sustainability work is not reflected in the brand and communicated to customers. Since The Company is a part of The Company Group, there is an opportunity for them to benefit from The Company Group's sustainable brand, as well as knowledge exchange and best practices between the sister companies. Furthermore, The Company Group is a large and well-known brand within the food industry and has therefore many eyes on them regarding their operations and sustainability work. That means that they are doing extensive sustainability work that The Company can take part in. However, to benefit from The Company Group's brand, but also build its own sustainable brand, The Company needs to set up sustainability goals of its own and implement a structured way of working towards achieving them.

6.3.2 Influencing customer order behavior

The Company has the opportunity to adjust their customers' order behavior and thereby how often deliveries are made, to directly affect the environmental impact of the transport operation. This was proved when the variable fuel cost was introduced and customers chose to consolidate their orders more. According to Ploos van Amstel and Balm (2016), fewer shipments can be achieved by having efficient city logistics operations. Every truck entering the city contributes to congestion and air and noise pollution (Ranieri et al., 2018), and by adjusting the deliveries so the trucks are fully utilized and the routes are optimized the externalities from the last mile delivery can be reduced. One way to influence the customers' order behavior is as brought up in Chapter 5.2.1 to offer financial incentives for customers to consolidate their orders. The Company should further investigate if this would have an impact on emissions from the transport operation.

6.2.3 Consolidation and collaboration

To avoid vehicles delivering part loads into urban areas, a UCC can be used (Browne et al., 2007). Benefits for The Company using a UCC include that the logistics costs and environmental impact can be reduced (Taniguchi, 2014). Further, the delivery reliability to the customers can be improved (Browne et al., 2011), which is one of the most important aspects brought up in the customer interviews. The Company should therefore monitor if Stockholm Stad is initiating UCC projects for products with similar characteristics as their own. The interviewed retail customer expressed interest in getting consolidated deliveries from all their smaller suppliers and this was due to a wish to decrease the number of deliveries received each day. Such a consolidation operation is however not something that The Company has the ability to start up itself, and would require the local authorities to promote, help with aid and funding, and bring together interested parties as described by Browne et al. (2007). A UCC leads to fewer trucks doing the same work

(Browne et al., 2007) and thus a better urban environment, but an early success of a UCC is not probable and thus requires initial funding.

Another type of collaboration is partnerships with other delivery companies on the market. The Company could look into partnerships with food delivery companies that deliver at other times than what The Company does. The utilization of the truck could then be maximized, as it could be used to deliver The Company's orders in the morning and then by the partner to deliver to other clients during the afternoon and night. This type of collaborative network could give joint benefits for both the collaborating parties and show positive results on both sustainability and efficiency according to Quak (2012). Furthermore, it could be easier to invest in e.g. electric trucks as the investment cost can be split between the two parties.

6.3 Challenges with implementing sustainable last mile deliveries

There are also challenges with implementing sustainable last mile deliveries. Through the interviews with The Company and the customers, five challenges have been identified. These five challenges are customer demands and willingness to pay, electrical vehicles, political directives, off-peak deliveries and consolidation and collaboration, which will be further analyzed below.

6.3.1 Customer demands and willingness to pay

The willingness to pay for sustainable deliveries is low among the customers, and in the survey, all customers answered that they do not want to pay extra for green deliveries. The customers still value sustainability highly, but generally do not want to change how they receive their deliveries today or pay more, which was also noted by Gaevears et al. (2009). This becomes a challenge for The Company, since its main goal as a company must be to remain profitable. For an investment to become profitable, it must either increase revenue or decrease cost. The biggest challenge, as identified by Demir and Syntetos (2022) is that minimization of emissions often does not minimize the cost. The benefits of investing in projects aiming to increase the sustainability of the last mile delivery can be hard to evaluate as Balm et al. (2014) state that the investments do not have to be connected to increased profit or revenue. Such investments will benefit society as a whole and are demanded by the customers who want to receive sustainable deliveries. However, the customers are not willing to pay, instead it is The Company who is expected to pay without receiving any monetary benefits.

6.3.2 Electric vehicles

The interviewed customers believed that electric vehicles are the future of sustainable deliveries, and some say that they will require their suppliers to have electric trucks in the future. For both The Company and the 3PL provider, that would entail investments in a completely new vehicle fleet which comes at a high cost. When looking at the operational costs, savings could be made by using electricity instead of diesel (Quak et al., 2016) but the purchase costs are higher for electrical

vehicles compared to conventional diesel trucks (Ranieri et al., 2018). Since the 3PL provider currently only owns trucks that run on HVO100, which complies with the current regulations of Stockholm Stad, they are not planning to renew their fleet in the near future. They are however following the evolution of the market, but say that the price of transport would likely increase if they were to start using electric trucks as the purchasing price is at least twice as high than for diesel trucks. The purchase price is thus a large obstacle for the implementation of electric trucks and for them to be competitive the price needs to be lowered (Melo et al., 2014; Kin et al., 2021). This is something The Company's customers are aware of, and they said that they will likely not have strict requirements for electric trucks in the next few years but rather further in the future. Alternative fuels, such as HVO100, are not as widely known as electricity among the customers. As long as vehicles that are running on HVO100 are used for the distribution in Stockholm, The Company needs to consider how to promote the benefits of this biofuel to their customers. Polydoropoulou (2022) means that information sharing has the potential to increase the awareness and receptivity of innovations, so The Company will have to educate the customers in a receptive way.

Another challenge is that electric vehicles have a shorter driving range compared to the diesel trucks that are used today. For The Company to be able to operate such a fleet, it would probably be necessary to have a hub close to the customers in Stockholm where the electric vehicles can be used for last mile delivery, or to use a 3PL provider with an electric fleet. The transportation planner at the current 3PL provider pointed out that it would be difficult to get the driving range of an electric truck to fit their distribution rounds today. However, electric trucks are developing quickly and Kin et al. (2021) stated that the price of batteries is expected to decline by almost 58 % between 2020 and 2030. Although it is still a challenge with the insufficient charging network and that the deployment of electric vehicles has not yet seen a large-scale take-off (Kin et al., 2021). Even though electric trucks might not be suitable for urban last mile delivery today in Stockholm due to its limited driving range, high investment cost, and insufficient charging network, it is important for The Company to keep up with the development.

Implementing sustainable last mile transportation further brings up more questions regarding the modes of transportation used earlier in the supply chain. The last mile deliveries might be a good starting point in the work towards reducing the negative environmental impact of the transportation operation as Bosona (2020) states that this part of the supply chain is the most polluting one. However, The Company should not only focus on the last mile delivery and the next step requires them to take a step back and regard the entire supply chain to see how the whole chain can be made more sustainable.

6.3.3 Political directives

The regulations from Stockholm Stad will put pressure on delivery companies, and not all kinds of vehicles will be able to operate in the inner city. Given the location of the 3PL provider, it will

be necessary to drive through the environmental zone of Stockholm Stad even to serve some of The Company's customers located outside of the city center. This means that the trucks must meet the requirements regarding size and weight. If smaller trucks need to be used to fit the regulations, a consequence might be that the number of delivery rounds needs to be increased to deliver the goods to all customers.

Looking further into the future, it is uncertain what regulations both Stockholm Stad and the government will set regarding urban distribution. Therefore, it is hard for distributing companies to know what types of vehicles they should invest in today to be able to reach future requirements. At the same time, it is not sustainable for the government to set strict requirements as Balm et al. (2014) describe that restrictions and legislations can have a negative effect on the efficiency and the economic success of a company. Changing political directives can become a big challenge for The Company, if regulations or incentives change so that investments in certain types of vehicle technologies become uneconomical. Since customers are not prepared to pay extra for sustainable deliveries, there must be economic incentives from policymakers to make that kind of investment feasible. If such incentives are suddenly taken away after investments are made, it will have a direct impact on The Company's profitability.

6.3.4 Off-peak deliveries

Although off-peak deliveries come with many benefits according to research, with the potential to reduce pollutants in cities (International Energy Agency, 2017) and reach higher driving efficiency and delivery reliability (Fu and Jenelius, 2018), such deliveries do not seem feasible to implement at The Company's customers in the near future. Only a small number of the interviewed customers said they would consider off-peak deliveries, and only if it gave them some kind of benefit. Holguín-Veras et al. (2005) said that a considerable amount of customers must want to get off-peak deliveries for it to be feasible. All customers in the survey and the interviews answered that they would like to receive goods in the morning or during the daytime, which hinders the implementation of off-peak deliveries. The industrial customers put emphasis on the need of having personnel available to receive the goods and one of the industrial customers pointed out that their certificates would make it very difficult for external people to be at the premises without supervision. To offer off-peak deliveries outside of the industrial and retail customers' opening hours is not something value-adding for their businesses as it would require them to hire extra staff to accept deliveries during off-peak hours. It would entail a cost without any gain, and it is therefore not likely that these larger customers would consider switching to such delivery times. There could also be difficulties linked with the legal aspect of making unmanned off-peak deliveries since the customer cannot check the products upon arrival. As Andersson (2022) states, there is then a need for a contract between the carrier and receiver. There are also regulations regarding noise in Stockholm to not disturb residents (Andersson, 2022) that could make it difficult to implement off-peak deliveries.

Off-peak deliveries also generate higher costs for The Company, since night-time deliveries are more expensive as labor costs increase due to unsocial working hours. Other costs decrease, such as the congestion tax in the inner city and on Essingeleden which sets incentives for driving at hours when there is less traffic. The congestion charge is the highest (Transportstyrelsen 2023b) when the driving speed is the lowest (Fu and Jenelius, 2018). The Company's deliveries are made during the morning hours when the congestion charge is between 15–45 SEK during the high season. If these are to be increased in the future, distributing companies in Stockholm might look into driving into the city during off-peak hours to make their deliveries. Even though the congestion tax and the fuel costs decrease when delivering off-peak, the labor cost increases significantly. According to the 3PL provider, the price for night-time deliveries depends on many things such as the distance, number of hours, and complexity of the work for the driver, but a rough estimate from the transport planner was that the price would increase by about 50 %.

6.3.5 Consolidation and collaboration

Although a UCC in Stockholm comes with many benefits, it also comes with challenges. The main challenge is that a UCC is not something The Company could start by itself. The implementation of a UCC and consolidated deliveries would require engagement from both authorities and several other companies (Browne et al., 2007). The Company is too small of a company to have the resources to initiate such a collaboration and thus must leave the development of a possible UCC to local authorities in Stockholm. In order for a UCC to be beneficial for The Company, the participating companies' goods must also require refrigerated and frozen transports. A challenge would then be to find companies transporting goods within the same temperature range and that could not contaminate The Company's goods. Since The Company delivers food products there are strict requirements that need to be fulfilled (Rådet för kyl- och fryskedjan, 2021), which limits the possibility to find feasible transport partners.

In a way, it can be said that the 3PL provider used in Stockholm today works as a small UCC, where goods from different companies are consolidated and distributed. However, since there are dedicated trucks for The Company's deliveries, the full potential for the 3PL provider to work as a UCC is not used. Having dedicated trucks is desirable from the aspect of having dedicated drivers who are experienced with The Company's goods and customers, which is important considering that the relationship with the driver is important for the customers. Brown et al. (2007) state that a disadvantage of a UCC is that the direct contact between the supplier and customer is lost. When collaborating in a UCC it is not certain that it will be the same driver who delivers The Company's goods every day, or even that the driver is employed by the same company. This brings another challenge regarding the responsibility of the goods if something gets damaged or lost during the delivery (Brown et al., 2007). On the other hand, the benefits of a UCC, such as lower logistics cost and environmental impact (Taniguchi, 2014), and better delivery reliability (Browne et al., 2011; Browne et al., 2007) are not reaped. The Company must consider the benefits and challenges

and decide what aspects are more important, to decide if they would want to participate in a potential future UCC in Stockholm.

Partnerships and collaborations outside of a UCC also come with challenges. If The Company were to partner up with another food delivery company that delivers at other times during the day, they would have to agree on strategic, tactical, and operational decisions according to Clophas et al. (2018). Clophas et al. (2018) also state that there is a risk that problems will occur if the partner companies are not willing to be fully transparent with each other and share all information. The Company would therefore have to find a company they would be willing to fully trust in order for such a partnership to work.

6.4 Evaluation of the opportunities and challenges

In summary, there are more challenges than opportunities for the case company to implement sustainable last mile deliveries as the situation is today. However, in order to stay relevant in the market in 5–10 years and continue to compete with the other suppliers of bakery ingredients, The Company will eventually have to implement sustainable deliveries. This is both due to customer demands, since customers ranked sustainability as one of the most important factors when choosing suppliers, and due to coming demands from policy makers. As stated by Kolasinska-Morawska et al. (2022), it is the customers who influence how the supply chain develops in the end. Without customers, The Company will not be able to keep running a business, so evidently it comes down to satisfying their requirements and needs.

Since the challenges outweigh the opportunities today, and the monetary benefits of sustainable investments are scarce, investing in sustainability has to be a strategic choice. Customer willingness to pay has proven to be low for such initiatives, meaning that The Company cannot expect to fully compensate for the investment cost through increased revenue. Instead, it can be seen as a necessary cost for the case company to carry to be able to keep operating in the market in the future.

7 ANALYSIS OF ADVANTAGES AND DISADVANTAGES OF OUTSOURCING URBAN LAST MILE DELIVERIES

This chapter analyzes the implications both for handling the urban last mile distribution in-house and for outsourcing it.

7.1 Implications for handling urban distribution in-house

The primary reason for handling the distribution in-house is to decrease the number of actors involved in the process. The flow of information gets increasingly slower with a growing number of actors, and fast information is something that is highly requested by customers. An increasing number of actors also leads to a loss of control. When outsourcing the distribution, the company is putting both its goods and its reputation in the hands of the 3PL provider. It is evident that the relationship with the truck driver is important for many customers, and a bad truck driver could potentially damage the relationship between The Company and their customers – which is also highlighted by Bode et al. (2011). From the interviews, it was clear that in the eyes of the customer, it is The Company that comes and delivers the goods even if there is another name on the truck. The 3PL provider therefore becomes an ambassador for The Company as a brand, and if something goes wrong it will reflect badly on The Company.

The loss of control also applies to the vehicle fleet and the possibility to influence the choice of vehicles. If The Company were to handle all transports in-house, they would have full control of the vehicle fleet. That would mean that the case company could have real-time access to the location of the trucks without having to go through any middle hands. It would also mean that The Company would have control over investment decisions, such as investing in an electrical fleet if that is something that becomes an order winner in the future. When outsourcing, all information about the vehicles is owned by the 3PL provider, and The Company has much less influence over investment decisions in the fleet. Further, The Company does not have the same possibilities to market that e.g., the deliveries are made in a sustainable way, since it is not The Company who owns that information. Even if the 3PL provider has sustainable modes of deliveries, it is not stated in the contract they have with The Company, and then the case company cannot communicate that to their customers. If they want to include that in the contract, the 3PL provider may want to charge extra.

The Company has a lot of knowledge and expertise when it comes to transport operations in-house. They have drivers and transport planners with many years of experience, and they are very valuable to The Company. It can be seen as brand-building for The Company to value this competence and the personal relationship it builds with customers. It can also become a matter of competitiveness as the personal relationship built with the driver at delivery is something that is highly requested by customers and offered by the competitors on the market. From the interviews and observations

made during the distribution rounds, it is seen that the smaller companies have a larger personal contact with the drivers than big industrial customers. The decision-makers at smaller customers were in some cases interacting with the drivers regularly, while for example a purchasing manager at one of the industrial customers never meet the drivers. Bode et al. (2011) pointed out that the outsourcing decision needs to include the people performing the physical distribution services and this may be especially important for the deliveries made for smaller companies.

When handling distribution in-house, there is a possibility to create a return flow of goods on the routes. A return flow of goods is beneficial from both an economic and environmental point of view since it reduces the need for additional transports. That possibility is lost if deliveries are outsourced since the trucks only operate between the 3PL provider and the customers. If products were to be stored at the 3PL provider, there is however a possibility to create a return flow. However, it would require that the specific products that are stored at the 3PL provider are located for pick-up within Stockholm, which is unlikely if only a few products are stored at the 3PL provider.

7.2 Implications for outsourcing urban distribution

One of the main reasons for outsourcing the distribution in Stockholm is to take advantage of the expertise there is on the market regarding deliveries to this specific region. Although there is a lot of expertise within The Company regarding transport operations in general, there is no expertise regarding distribution in the Stockholm area in particular. This expertise instead lies with the 3PL providers that are operating within Stockholm and is something they have gathered from experience over time. It would be both difficult, time-consuming, and costly for The Company to acquire the same expertise, so it might be more cost-effective to outsource Stockholm distribution operations. Apart from expertise, the 3PL provider also owns the informal knowledge that is collected from the daily operations and personal contact with the customers. Such knowledge is for example how the customers would like the deliveries to be made, which is something The Company does not know today. The value of this knowledge is hard to put in monetary terms but is something that both hinders The Company from switching 3PL provider and bringing the Stockholm distribution in-house.

The fact that one of the interviewees got a phone call from an angry customer who received a delivery from one of The Company's most experienced drivers – although not the driver who usually makes deliveries to that customer – tells a lot about the relationship between the driver and customer. According to the customer, the driver had no idea what he was doing – when in reality he just had no experience delivering to that specific customer. This indicates that the relationship between the driver and the customer is personal between a specific driver and a customer rather than between The Company and a customer. That gives reason to believe that it is less important if the driver actually is employed directly by The Company, and more important that the driver has a relationship with the customer and knows how he wants the delivery to be made. In

Stockholm, the majority of deliveries are made by the 3PL provider, and many of the interviewed customers there spoke highly of the drivers and the relationship they have with them. The fact that it was clear to the customers that The Company makes the deliveries, although the drivers are employed by the 3PL provider, indicates that it may not be the fact that the delivery is outsourced that is the problem if problems occur between the driver and customer. Instead, it is more likely that it is the handover between the previous and the new driver that has failed, if the new driver does not know how the customer wants their deliveries to be made.

Besides that the 3PL provider possesses expertise within urban last mile delivery in Stockholm, they also own the facility located close to the city. The 3PL provider furthermore owns the vehicle fleet and also has flexible manpower unlike The Company. The drivers at The Company have fixed routes and they have fewer employees that can cover if some of the drivers get sick. There are no extra personnel that can work when necessary, instead, the drivers have to cover for each other if something happens. The 3PL provider has contracts with many different companies and drivers and can call in more manpower on short notice if needed. That is something that can contribute to better delivery security, as the operation is less vulnerable.

Another implication for outsourcing the deliveries in Stockholm is the additional services the 3PL provider offers, such as storage of goods. Many benefits can be derived from having a warehouse in connection to the distribution center. This would increase flexibility, as it would allow customers to order goods with shorter lead times. The Company does not have a warehouse in close proximity to Stockholm today, and building one would require extensive investments. To store goods at the 3PL provider, which already has the resources and experience to handle both dry, refrigerated, and frozen goods, could be a good option.

One further implication for using a 3PL provider is their advantage when it comes to economies of scale, which also can benefit The Company. Since the 3PL provider handles the distribution for many other customers than The Company, they can consolidate goods and thereby optimize the utilization of vehicles and personnel. Due to The Company's size, the same economies of scale cannot be achieved within the corporation by itself. The consolidation of goods can reduce environmental impact and logistics costs (Taniguchi, 2014) but also gives the customers better delivery reliability and reduces the time they will spend on receiving deliveries (Browne et al., 2011; Brown et al., 2007). It is also much easier for the 3PL provider to scale up their operations if volumes increase, and that is something they have great experience with due to the seasonalities in their operations. If The Company were to increase its sold volumes in the Stockholm area over the next few years, it will be easier to increase the contracted volume with the 3PL provider than to invest in additional vehicles and personnel.

One of The Company's main challenges identified from the interviews with the employees was to keep the cold chain. The employees said that different drivers from different companies handle the

frozen and refrigerated goods differently, and thought that the outsourced deliveries more often failed to keep the cold chain than what deliveries made by The Company's own trucks and drivers did. However, analysis of data covering all delivery errors and their reasons showed that out of all delivery errors, failure to keep the cold chain only constitutes around 4 %. The large majority of delivery failures are broken goods that have either broken when packing or during transport. The data covered both internal and outsourced deliveries. This shows that failure to keep the cold chain is not as big of a problem as it is perceived within the company, and should not be a reason to avoid outsourcing.

8 CONCLUSION

This chapter aims to conclude the study and answer the research questions. It will provide The Company with recommendations for future implementation and also describe areas to be further researched by both the academia and the case company.

8.1 Discussion of the results

The purpose of this study is to examine how The Company should improve its distribution and last mile delivery setup in Stockholm to better meet the customers' expectations and needs, and at the same time consider costs and externalities. To fulfill this purpose a case study was conducted to answer the three research questions which will be reviewed in the following section.

8.1.1 RQ1

How can customers' expectations and needs be met for urban last mile delivery of bakery ingredients, potentially using innovations and new technologies?

Last mile deliveries in Stockholm are complex due to the customers' small storage spaces, their need for just-in-time deliveries, and transportation restrictions set by Stockholm Stad. To analyze the customer demands related to urban last mile deliveries, we first conducted a literature review to understand the various limiting factors in the urban environment and what innovations and technologies are available today. Then customers located in Stockholm were interviewed and a survey was conducted to identify the general expectations of the last mile delivery, which are presented in Figure 8.1.

Figure 8.1: General customer expectations of urban last mile delivery

These general expectations are met by the current last mile delivery setup of the case company described in Chapter 4.2.3 except for four identified gaps. The gaps along with their solutions are presented in Figure 8.2.

Figure 8.2: Overview of gaps to close for urban last mile delivery and their solutions

Some solutions require investments in new technologies, e.g. a delivery tracking system and electrical vehicles, while others can be implemented with current technologies. No other innovations, such as innovative vehicles, are considered reasonable for the case company to implement in the coming 5–10 years.

8.1.2 RQ2

What factors could hinder or enable the implementation of sustainable urban last mile deliveries?

From the analysis in Chapter 6, it was concluded that the following factors could hinder the implementation of sustainable urban last mile deliveries:

- Large investment costs for electrical vehicles
- Customers not willing to pay extra for sustainable deliveries
- Changing political directives which makes it uncertain whether the investment decision is feasible or not
- Higher cost and unwillingness from customers to receive off-peak deliveries
- The need for multiple parties to come to an agreement for consolidation and collaboration efforts to succeed

It was also concluded that the following factors could enable the implementations of sustainable urban last mile deliveries:

- The possibility to influence customer order behavior to get them to consolidate their orders through financial incentives
- The extensive sustainability work that is being done by the Mother Company, and potential synergies that can be achieved between the daughter companies
- The potential for collaboration and consolidation between companies and stakeholders in Stockholm

To summarize, there were more challenges than opportunities identified with implementing sustainable urban last mile deliveries, but sustainability was also ranked as one of the most important factors that customers look at when choosing suppliers. That makes sustainability a strategic question that has to be taken into account by the case company in order to stay relevant in the market and not lose customers to competitors who can offer more sustainable solutions.

8.1.3 RQ3

What advantages and disadvantages could a company get from outsourcing the urban last mile delivery?

The implications for outsourcing the urban last mile delivery as well as keeping it in-house are summarized in Figure 8.3 below.

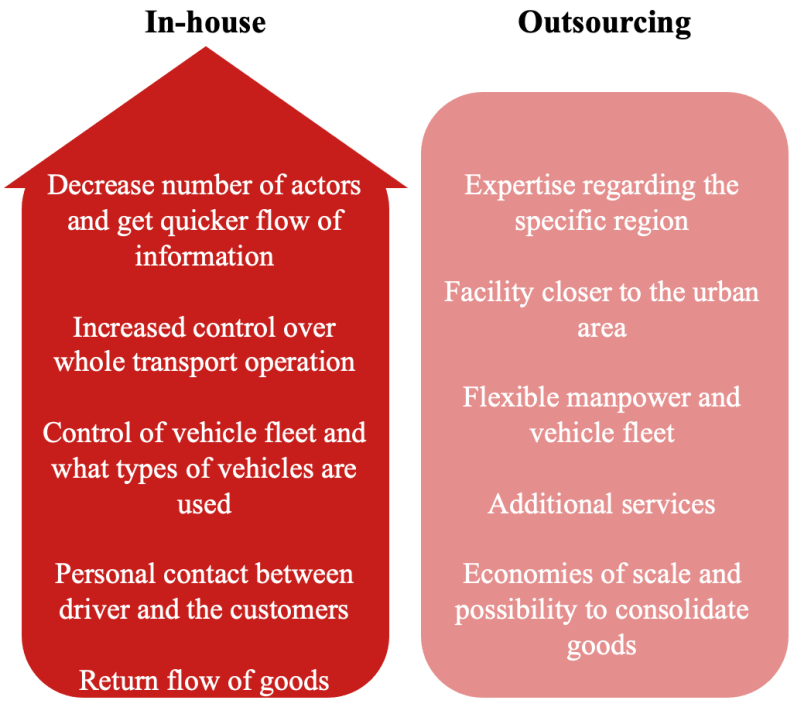


Figure 8.3: Overview of reasons for having the urban last mile delivery in-house respectively to outsource it

Even though there are benefits with both outsourcing and keeping it in-house, we think that strategically, outsourcing is the way to go forward – especially from a financial point of view. The implications of outsourcing outweigh the benefits of having the distribution in-house. However, outsourcing must be done right in order for it to be successful. There are several risks with outsourcing, and the most prominent one is the loss of control. When outsourcing the ownership of the transport operation, there is no way for The Company to know if the customer has received the goods or what happens along the way. The Company loses contact with the customer, and will only hear from them if something goes wrong. In order for anyone to be able to make a good delivery, they need information. Therefore, it is very important when outsourcing deliveries to prepare the transport company as much as possible and give them all available information about the customer, even information that is not written down. There is much knowledge that is accumulated by the drivers as they pick up things each time they make a delivery. That is why it is so important for The Company to collect this information from their customers and have it available in-house, not only trust the current 3PL provider to have it as it is today. The transfer of this knowledge is key to onboarding a new driver successfully, whether they work in-house or outhouse.

8.2 Recommendations

The analysis in Chapter 5 through 7 culminates in a number of recommendations to the case company. Some of these recommendations can be implemented right away, while some require strategic decisions and commitment over a longer time horizon. The recommendations are therefore divided into three groups presented below: to be implemented in the short-term, mid-term, and long-term. For the implementation of these recommendations to be successful, we recommend the case company to create a plan for the implementation and to allocate the necessary assets.

8.2.1 Short-term implementation

The actions that we recommend to start with are actions that can be implemented with The Company's current setup and capabilities, and require little initial investment. These are presented in the list below:

- Use the 3PL provider as storage for fast-moving products to increase flexibility
- Continue implementing a delivery tracking system, and make sure that the settings for notifications can be adapted to each individual customer
- Advertise and communicate the current sustainability efforts to the customers, such as fossil-free deliveries in Stockholm
- Put the sustainability work higher up on the agenda and create clearer processes and allocate assets to work with driving the sustainability question going forward
- Continue outsourcing the distribution in Stockholm, but work on taking back some of the control so that the decision to outsource is a strategic decision rather than a necessity
- Make use of the advantages that comes from being part of a big corporate group, and look for synergies with the other companies regarding e.g. sustainability work

8.2.2 Mid-term implementation

On a mid-term time horizon, we think it is important to put processes in place to follow the development regarding customer demands, market development and political directives and incentives for sustainable transports. There should be a clear division of responsibilities for each of these segments and a reporting structure where e.g. the current state is presented on a quarterly basis for the management team. Specifically, the case company should focus on:

- Continuing to follow customer demands and market development regarding electrical delivery vehicles
- Following the development of political directives and initiatives when it comes to a possible implementation of a UCC in Stockholm, as well as other financial incentives for sustainable transports

8.2.3 Long-term implementation

Actions that can have a large monetary impact on the business need to be implemented in steps and carefully evaluated after each step. These can be strategic decisions that need to be evaluated over a longer period of time. Over a long-term time horizon, we therefore recommend implementing the following recommendations:

- Collaborate to a larger extent with customers on both product and business development, such as a forecasting tool
- Create financial incentives for customers to consolidate their orders
- Investigate the potential of a partnership with another food delivery company in Stockholm
- Evaluate the cost and effect of introducing flexible delivery schedules
- Look into introducing climate compensation of the deliveries

8.3 Theoretical and practical contribution

Current literature within the urban last mile delivery of food products B2B is limited, while a lot of research is done within the B2C context. It is apparent to the authors that the increasing customer demands and regulations will put great pressure on the last mile delivery, which will change the way they will be conducted in the upcoming years. Customer demands in regards to last mile delivery in the B2B context is something that has not been researched before to the authors' knowledge. This thesis therefore contributes to filling a gap in research regarding the customers' expectations for B2B urban last mile deliveries. Additionally, this thesis also considers the aspects of costs and externalities in regard to urban B2B last mile deliveries, which are topics that are scarce in the literature. This thesis also adds to the few case studies that have been made in the Swedish market regarding urban last mile deliveries.

A practical contribution of this thesis is that the case company and other suppliers of ingredients within the bakery industry get a guideline of what the customers located in an urban area value and expect from urban last mile delivery. For these companies, this thesis will point to where future investments should be done to stay competitive and to gain market share. The analysis in Chapter 6 and 7 regarding sustainability and outsourcing can also be of practical contribution to distribution companies in other industries. Furthermore, the case company is presented with recommendations to take into consideration when planning their future urban last mile delivery.

8.4 Limitations and future research

Although this thesis contributes with theoretical and practical knowledge there are some limitations to the research. This thesis was written together with a company within the bakery ingredients industry, which limits the findings to the case company's setup in the Stockholm area. Other urban areas might not face the same challenges as Stockholm since different cities have

different types of infrastructure and legislation that limits the transportation made in the city. These different challenges could reflect on the customers' demands for urban last mile deliveries and it would therefore be interesting to investigate customers' expectations on a bigger scale and in more cities to draw more general conclusions.

The findings are linked to the case company's three customer segments. These segments may not look the same in other companies supplying bakery ingredients. The gaps identified between the customers' expectations and needs are compared to the case company's current urban last mile delivery and solutions are discussed according to this. Also, the economic impact of the proposed solutions would need to be further quantified to evaluate the feasibility to meet customer demands. Furthermore, the time frame for the interview study and the limited amount of customers with time available for an interview limited the amount and depth of collected information from each of the customer segments. More well-grounded conclusions could possibly have been drawn if the data collection had been more extensive. Furthermore, it was hard to get the customers to answer the survey as we noted that the bakery industry is very hectic and focused on baking rather than having people checking and answering emails. In future research a better approach could be to distribute the survey physically to each customer and kindly ask for 10 minutes to fill it out. For future research, both more customers and more companies within the same industry should be included to broaden the customer demand perspective.

Finally, only the last mile delivery of food products was studied and the results may differ from last mile delivery of non-food products. The perishability of food products requires a cold chain and fast deliveries to meet requirements and maintain high quality which may affect the customers' demands on these products. It would be interesting to further research urban last mile deliveries in a B2B context for other types of products since this is a rather unexplored topic in literature today.

REFERENCES

Andaloro, L., Napoli, G., Sergi, F., Micari, S., Agnello, G., and Antonucci, V. (2015) Development of a New Concept Electric Vehicle for Last Mile Transportations, *World Electric Vehicle Journal*, 7, 342–348. (10.3390/wevj7030342)

Andersson, K. (2022) Legala hinder och möjligheter för obemannade off-peak leveranser. *RISE Rapport 2022:56*. (ISBN: 978-91-89561-96-0)

Andersson, Ö., and Börjesson, P. (2021) The greenhouse gas emissions of an electrified vehicle combined with renewable fuels: Life cycle assessment and policy implications, *Applied Energy*, 289 (2021), 116621. (10.1016/j.apenergy.2021.116621)

Arrieta-Prieto, M., Ismael, A., Riviera-Gonzalez, C., and Mitchell, J. (2021) Location of urban micro-consolidation centers to reduce the social cost of last-mile deliveries of cargo: A heuristic approach, *Networks,* 79. (10.1002/net.22076)

Balm, S., Browne, M., Leondardi. J., and Quak, H. (2014) Developing an Evaluation Framework for Innovative Urban and Interurban Freight Transport Solutions, *Procedia - Social and Behavioral Sciences*, 125 (2014), 386–397. (10.1016/j.sbspro.2014.01.1482)

Boyer, K, Prud'homme, A. and Chung, W. (2009) The Last Mile Challenge: Evaluating the Effects of Customer Density and Delivery Window Patterns, *Journal of Business Logistics*, 30, 185-201. (10.1002/j.2158-1592.2009.tb00104.x)

Björner Brauer, H. and Khan, J. (2021) Diffusion of biogas for freight transport in Sweden: A user perspective, *Journal of Cleaner Production*, 312(2021), 127738. (10.1016/j.jclepro.2021.127738)

Bode, C., Lindemann, E., and Wagner, S. M. (2011) Driving Trucks and Driving Sales? The Impact of Delivery Personnel on Customer Purchase Behavior, *Journal of Business Logistics*, 32(1), 99–114. (10.1111/j.2158-1592.2011.01009.x)

Bosona, T. (2020). Urban Freight Last Mile Logistics—Challenges and Opportunities to Improve Sustainability: A Literature Review, *Sustainability*, 12(21), 8769. (10.3390/su12218769)

Browne, M., Woodburn, A., and Allen, J. (2007). Evaluating the potential for urban consolidation centres, *European Transport / Trasporti Europei*, 35(35), pp. 46–63. (ISSN: 1825-3997)

Browne, M., Allen, J., and Leondardi, J. (2011) Evaluating the use of an urban consolidation centre and electric vehicles in central London, *International Association of Traffic and Safety Sciences,* 35 (2011), pp. 1–6. (10.1016/j.iatssr.2011.06.002)

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

Cleophas, C., Cottrill, C., Ehmke, J., and Tierney, K. (2018) Collaborative urban transport: Recent advances in theory and practice, *European Journal of Operational Research*, 273 (2019), 801-816. (10.1016/j.ejor.2018.04.037)

Dell' Amico, M. and Hadjidimitriou, S. (2012) Innovative Logistics Model and Containers Solution for Efficient Last Mile Delivery, *Procedia - Social and Behavioral Sciences*, 48 (2012), 1505–1514. (10.1016/j.sbspro.2012.06.1126)

Fancello, G., Paddeu, D., and Fadda, P. (2017). Investigating last food mile deliveries: A case study approach to identify needs of food delivery demand, *Research in Transportation Economics*, 65 (2017). 56–66. (10.1016/j.retrec.2017.09.004)

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

Fu, J. and Jenelius, E. (2018) Transport Efficiency of Off-peak Urban Goods Deliveries: a Stockholm Pilot Study, *Case Studies on Transport Policy*, 6(1), 156–166. (10.1016/j.cstp.2018.01.001)

Demir, E. and Syntetos, A. (2022). Last mile logistics: Research trends and needs, *IMA Journal of Management Mathematics*, 33, 549–561. (10.1093/imaman/dpac006)

European Commission. (2011). White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource effective transport system, Brussels, 28.3.2011. COM(2011) 144 final.

European Commission. (2013). Commission Staff Working Document: A call to action on urban logistics, Brussels, 17.12.2013. SWD(2013) 524 final.

Gevaers, R., Van de Voorde, E., and Vanelslander, T. (2009) Characteristics of innovations in last mile logistics - using best practices, case studies and making the link with green and sustainable

logistics, *In Proceedings of European Transport Conference*, Noordwijkerhout, The Netherlands, 5–7 October 2009. (10.4337/9780857932754.00009)

Ha, N., Akbari, M. and Au, B. (2022) Last mile delivery in logistics and supply chain management: a bibliometric analysis and future directions. *Benchmarking: An International Journal,* Aop. (10.1108/BIJ-07-2021-0409)

Heick, P. (2022). Snart förbjuds bensin- och dieselbilar i Gamla stan och delar av city, *SVT*, 15 november. https://www.svt.se/nyheter/lokalt/stockholm/snart-forbjudet-att-kora-bensin-och-dieseldrivna-bilar-i-gamla-stan-och-city (Accessed: 2023-01-31)

Holguín-Veras, J.; Polimeni, J.; Cruz, B.; Xu, N.; List, G: Nordstrom, J., and Haddock, J. (2005) Off-Peak Freight Deliveries: Challenges and stakeholders' perceptions. *Transportation Research Record: Journal of the Transportation Research Board,* 1906(1), pp. 42–48 (10.1177/0361198105190600105)

International Energy Agency (2017). The Future of Trucks: Implications for Energy and the Environment, Paris: International Energy Agency. (10.1787/9789264279452-en)

Jadaan, K., Zeater, S., and Abdukhalil, Y. (2017) Connected Vehicles: an Innovative Transport Technology, *Procedia Engineering,* 187, 641–648. (10.1016/j.proeng.2017.04.425)

Jesson, J., Matheson, L., and Lacey, F. (2011) *Doing Your Literature Review - Traditional and Systematic Techniques*, SAGE

Kihlström, L-M. (2021) Sweden and Germany are leading the development for electric roads, *Vattenfall*, 21 January 2021. https://group.vattenfall.com/press-and-media/newsroom/2021/sweden-and-germany-are-leading-the-development-for-electric-roads (Accessed: 2023-03-02)

Kin, B., Hopman, M., and Quak, H. (2021) Different Charging Strategies for Electric Vehicle Fleets in Urban Freight Transport, *Sustainability*, 13, 13080. (10.3390/su132313080)

Kolasinska-Morawska, K., Sulkowski, L., Bula, P., Brzozowska, M., and Morawski, P. (2022). Smart Logistics – Sustainable Technological Innovations in Customer Service at the Last-Mile Stage: The Polish Perspective, *Energies*, 15, 6395. (10.3390/en15176395)

Kungl. Ingenjörsvetenskapsakademien. (2019) Resurseffektivitet inom livsmedelstransporter. Stockholm: Kungl. Ingenjörsvetenskapsakademien. https://www.iva.se/publicerat/ny-rapport-resurseffektivitet-inom-livsmedelstransporter/ (Accessed: 2023-02-15)

Lal, P. and Narayanswamy, S. (2022) Challenges in Last Mile Delivery – Case of FMCG Industry, *International Journal of Advanced Research and Review*, 7(5), 50–67. (10.5281/zenodo.6545108)

Lebeau, P., Macharis, C., and Van Mierlo, J. (2016) Exploring the choice of battery electric vehicles in city logistics: A conjoint-based choice analysis, *Transportation Research Part E: Logistics and Transportation Review*, 91(2016), 245–258. (10.1016/j.tre.2016.04.004)

Lebeau, P., De Cauwer, C., Van Mierlo, J., Macharis, C., Verbeke, W., and Coosemans, T. (2015a) Conventional, Hybrid, or Electric Vechiles: Which Technology for an Urban Distribution Centre? *The Scientific World Journal*, 2015. (10.1155/2015/302867)

Lebeau, P., Macharis, C., Van Mierlo, J., and Lebeau, K. (2015b) Electrifying light commercial vehicles for city logistics? A total cost of ownership analysis, *European Journal of Transport and Infrastructure Research*, 15, 551–569. (10.18757/ejtir.2015.15.4.3097)

Marmiroli, B., Venditti, M., Dotelli, G., and Spessa, E. (2020) The transport of goods in the urban environment: A comparative life cycle assessment of electric, compressed natural gas and diesel light-duty vehicles, *Applied Energy*, 260(2020), 114236. (10.1016/j.apenergy.2019.114236)

Melander, L., Nyquist-Magnusson, C., and Wallström, H. (2022). Drivers for and barriers to electric freight vehicle adoption in Stockholm, *Transportation Research Part D: Transport and Environment*, 108(2022), 103317. (10.1016/j.trd.2022.103317)

Melo, S., Baptista, P., and Costa, A. (2014) Comparing the Use of Small Sized Electric Vehicles with Diesel Vans on City Logistics, *Procedia - Social and Behavioral Sciences*, 111 (2014), 350–359. (10.1016/j.sbspro.2014.01.068)

Mentzer, J. T., Flint, D. J., and Hult, G. T. (2001) Logistics Service Quality as a Segment-Customized Process, *Journal of Marketing*, 65(4), 82–104. (10.1509/jmkg.65.4.82.18390)

Morganti, E. and Gonzalez-Feliu, J. (2014) City Logistics for perishable products. The case of the Parma's Food Hub, *Case Studies on Transport Policy*, 3 (2015), 120–128, (10.1016/j.cstp.2014.08.003)

Mulholland, E., Teter, J., Cazzola, P., McDonald, Z., and Gallachoir, B. P. O. (2018) The long haul towards decarbonising road freight – A global assessment to 2050, *Applied Energy*, 216(2018), 678–693. 10.1016/j.apenergy.2018.01.058

Nemoto, T. and Tezuka, K. (2002). *Advantage of Third Party Logistics in Supply Chain Management*. Graduate School of Commerce and Management, Hitotsubashi University

Oliviera, C., Bandeira, R., Goes, G., Schmitz, D. and D'Agosto, M. (2017) Sustainable Vehicle-Based Alternatives in Last Mile Distribution of Urban Freight Transport: A Systematic Literature Review, *Sustainability*, 9, 1324. (10.3390/su9081324)

Ploos van Amstel, W. and Balm, S. (2016) Dutch research on business models for light electric vehicles in city logistics, *World Light Electric Vehicle Summit*, 1(2016)

Polydoropoulou, A., Tsirimpa, A., Karakikes, I., Tshouros, I., and Pagoni, I. (2022) Mode Choice Modeling for Sustainable Last-Mile Delivery: The Greek Perspective, *Sustainability*, 14, 8976. (10.3390/su14158976)

Power Circle (2023). Statistik: Laddbara fordon i Sverige. https://powercircle.org/kunskap/ (Accessed: 2023-03-02)

Quak, H. (2008) Sustainability of Urban Freight Transport: Retail Distribution and Local Regulations in Cities. *ERIM Ph.D Series Research in Management* (ISBN: 978-90-5892-154-3)

Quak, H. (2012) Improving urban freight transport sustainability by carriers – Best practices from The Netherlands and the EU project CityLog, *Procedia – Social and Behavioural Sciences*, 39(2012), 158–171. (10.1016/j.sbspro.2012.03.098)

Quak, H., Balm, S., Posthumus, B. and Bruening, M. (2012) Innovative Solutions For City Logistics: Demonstrations and Viability Results, *In Proceedings of the European Transport Conference*, Glasgow, Scotland, 8–10 October 2012.

Quak, H., Nesterova, N., van Rooijen, T., and Dong, Y. (2016) Zero emission city logistics: current practices in freight electromobility and feasibility in the near future, *Transportation Research Procedia*, 14(2016), 1506–1515. (10.1016/j.trpro.2016.05.115)

Ranieri, L., Digiesi, S., Silvestri, B., and Roccotelli, M. (2018). A Review of Last Mile Logistics Innovations in an Externalities Cost Reduction Vision, *Sustainability*, 10(3), 782. (10.3390/su10030782)

Rodrigue, J-P., Comtois, C., and Slack, B. (2013). *The Geography of Transport Systems.* 3rd edition, Routledge

Rådet för kyl- och fryskedjan (2021). Branschriktlinje rätt temperatur under lagring och transport för kylda och frysta livsmedel. Stockholm: Svensk Dagligvaruhandel. https://www.svenskdagligvaruhandel.se/wp-

content/uploads/BRL.Ratt_.temperatur.lagringochtransport.kyldaochfrysta.livsmedel.pdf (Accessed: 2023-02-14)

Saunders, M., Lewis, P., and Thornhill, A. (2007) *Research Methods for Business Students*. 7th edition, Pearson Prentice Hall

Schliwa, G., Armitage, R., Aziz, S., Evans, J., and Rhoades, J. (2015) Sustainable city logistics – Making cargo cycles viable for urban freight transport, *Research in Transportation Business & Management,* 15(2015), 50–57. (10.1016/j.rtbm.2015.02.001)

Scorrano, M., Danielis, R. and Giansoldati, M. (2021) Electric light commercial vehicles for a cleaner urban goods distribution. Are they cost competitive? *Research in Transportation Economics*, 85 (2021), 101022. (10.1016/j.retrec.2020.101022)

Stockholm Stad. (2012). *Urban mobility strategy*

Stockholm Stad. (2018). *Stockholm Freight Plan*.

Stockholm Stad. (2022). *Regler för trafik i Gamla Stan*, https://tillstand.stockholm/tillstand-regler-och-tillsyn/transporter/regler-for-trafik-i-gamla-stan/, (Accessed: 2023-02-13)

Stockholm Stad. (2023). *Miljözon klass 1 - krav på tunga fordon*, https://tillstand.stockholm/tillstand-regler-och-tillsyn/transporter/miljozon--krav-pa-tunga-fordon/, (Accessed: 2023-02-13)

Stockholm Stad, (n.d). Miljözon klass 1 - krav på tunga lastbilar och bussar. https://tillstand.stockholm/globalassets/foretag-och-organisationer/tillstand-och-regler/tillstand-regler-och-tillsyn/transporter/miljozon---krav-pa-tunga-fordon/karta_miljozon1_20210101.pdf (Accessed: 2023-02-13)

Slabinac, M. (2015). Innovative Solutions for a "Last-Mile" Delivery - A European Experience, *2015: Proceedings of The 15th International Scientific Conference Business Logistics in Modern Management,* pp. 111–129, (ISSN: 1849-5931)

Swedish Energy Agency (2023). Statistik Över Transportsektorns Energianvändning, https://pxexternal.energimyndigheten.se/pxweb/sv/Transportsektorns%20energianvändning/?rxid=85d716df-7b86-4c82-9ff0-49210aa167da (Accessed: 2023-03-01)

Taniguchi, E. (2014). Concepts of city logistics for sustainable and liveable cities. Procedia - Social and Behavioral Sciences, 151 (2014), 310–317. (10.1016/j.sbspro.2014.10.029)

Trafikanalys. (2023). Fordon 2022, *Trafikanalys Statistik*, 2023:3. https://www.trafa.se/globalassets/statistik/vagtrafik/fordon/2023/fordon-2022.pdf (Accessed: 2023-03-02)

Transportstyrelsen. (2023a). *Miljözoner*. https://www.transportstyrelsen.se/sv/vagtrafik/miljo/miljozoner/, (Accessed: 2023-02-13)

Transportstyrelsen. (2023b). *Tider och belopp för trängselskatt i Stockholm*. https://www.transportstyrelsen.se/sv/vagtrafik/Trangselskatt/Trangselskatt-i-stockholm/tider-och-belopp/, (Accessed: 2023-04-24)

Wang, X. and Kopfer, H. (2014) Collaborative transport planning of less-than-truckload freight, OR Spectrum, 36 (2014), 357–380. (10.1007/s00291-013-0331-x)

Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods,* 6th edition, SAGE Publications

APPENDICES

Appendix 1 – General interview guide

Intervjuperson:
Datum:

Introduktion
Vi heter Martina och Hannah och läser vårt sista år på Industriell Ekonomi vid Lunds Tekniska Högskola. Vi skriver nu examensarbete i samarbete med Företag X där syftet är att undersöka hur Företag X ska utforma sin last mile delivery i stadsmiljö för att på bästa sätt möta kundernas förväntningar och behov, och samtidigt minimera kostnader och externaliteter.

Skulle du kunna börja berätta om dig själv, ditt arbete och ansvarsområden?

Teman som har behandlats

- Kvalitetsarbete samt kvalitetsbrister vid leverans
- Lagar och regulationer
- Hållbarhet och certifieringar
- Samarbetet mellan Företag X och deras 3PL
- Leveransschema och tillvägagångssätt
- Pris på leverans
- Utmaningar och förbättringsområden för dagens distribution
- Stockholmskundernas krav och önskemål på leveranser
- Tillväxt
- Implementering av logistikverktyg
- Digitala verktyg och kundnytta
- Strategi gällande in-house och outsourcing
- Strategiska investeringar för distributionen
- Framtidens distribution
- Arbetsdag och arbetsuppgifter för Företag X egna chaufförer
- Chaufförens kundkontakt
- Miljövänliga transporter, krav och trender
- Hållbarhetsarbete kopplat till transporter
- Dagens outsourcing av urban last mile delivery
- 3PLs planering och genomförande av leveranser i Stockholm
- 3PLs fordonsflotta
- Utmaningar med leveranser i Stockholm

Appendix 2 – Interview guide customers

Intervjuperson:
Datum:

Introduktion

- Vi heter Martina och Hannah och läser vårt sista år på Industriell Ekonomi vid Lunds Tekniska Högskola. Vi skriver nu vårt examensarbete i samarbete med Företag X där vi undersöker leveranser av livsmedel i storstadsmiljöer. Genom vårt arbete vill vi dra slutsatser om hur dessa leveranser bör utformas om 5–10 år för att på bästa sätt gynna både det säljande och köpande företaget, samt den urbana miljön.
- Beskriv kortfattat din bakgrund och roll inom företaget
- Beskriv företagets verksamhet

Frågor

Leverantörer

- Vad har ni för krav på era leverantörer?
    - Möts dessa idag?
    - Vad skulle leverantörerna kunna göra bättre?
- Vad värdesätter ni hos en leverantör?
    - Är det viktigt för er att ha en långsiktig relation med era leverantörer, eller är ni beredda att byta snabbt om någon kommer med ett bättre erbjudande?
    - Vad hade fått er att byta leverantör?
- Vilka upplever ni är "ansiktet utåt" för leverantörsföretaget?
    - Hur viktig är säljaren för ert intryck?
    - Hur viktig är chauffören för ert intryck?

Leveranser från Företag X

- Hur går en typisk leverans till idag?
    - Är ni nöjda med upplägget?
    - Vad hade kunnat göra leveransen bättre?
    - Vad ser ni för utmaningar med era leveranser idag?
- Vad är det viktigaste för er när det kommer till leveranser av varor?
    - Pris, hållbarhet, leveranssäkerhet, något annat?
- Hur vill ni att varorna ska levereras?
    - Förväntar ni er någon extra service kopplat till leverans? (T.ex. inbärning)
- Hur snabbt efter att ni har lagt en order förväntar ni er att få leveransen av varorna?
- Vilken tid på dygnet och inom vilket tidsintervall får ni leveranser av varor?
    - Stämmer detta överens med när ni vill få varorna?

    - Hur stort leveransfönster tycker ni är acceptabelt?
    - Hur tror ni det kommer se ut i framtiden, 5–10 år fram?
- Hur många gånger i veckan vill ni få leverans? (Fler eller färre än idag?)
    - Hur tror ni det kommer se ut i framtiden, 5–10 år fram? (Fler eller färre än idag?)
- Vill ni bli aviserade om när leveransen väntas komma fram?
    - Om ja, hur? (App? Hemsida? Sms?)
    - Hur många notiser?
- Hade ni varit villiga att betala mer för att förbättra leveranserna enligt era önskemål ovan?

Hållbarhet

- Är hållbarhet en viktig fråga för er som företag?
    - Om ja, hur arbetar ni för att minska er miljöpåverkan?
    - Väljer ni leverantörer baserat på hur hållbara de är?
- Hur viktigt är det för er att leveranserna sker på ett miljövänligt sätt?
    - Kan ni tänka er att betala extra för att leveranserna ska ske på ett hållbart sätt?
    - Kan ni tänka er att få leveranser på andra tider eller med lägre frekvens för att minska miljöpåverkan?

Framtidens leveranser

Idag täcks nästan hela Stockholms innerstad av en miljözon som reglerar vilken typ av fordon som får köra i området. Dessutom har Stockholms Stad som mål att bli helt fossilfria till 2040, vilket kommer att kräva en minimering av transporter, mer förnyelsebar energi och mer effektiva fordon.

- Hur tror ni detta kommer påverka er som kunder?
    - Förväntar ni er att leveranserna ska kunna ske på samma sätt som idag, eller tror ni att ni kommer behöva ändra era krav (t.ex. när det kommer till antal leveranser/vecka)?

Avslutning

Stort tack för att du tog dig tid att besvara våra frågor!

Appendix 3 – Survey to customers

Hej!

Vi heter Martina och Hannah och skriver vårt examensarbete på Lunds Tekniska Högskola där vi undersöker leveranser av livsmedel i storstadsmiljöer. Genom vårt arbete vill vi dra slutsatser om hur dessa leveranser bör utformas om 5–10 år för att på bästa sätt gynna både det säljande och köpande företaget, samt den urbana miljön. För att kunna göra detta behöver vi er input om vad ni har för förväntningar och krav på era leveranser, och uppskattar därför stort att ni tar er tid att svara på denna enkät. Enkätsvaren kommer inte att knytas till er som personer/företag utan ni kommer att vara anonyma i vår rapport.

Vi skriver vårt examensarbete tillsammans med Företag X, men vill förtydliga att era svar på denna enkäten inte utgör något som helst löfte från Företag X sida gällande framtida ändringar. Däremot så kommer personal på Företag X att ta del av de anonymiserade svaren som input för framtiden.

Var vänlig att svara på denna enkät senast **fredagen den 24/3**.

Tack för ert deltagande!
Martina Kylebäck Wennerlöf & Hannah Renhed

Om dig

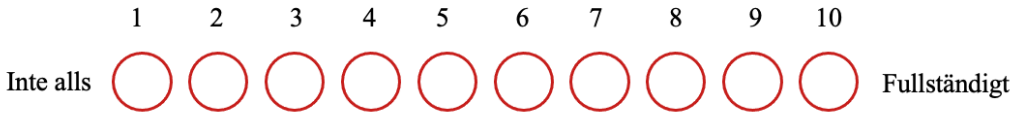
Vilket företag arbetar du på?

Vad har du för titel på företaget?

Frågor om leverantörer

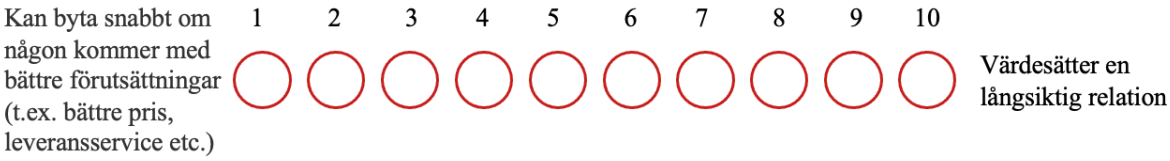
Vad är era främsta krav på era leverantörer?

I hur hög grad möts dessa krav idag?



Vad värdesätter ni hos en leverantör?

Hur lättvindigt kan ni tänka er att byta leverantör?

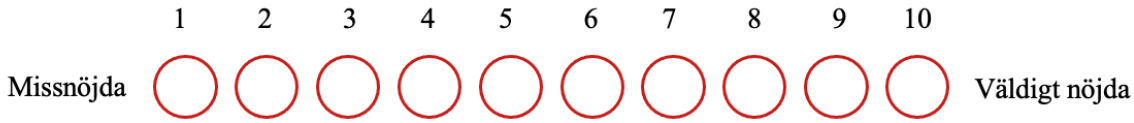


Vad hade fått er att byta en leverantör?

Frågor om leveranser

Hur går en typisk leverans från Företag X till idag? (Hur många dagar i veckan, vilken tid, vem lastar av varorna?)

Hur nöjda är ni med dagens upplägg av leveranser?

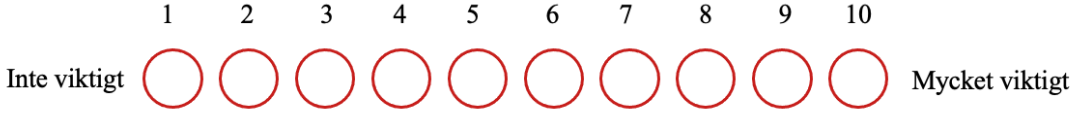


Vad hade kunnat göra leveranserna bättre?

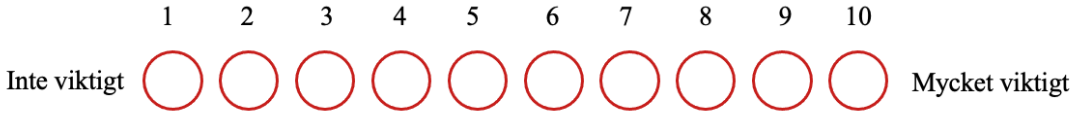
Är det någon service ni saknar? T.ex. inbärning av varor

Hur viktiga skulle du säga att följande faktorer är när det kommer till leverans av varor:

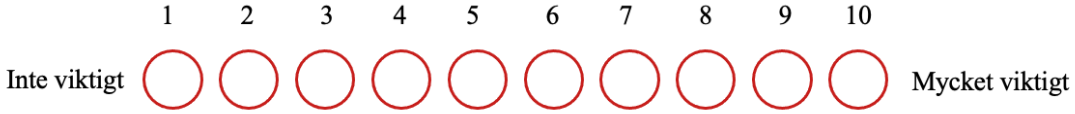
Pris



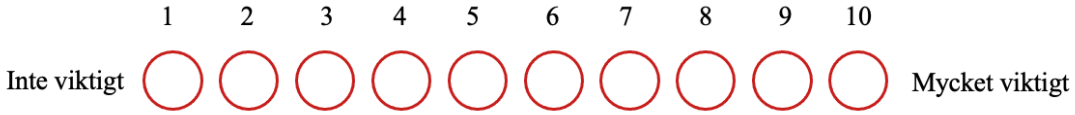
Leveranssäkerhet



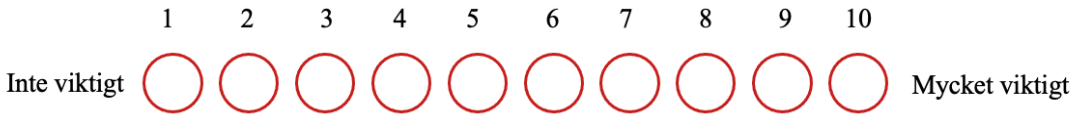
Hållbarhet



Relationen till säljaren



Relationen till chauffören



Inom vilket tidsfönster önskar ni få era leveranser?

Hur många gånger i veckan vill ni få leverans?

Vill ni bli aviserade om när leveransen väntas komma fram?

- Ja
- Ja, men bara om den är försenad
- Nej
- Spelar ingen roll

Om ja, hur?

- [ ] I en app
- [ ] På sms
- [ ] Via leverantörens hemsida
- [ ] Annat…

Frågor kopplade till hållbarhet

Är hållbarhet en viktig fråga för er som företag?

- ○ Ja, mycket viktig
- ○ Ja, ganska viktig
- ○ Varken viktig eller oviktig
- ○ Nej, oviktig
- ○ Annat…

Om ja, hur arbetar ni för att minska er miljöpåverkan?

Hur viktigt är det för er att era leverantörer är hållbara?

	1	2	3	4	5	6	7	8	9	10	
Inte viktigt	○	○	○	○	○	○	○	○	○	○	Mycket viktigt

Hur viktigt är det för er att leveranserna sker på ett miljövänligt sätt?

	1	2	3	4	5	6	7	8	9	10	
Inte viktigt	○	○	○	○	○	○	○	○	○	○	Mycket viktigt

Kan ni tänka er betala extra för att leveranserna ska ske på ett miljövänligt sätt?

- ○ Ja
- ○ Nej
- ○ Annat…

Kan ni tänka er att få leveranser på andra tider eller med lägre frekvens för att minska miljöpåverkan?

- ○ Ja
- ○ Nej
- ○ Annat…

Framtidens leveranser

Idag täcks nästan hela Stockholms innerstad av en miljözon som reglerar vilken typ av fordon som får köra i området. Dessutom har Stockholms Stad som mål att bli helt fossilfria till 2040, vilket kommer att kräva en minimering av transporter, mer förnyelsebar energi och mer effektiva fordon.

Hur tror ni att framtidens hårdare miljökrav kommer påverka er som kunder?

Förväntar ni er att leveranserna ska kunna ske på samma sätt som idag även i framtiden?

- ○ Ja
- ○ Nej
- ○ Annat…

Stort tack för dina svar!

Appendix 4 – Data analysis of products to store closer to Stockholm

In order for the data analysis of what products to store closer to the market to be repeatable when new data becomes available, the process is described step-wise below.

The analysis was based on sales data from 2022 in Excel, where all orders from all customers during a specific period of time (one year in this analysis) were collected and presented on separate rows, i.e. one row per product for each time it is ordered by a customer. The columns in the Excel file used were;

- Customer
- Mode of delivery
- Item number
- Item name
- Quantity
- Line status
- Price per unit
- Total price
- Created date

From the sales data, a Pivot diagram was created with each Item name as a separate row, and then the Sum of Total price and Sum of Quantity as columns. This list was copied and pasted two times next to each other, where the first list was sorted based on Sum of Total Price and the second based on Sum of Quantity. Then, all non-food products in the top of each list were erased as this thesis only considers the food products. From the remaining items, the top 20 in both lists were cross-checked to see what products could be found in both of the top 20 lists of most sold products based on price and quantity.

When analyzing different customer segments, the sales data were sorted to only include the Customer (the customer account number) in the specific segment or segments that were to be analyzed.

When analyzing extra deliveries, the Mode of delivery column was sorted to only include Express deliveries.

When analyzing canceled orders, the Line status column was sorted to only include Canceled orders.