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Last-Mile Delivery Models in E-Commerce: Impacts of Sectors, and Population Densities

Bachelor's thesis in International Logistics

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PREFACE

This bachelor's thesis was written as part of the International Logistics program at Chalmers University of Technology and corresponds to 15 credits within the 180-credit degree.
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SAMMANDRAG

Sista milen-logistik kännetecknas ofta av ineffektivitet såsom splittrade leveranser och begränsad konsolidering, vilket bidrar till ett växande antal leveranser från företag till konsument, ökad trängsel och större miljöpåverkan. Den ökande konsumentefterfrågan på snabba och billiga leveranser, i kombination med växande hållbarhetskrav, ökar pressen på leveranssystemen. Denna studie undersöker hur konsumentpreferenser påverkar utformningen av logistiklösningar för sista milen och syftar till att identifiera hur dessa preferenser kan bidra till ökad leveranseffektivitet. Studien genomfördes i området Göteborg, Sverige, med fokus på tre olika regioner för att undersöka variationer i alternativ för sista milen-leverans och konsumentpreferenser. De huvudsakliga preferenserna som analyserades var tid, kostnad, bekvämlighet och miljömässig hållbarhet. Data samlades in från 20 webbplatser inom olika e-handelssektorer. De leveransmetoder som utvärderades inkluderade hemleverans, utlämningsställen, paketboxar och beställ online-hämta i butik. Flera olika datainsamlingsmetoder användes. Resultaten visade att regionala skillnader inte hade någon betydande påverkan på de leveransalternativ som erbjöds av webbplatserna. Däremot varierade tillgången till leveransmetoder beroende på e-handelssektor. Resultaten indikerar att ökad transparens—såsom tydligare information om mottagarens närvaro, tillgängliga tidsfönster för hemleverans och miljöpåverkan av olika leveransalternativ—kan förbättra effektiviteten och hållbarheten inom logistiken för sista milen. Studien är begränsad till svenska e-handelssektorer, webbplatser och Göteborgsområdet.

Nyckelord: Sista-milen, Sista-milen leveranser, Konsumentpreferenser, E-handel

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ABSTRACT

Last-mile logistics are often characterized by inefficiencies such as fragmented shipments and limited consolidation, all of which contribute to a growing number of businesses-to-consumer freight trips, increased congestion and greater environmental impact. Rising consumer demand for low-cost and fast deliveries, combined with growing sustainability concerns is heightening the pressure on delivery systems. This study explores how consumer preferences influence the structure of last-mile logistics solutions and aims to identify how these preferences can improve delivery efficiency. The study was conducted in the area of Gothenburg, Sweden, focusing on three distinct regions to examine variations in last-mile delivery options and consumer preferences. The primary preferences analyzed were time, cost, convenience, and environmental sustainability. Data was collected from 20 websites across various e-commerce sectors. The delivery methods evaluated included Home Delivery, Pick-Up Points, Parcel Lockers, and Click & Collect. Multiple data collection techniques were employed. The findings indicated that regional differences had no significant impact on the delivery options provided by the websites. However, the availability of delivery methods varied depending on the e-commerce sector. The findings indicate that increased transparency, such as clearer information on attendance, available time slots for home delivery, and environmental impact of delivery options could improve the efficiency and sustainability of last-mile logistics. The study is limited to Swedish e-commerce sectors, websites, and the area of Gothenburg.

Keywords: Last-Mile, Last-Mile Delivery, Consumer Preferences, E-Commerce

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TABLE OF CONTENTS

LIST OF FIGURES

ACRONYMS AND TERMINOLOGY

Term	Definition
Last-Mile	The last leg of the transportation, where the goods are delivered to its final destination.
Consumer Preferences	What consumer favor or value most.
E-commerce	Electronic commerce.
Delivery Locations	The method and place of last-mile delivery, such as Home Delivery, Pick-Up Point, Parcel Locker, and Click & Collect.
Population Density	The number of people living within a specific area.

1. Introduction

E-commerce, or "electronic commerce", refers to the buying and selling of goods online. It has become increasingly popular over the past few decades, transforming the way businesses operate. E-commerce allows businesses to reach consumers all over the world, providing a wide range of services and products at the click of a button. The industry has revolutionized traditional retail by making transactions possible anywhere, at any time of the day. The e-commerce market today is one of the fastest growing markets and is not expected to slow down. In Sweden, this is no exception. According to Sveriges Riksbanken, 75% of consumers shopped online in the past 30 days in 2022, which is a significant increase from 2018, when 56% of consumers shopped online (*Många Handlar Online,* n.d.).

The e-commerce ratio is changing over time, with the improved acceptance of information and communication technologies and the perceived benefits like costs, risks, time pressures, social and environmental perspectives, leading up to that the e-commerce behavior is based on personal norms (Andruetto et al., 2023). The perceived benefits from e-commerce are different, with different needs of different types of e-shoppers.

Consumers who are new to the internet often have inexperience exposure to online shopping and are more likely to purchase items that are not readily accessible to them in their daily lives. This group of consumers requires simple and convenient processes not only for placing orders but also for retrieving them. More experienced e-commerce users, on the other hand, exhibit more varying expectations and preferences regarding what aspect of the shopping experience matters most to them. Some focus on efficiency in time and cost, while others seek new trends and a seamless shopping experience with flexible delivery options.

These different consumer segments are also influenced by demographic factors, including age, income level, education and geographic location. Different e-shopper groups vary in technological adoption, priorities and access to resources further influence the varying e-shoppers' behaviors across demographic groups leading to diverse e-commerce patterns.

The purchased online goods arrive in the cities to meet the needs of end consumers, and in order to reach the consumers, the parcel needs to be delivered to the last stretch of the leg, also known as "the last-mile". This crucial part is often considered the most complex and expensive part of the delivery process.

E-commerce orders usually contain fewer items per purchase compared to traditional retail, resulting in a large number of individual parcel deliveries. This rise in delivery demand increases competition among carriers. As a result, freight traffic in urban areas is affected. With deliveries having less potential for consolidation and not constantly being fully optimized, needing to reach customers through several alternatives near their homes, is leading to a fragmentation of shipments and an increase in B2C (Business to Consumer) freight trips (Beckers et al., 2022). With the increase of last mile parcel deliveries and the inefficiency of the last mile consolidation, last mile delivery has become a significant environmental concern due to its substantial impact on greenhouse gas emissions. The increase of last mile delivery has also created more congestion in cities as well as a result of higher costs for the e-commerce companies, because of the high cost of fuel prices, labor costs, and the need for more vehicles to handle deliveries. Additionally, the cost per delivery increases as the delivery area expands.

At the same time, consumer expectations continue to evolve. Today's online shoppers are not only focused on faster and low-cost delivery but are also increasingly aware of sustainability issues. As a result, four key preferences are shaping last-mile delivery: convenience, cost of delivery, time of delivery, and environmental sustainability.

Driven by these evolving consumer demands, businesses are adopting a range of last-mile delivery models to remain competitive and meet expectations. These include home delivery, pick-up points, parcel locker, and click & collect. Such models offer consumers greater flexibility and control over how they receive their purchases, even though they often increase operational complexity. Ultimately, the ability to align delivery services with what matters most to consumers is becoming a decisive factor in e-commerce success.

1.1 Background

The logistical inefficiencies of last-mile delivery highlight the need to rethink last-mile delivery strategies in response to changing consumer expectations and environmental concerns. The impact of e-commerce on last-mile logistics is often framed as a broad issue. Given the increasing demand for fast, low-cost deliveries and the variety of available delivery and pick-up alternatives, further research is needed to examine how these factors influence last-mile delivery. Much of the earlier research that the authors of this study are aware of is based on surveys conducted in a specific context. This study investigates and identifies instead general patterns in consumer preferences to ensure broader applicability and find the underlying factors that steer consumer preferences and not just a specific country or region. Understanding how consumers choose among these alternatives and how their preferences impact last-mile operations is essential for developing more efficient and sustainable e-commerce logistics.

This research is crucial for multiple stakeholders, identifying key behavioral trends and bridge the gap between consumer expectations and logistical constraints. For logistics companies, a better understanding of consumer preferences can improve delivery efficiency, optimize costs and enhance customer satisfaction. Public authorities can use these insights to develop policies that support sustainable last-mile solutions and ensure that infrastructure and regulations align with evolving e-commerce demands.

As the consumers' awareness of environmental impact grows, it becomes increasingly important for e-commerce companies to integrate sustainability into their delivery strategies. Providing transparent information about alternative delivery options and their environmental impact can help consumers make more informed choices. Parcel companies play a key role in making these options more visible and accessible, but for sustainability efforts to be economically viable, regulatory support from public authorities is necessary. Policies that incentivize environmentally friendly logistics solutions can help align consumer preferences with sustainable last-mile strategies.

1.2 Aim of the study

The study aims to identify the options of last-mile delivery locations and consumer preferences for the delivery options in e-commerce, to give a holistic picture of the subject. Further it aspires to investigate the available delivery options in Sweden to clarify the complexity of last-mile delivery. Understanding how consumer preferences shape delivery options is central to this research. As consumer preferences evolve, they directly influence the structure and development of delivery services, pushing logistics providers and parcel companies to adapt in terms of speed, convenience (flexibility), price, and sustainability. By analyzing these interactions, the study seeks to provide insights that contribute to more efficient and consumer-oriented last-mile delivery solutions.

1.3 Research questions

How does the population densities relate to the options in last-mile delivery?

How does the e-commerce sectors relate to the options in last-mile delivery?

What patterns can be identified in how last-mile delivery options are offered within Swedish e-commerce?

1.4 Delimitations

The study builds on existing research on consumer preferences, relying on previously published and validated data rather than conducting a new survey. By relying on this data, the analysis is limited to established findings.

In this study the writers have also chosen to limit the selection of different delivery location options to home delivery, parcel lockers, click and collect, and pick-up points. These options are considered the most central and widely used alternatives for last-mile delivery in the current market.

Another delimitation is the number of zip codes; these are selected to represent the different demographics of location in Gothenburg. A limited number of sectors for e-commerce in Sweden, as well as websites, and factors that differentiate the delivery methods have been selected. The selection is based on market share and factors influencing delivery methods, which are price of delivery, time of delivery, and the delivery method's sustainability degree.

2. Literature Review

This section provides the theoretical background necessary to understand the context of the study. The subjects discussed are the growth of e-commerce, last-mile delivery, consumer preferences of last-mile delivery, sustainability in last-mile, and last-mile delivery location options. By presenting previous research, this chapter aims to establish a solid basis for interpreting the results and drawing informed conclusions.

2.1 The Growth of E-commerce

E-commerce, short for electronic commerce, is the buying and selling of goods and services over the internet. It includes online retail shopping, marketplaces, and business transactions conducted through websites, smartphone applications, and social media platforms.

The advancement of technology has driven an accelerating number of people to shop online. In recent years, e-commerce has experienced significant growth, revolutionizing the retail sector. Its rise has profoundly transformed consumer behavior (Shamout et al., 2024). Due to the rapid growth of e-commerce, business practices around the world have been shaped and developed accordingly. Industry reports indicate that global e-commerce is projected to surpass USD 1 trillion by 2025 (Encarnación & Amaya, 2025).

Business-to-consumer, or *B2C*, in particular, is rising in plenty countries worldwide in a plethora of industries (Seghezzi et al., 2022). As reported by the European e-commerce report, the proportion of European internet users that purchased goods or services online is rising each year. Europe also exhibits a higher growth rate in B2C e-commerce (Dixit et al., 2022).

Consumers typically use their smartphones to browse online channels (Cotarelo et al., 2021). In physical stores, they compare goods and prices, expecting a similar result across both shopping options. Consumers progressively expect information and purchasing options to be available anytime and anywhere. Consequently, content consistency refers to the uniformity of information that retailers provide across both physical and online channels. Thus, the integration of information on both channels is of high value and e-commerce businesses should ensure that the online channels and the physicals store are coherent. The ability to seamlessly switch between channels while maintaining consistency in product offerings and pricing has contributed to a positive perception of the brand. Synchronizing both online and offline channels not only enhances brand perception but also significantly boosts customer satisfaction. By offering a consistent and seamless experience across platforms, retailers create added value for customers, making it easier for them to engage with the brand. It has also been shown that retailers with a variety of shopping channel offerings achieve a stronger relationship with the customer as well as a positive impact on customer loyalty (Cotarelo et al., 2021).

The ease and comfort of shopping online whenever and wherever has been a crucial factor in why e-commerce has grown in popularity (Gonzalez et al., 2023). Another contributing factor has been the wide range of goods and services that are available online, compared to in physical stores, along with the ability to share feedback of the purchasing experience with fellow customers (Gonzalez et al., 2023). It has also been found that customers often shop online when they are busy and unable to visit physical stores, as well as when retailers offer sales and promotions (El Moussaoui et al., 2023).

Furthermore, e-commerce also allows sellers to better manage their inventory and deliveries (Vrhovac et al., 2023). Online retailers can typically achieve an average profit margin of 30%, compared to the 15% profit margin common for standard retailers (Rodrigue, 2022). This significant difference is largely due to the distinct cost structures between the two retail models. For traditional stores, expenses like payroll, rent, and utilities represent some of the highest operating costs. These fixed costs are essential for maintaining physical locations and are difficult to reduce. In contrast, online retailers can often operate with lower overhead by eliminating the need for physical storefronts and reducing staffing requirements (Rodrigue, 2022).

Sweden has been considered as a pioneer in e-commerce, digitalization, sustainability, and innovation on several occasions. Although Sweden has repeatedly been ranked among the leaders in e-commerce adoption, the country's retailers are still in the early stages of optimizing their operations of last-mile delivery practices (Risberg & Jafari, 2022). The Swedish retailers are still relying on trial and error to determine the most efficient and cost-effective solutions for last-mile deliveries. Retailers that are focused on e-commerce promote their services by offering more last mile delivery options, contrary to retailers that are focused on physical retail. For example, online retailers often offer free deliveries or free deliveries over a predetermined shopping value (Risberg & Jafari, 2022).

While e-commerce offers numerous advantages to both sellers and buyers, as previously discussed, it also presents several challenges (Belvedere et al., 2024). One significant issue is its environmental impact. The growing demand for online shopping has led to an increase in the packaging of goods, which in turn contributes to higher energy and material consumption.

To mitigate the negative environmental impacts of e-commerce, for example excessive volume and weight of packaging materials can be implemented and used (Belvedere et al., 2024).

2.2 Last-Mile

The last leg of the delivery, called last-mile, is where the order placed is being delivered from the distribution center or retailer to the final destination (Gonzalez et al., 2023). This is a crucial part of the logistic chain as it is the most complex and determines if the consumer expectations regarding the delivery are met (Vrhovac et al., 2023). Encarnación & Amaya also highlight that last-mile delivery costs can account for up to 28% of the total delivery expenses (2025), making it the costliest part of the delivery. Similarly, Klein & Popp is noting that the cost of last-mile delivery is between 13% and 75% of total supply chain costs (2022). Additionally, Rita & Ramos estimate that 53% of the total delivery cost represents the cost of last-mile delivery (2022).

Over the past decade, this topic (last-mile) has gained increasing interest among researchers. Urbanization and the growth of e-commerce have led to a rising demand for last-mile delivery (Vrhovac et al., 2023). The population within cities continue to expand (Dixit et al., 2022) and the consumers´ of e-commerce is placing more orders, resulting in larger volumes of parcels that need to be process and handled (Vrhovac et al., 2023).

The characteristics of e-commerce orders typically consisting of fewer items than traditional freight shipments (Beckers et al., 2022) and requiring tight delivery deadlines set by consumers (Vrhovac et al., 2023) the last-mile delivery results in a fragmentation of shipments that are having less potential for consolidation and not being fully optimized (Beckers et al., 2022). In turn, this results in even several non-efficient last-mile deliveries in urban areas making the competition in the parcel delivery sector tougher—explaining why the costs for last-mile delivery accounting for that high percentage. Belvedere et al. (2024) highlight that inefficient last-mile delivery in e-commerce generates a greater environmental impact than traditional shopping.

The transportation in urban areas is mostly done by commercial vans (Gonzalez et al., 2023) and is having an operational behavior of multiple stops for reaching all the different locations so the goods is being transported as near the consumer as possible. Noise pollution, congestion, infrastructure damage and pollution are all mentioned as consequences of the increase demand of last-mile deliveries in urban areas (Dixit et al., 2022). At the same time, the awareness of the environmental impact from transport is increasing. To reduce emissions, energy-efficient transportation modes should be adopted by having a fleet of cleaner vehicles alongside improvements in vehicle efficiency of existing vehicles, and optimized utilization (Gonzalez et al., 2023).

The process of last-mile deliveries contains several stakeholders; e-commerce companies, third-part logistics providers and transportation firms (Shamout et al., 2024). Gonzales et al. (2023) also investigate the problems of last-mile deliveries from a sustainability perspective of environmental, economic and social factors from the stakeholders' viewpoint. They highlight that collaboration with consumers can lead to the implementation of better strategies that are improving resource management and contributing to a more sustainable last-mile delivery.

2.3 Last-Mile Consumer Preferences

With the significant growth of e-commerce over the past decade, there has been a notable shift in consumer behaviour (Shamout et al., 2024) and the pressure on last-mile deliveries continues to rise (Vrhovac et al., 2023). Customer expectations in e-commerce are high and last-mile delivery plays a crucial role in determining whether these expectations are met. Given its critical role in shaping customer satisfaction, understanding consumers preferences becomes essential. Customers seek more personalized services with higher service quality, encompassing flexible delivery times and locations, as well as convenient methods for collecting their purchases (Patowary et al., 2023).

Vrhovac et al. (2023) highlight this by emphasizing that if the delivery service fails to meet expectations, the overall consumers satisfaction with the purchasing process significantly declines. Patowary et al. (2023) also notes that an efficient last-mile delivery service is a competitive advantage for the e-commerce retailer.

Consumer preferences are constantly evolving and even a single consumer´s preferences can shift over time. Given the diverse range of factors influencing purchasing behaviour, delivery preferences can be varied and numerous. Several studies indicate a correlation between demographics and both e-commerce behaviour and delivery choices.

Beckers et al. (2022) note that demographics such as income, gender, age, education, zip code may influence consumer behaviour in e-commerce. Dixit et al. (2022) further highlight that e-commerce consumer behaviour is linked to age and employment status, along with exposure to emerging technologies which shape last-mile delivery preferences. Bouhouras et al. (2024) also demonstrate that factors like age, gender and income influence consumer´s preferred delivery options. In contrast, Nguyen et al. (2019) argue that not all demographic factors are relevant, as education and age does not appear to influence preferences for the choice of delivery.

Several studies identify multiple factors that influence consumer preferences for delivery options. Lead times, delivery convenience and pricing are considered highly relevant. (Patowary et al., 2023). Dixit et al. (2022) mention several attributes, including payment method, lead time, time window, delivery price, environmental impact, safety, security and reliability. However, the study is considering delivery time and price as the main preferences. Meanwhile, Encarnación & Amaya (2025) emphasize cost, speed and reliability as the most critical factors.

Based on these varying preferences for the choice of last-mile delivery option, we consider cost of delivery, time, convenience and sustainability to be the most crucial preferences, which will be examined in greater detail.

Cost of delivery

Cost of the delivery is seen as an important preference for choosing a delivery option, by several studies (Nguyen et al., 2019; Patowary et al., 2023). Consumers are generally price-sensitive (Nguyen et al., 2019) and is more affected by delivery costs than by the price of the product (Patowary et al., 2023). Nguyen et al. (2019) examined delivery costs on a number of Swedish websites and found that almost all provide free delivery, but with a minimum order value requirement. If a delivery option comes with a cost, the retailer would need to ensure it provides a superior service compared to the free delivery option to justify the expense and encourage the customer to pay (Nguyen et al., 2019).

Time

Time is an important preference, encompassing various aspects. Lead time refers to the time span between placing an order and the customer receiving the goods (Patowary et al., 2023). Delivery time refers to the duration required to transport the purchased goods to the final customer. With evolving consumer behavior and growth of e-commerce, consumers prefer shorter lead time to meet their immediate needs (Vrhovac et al., 2023).

Although Patowary et al. (2023) highlight that while customers are willing to spend most money on this preference, Klein & Popp (2022) note that consumers may accept longer delivery times in exchange of lower delivery fees. Filiopoulou et al. (2022) suggest that time is not only considered in terms of delivery speed but also as a way for consumers to save time by shopping online instead of visiting physical stores.

Timely and problem-free deliveries significantly impact customer satisfaction. Vrhovac et al. (2023) argue that when customers receive their goods on time and without any issues, they are satisfied with the delivery and more likely to purchase with the same e-commerce company again. Risberg & Jafari (2022) state that rather than prioritizing fast deliveries, the most important factor is providing an accurate and reliable expected delivery time. This highlights that beyond speed, reliability and efficiency in delivery play a crucial role in customer satisfaction (Vrhovac et al., 2023), which is connecting to a broader concept of the preference of convenience.

Convenience

Convenience is seen as a significant preference for choosing a delivery option in several studies (Bouhouras et al., 2024; Filiopoulou et al., 2022; Nguyen et al., 2019; Patowary et al., 2023).

Vrhovac et al. (2023) define convenience as the consumer´s understanding that e-commerce shopping is simpler, faster and requires less effort compared to traditional shopping. This is further illustrated by the consumer´s need for problem-free deliveries, free from delays, incorrect products or lost packages. Nguyen et al. (2019) further elaborate on convenience, emphasizing the consumers availability to choose their preferred time delivery time, including specific time slots and the option to receive the goods in the evening or on weekends.

Environmental Sustainability

In recent years, awareness of sustainability has increased, and in some cases, it is one of the key consumer preferences for choosing a delivery option (Klein & Popp, 2022). Belvedere et al. (2024) investigated consumers' willingness to choose a more sustainable delivery option. Their study suggests that when consumers are informed about the environmental impact of different delivery options, it could change their earlier preferences towards a more sustainable choice. This highlights that a deeper understanding of consumer preferences can play a crucial role in shaping last-mile logistics to become more sustainable and efficient.

2.4 Consumer Groups in Last-Mile Delivery

Nguyen et al. (2019) further segment the consumers into three groups: price-oriented consumers, convenience-oriented consumers and value-for-money consumers. Price-oriented consumers choose the option with the lowest delivery fee, convenience-oriented consumers prioritize the ability to select a time slot, and value-for-money consumers seek a balance between the lowest delivery fee and convenience. The study also states that the segments exhibit the same demographic traits, including gender and income, while noting that consumer preferences for delivery options are only partially influenced by demographics.

2.5 Last Mile Delivery Locations

In this paper the different delivery options are discussed. Delivery options in this context is described as the different choices that the customer can choose between when checking out on an e-commerce website. These options include price of delivery, time of delivery, location of delivery and carrier companies that preform the delivery. Delivery location refers to the method and location of the delivery. In this case the different delivery locations that are discussed are home delivery, parcel lockers, pick-up points, and click and collect.

Each method is tailored to meet the diverse needs and preferences of the end consumer, as discussed before. These methods not only reflect the growing demands for speed, convenience, and cost-effectiveness but also address the unique challenges that arise in the final leg of the delivery process.

Customers, increasingly, have demands for personalized service quality, including flexible delivery locations that can tailor to their preferred time and place of delivery, as well as the collection and eventual return of the goods (Patowary et al., 2023).

In Patowary et al.'s article, three different key types of delivery operators are mentioned. The first operator is the country's national postal operators. These are well-known postal firms within the country, and in Sweden, one example of such companies is PostNord AB (2023). The second type of operator are global operators that are multinational and have a worldwide presence. Examples of companies like this are UPS Inc., DHL, and FedEx Corporation. The third operators are courier companies and other express parcel specialists. These types of operators are distinct from both national postal operators and global integrators, with differences in their business models, coverage, and services (Patowary et al., 2023).

Additionally, in Patowary et al.'s article (2023), existing last-mile delivery locations are categorized into three primary types of delivery methods, each determined by the place of delivery. These delivery types vary based on the location where the consumer receives the parcel, catering to different customer needs and preferences. The first method is pickup, also referred to as click and collect, which involves customers collecting their parcels at designated locations such as distribution centers or retail stores. The second method is clustering, which involves the consolidation of parcels at specific locations that can be accessed by multiple consumers. This method offers several variations, such as parcel lockers and pick-up points, which are commonly located in places like bookshops, gas stations, or other stores. The final method is home delivery (Patowary et al., 2023).

Home Delivery

According to Vrhovac et al. (2023), home delivery is a customized, convenient, and efficient delivery method that contributes to building long-term customer relationships and an increase of customer satisfaction which ca be a competitive advantage. As stated by Klein & Popp (2022), home delivery is particularly appreciated by customers as it saves time and makes them the least involved in the delivery process.

Home delivery is often considered as the most common form of last mile delivery, especially in most Western countries with 55% in the U.K. and 52% in Germany (El Moussaoui et al., 2023). The delivery method implies that parcels are delivered directly to customers' specific addresses they provided to the retailers, most often their home address (Klein & Popp, 2022). The parcels are dispatched from a carrier depot and then delivered to the designated address. Home delivery is most commonly done in the form of either attended, when the recipient is present for the delivery or unattended home delivery, where the customer is not present (Klein & Popp, 2022). Unattended home delivery either means that the parcel is received by a neighbour or that the parcel is placed outside the door of the customer's home (Patowary et al., 2023).

Attended home delivery is common for services and goods that require special handling (Waßmuth et al., 2023). For example, when the parcel is fragile, confidential, big and bulky, or highly valuable, the delivery requires that the recipient must be present at their home so that the customer can confirm the reception of the parcel by signing a receipt (El Moussaoui et al., 2023). Attended home delivery necessitates that both the courier and the customer be synchronized (Bonomi et al., 2025). In most cases, the customer chooses a narrow timeslot for when the parcel shall be delivered based on the customer's preference and availability. The courier then plans a routing schedule that fits the delivery demand in the specific timeslots, and at the same time, minimizes the delivery costs.

This can pose a significant problem since customers might not be available during the entire timeslot. The stop and drop off of the parcel at the customer's home are generally quick and the courier's schedule is often cramped in order to make all planned deliveries on time

(Bonomi et al., 2025). Even if the timeslot allotted for the delivery is a reasonable amount of time, the coordination of various factors to ensure the courier stays on schedule is crucial and could become problematic. Factors like uncertain travel times due to, for example, traffic congestion might also become problematic with the on-time delivery of the parcel. This asynchronization commonly leads to failed deliveries, that are very expensive and time costly for the courier company. It contributes to customer dissatisfaction, as well, as the courier is not following through with the delivery successfully (Bonomi et al., 2025). In the case of a failed attended delivery, courier companies often require that the customer arrange a new timeslot for re-delivery, alternatively that the parcels be delivered to the company's depot (El Moussaoui et al., 2023).

To mitigate the problem of failed deliveries, more precise timeslots for home delivery could be implemented, but this could also complicate the couriers' routing process (Klein & Popp, 2022).

Parcel Lockers

Parcel lockers are aggregated structures, typically located in commercial and public spaces, like supermarkets, subway stations, and shopping centers (Encarnación & Amaya, 2025). As a form of self-service, parcel lockers allow customers to independently retrieve their parcels. At these appointed locations for the parcel lockers, the parcels are delivered by the carriers and held until the customer retrieves them. The recipients are then notified by text message, an application or by email with a code to unlock the locker, when the parcel is ready for collection. This delivery method requires that carriers form agreements with the parcel locker providers. This contract includes that the providers hold the parcels for the carrier for a predetermined number of days until they are sent back. Parcel lockers allow for consolidation of deliveries and help to optimize delivery routes, while at the same time reducing operational costs (Encarnación & Amaya, 2025).

Even though parcel lockers add extra effort in the delivery process for the customer, in the way that the customer must retrieve the parcel at a separate location as opposed to home delivery, studies have found that they are a promising alternative and an optimal solution for failed deliveries (Seghezzi et al., 2022). Parcel lockers are also considered easily accessible and convenient for customers as the customer can choose at what time to pick up the parcel. The delivery location allows for an increased delivery density and economic advantages for carriers when they can coordinate several individual deliveries to the same location, which reduces the transportation costs (Encarnación & Amaya, 2025). It has also been found that parcel lockers improve the environmental aspect of last mile delivery in the way that they enable consolidation deliveries (Belvedere et al., 2024). Another advantage of the parcel lockers is the convenient location that they offer. The commercial and public spaces that they are located allow the customer to strategically pick up the parcels where it coincides with their schedules in daily activities (Darren et al., 2024). Parcel lockers are considered particularly beneficial in suburban areas compared to home delivery because of the increased, complex and costly delivery routes that home delivery generally requires (Encarnación & Amaya, 2025).

Pick-Up Points

Pick-up points represent a type of unattended delivery system that allows customers to retrieve their parcels from designated locations rather than having them delivered directly to their homes or offices. These locations can include retail stores, post offices, or strategically placed collection points along major roads or near public transport hubs (El Moussaoui et al., 2023) (Klein & Popp, 2022). Once delivered, parcels are typically stored at these locations for a specified period, until the recipients retrieve them. Pick-up points are always manned collection points and are restricted to the operating hours of the specific site, meaning that customers must collect their parcels during these designated times (Klein & Popp, 2022). This model offers increased flexibility for consumers who are unable to receive home deliveries, but it also places limitations on the time frame during which retrieval is possible, as the pick-up points are always bound by the operating hours of the hosting establishments.

Consumers often choose to collect their parcels from pick-up points as part of their daily routines, such as on their way to work or during other errands (Bouhouras et al., 2024). This method of parcel retrieval offers significant convenience, as it allows customers to collect their packages at a time that fits within their schedules, effectively consolidating the task with other activities. By doing so, customers can use their time more efficiently and avoid making separate trips solely for parcel collection (Bouhouras et al., 2024).

Additionally, because consumers coordinate the collection of their parcels with their existing activities, pick-up points can help reduce the environmental impact of last-mile delivery. The reduction in home deliveries means fewer individual trips by delivery vehicles, which in turn can lower carbon emissions associated with parcel transportation (Klein & Popp, 2022). However, it is important to note that in some cases, customers may make additional trips to retrieve their parcels from pick-up points, particularly if the location is not connected to other daily activities. These extra trips could counterbalance some of the environmental benefits by increasing transportation emissions (Klein & Popp, 2022).

One of the key advantages of the pick-up point system is that it provides customers with the freedom to choose the most convenient collection location (Bouhouras et al., 2024). This flexibility ensures that consumers can select a pick-up point that aligns with their daily schedules and routes, which contributes to the overall convenience of the delivery method. Moreover, pick-up points offer significant benefits to retailers. By consolidating several parcels at a single pick-up point, retailers can lower delivery costs, as it reduces the need for multiple separate deliveries to individual addresses. Furthermore, pick-up points help reduce the occurrence of failed deliveries (Bonomi et al., 2025). Since customers are not required to be at home to receive their parcels, the likelihood of missed or rescheduled deliveries decreases. This not only improves customer satisfaction but also enhances operational efficiency for retailers, contributing to a more streamlined and cost-effective delivery process (Bonomi et al., 2025).

Click and Collect

Click and Collect is a delivery location that combines e-commerce with traditional shopping, allowing consumers to make purchases online and then collect their goods in-store (Cotarelo et al., 2021). Cotarelo et al. (2021) suggests that Click and Collect leverages the strengths of both purchasing systems and can be considered a more sustainable delivery location than home delivery. Their study indicates that this delivery location provides consumers with greater flexibility as it does not requiring them to be at home at a specific time unlike home delivery. Additionally, it may help reduce unnecessary trips by minimizing failed deliveries, thereby lowering emissions (Cotarelo et al., 2021).

Klein & Popp (2022) suggest that 44% of supply chains executives worldwide offer Click and Collect. According to Patowary et al. (2023), between one-third and half of the investigated e-commerce companies provide this option in Sweden. Their study attributes this limited availability to the fact that not all e-commerce companies have physical stores or that their existing stores are not located close to consumers.

Furthermore, Filiopoulou et al. (2022) suggest Click and Collect is not a widely preferred delivery location among consumers. El Moussaoui et al. (2023) propose that the usage of Click and Collect depends on population density and store locations. Their study indicates that consumers in urban areas are more likely to choose this option compared to those in suburban areas.

2.6 Factors affecting last-mile delivery and its location

Figure 1 visually summarizes the key aspects of last-mile delivery identified in the literature review. It highlights the main customer preferences, which are cost of delivery, time, convenience and sustainability. The cost of delivery refers to both the delivery fee itself and the minimum order amount required to qualify for free delivery. Time is defined as the estimated number of working days from when the order is ready for shipment until it reaches the customer. Convenience includes the ability to choose from multiple delivery locations, select a specific delivery time for home deliveries (time slot), and decide whether to be present or not when receiving a home delivery (attended or not attended). This study does not include the perspective of problem-free deliveries or on-time performance, as these aspects cannot be accurately evaluated. Finally, sustainability refers to whether information about the environmental impact of the last-mile delivery location is available to the customer when purchasing an item.

The figure also highlights the most common different delivery locations including home delivery, pick-up points, click and collect and parcel lockers—which are clearly described in the literature review. These locations aim to provide flexibility for consumers that allows them to choose a delivery method that best aligns with their individual needs and priorities (preferences).

Based on the literature review, there is no clear and direct connection between specific customer preferences and their preferred last-mile delivery option. This gap emphasizes a need for further research on how consumer preferences can be better aligned with the last-mile delivery options to become more efficient. The following chapters will explore this relationship.

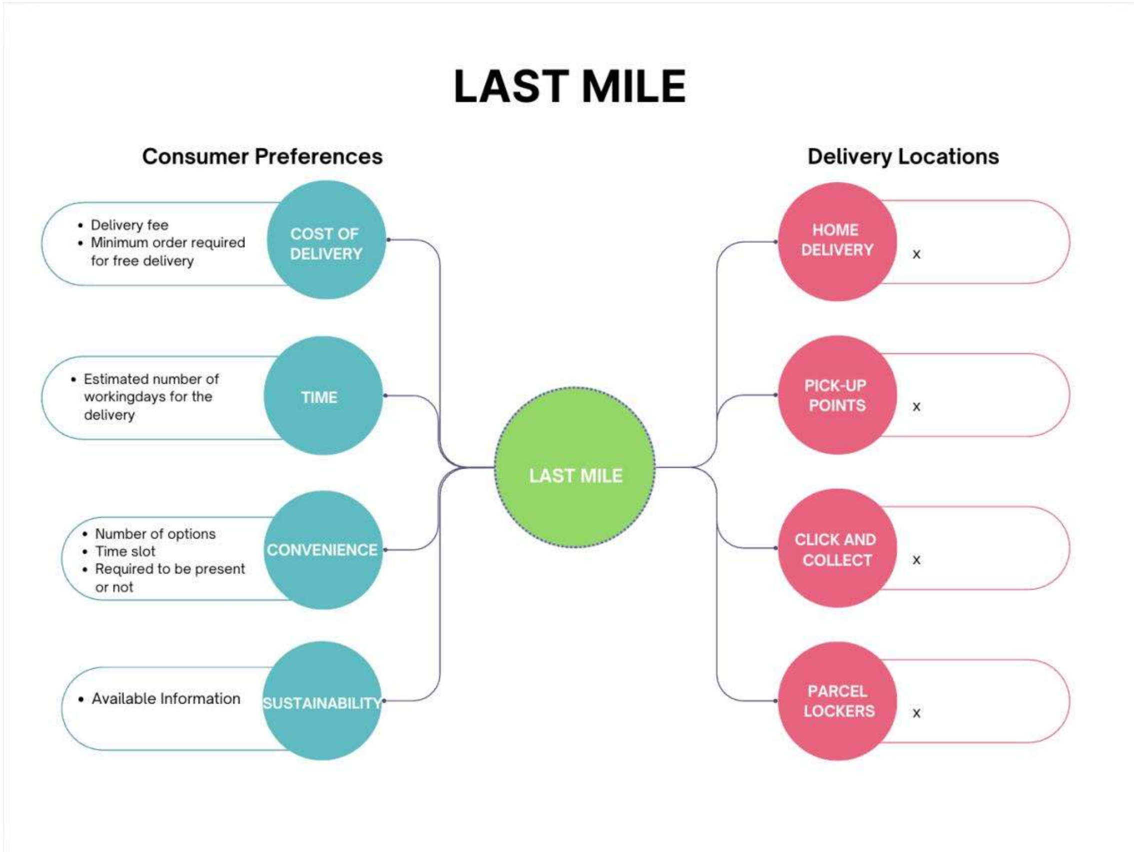

Figure 1. Overview of last-mile delivery preferences and locations that summarizes the literature review. The figure illustrates the most common consumer preferences and delivery locations which are further explored in the research.

3. Methods

This chapter presents the methods used in the study. It begins with a brief overview of the types of methodologies applied, which combine both qualitative and quantitative approaches. The chapter then outlines the research process, divided into three phases: Phase 1—Secondary Data Collection of E-commerce Sectors, Phase 2—Preparations for the Data Collection, Phase 3—Systematic Data Collection from Swedish E-commerce Websites, and Phase 4—Descriptive Data Analysis. The chapter concludes with a reflection on the study´s reliability and validity, as well as the ethical aspects related to the research.

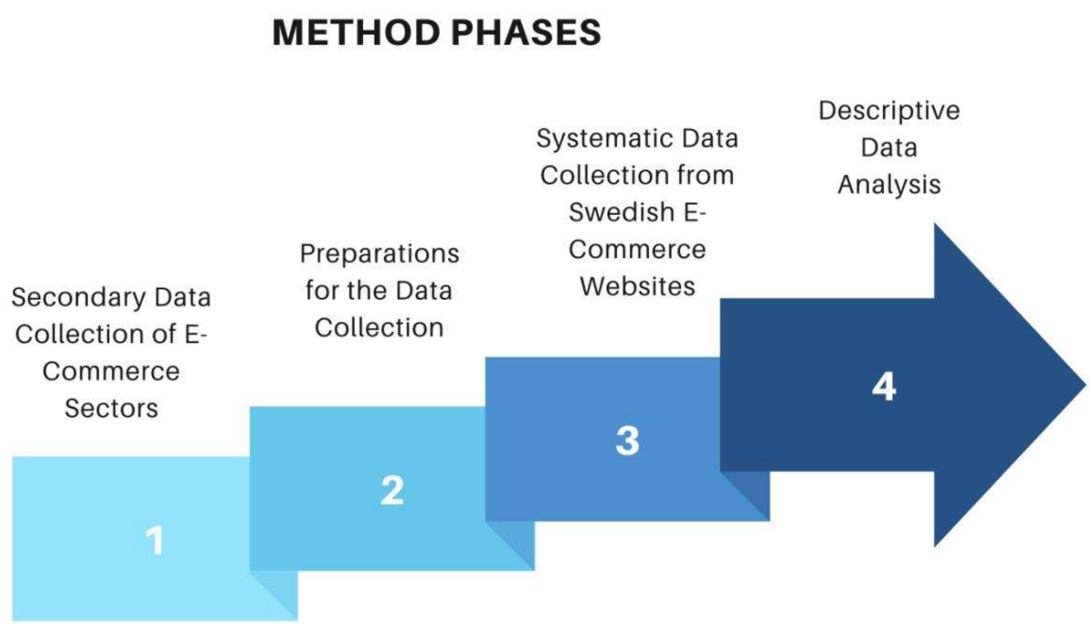

Figure 2. Phases for the method in three different steps.

3.1 Types of Methodologies

This report follows a qualitative methodology with the aim of analyzing data with a focus on words rather than numbers to explore behaviors, patterns and underlying factors within a given context (Bell et al., 2019). A qualitative approach is suitable for the report as it allows for an in-depth exploration of consumer preferences and how they influence different delivery options and the last mile logistics.

By adopting a qualitative approach, we gathered data from selected reports and e-commerce websites and enabled a comparative analysis. This enables the identification of patterns in consumer behavior and delivery preferences across different contexts. It also provides an understanding of differences and similarities between delivery locations and what they entail. This, in turn, makes it possible to see what types of options should be available to meet customer expectations.

The report also uses quantitative methodology. Measurement plays a crucial role in analyzing the collected data. The data must be processed to allow for meaningful statistical explanations. By applying quantitative data analysis techniques, the dataset is reduced to its essential components for answering the problem statements of the report and making it coherent for the readers. The results of the data analysis can then be interpreted and compared to the narrative literature review (Bell et al., 2019).

To collect data about the various delivery options in Sweden, a quantitative analysis focusing on a selected number of e-commerce companies and their websites was done. This approach enables the systematic retrieval of data regarding available delivery options and their estimated delivery times, costs and the level of transparency concerning the environmental impact of each option. By analyzing this data, the aim is to identify common delivery practices and establish a representative overview of the typical delivery options available in Sweden.

3.2 Phase 1: Secondary Data Collection of E-commerce Sectors

Having completed the narrative literature review and gained a deeper understanding of the topic and previous research, the secondary data was collected from reports by an established courier company in Sweden to get an understanding of which sector´s there is prevalent in e-commerce.

Secondary analysis refers to the examination of data that other researchers has collected (Bell et al., 2019). This data collection can both be considered as quantitative and qualitative. Our analysis is primarily based on secondary quantitative data, gathered through annual reports done by one major courier company, PostNord AB, in Sweden. The data collected from the report is by itself considered quantitative, but the selection of the sources for the data collection introduces a qualitative aspect as the researchers deliberately chose them to form the foundation of the analysis. This contributes to an overview of the most utilized branches and commercial companies in Sweden to get an accurate representation of the market in the country studied.

3.3 Phase 2: Preparations for the Data Collection

The method of Convenience Sampling, meaning the collection process of data from a research population that is effortlessly reachable, was utilized for the data collection because of its easily accessible quality (Golzar & Tajik, 2022). This method enabled for sampling of readily available e-commerce websites to be observed, and convenient zip codes to be employed.

The preparing steps for the secondary data collection of sectors and websites:

1. The sectors for the study were chosen.

The first step of the preparation for the systematic secondary data collection was to choose the most relevant and popular sectors in Sweden to base our findings on. These sectors were chosen based on the PostNord E-barometer report from the secondary data collection in the previous phase, using the criterion of the three largest sectors within the Swedish e-commerce industry (PostNord, 2024).

The report provided figures on each sector´s total sales in 2024 along with the percentage of sales made through e-commerce. To identify the largest sectors in terms of e-commerce, the total e-commerce sales were calculated for each sector.

The sectors with the highest e-commerce sales were then identified as Pharmacy (SEK 3.38 billion), Home Electronics (SEK 13.33 billion) and Clothing & Shoes (SEK 5.88 billion). These sectors were selected as the basis for the continued data collection.

This approach ensures that the study effectively represents the Swedish e-commerce market while maintaining a focused scope.

2. Convenience Sampling of e-commerce websites were selected.

The next step of the preparation for the systematic data collection process was to choose a sample of e-commerce websites. This selection was a *Convenience Sampling*, combining subjective and systematic selection, and was based on a secondary data statistics identifying the top 100 largest e-commerce companies in Sweden for 2024 done by Bonzer (*Sveriges Topp 100 E-Handlare 2024: Analys Av Bonzer*, n.d.).

Bonzer's statistics were, inter alia, divided into Monthly Organic Traffic, which is the number of visitors per month that visit a website unpaid (organically) via a search engine. *Unpaid*, meaning that the visitor finds the website without the website paying for advertising for it.

Of these 100 websites, those in the chosen sectors were identified. The websites were categorized into the sectors based on the types of goods that were displayed on the site. For the more ambiguous websites where it was more unclear what sector the online shop belonged to, the categorization was determined using the website's branch code, or *SNI-code.*

After gathering and categorizing the sites, the websites that could not be used for the data collection for different reasons were filtered out.

The total Monthly Organic Traffic was calculated for each sector based on the chosen websites from the list. The sample size was then determined based on the sector with the least amount of total Monthly Organic Traffic, which was Home Electronics, with 5.6 million visits per month, to get a fair comparison between the three sectors. This resulted in seven websites for Home Electronics. For the two remaining sectors, the websites with the highest rankings in the list were selected based on the Monthly Organic Traffic measure, until the total traffic resulted in 5.6 million visits. The websites outside this limit were sorted out. This resulted in four websites for the Pharmacy sector, and nine for Clothing & Shoes.

3. The zip codes used for the analysis were picked.

In order to understand how different geographical areas influence the available delivery locations and various shipment factors, three different zip codes around Gothenburg, Sweden were selected. The selection of these zip codes was based on the article *Assessing the Inequalities in Access to Online Delivery Services and the Way COVID-19 Pandemic Affects Marginalization* by Ivan Sanchez-Diaz et al., which included several zip codes, each with relevant data.

Given the study´s focus on Gothenburg, all zip codes that did not start with the number *4* were excluded, as well as some zip codes that were farther away from the Gothenburg area.

The selection of each zip code was based on population density. To give a broad representation of the zip codes, the data was sorted by population density and the median was calculated. To represent a high-density area, one zip code with larger than the median was selected. To represent a medium-density area, one zip code around the median was selected. Lastly, to represent a low-density area, one zip code lower than the median was selected.

A subjective selection was made since the study focuses on Gothenburg and zip codes considered too far away were excluded.

4. Organizing an excel table was done.

Once all the samples had been selected and finalized, an Excel table was created for the systematic data collection. As consumer preferences had already been identified with the Literature Review, they were used as the framework for structuring the table and determining its content. The table was therefore divided into four main sections: Convenience, Time, Cost of Delivery and Sustainability. Each of these sections was further broken down into detailed categories based on the specific components of the previously defined consumer preferences and what they entailed.

For the section of *Convenience,* columns were created within this section to capture if Attended, Not Attended and Time Slot were available for Home Delivery. In addition, columns were added to document all available delivery options for each delivery location. These locations were based on the categories identified in the literature review: Home Delivery, Pick-up Points, Parcel Lockers and Click & Collect. Within each of these delivery locations, additional columns were included for the different parcel and transportation companies offering a service in respective delivery location.

For the section of *Time*, it included columns indicating whether faster delivery options were available, as well as the maximum and minimum delivery time for each delivery location. Additionally, separate columns were created to record the maximum and minimum delivery times specifically for faster delivery options, again categorized by delivery location.

For the section of Cost of Delivery, columns were created for the cost of faster delivery, the cost for each delivery location across all identified delivery companies, the availability of free delivery and the minimum order value required for free delivery.

For the section *Sustainability*, a column was included to indicate whether any information related to sustainability was available on the website when purchasing an item. This marked the final part of the table structure used for the systematic data collection.

3.4 Phase 3: Systematic Data Collection from Swedish E-commerce Websites

After having all the preparations done, the next step was to execute the systematic data collection. Systematic data collection is a process that ensures accuracy, reliability, and validity by gathering data in a structured way. It entails defining clear objectives, selecting relevant data collection methods, such as surveys or observations, and performing standardized procedures in order to minimize errors and biases (Babbie, 2020).

By systematically collecting data, errors and biases in the results gathered from various e-commerce websites are significantly minimized. A structured approach ensures that the data is collected consistently and in a repeatable manner, reducing inconsistencies and improving accuracy. Additionally, systematic data collection provides a clear and well-documented rationale for data selection, making the process more transparent and justifiable. This, in turn, enhances the reliability and credibility of the findings, leading to more trustworthy results. With accurate and dependable data, conclusions become more robust, increasing confidence in decision-making and enabling data-driven insights that can drive effective strategies in e-commerce analysis.

1. Information of the different delivery alternatives was gathered.

Information about the websites' delivery cost, time, available locations, and courier company alternatives were gathered from the selected websites based on the three zip codes. This was done by visiting the websites, adding an item with the price of around SEK 199 to the cart, proceeding to checkout, entering the zip codes and viewing the available delivery options. Screen shots were taken of the delivery options on each website in order to be able to reference and control check at a later time.

2. The results were compiled.

Based on the data collected in the step described above, the information was compiled into the table that had been created in Excel. The same table structure was used across all sectors. The e-commerce website and relevant zip codes were entered into the table. For all columns with binary options (Yes or No), values were recorded as 1 for Yes and 0 for No. For example, the columns for Attended or Not Attended were filled in using this format.

The price of delivery and delivery time were also recorded, with delivery cost noted in numerically in SEK, and delivery time expressed in number of working days for each available delivery option.

In addition, if any information about ecolabels was available on the website, this was initially noted in the form of a comment. It was then transformed into a quantitative format, with a 1 indicating that any information was available during the purchasing process, and a 0 indicating that no such information was found.

If information sought after was missing on the website, the website´s delivery policy page was checked. If the relevant information could not be found, the column was filled with N/A.

3. Summarizations of the collected data was done.

To get a clearer picture of all data collected, summarizations of the data were assembled into tables in excel. The data from the different e-commerce websites were summarized into averages and minimums/maximums for the different factors of the delivery location options, which gives a more comprehensive comparison of how each metric performs across each sector and zip code. The data was also evaluated on a scale of *Really Low* to *Really High*, which shows the value of the data rather than just the raw numbers. This provides a more intuitive understanding of how each delivery option compares across the sectors and zip codes, helping to highlight overall trends and outliers that may not be immediately apparent from numerical data alone.

3.5 Phase 4: A Descriptive Data Analysis

Finaly, a descriptive data analysis was done to summarize and organize the collected data to provide a clear overview and to identify patterns of the result. By comparing delivery services across different sectors and locations (zip codes), the analysis explored possible variations in last-mile delivery conditions. Tables helped visualize the findings by highlighting trends. The results were interpreted in relation to previous research to identify key insights into consumer preferences and last-mile delivery options. This approach aimed to enhance the understanding of e-commerce logistics and the factors influencing last-mile delivery.

Initially, the analysis attempted to include all raw data in the analysis rather than the averages, aiming to capture the full range of variations within each sector. This was possible for the analysis of cost of home delivery. The boxplots could effectively visualize the distribution of costs. However, due to differences in the number of websites visited within each sector, it became challenging to effectively visualize all data for all variables. Despite efforts to include all basic data, it was found that the most significant differences were clearly revealed in the averages and ranges. In this approach, the data was divided by the number of data point available, and the ranges—from minimum to maximum days or price.

For the analysis cost of home delivery, the analysis included all raw data. The boxplots could effectively visualize the distribution of costs.

3.5 Ethical Aspects

Ethical considerations are crucial when collecting and using data. Most academic sources, including reports, articles and books fall under copyright protection. Copyright is a type of intellectual property right that gives creators ownership of their work and protects it from unauthorized use (Bell et al., 2019). Given this, it is crucial in this study to ensure that all collected data is legitimate and properly authorized.

To maintain compliance with copyright regulations, all data has been manually sourced from publicly available websites and articles accessed through Chalmers University of Technology’s available databases. Further, all referenced resources have been properly cited using the APA system to ensure accuracy and adherence to ethical research standards.

3.6 Reliability and Validity

Four criteria were considered to ensure the trustworthiness, reliability and validity of the report (Bell et al., 2019). Credibility was ensured by using multiple carefully selected data sources. Transferability was strengthened by providing detailed descriptions of the research context. Dependability was supported through a transparent process by documenting the data collection process. Confirmability was ensured by that the evaluation and explanation is grounded in the data and have an objective foundation rather than being influenced by researcher bias.

4. Results

This chapter present the result of the investigation based on the systematic data collection. The findings are structured to answer the research questions by highlighting patterns and differences in last-mile delivery options across various e-commerce sectors and geographic locations. The analysis focuses on key consumer preferences identified in the literature review; cost, time, convenience and sustainability. It explores how these are reflected in the actual delivery alternatives available to consumers.

4.1 Summary of the Results

In this section, the common themes and most evident patterns from the results are presented, based on summary tables for each sector and density category, which include both numerical data and subjective labels.

4.1.2 General Summary of the Sector Results

Here the results for the sectors are presented to see if no matter what the consumers is purchasing their most significant consumer preferences can be satisfied. The results are presented in both numerical and subjective summaries, with visualizations and tables used to support interpretations. Metrics such as delivery time and cost are presented as ranges, while features like attended delivery, time-slot availability and sustainability information availability are treated as binary indicators. These variables and the number for the different options are presented as averages.

Preference	Metric	Pharmacy	Home Electronics	Clothing & Shoes
Convenience	Attended	58%	43%	22%
	Time Slot	50%	21%	N/A
	Number of Options for Home Delivery	3.8	1.1	1.9
	Number of Options for Pick-up Points	1.8	0.9	1.4
	Number of Options for Parcel Lockers	2.0	1.1	1.8
	Availability of Click & Collect	75%	85.7%	55.6%
	Number of Options	8.4	4.1	5.9
Time	Time Range for Home Delivery (Days)	0-6	0-5	1-5
	Time Range for Pick-up Points (Days)	1-6	1-4	1-5
	Time Range for Parcel Lockers (Days)	1-4	1-5	1-5
	Time Range for Click & Collect (Days)	1-3	0-3	1-5
	Faster Delivery Available	50%	9.5%	33.3%
Cost of Delivery	Delivery Fee Range Home Delivery (SEK)	0-59	29-129	39-159
	Delivery Fee Range Pick-up Points (SEK)	0-49	19-59	29-59
	Delivery Fee Range Parcel Lockers (SEK)	0-29	0-59	29-59
	Delivery Fee Range Click & Collect (SEK)	0-0	0-0	0-29
	Minimum Order for free delivery (SEK)	199	500	300
Sustainability	Available Information	100%	52%	78%

Figure 3. Summary of sector results based on numerical labels for delivery preferences across three product categories: Pharmacy, Home Electronics and Clothing & Shoes.

Preference	Metric	Pharmacy	Home Electronics	Clothing & Shoes
	Info about Attended	Medium	Medium	Low
	Time Slot	Medium	Low	N/A
	Number of Options for Home Delivery	High	Medium	Medium
	Number of Options for Pick-up Points	Medium	Low	Medium
	Number of Options for Parcel Lockers	Medium	Medium	Medium
	Availability of Click & Collect	High	High	Medium
Convenience	Number of Options	High	Medium	Medium
Time	Time Range for Home Delivery (Days)	Low-High	Low-Medium	Low-Medium
	Time Range for Pick-up Points (Days)	Low-High	Low-Medium	Low-Medium
	Time Range for Parcel Lockers (Days)	Low-Medium	Low-Medium	Low-Medium
	Time Range for Click & Collect (Days)	Low-Low	Low-Low	Low-Medium
	Faster Delivery Available	Medium	Really Low	Low
Cost of Delivery	Delivery Fee Range Home Delivery (SEK)	Low-Medium	Low-Really High	Medium-Relly High
	Delivery Fee Range Pick-up Points (SEK)	Low-Medium	Low-Medium	Low-Medium
	Delivery Fee Range Parcel Lockers (SEK)	Low-Low	Low-Medium	Low-Medium
	Delivery Fee Range Click & Collect (SEK)	Low-Low	Low-Low	Low-Low
	Minimum Order for free delivery (SEK)	Low	High	Medium
Sustainability	Available Information	Really High	Medium	High

Figure 4. Summary of sector results based on subjective labels for delivery preferences across three product categories: Pharmacy, Home Electronics and Clothing & Shoes. The figure presents subjective ratings from very low to very high.

According to the findings of the study, the analyzed websites typically provide multiple types of delivery locations, often offering more than one alternative within each delivery category. As illustrated in *figure 3*, the Pharmacy sector stands out by providing an average of 8.4 delivery options in total. In contrast, the Home Electronics sector offers significantly fewer alternatives, with an average of only 4.1 delivery options—less than half that of the Pharmacy sector. The Clothing & Shoes sector falls in between, with an average of 5.9 delivery options.

These figures suggest that the Pharmacy sector places a greater emphasis on delivery flexibility, potentially aiming to accommodate a broader range of consumer preferences or urgency in product delivery. The trend is consistent when examining the number of options available within each specific type of delivery location, further reinforcing the notion that the prioritization of delivery alternatives is highest in the Pharmacy sector, followed by Clothing & Shoes, and lowest in Home Electronics.

When examining the "Attended" metric, which refers specifically to home delivery options requiring the recipient to be present upon delivery, the Pharmacy sector emerges as the most prominent proponent of this delivery method, with a percentage of 58. This suggests a strong emphasis on direct-to-consumer service, likely due to the regulated nature of many pharmaceutical products. In contrast, the Home Electronics and Clothing & Shoes sectors resulted in a lower percentage, indicating a comparatively lower reliance of attended home deliveries.

However, the ranking of sectors shifts when considering the "Availability of Click & Collect" metric, which refers to the option for customers to pick up their orders at designated locations rather than having them delivered to their homes. In this case, the Home Electronics sector leads, offering Click & Collect options more frequently than the other two sectors. The Pharmacy sector ranks second, while the Clothing & Shoes sector provides this option the least.

The delivery location option that is the fastest has been shown to be click & collect, while home delivery, parcel lockers, and pick-up points generally takes the longest amount of time for delivery. The Pharmacy sector presents a somewhat paradoxical case: while it offers the highest number of faster delivery options—such as same-day or next-day delivery—it is also the sector that can take the longest overall time to deliver, with some deliveries extending up to six days. In contrast, the Clothing & Shoes sector is the most consistent when it comes to delivery time. Regardless of the delivery location type, it offers a uniform delivery timeframe with the same amount of delivery time for all delivery location options. As for the Home Electronics sector, the time variable varies some between the different delivery location options, as well—click & collect offering the shortest delivery time, and the other three delivery locations alternatives being more similar in delivery time.

Home Delivery is the most expensive option and click & collect is the most affordable alternative; otherwise, the costs are fairly similar. This is likely because the transport companies have established agreements with the different sectors. Pharmacy has the lowest minimum order value. Overall, Pharmacy is the most affordable option.

Information available about sustainability for the delivery options often come in the form of ecolabels. Pharmacy is the sector that presents this information the most often, in actuality 100% of the time according to the study. Home Electronics offers this almost half of what the Pharmacy sector does, with 52% of the time. However, some discrepancies were observed in the data collection process: certain service providers offered the same delivery option, for example, parcel lockers, with ecolabels on one website but on the other website the ecolabels were not shown. This inconsistency may reflect differences in how individual e-commerce websites choose to display or highlight sustainability credentials rather than an actual difference in service quality.

The minimum order value for free delivery turned out to be fairly different depending on the sector. Pharmacy was the sector that required the most affordable value of the order for free delivery. Next in order was the Clothing & Shoes sector, and lastly Home Electronics websites.

4.1.3 General Summary of the Population Density Results

Here the results for the population densities are presented to see if the customers no matter where they live could be satisfied with the most significant consumer preferences. The results are presented in both numerical and subjective summaries, with visualizations and tables used to support interpretations. Metrics such as delivery time and cost are presented as ranges, while features like attended delivery, time-slot availability and sustainability information availability are treated as binary indicators. These variables and the number for the different options are presented as averages.

Preference	Metric	High Density	Medium Density	Low Density
Convenience	Attended	51.5%	51.5%	7.1%
	Time Slot	51.8%	44.6%	0%
	Number of Options for Home Delivery	3	2.7	1.2
	Number of Options for Pick-up Points	1.4	1.4	1.4
	Number of Options for Parcel Lockers	1.6	1.6	1.6
	Availability of Click & Collect	72.1%	72.1%	72.1%
	Total Number of Options	6.8	6.5	5.1
Time	Time Range for Home Delivery (Days)	0-6	0-5	1-6
	Time Range for Pick-up Points (Days)	1-6	1-6	1-6
	Time Range for Parcel Lockers (Days)	1-5	1-5	0-5
	Time Range for Click & Collect (Days)	0-5	0-5	0-5
	Faster Delivery Available	32.5%	32.5%	27.8%
Cost of Delivery	Delivery Fee Range Home Delivery (SEK)	0-149	0-149	0-149
	Delivery Fee Range Pick-up Points (SEK)	0-59	0-59	0-59
	Delivery Fee Range Parcel Lockers (SEK)	0-59	0-59	0-59
	Delivery Fee Range Click & Collect (SEK)	0-29	0-29	0-29
	Minimum Order for free delivery (SEK)	333	333	333
Sustainability	Available Information	78%	78%	74%

Figure 5. Summary of population density results using numerical labels for delivery preferences across high, medium and low population density areas.

Preference	Metric	High Density	Medium Density	Low Density
	Attended	Medium	Medium	Low
	Time Slot	Medium	Medium	Very Low
	Number of Options for Home Delivery	High	High	Medium
	Number of Options for Pick-up Points	Medium	Medium	Medium
	Number of Options for Parcel Lockers	Medium	Medium	Medium
	Availability of Click & Collect	High	High	High
Convenience	Total Number of Options	High	High	Medium
	Time Range for Home Delivery (Days)	Low-High	Low-Medium	Low-High
	Time Range for Pick-up Points (Days)	Low-High	Low-High	Low-High
	Time Range for Parcel Lockers (Days)	Low-Medium	Low-Medium	Low-Medium
	Time Range for Click & Collect (Days)	Low-Medium	Low-Medium	Low-Medium
Time	Faster Delivery Available	Low	Low	Low
	Delivery Fee Range Home Delivery (SEK)	Low-Really High	Low-Really High	Low-Really High
	Delivery Fee Range Pick-up Points (SEK)	Low-Medium	Low-Medium	Low-Medium
	Delivery Fee Range Parcel Lockers (SEK)	Low-Medium	Low-Medium	Low-Medium
	Delivery Fee Range Click & Collect (SEK)	Low-Low	Low-Low	Low-Low
Cost of Delivery	Minimum Order for free delivery (SEK)	Medium	Medium	Medium
Sustainability	Available Information	High	High	High

Figure 6. Summary of population density results using subjective labels from very low to very high, for delivery preferences across high, medium and low population density areas.

According to the findings of the data collected in the Zip Code Summary, the total number of delivery options offered is relatively similar across all population density levels. Based on the observed averages, High and Medium-Density areas can be grouped together under a subjective classification of “High”, while Low-Density areas fall into a “Medium” category in terms of the total number of options available. The numerical averages provide a clearer picture: Low Density zip codes have an average of 5.1 options, while Medium and High Density areas have averages of 6.5 and 6.8 respectively. While the difference between Medium and High Density is minimal, the gap between Low Density and the other two categories is more pronounced.

This suggests that most delivery service providers aim to offer a relatively consistent number of options regardless of the area´s population density. Still, the data indicates that zip codes do have an impact, as customers in Low Density areas face slightly fewer choices. These differences will be explored in more detail in the following sections.

Further analysis of the convenience category focusing on attended delivery and the ability to select a time slot, both these features apply only to the home delivery option. In terms of attended delivery, both High and Medium density areas fall into the subjective classification of “Medium”, whereas Low density areas are classified as “Low”. This classification is supported by the numerical data, which shows that attended delivery is available in 51.5% of cases in both High and Medium density areas, while availability drops sharply to just 7.1% in Low density areas. This highlights a clear disparity between Low density areas and the other two categories, despite no difference between High and Medium density zones.

The ability to select a time slot shows a more noticeable variation across density levels. It remains at a medium level for both High and Medium Density areas but dropping significantly to 0% availability in Low Density areas.

Since both attended delivery and time-slot selection are exclusively tied to home delivery, this downward trend reflects a broader pattern: customers in less density populated areas experience reduced access to certain convenience features. This relationship will be examined in greater depth in the following sections.

The data in the Time category shows minimal variation across the different density levels. Most values remain relatively consistent, indicating that population density has limited impact on general delivery speed expectations. Low Density areas stand out slightly when it comes to Availability for Faster Delivery, suggesting that customers in less populated areas may have reduced access to quicker delivery options. Overall, no strong or consistent pattern emerges within this category, which implies that delivery time tends to remain relatively stable regardless of population density.

It is also important to note that the “Time” variable represents a range. It reflects the shortest to the longest estimated delivery time, typically displayed by delivery service providers at checkout. This means it reflects the delivery providers´ estimates of availability, rather than the actual performance or speed of deliveries.

The *cost* data is also presented as a range, from the lowest to the highest possible delivery fee. According to the summary, the costs across population density levels remain consistent. Home delivery tends to have the widest range and the highest maximum cost, making it the most variable and potentially expensive option. Pick-up points and parcel lockers exhibit a narrower cost range, and a lower maximum cost than home deliveries. Click & collect emerges as the most cost-efficient option, featuring both a narrow price range and the lowest average costs overall.

The average minimum order value required to qualify for free delivery remains consistent across all density levels. This consistency likely reflects the use of standardized thresholds by e-commerce websites, which typically apply fixed order requirements regardless of the customer´s geographic location.

In terms of sustainability, the availability of environmental information appears to be the same across all densities. This is most likely due to the use of standardized ecolabels or certifications applied by e-commerce platforms or delivery companies.

4.2 Differences in Sectors

This chapter focuses on the most significant differences observed between the sectors. It provides a deeper analysis of the results where notable variation in the average number of delivery location options, the cost range for home deliveries and the availability of faster deliveries have been identified.

4.2.1 The Sectors' Amount of Delivery Location Options

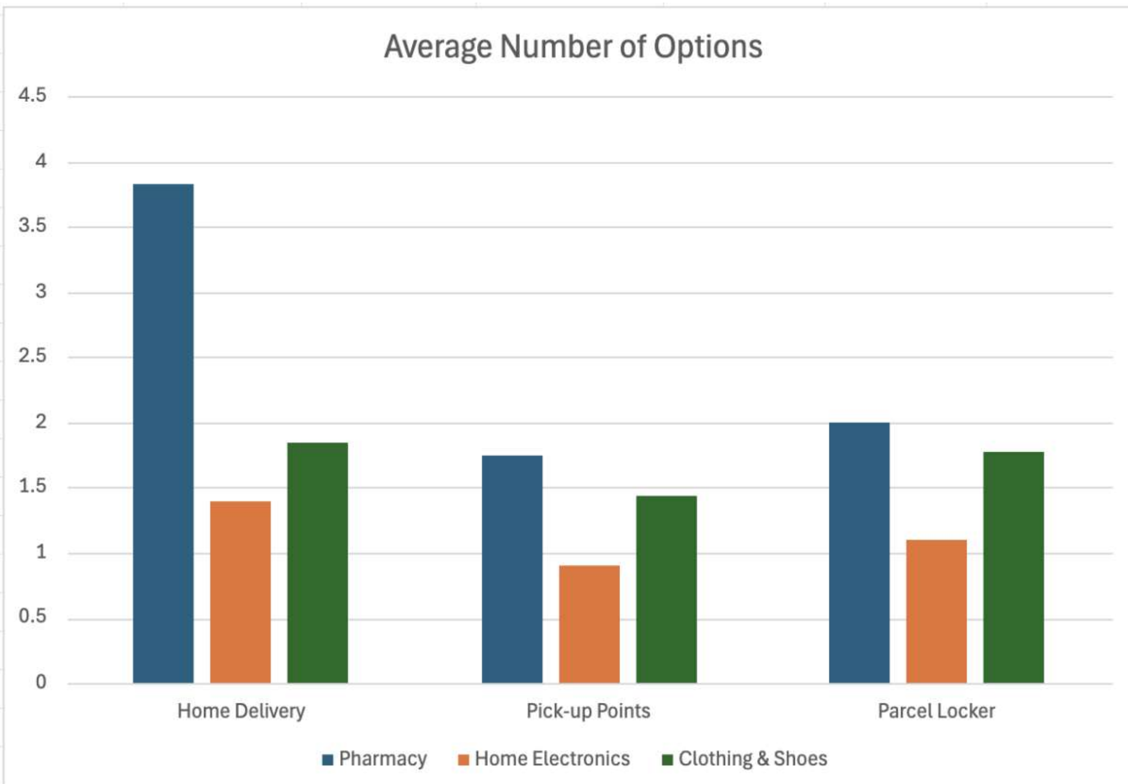

Figure 7. Average number of delivery location options available across three product sectors—Pharmacy, Home Electronics and Clothing & Shoes—divided by: Home Delivery, Pick-up Points and Parcel lockers.

The number of delivery location options varied some between the three different sectors. For home delivery, as discussed in the previous section, was most prevalent and most offered in the Pharmacy sector. The average number of home delivery options per Pharmacy website was 3.8, which is quite considerably more than what the Home Electronics and Clothing & Shoes websites offered, the prior offering 1.4 options per website, and the latter offering 1.9. This indicates that the Pharmacy sector prioritises home delivery the most in comparison to the other two sectors studied.

Looking to the pick-up point options, this was the delivery location that was the most similar between the three sectors, as can be seen in *figure 8*. Even though the numbers were resembling, the Pharmacy websites, also here, offered the most amount of pick-up point alternatives per website compared to the Home Electronics and the Clothing & Shoes websites. The average number of pick-up point options that the Pharmacy websites offered were 1.8 per website, and for the Home Electronics websites the number was the least amount of alternatives, with 0.9 options per site. The average number of pick-up point options per Clothing & Shoes website was 1.4.

Regarding the delivery location *Parcel Lockers*, the Pharmacy sector was, once more, the leading provider of this delivery location type. Comparing the average number of parcel locker alternatives per website, Pharmacy sites had almost twice the number compared to Home Electronics websites, the prior offering 2 pick-up point alternatives per website, while the latter offered 1.1 on average per website. The Clothing & Shoes websites provided on average 1.8 parcel locker options per site.

To summarize, the Pharmacy sector was the main provider of all three types of delivery locations.

The click & collect delivery location is not included in this visualization, as it was measured using a binary response (Yes or No).

4.2.2 The Sectors' Cost of Home Delivery

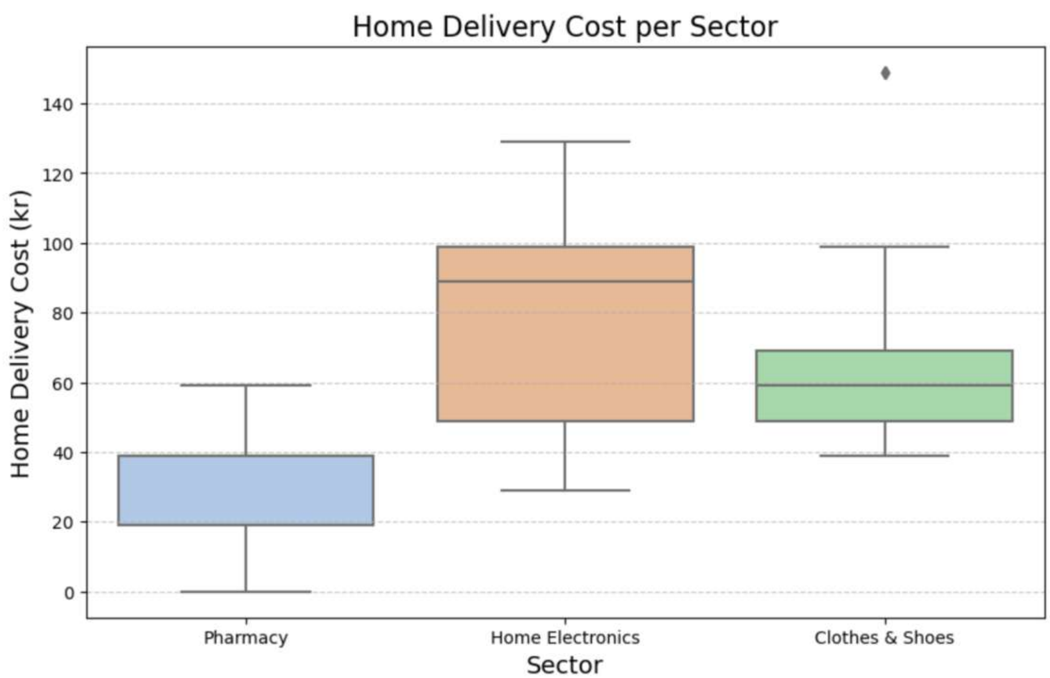

Figure 8. Distribution of home delivery costs across the three sectors: Pharmacy, Home Electronics, and Clothing & Shoes using a boxplot.

The results showed a few differences in the cost of home delivery across the three sectors studied. The Home Electronics sector offered a fewer total number of home delivery options compared to the Pharmacy sector, despite the study analyzing seven websites for Home

Electronics and four websites for Pharmacy. Across all Pharmacy websites examined, a total of 18 home delivery options were identified, whereas the Home Electronics websites offered only 10 alternatives. The Clothing & Shoes sector demonstrated a total number of 19 home delivery options, comparable to that of the Pharmacy sector.

Despite the apparent similarity in the total numbers between the Pharmacy and Clothing & Shoes sectors, a closer analysis revealed a noteworthy distinction. When evaluating percentagewise, the Pharmacy sector still outperforms the Clothing & Shoes sector in terms of the number of home delivery options. This is particularly evident when considering that the number of websites analyzed for Clothing & Shoes was five websites more than for Pharmacy. This indicates that, on average, Pharmacy websites provide a greater number of home delivery options per site, underscoring the sector's stronger focus on home delivery flexibility.

The cost of home delivery varied notably across the three sectors examined, highlighting key differences in pricing strategies. Among them, the Pharmacy sector emerged as the most affordable option. The minimum home delivery cost recorded among the Pharmacy websites was SEK 0, while the maximum cost reached SEK 59. In contrast, the Clothing & Shoes sector demonstrated significantly higher pricing, with a minimum cost of SEK 39 and a maximum of SEK 149. This indicates that home delivery from Clothing & Shoes websites was at least SEK 39 more expensive at the lower end, and up to SEK 90 more costly at the upper end, compared to Pharmacy websites.

The Home Electronics sector exhibited home delivery prices that closely mirrored those of the Clothing & Shoes sector. Specifically, the minimum delivery cost was SEK 29, and the maximum reached SEK 129. These figures shows that the Home Electronics websites are more aligned with the Clothing & Shoes sites regarding the cost of home delivery, than with the more affordable Pharmacy sector.

Generally, the Pharmacy websites not only offered lower minimum and maximum prices; the sector had a lower average cost for home delivery, as well. The average cost for Pharmacy was SEK 15.7 while the average cost for home delivery on the Home Electronics and Clothing & Shoes websites was significantly higher. For Home Electronics websites the average cost was the most expensive, the cost being SEK 84.3, and the average cost for the Clothing & Shoes websites was SEK 65.1. The average prices for home delivery across the three different sectors revealed that the Pharmacy sector offered the most affordable home deliveries, with a greater number of options being less expensive.

Even though the minimum and maximum for the Home Electronics websites were lower than those observed on the Clothing & Shoes websites, the average cost of home delivery was nonetheless higher in the Home Electronics sector, making more options more expensive per Home Electronics website relative to home delivery costs on Clothing & Shoes websites. This suggests a pricing pattern where despite having a potentially lower cost floor and ceiling, Home Electronics websites more frequently position their delivery services at premium prices.

4.2.3 The Availability of Faster Delivery Across the Different Sectors

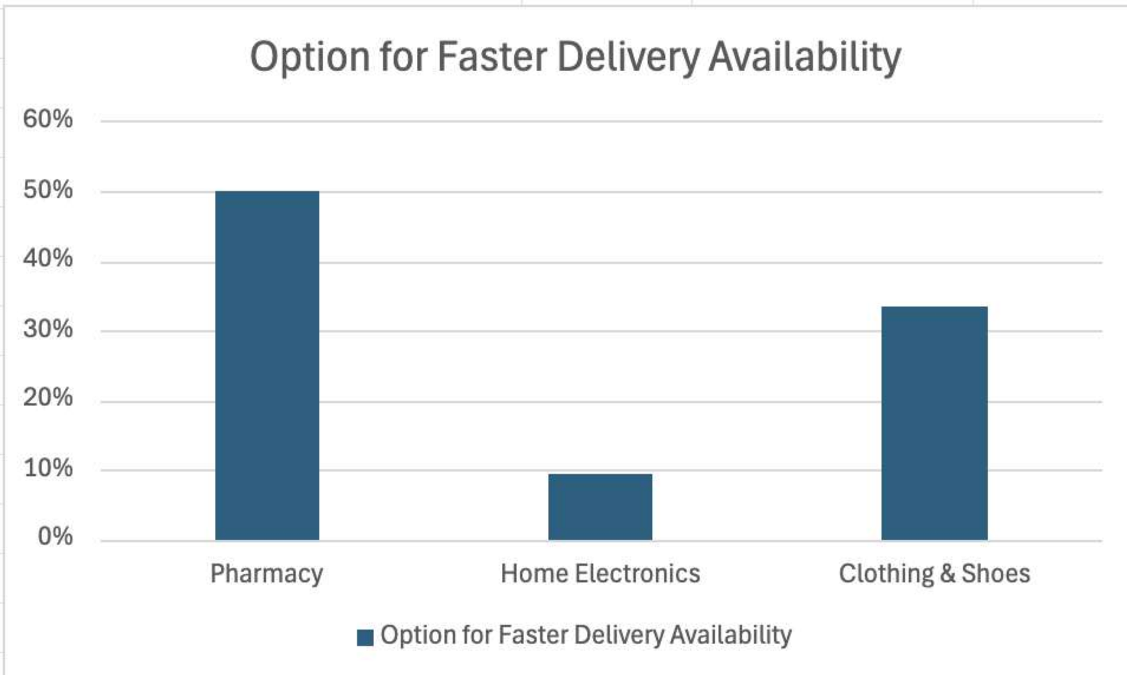

Figure 9. Percentage of faster delivery options available per sector in percentage across the three sectors: Pharmacy, Home Electronics, and Clothing & Shoes.

The availability of faster delivery options varied noticeably across the three sectors analyzed. The Pharmacy sector stood out as the leading provider, offering faster delivery alternatives on 50% of the websites reviewed, which indicates a relative strong emphasis on speed.

In contrast, the Clothing & Shoes sector ranked second, with faster delivery options available on 33.3% of the websites. While not as prominent as in the Pharmacy sector, this still reflects a moderate prioritization of delivery speed. At the lower end of the scale, the Home Electronics sector offered faster delivery on only 9.5% of the websites studied.

The types of delivery location for the faster delivery option also varies quite a lot. For the Pharmacy sector, the faster delivery option was only offered by the click & collect delivery location options. For these speedier options the delivery time was same-day delivery for both websites offering faster delivery. When comparing the normal delivery time to the faster, the faster delivery option was up to 2 days quicker.

The Home Electronics sector, as mentioned before, were the sector providing faster delivery the least number of instances. This sector only offered faster delivery on one of the websites, and the delivery location for this delivery option was home delivery. On this website, the faster delivery alternative took 0-1 days. Comparing to the normal delivery time for home delivery in this sector, the faster delivery option was up to 5 days faster, resulting in quite a big contrast between normal and faster home delivery time.

For the Clothing & Shoes sector, the results were markedly different. The types of delivery locations that offered faster delivery were thrice the number compared to the other two sectors. The delivery locations providing faster delivery were parcel locker, home delivery, and pick-up points. The Clothing & Shoes sector thusly offered a wider range of delivery location options than the other two sectors.

The faster home delivery option on the Clothing & Shoes websites were a maximum of 3 days faster than the normal home delivery time. For the faster pick-up point delivery option, the delivery time was only 1 day quicker compared to the normal delivery time. Lastly, the faster parcel locker delivery alternative was up to 3 days speedier than the normal delivery time, as well. This suggests that the Clothing & Shoes sector focuses on a wider selection of faster delivery alternatives relative to the other two sectors.

These results therefore show that while the Pharmacy sector offers a greater proportion of the availability of faster delivery offered, the Clothing & Shoes sector provides numerically more faster delivery alternatives, as well as a larger number of faster delivery location variability.

4.3 Differences in Population Density

This chapter focuses on the most significant differences related to population density. It provides a deeper analysis of the results where notable variation in the average number of delivery location options and the cost range for home deliveries has been identified.

4.3.1 The Different Population Density Areas Amount of Delivery Location Options

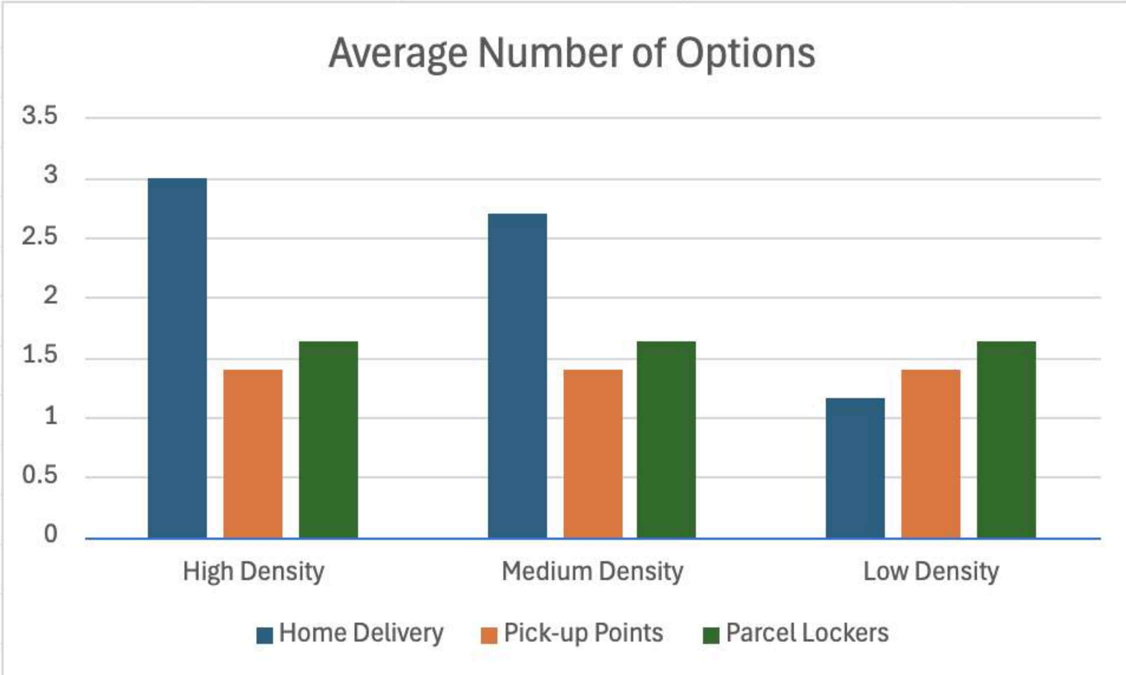

Figure 10. Distribution of average number of available delivery locations; home delivery, pick-up points, and parcel lockers, within areas of varying population density (high, medium, and low).

Pick-up Points show a consistent average of 1.4 across all zip code density levels, suggesting that this delivery option is equally accessible regardless of population density. Specifically, the number of available pick-up points ranges from 0–3 for all the websites explored. Only 2 of the 20 examined websites do not offer pick-up point delivery, regardless of the area´s density.

This consistency suggests that pick-up delivery is a well-established and broadly implemented option, offering equitable access across the different population density areas.

Parcel lockers are offered in greater average numbers than pick-up points with an average of 1.6, and it remains constant regardless of the population density level. Across all the websites from which data was collected, the number of parcel lockers offered is consistent across all density levels, with only two websites not providing this service out of 20 in total. The number of available parcel locker ranges from 0–3 for all websites explored.

This pattern mirrors that of pick-up points, indicating a stable and uniform availability of parcel lockers across different population densities

An analysis of the total availability of delivery options reveals a clear decline from high to low-density areas, while the difference between high- and medium-density levels remains relatively minor. The total average number of options is the highest in high density areas, with only a slight decrease in medium-density areas, followed by a more pronounced drop in the low density areas. Across the entire dataset, the most substantial difference in availability is observed between low density areas and the other density levels, indicating a disparity in service access in less populated areas.

However, while the overall decline in total delivery options is moderate, a much clearer and more substantial difference becomes apparent when looking specifically at Home Delivery services. This delivery location most clearly reflects the variation in available alternatives depending on the zip code. While the graph illustrates differences in the average number of home delivery services, the variation is even more pronounced when examining the complete dataset. In many cases, high-density areas offer up to around eight home delivery options, whereas low density areas may have only one or in some instances, none at all. Other examples include decreases from six to two, four to one, or six to zero options as one move from high to low density areas.

These patterns indicate that home delivery and other last-mile logistics solutions are strongly influenced by geographic conditions. Unlike parcel lockers and pick-up points, which remain relatively stable across density levels, home delivery is significantly less accessible in sparsely populated areas. Population density clearly plays a significant role in determining the level of service provided.

This pattern also aligns with the previously discussed trends in the zip code summary, where both attended delivery and time-slot availability show a clear decline in low-density areas. This is likely due to their direct connection to home delivery services. In the case of availability to select a time-slot deliveries, the availability drops to 0% in low density areas, possibly because the option that was offered in the high and medium density areas, is not offered at all within the low population density zip code.

The click & collect delivery location is not included in this visualization, as it was measured using a binary response (Yes or No). According to the density summary, this variable did not differ across density levels and therefore does not contribute to differentiation in this context.

4.3.2 The Population Densities´ Cost of Home Delivery

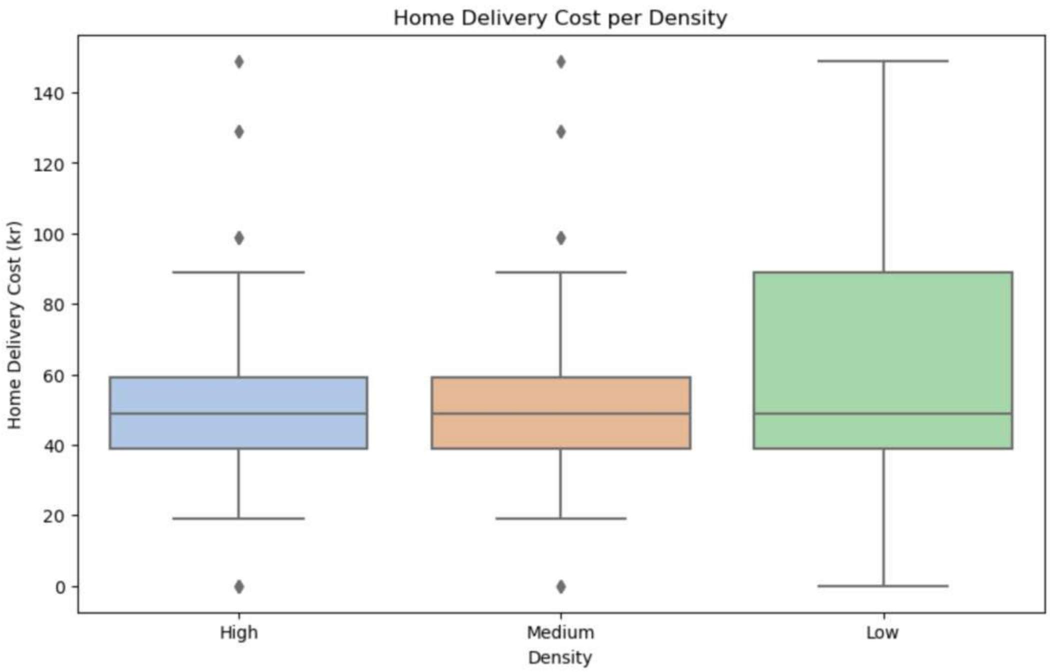

Figure 11. Distribution of home delivery costs across the different population density areas. The boxplots display the median, quartiles and outliers, highlighting the variation between high, medium, and low population density areas.

In the summary of zip codes, the overall range of Home Delivery Costs appears the same across all population density levels. However, when examining the data in more detail, the dispersion of costs varies. This is particularly influenced by the number of home deliveries offered in low-density areas.

In areas with high and medium population density, home delivery costs are relatively consistent and predictable. The median cost is SEK 49 for both groups. These categories also contain a relatively large number of observations specifically for home deliveries; 50 in high density and 45 in medium density areas. The number of observations increases the reliability of the statistical measure. The interquartile range is similar in both groups, indicating a greater proportion of delivery costs are clustered around the median of SEK 49.

In contrast, low density areas display a different pattern. While the median cost remains SEK 49, the overall variation is much greater. The boxplot for this group is visibly wider, and the 75th percentile reaches SEK 89, compared to just SEK 59 in medium and high. This larger spread can be partially explained by the smaller size of observations, with only a number of 21 for home deliveries in the low-density group. This makes the results more sensitive to individual outliers. At the same time, the wider distribution suggests that delivery costs in these areas are genuinely more unpredictable with fewer values concentrated near the median.

In summary, although the median price does not differ between the groups, the variation and uncertainty in delivery costs are clearly higher in low density areas. This aligns with the previous findings that low density areas also tend to have fewer home delivery options available, which may contribute to the increased cost variability. Since transportation providers and their service pricing remain unchanged across the three zip codes, this does not account for the wider dispersion in low density areas. Instead, it is likely explained by the absence of home delivery options near the median price that are available in high and medium density areas but not offered in low density areas.

5. Discussion

This chapter discusses the results through the lens of the four key consumer preferences identified: convenience, time, cost of delivery and environmental sustainability. The discussion analyses how these preferences contribute to the formation of last-mile delivery options across different geographic locations and sectors.

5.1 Convenience

As stated in the literature review, convenience plays a central role in consumers´ choice of delivery location. Convenience is defined not only as the ability to require less effort compared to traditional shopping but also as the opportunity to select delivery time slots, choose between attended or unattended delivery, and pick among various last-mile delivery options (Vrhovac et al., 2023). This aligns with the study´s findings, where all sectors and population density levels show a common pattern: the availability of the most prevalent delivery locations—home delivery, pick-up point, parcel locker, and click & collect. This suggests that, regardless of where consumers live or which product category they shop from, a base level of delivery convenience is consistently offered. The range of options available appears to meet basic consumer expectations across the board.

According to the literature, home delivery is considered a highly prioritized and customized delivery option that plays a key role in building long-term relationships with customers. It is perceived as both time-saving and convenient and is often regarded as the preferred last-mile solution by consumers (El Moussaoui et al., 2023). This explains why many sectors and density levels aim to offer it broadly; across almost all sectors and population density levels, home delivery consistently shows the highest number of available options on average when compared to pick-up points, parcel lockers, and click & collect. This pattern reinforces its position as the most common and prioritized delivery method in Swedish e-commerce, in line with how it is framed in the literature as the most convenient and valued choice by consumers.

However, despite this general prioritization, the results reveal clear differences in the actual availability of home delivery across both sectors and population density levels. In the case of home delivery, the difference is most pronounced, as it is the option that shows the greatest variation between two variables. Although home delivery is generally regarded as the most convenient and widely offered delivery method, its availability is not consistent. It is significantly lower in low-density areas and within certain sectors, particularly Home Electronics, and Clothing & Shoes. In contrast, availability remains relatively high in sectors like Pharmacy, and density areas of high and medium.

A possible explanation for the inconsistent availability of home delivery, particularly in low density areas, could be related to logistical and economic challenges, as suggested in the literature. Home deliveries often require tight scheduling and careful route optimization to be efficient. When deliveries fail, it can result in significant time and cost losses for courier companies (Bonomi et al., 2025). These challenges may be especially pronounced in low populated areas, where the distance between delivery stops is longer and the number of potential deliveries per route is lower. As a result, the cost per successful delivery may be higher, potentially making it less profitable for companies to offer home delivery services in these areas. This could explain why consumers in urban areas tend to have greater access to home delivery options, while those in low density areas may experience limitations, which in turn may affect their overall perception of convenience and satisfaction with e-commerce services.

This disparity has implications for consumers. For individuals living in low-density areas, the lack of consistent home delivery services could contribute to a feeling of digital exclusion, where the convenience promised by e-commerce does not fully materialize. Over time, this could influence shopping behavior, potentially discouraging online purchases of goods that require attended delivery or that are not suited for pick-up alternatives. This trend could reinforce geographical inequalities in access to modern retail solutions, specifically as more commerce moves online.

Sector specific patterns also suggest strategic delivery offerings based on product characteristics. For example, the Home Electronics sector shows a notably high use of click & collect, while offering fewer alternatives such as home delivery or parcel lockers. This could be explained by the nature of electronic goods: they are often large, expensive and may require consumer inspection or consultation prior to purchase. Many retailers in this sector operate physical stores that double as showrooms, making click & collect a natural fit. Furthermore, the high value of these goods may discourage unattended delivery options, like pick-up points and parcel lockers, leading to fewer available delivery modes overall.

Attended delivery introduces additional complexity. The results show variability across both sectors and population densities but also highlight a lack of transparency regarding whether deliveries are required to be attended or not. This information is often absent at the point of purchase, making it difficult for consumers to plan accordingly. For expensive or fragile items, some customers may prefer or even expect attended delivery. Uncertainty in this area could lead to hesitation or abandonment of online purchases, particularly when customers are unsure whether they need to be home at a specific time or risk a missed delivery.

This lack of clarity also applies to time slot selection. Although offering a time slot is a convenience enhancing feature, it is not always evident during the purchasing process whether this option is available. As emphasized in the literature, the effectiveness of last-mile delivery relies heavily on coordination. If consumers are not informed early on about delivery requirements or available time slots, their expectations may not align with the actual service. This gap of information could create friction in the shopping experience and diminish the perceived convenience of online shopping.

Improving the transparency of delivery conditions, especially concerning attended delivery and time slot availability, could enhance customer satisfaction and better align expectations with reality. Providing clear, upfront information at checkout regarding the delivery location selected, whether attendance is required, and what time slot options exist would help consumers make more informed decisions. This would not only improve the customer experience but could also reduce the rate of failed deliveries, benefiting both courier companies and end-users.

5.2 Time

According to earlier research, as mentioned prior in the literature review, the time of delivery is an important aspect of customer satisfaction regarding the e-commerce shopping experience. The results of the study revealed both similarities and differences between the sectors and population densities regarding the customer *time* preference.

The results showed that there were minimal-to-no differences in both the delivery times for the delivery location options, and the delivery time for the population densities. This shows that the majority of the websites in all three sectors do not offer varying delivery times depending on where the customer is located. The uniformity of delivery time could be because of predetermined delivery policies that the e-commerce companies have with local courier companies. These contracts probably include standardized delivery times for a set region. In previous research, the most important factor has been said to be the providence of accurate and reliable delivery time (Risberg & Jafari, 2022), which could be a reason for why the websites have chosen to use similar, if not almost identical in some cases, schedules for the delivery times across different areas.

As mentioned before, the delivery times are presented in a range of days instead of a specific delivery day. This contributes to the standardized policy, making it possible for the e-commerce companies to keep their promise of on-time deliveries. This also contributes to reliable delivery which, again, has been stated to be crucial for customer satisfaction. The only population density area that differs from the other two areas regarding the delivery time, is that the low-density area is offered the least amount of faster delivery options in comparison to larger population density regions. This could be because the low-density areas usually are located farther from warehouses, distribution centers, or urban hubs where products are stored, which makes it more difficult for websites to provide faster deliveries.

The most significant differences were shown to be between the different sectors when it comes to delivery times. Although the general trend of the delivery times across the sectors were similar, there were some notable differences as well. As presented in the results, the Pharmacy sector offered the highest number of faster delivery options compared to the other two sectors. Many pharmacy products, such as prescriptions and over-the-counter treatments, are time-sensitive or critical to health, which could be a reason for why the Pharmacy websites generally prioritize faster deliveries. As mentioned above, a speedy delivery time is vital for customer satisfaction, which could be a reason why Pharmacy websites focus on this. Interestingly, the Pharmacy websites also resulted in the longest delivery times, which could be due to the high variability in product type. Pharmacies deal with a mix of products—some are eligible for fast delivery, while others, like controlled substances or refrigerated medications, require special handling and may only be delivered by slower deliveries. Prescription products also often require doctoral approval which can delay shipment even if fast delivery is technically available once processing is complete. Pharmacy was also the sector where the delivery time changed the most depending on the delivery location option, which could also be as a consequence of the regulatory and handling constraints that some pharmacy products require. For example, some medications can only be delivered to secure or authorized locations, which can slow down certain methods like home delivery compared delivery locations like click & collect, where the customer does not need to wait for approvals.

The Clothing & Shoes websites provided the most consistent delivery times across all delivery locations. A reason for why this is, could be that Clothing & Shoes products are typically standardized products that do not require special handling, making shipment easier and more uniform across the delivery locations. This consistency also contributes to a higher customer experience, under striking the importance of reliability discussed in the literature review (Vrhovac et al., 2023). Regarding the availability of faster delivery, the Clothing & Shoes sector was the second largest provider of this option. While not as dominant as the Pharmacy websites, this still indicates a moderate prioritization of speed, likely driven by rising customer expectations in fashion retail and the increasing competitiveness of online apparel shopping. Faster delivery can be a valuable differentiator, especially for time-sensitive purchases like event wear or seasonal trends.

In the Home Electronics sector, delivery times show moderate variation across different delivery location options. Notably, click & collect emerges as the fastest method, likely because it allows retailers to leverage existing store or warehouse inventory for immediate fulfillment. The other three delivery modes—home delivery, parcel lockers, and pick-up points—tended to have more comparable delivery times. This suggests that for electronics, which are often bulkier, high-value, or require careful handling, the different delivery location treat these products similarly. The Home Electronics websites offered the least amount of faster deliveries. This limited availability suggests that speed is not as central to the sector's fulfillment strategy. Several factors may explain this: electronics often require careful packaging, security measures, and sometimes involve bulkier items, all of which can complicate, or delay faster delivery. The lack of faster delivery available in this sector could lead to a decrease in customer satisfaction since customers may experience longer delivery times.

5.3 Cost of Delivery

Cost of Delivery is highlighted in the literature as a central preference when consumers choose among delivery options (Nguyen et al., 2019; Patowary et al., 2023). This is reflected in our findings, where noticeable variations in delivery costs appear across both delivery options and sectors suggest that pricing strategies are likely tailored to consumer price sensitivity. As previous studies show, consumers are highly responsive to delivery costs, often more so than to the price of the product itself (Patowary et al., 2023), which may encourage companies to offer lower cost or free delivery to remain competitive (Nguyen et al., 2019).

In our results, Home Delivery consistently shows the widest range and the highest maximum cost, across all sectors and population density levels. A possible explanation for this is the added logistical complexity and cost associated with home delivery. Delivering to a single address demands more time, coordination and vehicle resources per package, while delivery to Parcel Lockers or Pick-up Points enables bounding of multiple deliveries to a single location, thereby lowering cost per unit. This operational difference likely drives the pricing disparity.

Click & Collect emerges as the most affordable option. This delivery location is often offered for free or at a minimal cost, particularly in the Pharmacy and Home Electronics sectors.

Unlike the other sector, Clothing & Shoes applied for a fee up to SEK 29 for Click & Collect. This might reflect the sector's pricing structure or fulfillment strategy.

One possible explanation for the generally low cost for Click & Collect is the reduced operational burden placed on the service provider. Since the customer takes the larger part of the delivery journey by travelling to and retrieving the order themselves, the service requires less logistical coordination. It also involves lower delivery risk and minimal last-mile effort. In this sense, the more effort required from the customer the less effort and cost is required from the retailer or courier. This is reflected in the low or even non-existent fees associated with the delivery location, Click & Collect.

When comparing sectors, the Pharmacy sector displays the lowest overall delivery cost range. This aligns with the nature of pharmacy products, often smaller, essential items purchased frequently. This may prompt companies to offer low-cost delivery options to maintain regular customer flow and expectation of accessibility. In contrast, Clothing & Shoes shows the highest average delivery costs, with frequent placement of Home Delivery at premium price points.

In terms of population density, delivery cost patterns were generally consistent across areas. The only noticeable difference was in how the costs were distributed. In low-density areas, fewer home delivery options were available, and prices around the common median of SEK 49. One possible explanation as discussed earlier is that the cost of delivering to these areas is harder to standardize. Variability in travel distance, lower drop density with a risk of failed deliveries may cause retailers to either not offer their service or have a higher price for these areas.

Lastly, the minimum order value required for free delivery showed clear variation across sectors, ranging from SEK 199 in Pharmacy to SEK 300 in Clothing & Shoes, and SEK 500 in Home Electronics. This likely reflects the average product values and purchase frequency in each sector. Higher-value items, such as electronics, often require fewer purchases per customer and can sustain higher thresholds, while lower value and frequently purchased goods (like pharmaceuticals) necessitate more accessible free delivery limits. Across population densities, these thresholds remained stable. This suggests that minimum order values are standardized for the e-commerce websites and not geographically adjusted, likely to simplify communication and maintain fairness across customer groups.

5.4 Environmental Sustainability

As discussed in the literature review, sustainability in last-mile delivery is increasingly becoming an awareness for customers and is progressively becoming more important for the consumer (Klein & Popp, 2022). Environmental sustainability in last-mile focuses on reducing the inefficiencies of the delivery process and the carbon-intense transports. In earlier articles, it has been discussed that collaboration between the consumers can trigger an adoption of more efficient strategies for sustainable last-mile deliveries (Gonzalez et al., 2023).

When researching the websites for the study, the potentially available information about environmental sustainability was presented in the form of ecolabels such as *Svanenmärkt*, or a notation of "Fossil Free" for the delivery options claiming to be free of fossil fuels. Moreover, this was true only for certain delivery location options, and it was the courier company—not the type of delivery location—that determined the availability of information. The information by the courier company was also only available on certain websites, for example the courier company Instabox only gave information about sustainability on the website apoteket.se and not on bubbleroom.se.

Concerning the information available on the websites about the environmental aspect of last-mile delivery, the results show a wide variety depending on the sector. The Pharmacy sector showed an overwhelming result of 100%, meaning that all websites investigated gave the costumer information about environmental sustainability when choosing a delivery location option. This can therefore be interpreted as an imperative feature for the Pharmacy websites, showing that the customers of the Pharmacy sector care about environmental sustainability, and that Pharmacy websites are aware of their consumers' concerns. This also shows that consumers of this sector match earlier research—that more and more customers demand transparency and improvement of last-mile sustainability.

The Clothing & Shoes sector resulted in quite the strong outcome, as well. 78% of the Clothing & Shoes websites gave information about environmental sustainability. While not as significant a result as the Pharmacy sector, the Clothing & Shoes websites still presented a high demand for environmental awareness. This shows that consumers of this care about environmental sustainability, mirroring earlier papers, and that the sector generally is meeting this expectation.

Lastly, the Home Electronics sector displayed the lowest result when speaking of availability of sustainability. Even though this sector gave the weakest result of 52%, this could still be considered a notable portion. Either the availability of information about sustainability is not as important in this sector as in the other two sectors for the consumer, or the Home Electronics websites are simply not meeting this need.

Looking at the results of the different population density areas, the outcome was very similar to each other across the regions. The result of 78% was the same for both the high population density area and the medium density area. The low population density area only differed by 4%, resulting in 74% for this region. This indicates that the availability of information about environmental sustainability is neither more nor less important in different regions. When examining the different websites' delivery policies, it is common for the delivery policies to have the same agreement regardless of the delivery location destination. This could be a reason as for why the results were so similar to each other in this regard.

6. Conclusion

In this chapter, the conclusions of the study are presented, summarizing the key findings and answering the research questions. By reflecting on the analyzed data and drawing conclusions from the various parts of the study, this section provides a clear overview of the insights gained.

6.1 Geographic location does not matter, only for rural home deliveries

Generally, geographic locations' relation to the last-mile delivery locations, do not seem to have a strong connection. The main difference that depends on geographic location, or population density, is the delivery location option *home delivery*. This delivery location is different in terms of the Convenience preference, showing a larger number of home delivery alternatives per website the higher the population density. The overall total number of delivery location options also increases with the population density. Because higher populated areas mean more potential customers, which makes it profitable for multiple delivery services to operate in the area, could be an explanation for these results. In dense urban areas, delivery routes can also cover many customers in a small area, reducing travel time and fuel costs for the couriers. Otherwise, the results across the board are much alike.

6.2 E-commerce sectors decide the amount of alternatives and the cost of delivery

The results from the sectors were quite different, though. The Pharmacy sector proved to be superior in all delivery location alternatives. This sector is generally the speediest, most affordable, and offers the most alternatives, and provides the most amounts of time information about environmental sustainability. The delivery option that was provided the greatest number of times was home delivery, and this was also the most expensive option. The popularity of home delivery could be explained by the time-saving and convenient quality of the delivery location. It is possible that the higher delivery rates for home delivery could be a result of the added logistical expenses. These results could also be because pharmacies often prioritize quick delivery since customers may need medications urgently. The lower delivery costs could be explained by the typical pharmacy products which are often smaller and essential, and purchased more frequently.

The Clothing & Shoes sector and Home Electronics sectors are not so clear. In regard to number of alternatives for the different delivery locations, the Clothing & Shoes sector provided the most number of alternatives per website. This is likely reflecting the sector's focus on customer experience and flexibility.

However, when examining the results of the costs for the different delivery locations, Home Electronics is the more affordable option of the two sectors. Home delivery was the greatest number of times offered and the most expensive option for both sectors, here as well.

6.3 Most Consumers' Preferences are Satisfied, but there is Still Room for Improvement

The findings show that the companies studied offer last-mile delivery options in line with the consumer preferences identified in the literature review. E-commerce providers appear to design delivery alternatives to align with what consumers value most; convenience, low or no delivery cost and timely delivery. This is evident in the availability of common delivery locations such as home delivery, parcel lockers, pick-up points, and click & collect, as well as the frequent offering of free delivery for orders above a minimum threshold.

Despite the sectoral and geographic differences many aspects, such as delivery time, remain relatively consistent. This could suggest that consumers do not express a strong demand or perceived need for even faster delivery or that the transport companies do not consider faster delivery feasible or necessary. As the delivery stage is often the final and most crucial interaction between the retailer and the consumer, meeting expectations at this point is essential.

However, some areas still lack transparency, particularly regarding whether deliveries require attendance, the availability of time slots, and the environmental impact of different delivery options. Providing greater clarity on these factors at the checkout stage could enhance customer satisfaction, reduce failed deliveries and empower consumers to make more sustainable and informed decisions. In turn, this could encourage several logistics providers to adopt more environmentally sustainable practices, especially if environmentally friendly options become a preferred choice among consumers.

While consumer preference alone may not resolve all challenges associated with last-mile delivery, such as urban congestion or the growing volume of shipments, they clearly play a central role in shaping the current delivery landscape. As sustainability becomes an increasingly important priority, more transparent and informative delivery systems could help bridge the gap between convenience and environmental responsibility.

7. Recommendations for further research

This study did not include a consumer survey to identify preferences specific to the chosen area of Gothenburg. Conducting such a survey could provide valuable insights into the local population's attitudes, particularly regarding environmental sustainability. If more information about the environmental sustainability of delivery services were available to consumers in this area, it could potentially influence their purchasing decisions. This raises critical questions, such as: Would residents of this area have made different choices if they had access to more information about the environmental impact for the different delivery options? Would environmental sustainability be a high priority for them?

Another recommendation for future research is to use a bigger database. In this study, only three sectors were used, and a total of 20 websites were studied. Furthermore, only three different zip codes were investigated. For future research in this field that is similar to this study, it is recommended to use more websites, sectors, and zip codes in order to get a more precise and applicable result. This would offer a more comprehensive understanding of consumer behavior across different parts of the area studied.

For future research, the websites' delivery policies regarding environmental sustainability could be investigated. This raises the question of; what do the e-commerce companies require from the parcel companies regarding their transparency of the transportations environmental impact? Another question to investigate is if the geographic locations matter in other cities in Sweden?

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Appendix 1

Sectors' and Websites' sample calculation

Websites Data Collection.xlsx

Summary Data Collection.xlsx

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