Master's degree thesis

LOG950 Logistics

Measuring consumer preferences:

Attributes impacting choice of home deliveries in Oslo.

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Abstract

The consumers habits and preferences have a massive impact on the e-commerce demand and last mile delivery. E-commerce is a growing trend for procuring goods, be it by firms or private persons. The requirements for sustainability and environmentally friendly solutions are not only demanded form authorities and industries but from the consumer side as well. The various stakeholders are constantly trying to implement new concepts and solutions for deliveries, especially for the last mile. Considering the challenges for last mile deliveries, in relation to the increase of e-commerce and consumers using home delivery. The implementation of crowdshipping has in combination with micro hubs the potential to improve environmental, social and economic sustainability. This thesis is devoted to establishing the factors consumers value most when deciding upon having a purchase delivered home. This study determined its empirical results form the stated choice experiment and the review of existing literature. Findings show the attributes affecting choice is price, lead time, emissions and flexibility. Punctuality were not significant in this given case. The extent to which they affect choice is expressed in terms of utility measure by estimated coefficients.

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Chapter 1

1. Introduction

The environmental challenges facing humanity is one of the largest problems presently affecting todays civilized society. The movement began long ago and has only increased with time as the general public starts to understand the magnitude of the situation. Policy makers and authorities are taking action and actively working to decrease pollution and become more sustainable by using different measures such as offering companies implementing sustainable solutions subsidies. Even private homes are offered subsidies by implementing energy saving solutions or other similar adoptions. With the difficulty of the environmental situation constantly being addressed in every form of media, with conferences in all business sectors worldwide addressing it, the awareness of the environmental situation is higher than it has ever been.

Transportation is a field that are particularly affected by this change. Biofuel, electric vehicles, crowdshipping, consolidation centers and drones are some of the ideas that are being implemented or tested to improve sustainable transport. The transportation sector alone consists of a sizeable portion of the world's total emissions at 37%. During the pandemic the global transportation activities fell with almost 50% , and as things are changing back to normal, the activities are expected to stabilize and in turn increase pollution (IEA 2021).

Sustainable business practices have become a big source to achieve or competitive advantage in a market. Innovative ideas improving sustainability from traditional methods has become widespread and is heavily incentivized. These innovations are driving startups, as well as seasoned firms to find new ways to optimize supply chains and at the same time increase efficiency.

According to Boyer, Prud'homme, and Chung (2009) the last step delivering to the end user, is the most expensive and difficult part in logistics. Transport is relatively easy, until the parcels arrive at consolidation centers. When the parcels are separated for further transport to the multititle locations of the end users, the shift in complexity of the delivery is quite significant.

Innovations like Uber and lift has changed the passenger transportation market, encouraging drivers to travel with passengers. A similar idea to this, but for transport in last mile delivery is crowdshipping. It uses regular people's spare capacity to transport parcel to end consumers.

Commuters bring parcel on already planned trips, in turn reducing the strain on transportation infrastructure.

A prerequisite for innovative solutions such as crowdshipping to be accepted as a method of deliver goods to end users, is that the service must present higher benefits for the customer than what todays practiced delivery already provide.

1.1 Research problem

With an increasing E-commerce activity the demand for home deliveries is also increasing. The consumers are expecting more and more from transportation companies and keeping up with the development is straining. When consumers are shopping online they make choices, the factors influencing this choice are many, an important one is connected to the transportation. Different attributes connected to the delivery are all inflicting the consumers choice.

In order to be able to have a competitive advantage in the transportation market, firms want to maximize the probability that people and partners prefer your transportation service. To do this they have to have the optimal configuration of what is possible to provide. This research aims to find out what specific attributes, and to what degree they affect the utility of the customers in a specific case. Having possible attributes that can be affected in the case legitimize the research as it can be used for real world application.

People have different preferences when it comes to home delivery, some may only require it to be a fast as possible, while others wish for it transported at the lowest possible price. The consumers choice whether to have a purchase delivered or not, is riding on their preference. So what options are there for deliveries, and what are the factors the consumer values the most while choosing home delivery.

The expectation is that consumers overall desire is to spend the least amount of money possible when using home delivery, but considering for example Amazon primes growing amount of paying subscribers (Dean 2022), who by paying a membership fee receive the alternative for same day delivery and within the hour option. The choice for a shorter lead time and the opportunity to influence the delivery time, could pose as a high valued factor as well.

The research conducted in this work focuses on the consumers preferences and point of view. The results presented may prove useful for transport service companies with fresh and valuable information on their current and potential targeted group. In addition, firms may use the findings to determine to what degree the consumers are willing to adjust to a substitute for other preferred attributes. Other researchers may view these findings helpful in further research.

All the collected empirical data were from representants that in general is from Oslo, the capital of Norway, or nearby urban areas. Oslo has a population of about 700,000 people, which is a particular suitable population for this study. Considering that Oslo is the largest and most inhabited city in Norway and because of Oslo´s recourses and functional transport infrastructure, it is the most attractive choice as the findings in our study should be able to be generalized and converted for other similar structured cities.

1.2 Research question

As mention in the introduction the last step in the delivery process, is often being the most challenging and expensive. Transport service providers continuously work to improve and adapt to the growing demand. Implementing new methods for home delivery relies on several factors to succeed. Initially it has to be useful in practice and not only in theory, for both the provider and the consumer. An important thing to know is therefore what the needs of the consumer are. What this research aims to answer is the following questions.

What are the factors that impact a consumer's choice of home delivery in Oslo, and to what degree?

How can these factors be measured appropriately?

Besides this, the research explores the consumers thoughts and opinions such as the expectance of crowdshipping or eco-friendly solutions, although this will not be quantified, it could show to be useful in understanding a consumer's motivation of choice. All of this is answered along the thesis, and more specifically in chapter 5.

Furthermore as suggested by Colin Robson (2016), a research hypothesis needed to be developed. Based on the specific case explored, the existing literature and the respective

methodology used in this thesis. The hypothesis is stated as: The consumers choose home delivery, based on attributes for the delivery options available, such as price, distance, lead time, punctuality and choice of delivery time.

The data establishing the reality of this statement is collected using a web-based questionnaire as a part of a discrete choice experiment. Tools such as R, Ngene, and Excel are used to handle and analyze the data, to obtain optimal results.

1.3 Structure

Before the reader of this thesis moves on to results, they need to understand how to navigate the in this document. Chapter 2, which comes directly after this part, includes a thorough review and introduction of existing literature related to the area of research. The relevant topics and theories, such as last mile delivery, e-commerce, crowdshipping and consumer behavior. In chapter 3 the case is presented and described closer, connecting the theories to the practical part of the research. Chapter 4 identifies the methods and models used to collect, process, and analyze the data. This chapter is crucial before presenting the actual findings. As it is the advocate to the validity of the stated results. Chapter 5 Interpret and discuss the result of the findings. Chapter 6 discusses the implications of the research. In the end, consolations and recommendations for further research and limitations in the current study's in Chapter 7.

Chapter 2

2. Literature review

The literature review is important to get a comprehensive understanding and contextualizing the theoretical aspects and terminology, and to find what is missing or what opportunities there are for further research. It is also key in understanding and interpreting the results of the research conducted. The purpose of the thesis is to answer the research questions, of to what degree does the different attributes affect the consumers choice for home delivery in Oslo, and how to properly measure the preferred attributes. In order to do this we first need to present and review the already existing literature and from resources such as journals, articles, books, web recourses and databases (Rowley and Slack 2004).

This chapter covers a wide scope of theory from last mile delivery, e-commerce and other relevant topics related to the research. These are mapped out form previous literary works that are highly central for understanding this field of research. First is an introduction to e-commerce and consumer behaviors in chapter 2.2. Seeing as this is important to understand the recent trend in e-commerce, as well as understanding the views of the consumers and their significance as the targeted respondents. The next chapters focus on the direction of last mile deliveries and what it entails, presenting some concepts and solutions proposed for handling challenges occurring there. Further chapter 2.7 is the review of some theoretical framework from existing literature adopted into this research.

2.1 Review methodology

The structure of the literature review builds upon the article of Rowley and Slack (2004), which aims to support student writing dissertations to excel at the literature review. They propose four useful search strategies. These are citation pearl growing. This is where to start with a few documents and use those to find new documents with related literature. Second there is brief search, where one swiftly gathers a few documents. This is often useful as a starting point. Thirdly is to create Building blocks. Beginning with a search, then to build upon it with synonyms and related terms till one have a comprehensive set of literature. Lastly are successive fractions, search in the already gathered set of documents, in order to exclude less relevant and, for whatever reason, not useful documents.

After retrieving and reading a number of articles, it is important to map out what should be reviewed as a means to understand the theory and the relation between different concepts introduced in this research. This is done by creating a mind map, also known as a concept map. In figure 1 are the key concepts mapped out form from literature related to the research problem established. The key concepts are illustrated by the circles, and the connection between them are represented by the lines.

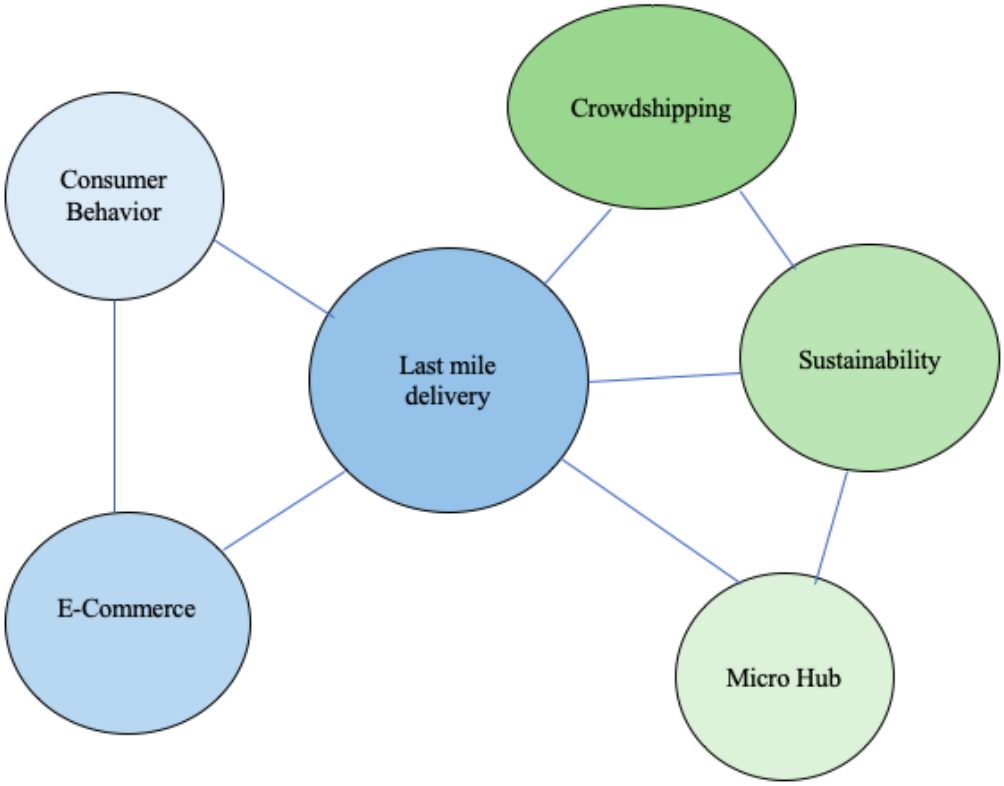


Figure 1: Concept map

The search engines used are mainly Google Scholar and 'Oria', which is the Norwegian University library for printed and electronic material and resources. The type of literature represented in this research are journal articles, conference proceedings, books, reports, web pages, and thesis'. By following the approach form Ros Carnwell and William Daly (2001) which is considered a very common way of adapting a literature frame. The literature is divided into themes and categories. Providing the opportunity to introduce theoretical and empirical literature.

2.2 E-Commerce

In reports from the UN trade and development experts, UNCTAD e-commerce sector with their convenience of accessibility, seen a dramatic increase of 3% in all digital retail sales in the world in 2020 as an effect of covid-19 (United Nations 2021). According to Chevalier (2022) with Statista, e-commerce retail sales amounted for roughly 4.9 trillion U.S. dollars globally. Figure 2. shows a forecast of a 50-percentage sales growth during the coming four years, reaching close to 7.4 trillion dollars by 2025.

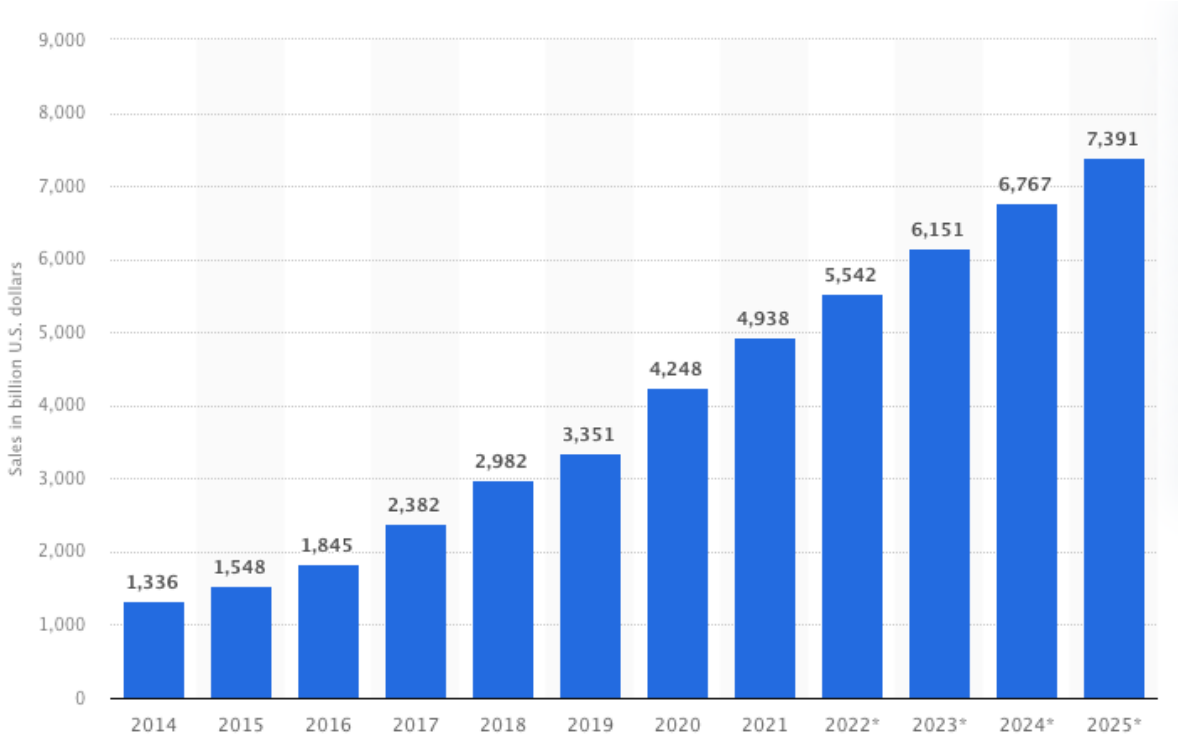


Figure 2: Statista, E-Commerce worldwide growth forecast. Sales shown in billion USD (Chevalier 2022).

E-commerce is the term for electronic commerce or online trading, referring to a business model that provide the opportunity for businesses or individuals to buy and sell goods and services through electronic systems online. There are three main models for e-commerce, business-to-business (B2B), business-to-consumer (B2C) and consumer-to-consumer (C2C). 18% of all sales worldwide comes from e-commerce (Bloomenthal 2021).

The E-commerce businesses has grown rapidly in recent years, with the development and easily accessibility of and from the internet. This accessibility has made the “world a smaller place”,

which have created a platform and extended marketplace for trading all over the globe. China is leading in the world of e-commerce sales. The usage of online shopping is proving to be efficient and often more convenient for the consumer than the conventional method, with the access to a broader range of alternatives or the opportunity to buy a prefeed product to comparatively lower cost. The convenience and access to the internet have caused consumers of all ages from all over the world to choose online shopping without a second thought. Due to online shopping and growth of B2C deliveries, these deliveries usually consisting of only one package, the urban freight-related problems have increased. This has escalated the negative impact of pollution from traffic and reduced the urban mobility. With e-commerce and online shopping, there will always be the risks related to personal information and privacy, chances of fraud, non-deliveries, delays and compromised quality of goods, etc. There are organizations collaborating with authorities continuously working on improving safety and minimizing the risk elements related to the usage of e-commerce (Chattopadhyay and Deshpande 2021).

2.2.1 E-commerce consumer behavior

E-consumer habits and behavior plays a vital role in e-commerce worldwide, assessing them are substantial for urban planners, online retailers, and transport operators to be able to improve and evaluate new delivery options. E-commerce can be a helpful medium for businesses to get an insight and knowledge of the consumer and their expectation and opinion. Integrating marketing and communication, involving different organizations from different sectors and industries to manage various coordination of marketing challenges, as means to adapt, improve and stay competitive. This may entail managing activities such as doing market research, preform analysis of consumer behavior, evaluate consumer choice criteria, promotional activities and review customer feedback and testing of new products. These are significant ways for a business to "improve the overall delivery value quality of the product and also delivering customers various benefits to have better satisfaction towards organizations product and service". (Chattopadhyay and Deshpande 2021).

Research shows that options of delivery, short delivery times in particularly, influence decisions while e-shopping. It is important for organizations to analyze consumer overall demographic in various scenarios to study their attitude and involvement of online shopping.

In a study done by Amorim et al. (2020), findings argue that the delivery time, delivery reception, and the flexibility of delivery reception are critical attributes that influence customers preferences substantially when choosing home deliveries of e-grocery products.

Caspersen and Navrud (2021) preformed an experiment on Norwegian females from the ages 18 to 70. Addressing whether the consumers behavior and environmental attitudes are reflected in the stated preference from last mile delivery. The findings indicate that the female consumers are positive of the environmentally sustainable options for delivery and are rather accepting of a longer lead time if it results in reduced emissions. This implies that other incentives, rather than price can make the consumers select a more sustainable delivery. Their findings strengthen the argument for development of sustainable delivery strategies.

In their paper Dias, Oliveira, and Isler (2021) analyze and evaluate how attributes for delivery, such as delivery time, delivery fee, and delivery reception effect consumers behavior when shopping online. Their results show that the behavior of middle-aged consumers (35–49 years old), are affected by the delivery attributes, the fee for delivery in particularly. They established that the delivery fee is influencing the consumer during a purchase of either electronics, books or leisure products.

2.3 Last Mile Delivery logistics

Last-mile research has grown exponentially over the later part of the last decade, still, there is a lack of clear theory, and the research is very fragmented. “The last mile” is known for being the costliest part of the supply chain. It could be from 13-75% of the overall supply chain cost. This is a significant figure. A better understanding of the last-mile logistics is needed in order to solve associated problems caused by it, such as air pollution and greenhouse gas emissions, congestion, noise, and other nuisances as well as better the economic, social and environmental impacts (Olsson, Hellström, and Pålsson 2019).

In a study by Mommens et al. (2021) done in Belgium. They investigated, which deliveries were preferred between collection points or home deliveries, with a focus on the aspect of three area types: urban, urbanized and rural areas. The findings from analyzing the transport-related external costs for an e-commerce platform, which only sells non-food products, indicates that

the different area types and their characteristics does affect the sustainability impact on both delivery choices. For rural areas, home deliveries using a well-established logistics service provider were distinctly more sustainable than deliveries to collection points, which often adds a collection trip for the consumer. For the urbanized areas, the findings were similar, but not with as distinctive differences. The collection point deliveries are in urban areas preferred in terms of sustainability.

Another study done by Buldeo Rai et al. (2019), concluded that collection points were preferred in regard to the environmental aspect, rather than home deliveries. Though this was only the case when consumers collection trips were carried out by walking or biking.

In research performed at the University of California, models for e-commerce demand, last-mile delivery operations, and cost and sustainability assessment were developed. The modeling framework was then applied to different delivery scenarios, to evaluate potential impact of the strategies. Some of their key findings were in short:
"That costs and emissions rise exponentially when delivery times are shorter. Strategies of outsourcing delivery offer advantages for meeting short time windows. A system of distribution micro-hubs paired with delivery cargo bikes can out-perform truck deliveries in certain circumstances. Distributing packages to central collection points for consumers to pick up can save operational costs but may increase emissions. Delivery with electric trucks renders lower costs than delivery with a diesel fleet." (Jaller and Pahwa 2021).

With the growing developments of online shopping and home delivery, the impact of the last-mile distribution causes more and more problems in urban areas all around the globe. Not only is the demand increasing but the lead time is also decreasing. The pressure and expectations to deliver efficiently are high and are only getting higher. Some of these developments and changes in expectations, result in increased pressure on road traffic networks in sensitive areas such as residential areas, and as the growing number of parcels needed to be delivered to customer homes, increases the number of delivery couriers circulating in the city centers which may add to congestion, pollution, and negative health impact (Boysen, Fedtke, and Schwerdfeger 2021).

These challenges occurring from the growth development may also provide opportunities and new possibilities for companies like Amazon and UPS. They have started to develop alternative

last-mile delivery options that are innovative and efficient to handle the increasing demand, like more sustainable vehicles, such as autonomous drones or electric trucks (Visser, Nemoto, and Browne 2014; Persson 2021).

Other firms and organizations are seeking to develop new alternative solutions including autonomous vehicles such as UAV´s and robots. Another is changing what kind of fuel delivery vehicles are using, even though this does not help in the aspect of congestion and parking. Introducing and developing industry 4.0 technologies can also improve sustainability making it possible for use of GPS, smartphones and vehicle identification. This enables real time simulation and adaptations used to optimize last mile logistics activities, energy savings and load capacities. This in turn increases efficiency (Bosona 2020).

In an article from the Department of Transport and Regional Economics - University of Antwerp, it is stated that the characteristics that success depends upon when introducing new and innovative concepts for last-mile logistics are service level, security and type of delivery, geographical area, market penetration, fleet and technology and environment. While focusing on these characteristics alone does not guarantee success, it appears to be more likely to increase performance when adapting them (Gevaers, Van de Voorde, and Vanelslander 2009). In another paper by Srinivas and Marathe (2021) it is stated that while several of the innovative modes used and tested for last-mile delivery, like drones, are focusing on minimizing the cost of logistics and reducing delivery times, achieving the targeted objectives have been demonstrated to be difficult to achieve.

Even though the experiences with eco-friendly vehicles for commercial and distribution is still quite marginal and is continuously being explored and studied further in pilots and tests, to gain knowledge of prerequisites and opportunities from using electric vehicles preforming urban deliveries.

Electric vehicles are considered an innovative technology that create no local emissions, and is a possible approach leading to the reduction of emissions like fumes and noise from the general urban transport and distribution. Currently there is a relatively low range limit for the battery-powered trucks and delivery vans, which can cause a few logistical problems in the adaptation from combustion engine vehicle. Adapting may call for some changes in routings and distribution concepts. (Ehrler, Schöder, and Seidel 2021).

Collaboration between businesses, logistics service providers, citizens and the public sector is key in order to develop sustainable urban logistics. Policymakers are continuously pushing for increased sustainability in the system, such as implementing smaller electric vehicles. Several studies have shown that the net energy consumption is reduced and that e-commerce is more sustainable, even though smaller vehicles must travel longer distances because of capacity constraints (Patella et al. 2021).

According to Tian and Sarkis (2022) "Online shopping results in a greater number of product exchanges or returns". There are carbon emissions implications by purchasing products online and returning these products will add to these implications just as substantively. The returns from online purchases are twice to four times the amount of the purchases returned from physical store.

Even though product returns are inefficient from one business point of view. The opportunity of returns might also be viewed as a positive and attractive factor for a lot of customers. So by giving the customer the option, may increase the number of customers. Take Zalando for example, who continues to strive to be more sustainable, but even when all Zalando (2020) stores has an average return rate of 50% they still offer free return. Because the handling of returns, directly impacts the customer satisfaction level. Fast and inexpensive returns, as well as good management of complaints, leads to higher chances for a customer to appreciate the service, and continue purchasing from that shop. (Lysenko-Ryba and Zimon 2021). Zalando still resells 97% of the returned purchases.

2.4.1 Crowdshipping

One concept gaining more and more popularity in the last mile logistics category is crowdshipping. Crowdshipping or Crowd logistics is a concept where delivery operations are carried out using the crowd (regular people, civilians). This is done by using the excess capacity of already planned journeys, this service is commonly offered through an online platform with various elements and options. When they bring parcels with them on trips already being done, it gives economic, social and environmental benefits (Buldeo Rai et al. 2017). A definition derived by Buldeo Rai et al. (2017) defines crowd logistics as "*An information connectivity enabled marketplace concept that matches supply and demand for logistics services with an undefined and external crowd that has free capacity with regards to time and/or space, participates on a voluntary basis and is compensated accordingly*". Gatta et al. (2018) present

in their paper empirical data showing crowdshipping as form of delivery that have not only environmental, but also economic benefits.

By using a combination of micro-hubs and crowdshipping together as a delivery paradigm. There is a possibility to decrease emission, fuel usage and operating costs, by reducing the number of trucks taking dedicated trips for deliveries. This of course relies on the fact that the crowdshipper does in fact use eco-friendly modes of transportation and is not taking a dedicated trip as a means of extra income, otherwise it cannot be defended as sustainable. Sudheer Ballarea (2020)) also stated that crowdshipping can succeed only if micro hubs are located strategically for utilizing the resident density of the area. The bigger the population the higher are the chances of attracting citizens to act as crowdshippers.

Online or App-based services have as of late become rather common within logistics services. The purpose for the service platform act as a common channel to connect *couriers* and *senders*. And in the case of crowdshipping, the curriers would typically be, as mentioned previously, normal people and commuters taking the trips anyway. The senders could be represented as firms (B2B or B2C), individuals (C2C), or receivers who wants to have packages transported with efficiency, saving expenses. Crowdshipping platforms creates value by presenting the demand and supply, by providing optimal combinations for senders and curries while still considering the curries interest. The service platform seeing as it is online, can provide an easy and accessible opportunity for curriers to have an additional income, even those who don't have a vehicle, giving that they can utilize the role of public transportation such as metro, tram and bus network (Le et al. 2021).

After comparing platform services and characteristics, Pourrahmani and Jaller (2021) established four main factors that differentiate services: "*platform type, delivery type, delivery mode, and pricing strategy*". Through their study of major crowdshipping services, delivery platforms and a comprehensive examination of state-of-research. Their study tells that cost-saving and trust are crucial to attract citizen to participate. The cost-efficiency relies on the elements of expenses, the couriers' revenue, flexibility and mode of transportation. Crowdshipping may be beneficial for sustainability and the environment if eco-friendly

transport modes are in fact used, and or through avoiding dedicated trips and minimal detours in existing trips.

Willingness to pay (WTP)

The service platform aims to cover supply and demand, and offer services for different distances, such as for international, national, inter-city, and urban areas. But there needs to be a balance between the willingness to pay (WTP) and the expectation to-be-paid (ETP). WTP which is defined as "the maximum price that a customer is willing to pay for buying a product or using a service". By evaluating and creating optimal prices and optimal compensations in regards to the supply and demand required, while considering the expected profits of the firm and the potential surplus for the platform-users'. The firms can "improve the operational models, matching routing strategies, and better control external impact" (Le et al. 2021).

2.5 Micro hubs

There are various methods and concept available to possibly improve and to meet the need for future-oriented urban logistics. While it may still be unclear and difficult to predict the effect of some of the last-mile delivery solutions proposed in recent years, micro hubs appear to reduce delivery emissions and congestion (Heumann et al. 2021). The micro hubs transitioned from the concept of Urban Consolidation Centers (UCC). Micro hubs are last-mile consolidation and distribution facility point located in or near an urban area. A prerequisite for the location of the micro hub facility is to assist in urban areas where delivery operations are challenging due to limitations such as lack of curb space for larger vehicles, low accessibility and restrictions on streets and for traffic. By locating the micro hubs close to end-users and optimizing load distribution within a delivery zone, it aspires to reduce the total vehicle trips in urban area. In addition, it allows for utilization of eco-friendly modes of transportation, which in general have a shorter travel range, such as electric vehicles, electric cargo bicycles, and pedestrian transportation. The transport providers can also utilize micro hubs for storage and transshipment (Janjevic and Ndiaye 2014).

Several attempts of city logistic initiatives using the UCC concept, have shown to fail. Research findings reveal that many UCCs do not succeed due to "unsustainable long-term operational models, low profitability, high reliance on government subsidies, strict policy measures regarding UCCs , and dissatisfaction with service levels." (Dreischerf and Buijs 2022). Though

these UCC failures doesn't necessarily determine that the concept for micro hubs or additional terminals should be ruled out.

The authors Katsela, Pålsson, and Ivernå (2021) establish in their study that an "efficient terminal handling is the key to cost-effective city logistics and urban freight", consolidating freight both in the UCC or transport providers' respective terminals and the micro hubs can reduce expected travel distance and the negative impact on the environment. A recent study by Katsela et al. (2022), supports their previous work, that micro hubs can be a valuable opportunity to alter and improve the sustainability and efficiency of urban freight delivery, and be a means to handle difficulties of multi-sector collaboration. Noting that there are cities all over the world actively using innovative micro consolidation.

Electronic cargo vehicle, in combination with a micro-hub loading station managing and preparing cargo boxes of parcel goods, could be an attractive solution in the last mile delivery problems within highly populated dense areas requiring high capacity. The hubs may come to be an additional asset with an electric battery. As the hub could enable the vehicle to double the daily range, with shorter trips more fit for an e-van and the possibility for frequent charging while refilling cargo. Though adding the hubs will require a new step in the supply chain which often is more expensive (Fritz 2020).

Sudheer Ballarea (2020) have in a study evaluated the performance of micro hub in combination with crowdshipper delivery model, compared to the traditional hub and spoke model. It is evident from the study that a combination of micro hubs and crowdshippers can significantly reduce the number of trucks needed, the total daily operating costs and total consumption of fuel. Despite the obvious benefits, the model for crowdshipping create higher chances of risks such as safety issues, liability concerns and legal challenges. As the practicality and efficiency of the concept is depending on the number of citizens available and willing to act as a crowdshipper, this model still has challenges and matters that needs improving.

2.7 Theoretical framework

This subchapter on theoretical framework presents the validity of the research presented in this thesis. At first the concepts within the empirical research were examined and used. Due to the diversity degree of consumers, home deliveries and the concept of crowdshipping there is various methods to measure the determine factors that influence the attributes in this study. The methods and approaches applied are chosen from a selection credible and appropriate papers.

Huang et al. (2020) based their research process on these five steps:

1. Questionnaire design.
2. Questionnaire pre-test.
3. Data collection and control variables selection.
4. Data analysis.
5. Identification of factors influencing continuous participation intention.

This structure support the purpose of investigating factors that affect consumers choice when choosing home delivery and is backed up by Dias, Oliveira, and Isler (2021), who in their research, similar to ours, assessed the effects of delivery attributes on consumer behavior for E-shoppers. For their actual design, Huang et al. (2020) divided their questionnaire into two parts: demographic information on the respondents and validated scales for their key variables. The answer options for the variables were in the form of five rankings, indicating agreement or disagreement.

Since this research is similar to Punel, Ermagun, and Stathopoulos (2018) study, it supports the use of web-based questionnaire. They studied how and to what extent the attitudes, preferences, and characteristic of crowdshipping users and non-user are. The distribution of the questionnaires used for this thesis was done through various platforms, social media groups, and print media, while also physically sharing QR-codes. Both the pilot testing and the main questionnaires were web-based, using the application from google “google forms”. With its functionality and competent handling of personal data, Google forms served as a practical application to develop the questionnaires with. Since this research is targeting people commuting to or residing in Oslo or in nearby urban areas. The main questionnaires were presented to the respondents meeting face to face, giving them the opportunity to answer right then and there, asking questions during if needed. If not answered in person, the opportunity

was given for them to grab a QR-code supplied, answering the questionnaire at a more convenient moment later. More details about the approach will be presented in the chapter 4 about methodology.

The approach of Huang et al. (2020) were applied in this study. In the process of computing the questionnaire a pilot test was performed with the first draft of the questionnaire. The responses acquired and information collected were used to ensure the validity of the parameters, make changes needed for it to be understandable and intuitive for the respondent of the questionnaire. The results that were acquired from the first questionnaire, resulted in the attributes chosen used further in the main stated preference questionnaire. The analysis and findings this are presented in chapter 5.

Chapter 3

3. Case description

As mentioned previously in the literature review, crowdshipping is a means for transporting and delivering goods, using commuters to deliver parcels on trips that they would undertake anyway. It makes last-mile delivery more economic and efficient for both the consumer and shopper. The concept is becoming more acceptable as the everyday society is taking steps to protect the environment, improve sustainability, so that traffic congestion and externalities are reduced. Previous research on crowdshipping shows that online shoppers are willing to use crowdshipping services to receive or send parcels, with the citizens/a commuter willing to act as a crowdshipper. This research intends to look at attributes that shape the consumers preferred choices and the potential for more sustainable home deliveries in the city of Oslo.

3.1 E-commerce in Norway

The global market for e-commerce is continuing to grow and will continue for the next few years. The e-commerce market includes online purchases of physical goods to a private end user (B2C), meaning purchases via the computer, smartphones and tablets. For most Norwegians, shopping online is considered a more convenient means of shopping rather than going to a physical store. Norway had an e-commerce revenue of US$8 billion in 2021, the 26th largest on a global scale. That is an increase of 16%, for the Norwegian e-commerce market from 2020, contributing to the growth rate of 29% worldwide according to ecommerceDB (2022). Norway has an expected growth for the next four years, indicated by the Statista Digital Market Outlook of a 6% increased annual rate. The statistics show that customers on average has a spending €220 per month normally from purchases of 3-4 times a month. And during 2020, 79% of the Norwegian population had shopped online at least once. 40% of Norwegians perform cross-border purchase with China, UK, US, and Swedish online stores (ecommerceDB 2022).

The e-commerce market can be divided into five categories, in Norway Fashion is the largest segment which accounts for 27% e-commerce revenue in 2021, electronics & media for 23%, toys, hobby &DIY 21%, food & personal care 17%, and furniture & appliances 12%. The top 3 the biggest competitors on the market for Norwegian e-commerce, account for 15% of

Norway´s online revenue, in 2021, elkjøp.no with US$542 million revenue, Komplett.no with revenue of US$292 million, and zalando.no with US$231 million (ecommerceDB 2022).

Considering the recent development with home offices, constrictions like travel bans and infection control due to the corona pandemic, a major ripple effects occurred in the Scandinavian retail, resulting to the e-commerce growing at a furious pace according to BringResearch (2020). DnB presented in 2021 figures showing that retail sales in Oslo decreased by 94%, while online shopping increased with 208% when stores and shopping centers were closed due to the shutdown in January because of covid-19. This development of increase in online purchasing was also showing in municipalities like in Asker by 143%, Bærum 117% and Drammen 126%, and the retail sales decreased by 61%, 68% and 46 % respectively. And even though Stavanger didn't have as comprehensive restrictions as the municipalities mentioned previously during this time. Stavanger had the biggest growth of purchases through online stores, with an increase in week 6 as high as 619% compared to week 6 the year before. While purchases in physical stores decreased by 20% (NTB 2021).

3.2 Deliveries in Norway

In Norway 50% of all transported goods is cited by PostNord. Posten and Bring rates 41% and 26%, and are amongst the top three delivery service companies used by *online* retailers in Norway (ecommerceDB 2022).

In reports provided by BringResearch (2020) a survey done in collaboration with IPSOS and Bring. Shows that consumers delivery habits have been affected by covid-19, and that 3 out of 10, say that they due to the pandemic have changed their shopping habits. Amongst them many tell that they have started to buy more online, and that they have started buying from new or more vast choice of categories than before. The survey also reports that during the pandemic, fewer consumers chose the option to pick up the package at pick up points or at the stores themselves, and there have been an increase of people choosing home delivery or drop off in mailboxes.

For the online shoppers in Norway, environment and sustainability have become increasingly important. Close to half of the consumers request insight and information from the online stores in regards to the environment and sustainability of their operations. 3 out of 10 customers is reportedly making a conscious choice when selecting to purchase from an online store

(BringResearch 2020). The report from Bring show that with the increasing awareness and insight, comes a growing desire from the consumers for more sustainable and environmentally friendly trade. It is particularly a clear focus among consumers under the age of 40 years old. 97% under the age of 40, shop online for physical goods. This generation are the ones that sets the highest demands for a future with better sustainable trade. Close to half of the Norwegian men that are shopping online, request information from the store regarding environment and sustainability. Only 1 out of 10 seem to experience that they have received the information they wanted (Bring Research 2019). This shines a light on the challenges caused by lack of trust and confirmation of initiatives taken to improve on these subjects by the businesses. This is something we will discuss in our findings, in regards to respondents' answers to our qualitative question about their willingness to pay a small fee for eco-friendly delivery.

Because of this development many online stores strive to meet the customers' requirements and demands. By for instance using recyclable packaging or focus on a more ecofriendly production. The transportation sector is also a part of the requirement from customers of the online stores of sustainability and emission. Take Bring for example, they have been working systematically with sustainability since 2008, seeing as they acknowledge the fact that they are a part of the emission problem. Bring knows that they have to be part of the solution to make a difference and take responsibility. They have therefore set a goal, to only be using renewable energy sources form vehicles to buildings by 2025. They have in recent years reduced emissions mainly in cities, so today postal distribution is CO2-free in approximately 50 cities in Norway. Bring are now intensively working towards making parcel deliveries greener (Bring Research 2021).

3.2 Transport in Oslo

Oslo is a growing city and with an increase in population comes an increasing demand for goods and capacity of urban freight. Causing challenges to the logistical operations, covering the everyday supply and demand (Galkin et al. 2021).

Better public transport services have for many years been a political priority in Oslo. In recent years this has ensured a greater number of people traveling using public transportation rather than by cars. There is a close to 24-hour option for public transportation within the city of Oslo, with a large and efficient network of trains, trams, subway, buses, and boats. Subway and the

train transport the highest amount of people within the city, mainly underground. Buses and trams are the main modes of on-the-surface transport, while the boats carry the commuter on sea/fjord (Oslo Kommune Miljø 2022).

According to Ruter (2022), the public transportation is not only just a solution to ensure the citizens a means for efficient regional accessibility, however it can also contribute to reducing the emission release from the publics transportation habits. Ruter who is the main provider of public transportation in Oslo has an ambition to be emission-free at the end of 2028. Ruter is working towards removing emissions by electrifying all their modes of transport, improving the local air quality.

The city council in Oslo, has a vison that Oslo city shall have zero emission by 2030. They are investigating how zero emission zone could function in Oslo, with an intention of establishing a pilot project. They want to use the implementation of a zero-emission zone as a tool to easier transition the city to ecofriendly vehicles. The purpose of the zone is to improve the urban environment and reduce greenhouse gas emissions from road traffic. The end goal is an upgraded and emission-free city, with cleaner air, less noise and easier accessibility for residents and businesses. In the zero-emission zone it shall only be permitted to drive with vehicles that use electricity or biogas. This is only one of several measures to improve the urban environment in Oslo and reduce greenhouse gas emissions (Oslo kommune 2022). Though this is still just in the planning phase, in the future it can become reality, before that can happen there must be existing solutions that meet the requirements, crowdshipping might hopefully be one of them.

3.3 The LEAD project

The Lead project is a European Union Horizon 2020 funded project. Horizon 2020 is EU's research and innovation funding program, from 2014-2020 with a budget of nearly €80 billion (European Union Horizon 2020). The purpose of the LEAD project is to gather information and analyze various solutions for on-demand urban logistics, by living labs in six cities (Madrid, Oslo, Budapest, Porto, The Hauge, Lyon). And use the relevant information and experiences, to develop and implement innovative solutions and measures that are capable of supporting low to zero emission last mile delivery logistics for urban freight distribution and demand economy through digital twins (LEAD Projects 2022). The objectives and strategies of LEAD-project is displayed in Table 1, while the objectives of digital twins are shown in Table 2.

Concept	Objective
Value Cases and Co-Design	To develop a contextual framework to support the design and implementation of cost-effective sustainable integrated city logistics systems, by involving stakeholders in the co-creation of innovative last-mile solutions and services that address the needs of the on-demand economy.
Digital Twinning tools	To design and develop a simulation-based assessment environment and a Digital Twin Model for evaluating alternative city logistics strategies, measuring the impact of interventions, and supporting well-informed data-driven decision and policymaking.
Validation in Living Labs	To demonstrate and validate project concepts and tools in six intervention areas (Madrid, The Hague, Lyon, Budapest, Oslo, Porto) with heterogeneous urban, social, and governance conditions and logistics profiles, representative of the European diversity, involving all actors in exploring combinations of different measures toward implementing optimal logistic solutions.
Scale-up	To formulate a Roadmap towards PI-inspired zero-emission city logistic consolidating project experiences from the living Labs, accelerate take-ups of sustainable solutions through stakeholder engagement and capacity building and provide practical guidelines on the use of LEAD tools and Digital Twins in SUMPs (Sustainable Mobile Mobility Plan) and SULPs (Sustainable Urban Logistics Plan) process steps.

Table 1: Objectives of Lead concepts (OSLO LEAD 2020).

According to De Witte et al. (2021) "living labs can generally be defined as open innovation systems where end users and other stakeholders (e.g. citizens, regulatory bodies, healthcare professionals, developers, etc.) are involved in the exploration, co-creation and evaluation of solutions in realistic circumstances." The living labs provide arenas for the stakeholders of

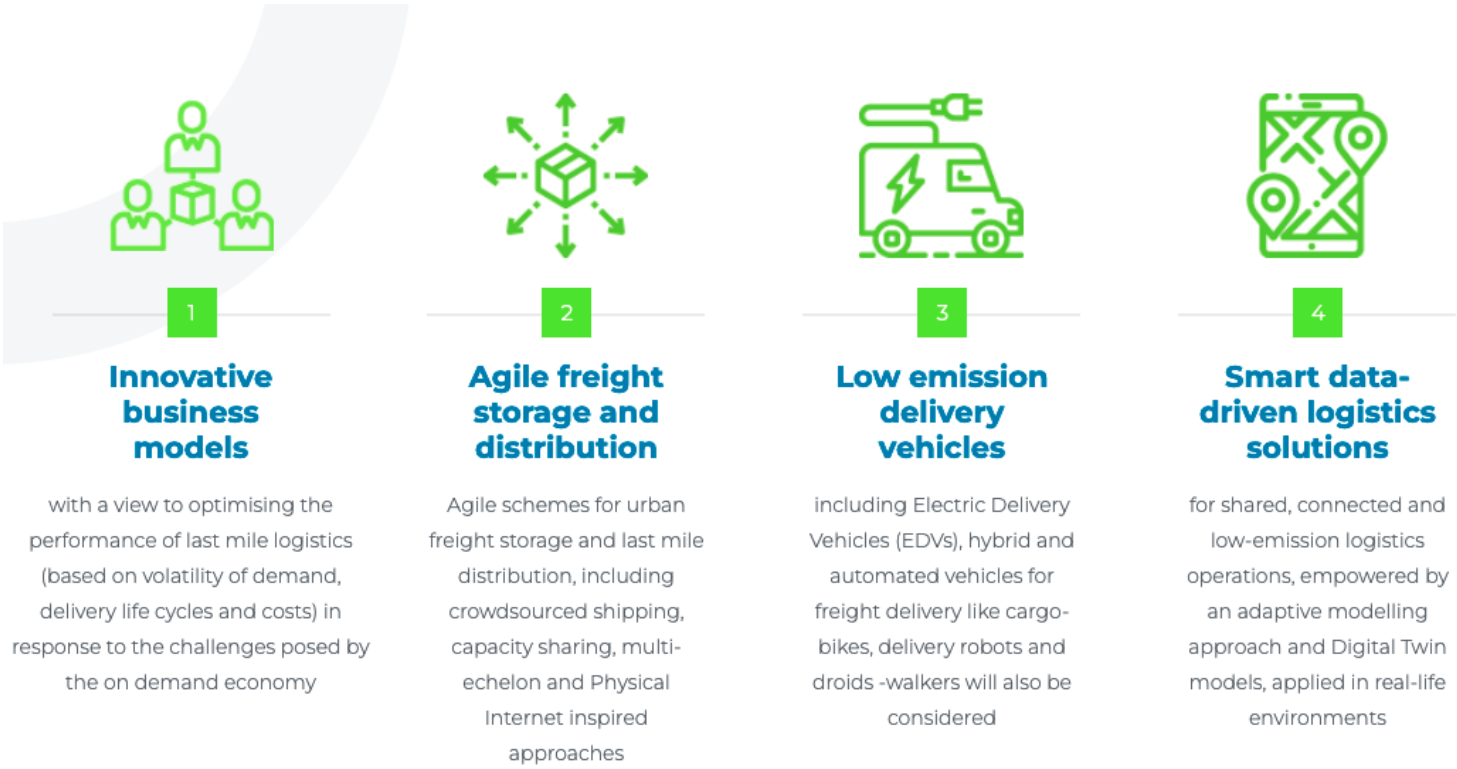
innovations, to share views and ideas, as a means for facilitating the development of new solutions. The use of living labs has shown to improve the understanding of elements contributing to the possibility of successfully innovate in various social, environmental and cultural contexts. Testing for product-market fit, researchers and developers gain new insights that can achieve positive economic effects.

Concept	Objective
Efficient Operations	The ultimate objective of introducing Digital Twins in last mile logistics is to improve the operation and efficiency of parcel delivery, reduce costs and externalities through forecasting and predictions of future states and support advanced decision making through the entire logistics lifecycle, while also fostering stakeholder participation via reliable real-life information.
Data-driven Decisions	Technology enablers for building Digital Twins include modelling, predictive analytics and decision-making methods, and the use of lifecycle-oriented knowledge with historical and real-time operational and city data. A Dynamic Data-Driven Application System (DDDAS) will manage the real-time coordination of models and data, interfacing to digital platforms, APIs and sensors and integrating city data in the models.
Co-Design	The Digital Twins will enable the co-design of value cases by suppliers, shippers, policy makers and urban planners, and the development of solutions for integrated systems of logistics/freight operations in urban, metropolitan and peri-urban areas, introducing low-emission, connected/automated delivery vehicles

Table 2: Objectives of digital twins (LEAD 2022)

In their paper Liu et al. (2021) analyzed the status and reviewed the state-of-the-art of digital twin from the perspective of concepts, key technologies, and industrial applications, and tried to define digital twin. The concept being hard to define, several different conceptual models and reference models of digital twin have been proposed. Though "The basic idea of digital twin is simple, that is linking physical object and digital object in an accurate and real-time manner" The current digital twin concept is general and ambiguous. The Digital twin's application is summarized by Liu et al. (2021) as different phases in the life cycle, where the digital twin is used in different ways in different kinds of processes and systems.

Figure 3: Strategies (LEAD Projects 2022).



3.4 Oslo LEAD

"Green shipping of larger items through the urban transport network".

The objectives for the living lab in Oslo, concentrates on Business to Consumer, home deliveries being the most favored option from a customer perspective. Four different scenarios had to be established with a vision of flexible service, involving a pre-determined selection of operators which are, the commuters (everyday person), Nimber's community members (curriers) and regular logistics operators (trade-offs between costs and reliability issues). Suitable for setting up a micro-hub located close to the main road system and a bus station at Lysaker in Oslo (OSLO LEAD 2020).

The following elements is explored in the LEAD project:

- *Business models financially viable and beneficial from a social/environmental perspective;*
- *Senders'/bringers'/receivers' preferences for alternative delivery service concepts;*
- *The interplay between demand and relevant supply design of energy-friendly dedicated services and crowdshipping services;*
- *The role for a micro-hub to enhance delivery/pick-up flexibility;*
- *The economic, financial and environmental potential for a green dedicated and crowdshipping service;*
- *The Integration of data modeling (Discrete Choice Modeling & Agent-Based Modeling) with real-market data to support a Digital Twin approach.*
- *Maybe a stronger focus on sustainable crowdshipping of larger items through the road network than intended in the first place.*

3.5 Description of the service and partners

This specific study is conducted in association with the 2020 LEAD horizon project. The Norwegian components includes the University of Molde as the research partner, Nimber as the industrial partner, and Oslo Municipality as the public administration.

3.5.1 Introducing "Nimber"

Nimber has a community delivery service platform that helps connect people who either wants to send something or have goods transported, to trusted people who are traveling the same way as the goods are being sent. Nimber aim to utilize the spare capacity of cars already on the road, by actively using the local community, commuters and whoever is traveling. Hence cutting down on the usage of excess transportation, that would only be used for a dedicated delivery trip. Creating an opportunity for less pollution and lower demand for cars on the road, thereby reducing the CO2 footprint from consignments.

Nimber is now the first choice of delivery for over 100,000 businesses. They are currently operating in three cities in Europe, London, Greece, and Oslo. Nimber specializes in goods which does not fit into the traditional terminal structure. Though they do offer to fulfill everyone's needs, be it ordinary parcels and goods (Nimber 2022).

3.5.2 The Service provided

Nimber currently has their focus specifically on crowdshipping and the use of micro hubs. In collaboration with the LEAD-project, Nimber will provide customers home delivery for their purchased good. They will handle transportation of the goods by e-vans, to a consolidation hub located close to a public transport station at Lysaker. Implementing the micro hub to their supply chain, is an opportune way to provide crowdshipping service. The delivery will then be fulfilled, either by a crowdshipper or a dedicated bringer.

The implementation of the micro hub and crowdshipper, creates various new scenarios. Which we in this study are going to look into, with these scenarios in regards to customers perceptions and preference of the different home delivery alternatives. The scenarios are represented below in figure 4 and table 3.

3.6 The LEAD project scenarios

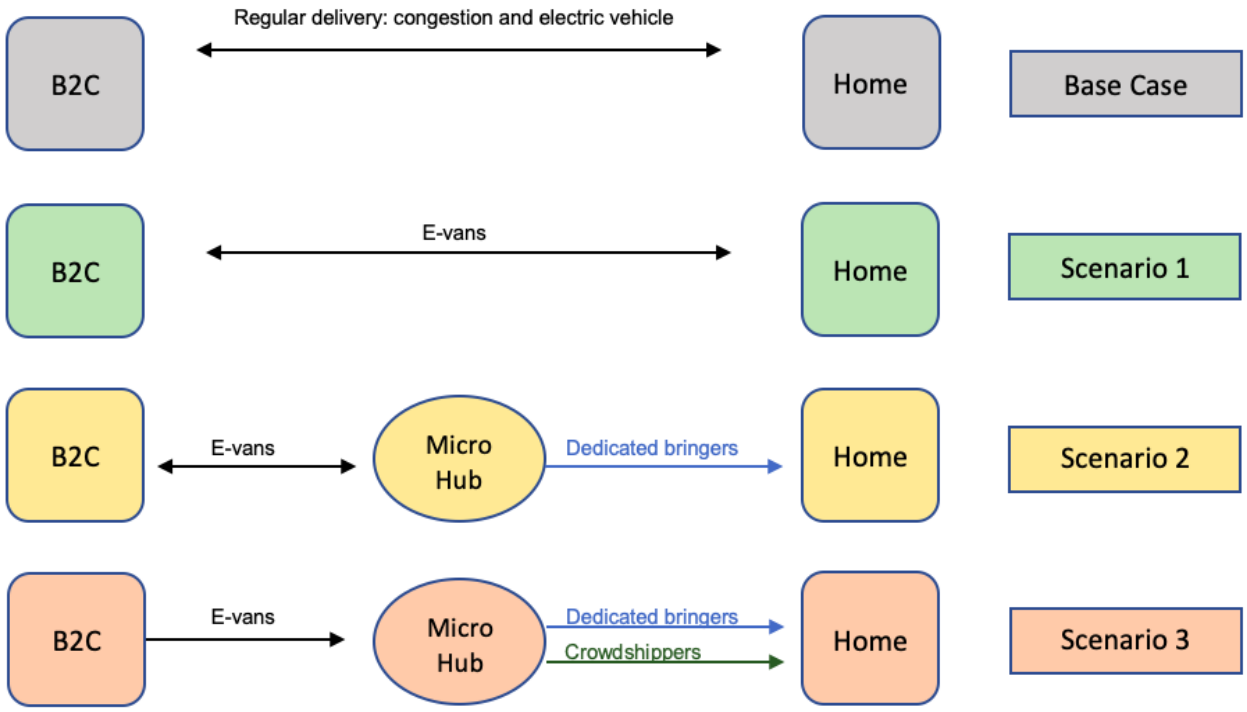


Figure 4: Delivery scenarios

Attribute	**Scenario 1**	**Scenario 2**	**Scenario 3**
Price of delivery	610kr	550kr	460kr
Punctuality of delivery	30min -1 hour	Less than 30min	Less than 30min
Time from order to goods received (Lead time)	4 days	2 days	3 days
Amount of Co2 emitted per delivery (sustainability indicator)	Medium	Low	High
Flexibility (option to change date and time)	No	Yes	Yes

Table 3: Representation of the various scenarios and attributes introduced for the case..

These are the various attributes used in the stated preference survey which were determined by the questionnaires performed at the start of the research. Later chapters will go more into more detail and reasoning for these attributes and measures. The prices and numbers for punctuality, flexibility and expected lead time for delivery, are estimations provided by Nimber. All

scenarios describe a delivery Nimber is able to provide with the given measures for the specific scenario. This is done in order to simulate reality as close as possible, making the results of the thesis applicable for practical use.

3.6.1 Scenario 1: E-vans

In scenario one, Nimber will be performing the whole delivery from goods purchased to end user has received the parcel, with the use of E-vans. Transitioning from using fossil fueled vehicles over to E-vans will reduce urban pollution by replacing deliveries performed by fossil fuel vehicles, to ones being battery powered. Given that it is needed more electronic vehicles to perform the same number of deliveries and increasing the toll it takes on transportation infrastructure and increased congestion, giving the attribute describing sustainability a medium level.

The delivery time is 4 days, because the transport will have to be combined with others deliveries on the route, this also affect negatively on the punctuality for the delivery. Currently the batteries for electric vehicles have range limit, meaning that the vehicle will have to take more frequent stop to recharge, these charging stops will take longer than the traditional refueling of fossil vehicles. Because the route is not optimized due to the limitations, and already weakened lead times form charging battery, the ability for customers to have the flexibility of changing date or time is not present.

The high price at 610kr per delivery, the transport service provided with e-vans, is limited by range constriction, and restricting the total deliveries they are able to provide, thereby reducing the firm's chances for optimization. Each delivery takes more time, with more vans and increasing costs such as wages, is factors justifying the price.

3.6.2 Scenario 2: Micro-hubs

For the second scenario is transport of the customers purchase to micro-hub at Lysaker with e-vans, where goods will get sorted and organized, then delivered by a dedicated bringer to the same general area.

Utilizing the implementation of the micro hub, as a charging station for the e-vans while loading up, and taking shorter delivery routes, could enable the electric vehicle to double the daily range. Enabling them to supply a greater number of total deliveries. Even though adding a step in the supply chain is often expensive. Given that they can meet a higher level of demand, the price can be reduced to 550kr.

The shorter routes will also allow for more frequent trip, and a greater level of adaptability, meaning the delivery time will as illustrated in table 3 be reduced from 4 to 2 days. Even with the new limitation on the routing, the micro hub creates the opportunity to sort and reload, filling the e-vans, with parcels that are all going to the same specific area. Punctuality will be better, as well as enabling flexibility of the deliveries.

3.6.3 Scenario 3: Crowdshippers/crowdsourcing

As a response to the high demand for home deliveries, Nimber provide the service of crowdshipping. Ideally serving as a more efficient and economic than the traditional delivery options. This scenario includes having the consumers purchase goods transported to the hub, where it gets sorted and deliveries assigned, either to crowdshippers or by dedicated bringers to complete the home deliveries to the costumers. By including crowdshipping, Nimber can initially scale down on the total of trucks necessary. Reducing the amount of cost for daily operations, maintenance expenses, lover taxes, and can therefore provide deliveries at a lower price of 460kr.

The reason for the amount of emissions being rated as high. Is related to the uncertainty of mode of transportation used by the crowdshippers. Even though the crowdshipping method aim to lower emission and not use combustion transport, it cannot be guaranteed that the crowdshipper does in fact use ecofriendly transport.

The lead time is higher when applying the use of crowdshippers, because the delegation of operation and flexibility for delivery method conversion is slower. Since Nimber initially want crowdshippers to handle the delivery, they can announce the job, and appoint it to the optimal crowdshippers willing to accept the assignment. And if the assignment is neither optional or no willing crowdshipper is suitable to fulfill the assignment, the company has to organize and complete the delivery with a dedicated currier.

These scenarios are further compared and discussed later in the thesis. as one of the main objectives of this research is to determine which one of these configurations the customer would choose or prefer for their delivery.

Chapter 4

4. Methodology

This chapter of our thesis describes how the research has been conducted. This lays out the foundation concerning the data being collected and is an important part of acquiring sound data and further interpreting it. This chapter draws its structure and is based on Saunders (2015) book on methods for business students. In this book, they analyze different research methods and connected theories. Figure 5 below shows an illustration of how the methodology is set up. First three parts in the figure consists of methodological theory, the last two is more case oriented.

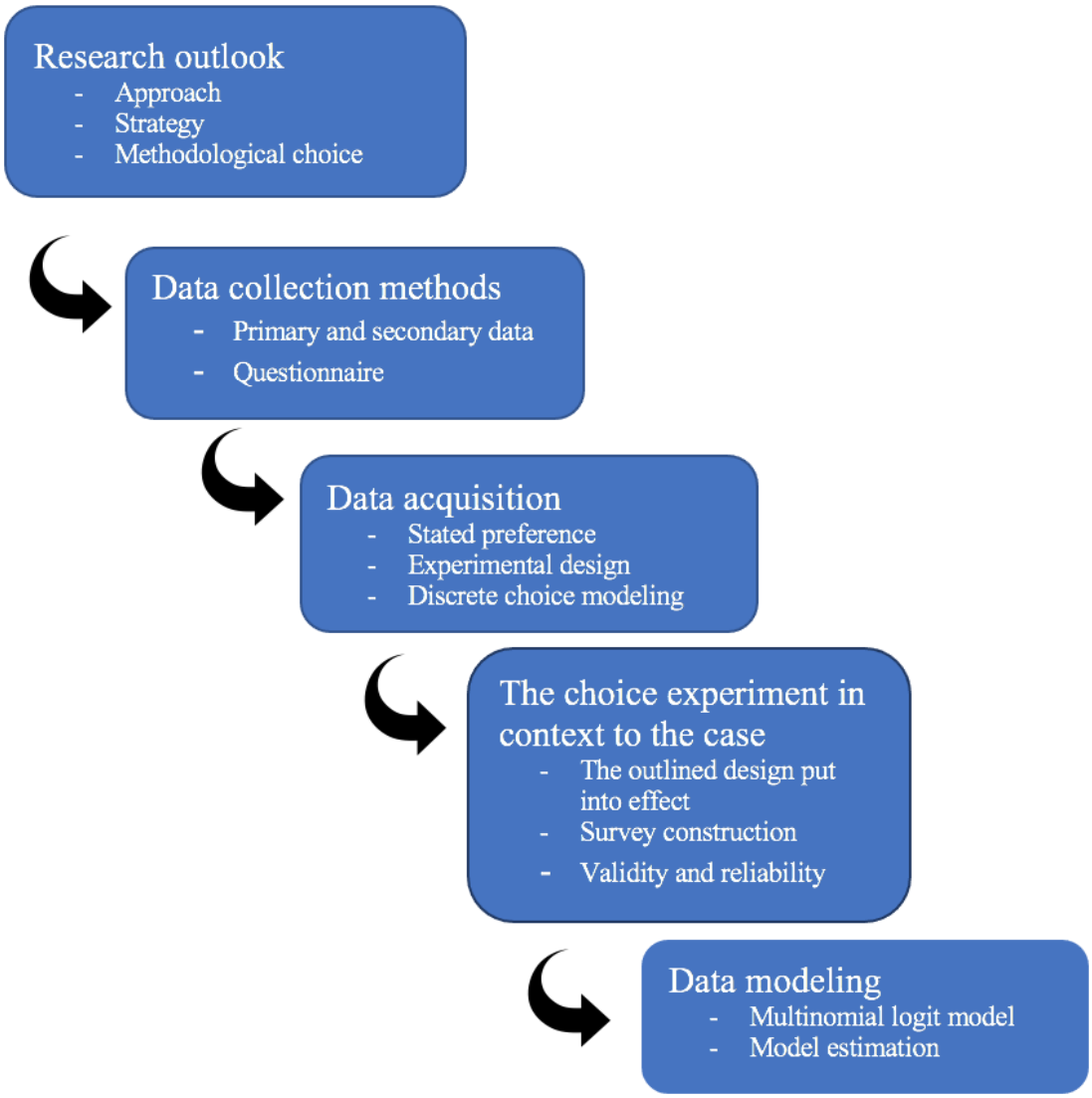


Figure 5: Methodology overview

4.1 Research outlook

It is important to illustrate the philosophy of the research conducted. The research outlook clarifies the justification for the data collection methods used in order answer the research question. Humans always make some assumptions at every stage of the research process. These are either ontological, epistemological or axiological assumptions. Different approaches can be taken, below in figure 6, the research onion displays different levels and philosophies adopted in this research.

Epistemology relates to assumptions about knowledge, whether it is valid, acceptable, reliable and legitimate knowledge, as well as how to communicate knowledge to others. The five philosophies (positivism, critical realism, interpretivism, pragmatism, postmodernism) are briefly explained below.

1. Positivism is a philosophy that entails observing social reality. Data comes from observing phenomena. You can use existing knowledge to make a hypothesis and this is either accepted or denied during the research process. It focuses on the empiricist method and should only produce data that are not influenced by factors such as biases or human interpretations.
2. The philosophy of critical realism mainly focuses on giving an explanation to experiences and what people see by understanding the underlying structures of reality that shape the events they observe. A critical realist highlights how often our senses can deceive us, and reality is the most important philosophical consideration, and it is external and independent.
3. Interpretivism argues that humans and their social world cannot be studied in the same way as physical objects or phenomena. It wants to create new and richer interpretations and understandings of the social world and different contexts. A person with a different culture at a different time may create other meanings and social realities.
4. Pragmatism is a philosophy that does not see any one of the others as wrong. There may be multiple ways of researching a topic. It seeks to reconcile subjectivism and objectivism, values and facts, as well as accurate knowledge and contextualized experiences.
5. Postmodernism seeks to give room for new marginalized views. It wants to question already accepted ways of thinking, and it emphasizes language and power relations.

There is no true or false way to describe the world, but we come to collective agreements with worlds. These agreements are influenced by the power relations and ideologies that dominated in that context (Saunders 2015).

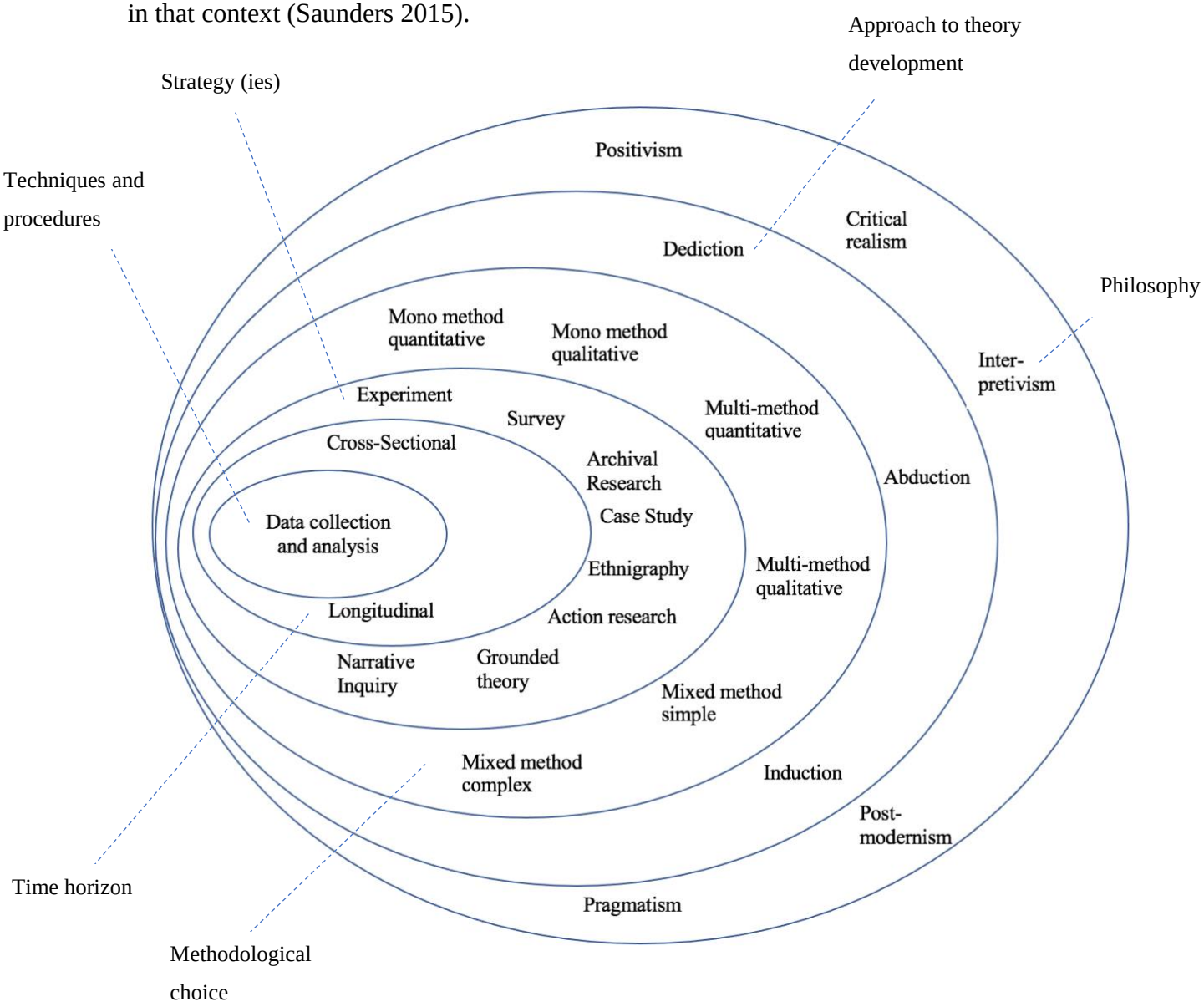


Figure 6: Research onion (Saunders 2015).

The philosophy adopted in this thesis is positivism. The result following from using this philosophy will be based on empirical research, collecting sizeable amount of primary data for analysis and interpretation. Also included will be methodologies that allow to measure some behavior actions of the individuals. Focusing on discovering observable and measurable facts and realities, and not worrying that human interpretation or reasoning will taint the results.

4.2 Approach

The deductive and inductive approaches are the two main approaches in theory development. Deductive reasoning is when you arrive at a conclusion using logic to analyze a set of premises. If all premises are true, then the conclusion also has to be true. On the other hand, the inductive approach has a lack of logical argument between the conclusion and the observed premises (Saunders 2015).

This research uses a deductive approach, as it is researching a theory derived from reading academic literature and using a research strategy to test this. Positivist research usually uses the deductive approach, and it is also the main approach in natural sciences. A deductive approach progresses in some steps:

1. Developing a hypothesis or idea.
2. Deduce testable propositions (Deciding what needs to be measured and what relationship these variables have)
3. Examine the premises and logic of the arguments producing the propositions and compare with existing theories to see if it can give an advance in understanding, if it does, continue.
4. Test the hypothesis by collecting data and analyzing it.
5. If the test fails, the data of the analysis is not congruent with the premises from the start, the theory is false. Here you either modify or reject and start the process over.
6. If the data is consistent, the theory is corroborated.

(Saunders 2015)

4.3 Research Strategy

The strategy layer of the research onion depicts the research strategy. This can be defined as the plan the researcher has to go about answering the research question. It is the connection between your research philosophy and the method you chose for collecting and analyzing the data. The choice of research method or strategy will be guided by the research question, as there needs to be reasonable coherence throughout the research design. Strategies that are often used in research are experiment, survey, archival research, case study, ethnography, action research, grounded theory and narrative inquiry. The first two, experiment and survey are strongly linked

to quantitative research (Saunders 2015). Given that this thesis uses a deductive approach experiment and survey were the strategies used.

Experimental research holds all conditions the same except the independent variable to establish causal relationships between variables (Ross and Morrison 2004). In this research, the choice/ preference variable is manipulated, and the attributes are kept the same. This is done using an efficient design in order to find out what attributes are affecting the choices of consumers when choosing home deliveries. A survey or questionnaires are used in order to collect large sums of data efficiently and standardized. More about this will be presented in the data collection part of the chapter.

4.4 Methodological choice

This layer in the research onion is about deciding what type of data is going to be used in the research, either qualitative, quantitative or both. The methods that can be used are mono, multi or mixed method. Both quantitative and qualitative have mono and multi methods, meaning you use one (mono) technique or multiple (multi) techniques for collecting the data. This of course includes the corresponding data analysis procedures for the chosen techniques. The mixed methods research design is a mix of both qualitative and quantitative techniques and analysis procedures (Saunders 2015).

Qualitative research is often associated with the interpretive philosophy as well as being used by others as well. It is characterized by the fact that it studies participants' meanings and relationships between them. It uses different non-standardized data collection methods and is likely to use non-probability sampling techniques (Saunders 2015).

Quantitative methods are "defined as systematic investigation of phenomena by gathering quantifiable data and performing statistical, mathematical, or computational techniques". Quantitative research is intended to be objective, elaborative, and even expected to be investigational. Data collection is done in structured methods and is conducted from larger samples that can represent a whole population. Results from quantitative methods are expressed as logical, statistical, and unbiased (Brown 2003; Kroes and Sheldon 1988).

Mostly quantitative data is utilized in this research. It also contains qualitative data making it a multi-method choice. In addition, the quantitative research also helped to narrow down the list of important attributes and, setting their levels.

4.5 Data collection

There are two types of data, primary and secondary data, which are collected and used in different ways. Primary data is provided by sources that supply raw information and first-hand evidence, allowing for direct access to the subject of the research. There are several methods for gathering and providing data such as interview transcripts, statistical data, and works of art. Secondary data is collected from secondary sources that provide second-hand information and statements from different researchers. A secondary source may supply, describes, interpret or synthesizes primary sources. Ways of collecting secondary data may include academic books, case studies and reviews (Kroes and Sheldon 1988; Streefkerk 2018)

Both primary and secondary data are utilized in this research. The primary data collection method is primarily based on stated preferences as well as supplementary questions in the form of a survey.

4.5.1 Primary Data

Questionnaires and interviews were the methods used for collecting primary data. Secondary data from relevant literature and more so the input from the case company and logistic scholars were the basis for synthesizing the list of attributes used further in the experimental design. First, there were a list of 9 attributes that were decreased down to the 5 most important ones after the first survey was analyzed. The data collection process for primary data consisted of multiple methods in order to maximize output. Firstly, it was administered online to friends, family and acquaintances. Secondly, QR codes were made and printed out on pamphlets in order to scan for a direct link to access the survey on the respondent's smartphones. These were distributed to possible respondents at various locations, mostly at the location of IKEA Slependen. This gave them the ability to access the survey at a later time as most people did not have time or did not want to stop and do the survey right then and there.

A prerequisite before collecting the data is to test it to reveal if there were any problem that was not caught upon the making of the survey. This was done by constructing a pilot study. No matter how strapped for time you are, you should always pilot test your study. Pilot testing helps refine questions, ensuring the data is collected correctly and ensuring the validity of your questions. It gives validity to the questionnaire and the data collected, in addition to making it more likely to succeed (Saunders 2015).

Two different surveys were done in this research. The first was to collect data on what attributes are most important for a customer when choosing a home delivery. The second was the main stated preference questionnaire. Both were piloted before distribution and followed the same approach. Testing in a focus group to get feedback and to gage the respondent's reaction to the survey, in addition to it being administered online. The main questionnaire was also piloted on strangers in a similar setting as to how the data collection was conducted. The feedback given was used to refine and adjust the survey to ensure an easy to understand and simple to answer survey.

4.5.2 Questionnaires

Questionnaire is a method that make it easy to collect large sample of data. All respondents answer the same questions, and it is often predetermined options for the answers. For this research, everything was the same, except for the choice situations in the different blocks of the questionnaire. The design of a questionnaire can determine its success and affect the validity of the data collected. Things to be aware of when designing a questionnaire is to carefully design individual questions, have clear and pleasing visual presentation, lucid explanation of the purpose and a well-planned and executed delivery of the questionnaire (Saunders 2015). This goes together with as mentioned, piloting it.

Different types of questionnaires exist as seen in figure 7. You can choose between self-completed, interviewer or a mixture of them. For this research it is mainly used a self-completed internet questionnaire. Giving the possibility for both web and mobile access.

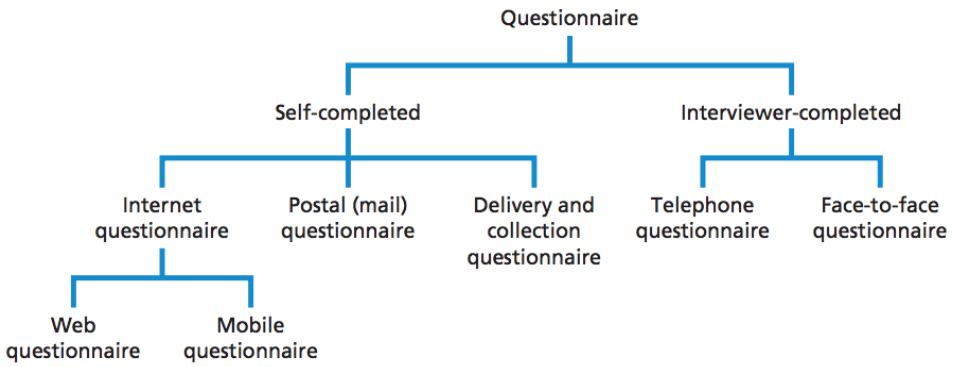


Figure 7: Types of questionnaires (Saunders 2015).

The questionnaire was constructed in google forms as this is a known and user-friendly way to develop and distribute questionnaires. It gives an easy export button exporting the data into an excel file, removing the possibility of errors when transferring data.

The stated preference questionnaire consisted of three parts, viewpoint on sustainability questions (1), stated preference choice sets (2) and sociodemographic and socioeconomic questions (3). To limit the number of choice sets, there were six questionnaire blocks, only giving each respondent six choice sets in the second part of the questionnaire. Blocking is explained further in the experimental design subchapter.

4.5.3 Secondary data

All secondary data used in this thesis were collected from other research papers, literature reviews, journals, statistical reports, articles, books, former thesis' and other similar literature. Reliable websites were also used to obtain information. All the attributes used in the research were extrapolated using secondary data.

4.6 Data acquisition

Suitable software for the purpose of analysis of the data are used. R studio is a tool that can be used for statistical analysis. By using R you can take raw data that gives little to no sense to anyone and analyze and it to understand the connections and get a readable picture of what the data shows.

4.6.1 Stated preference

Stated preference is a survey-based technique for establishing nonmarket valuations. These valuations are not tradeable in money, but it could in terms be valued as what the common person would be willing to pay for something, rather than go without it. Such as clean water and fresh air or sustainable wildlife (Brown 2003).

The stated preference method relies on the answers collected form respondents, by carefully worded survey questions. The stated preference survey are great means for forecasting decisions, by proposing options from hypothetical scenarios to the respondents, thru a selection of questions with a fixed set of conditions created with the experimental design. The respondent was asked to express their preferences by making a choice between the indications presented. There are three structures of indications for a person to express their preferences: "sorting the alternatives (ranking), assigning value to the various alternatives (rating), or simply choosing the preferred alternative (choice)" (Gatta et al. 2019).

The stated preference is utilized in this thesis. It was used while submitting respondents to different hypothetical choice situations after the conclusion of what attributes to move forward with after the first questionnaire. After this the experimental design was generated. It consisted of 36 choice situations. Each choice situation consists of 5 attributes. 3 of the attributes have 3 levels, and 2 have 2 levels. When presented to the respondents, they could choose between two options in the choice situation, either alternative 1 or alternative 2. The two options have different configurations on the levels of the attributes.

4.6.2 Experimental Design

An experimental design is generated in order to help build the stated choice experiment. The purpose of conducting experiments is to find out what the influence of an attribute has on the observed outcome. In a stated choice experiment this means that you want to determine what influence the design attributes has upon the stated choices made by the respondents in the experiment or survey. In order to have statistically robust data, you need to pool the respondents (ChoiceMetrics 2018).

Simply put, the experimental design can be seen as a matrix, a tool for deciding what values goes where in the stated preference choice experiment. The values in the matrix will represent the levels of the different attributes, and the columns and rows will represent the choice situations. Further, in the Ngene user manual they present a three-step plan for making a stated choice experiment. First is the complete model specification, where all parameters estimated must be determined. Secondly, based on the specification made, an experimental design is selected and generated. The last step is making the questionnaire that are used to collect the data based on the chosen experimental design (ChoiceMetrics 2018).

Before creating an experimental design, the model specification needs to be set by addressing which alternatives needs to be included, and which attributes are included for each alternative. In this thesis there are two alternatives, and all chosen attributes are represented in the alternative because the alternatives have a generic parameter and are unlabeled e.g., 1 and 2 or A and B.

As there are many experimental designs to choose from, we need to find the one that fits our case best. In order to find the best design, some decisions need to be made. These are according to ChoiceMetrics (2018) Ngene 1.2 user manual & reference guide,

- "*Should the design be labelled or unlabeled?*
- *Should the design be attribute level balanced?*
- *How many attribute levels are used?*
- *What is the attribute level ranges?*
- *What type of design to be used?*
- *How many choice situations to use? »*

Different design types are considered. The two most common are full factorial or fractional factorial design. The most well-known form of fractional factorial design is orthogonal design. Different designs are further explained in the next parts of the chapter.

When the design is created, the next step was to construct the questionnaire. The table brought forth by the design will not make much sense to a respondent, therefore it is made into a comprehensible choice situation (ChoiceMetrics 2018). The table below illustrates an example of a choice situation between two options for buying a train ticket home.

	Option A	Option B
Attribute 1: Price	100NOK	150NOK
Attribute 2: Travel time	60 minutes	45 minutes

Table 4: Choice situation example, two options for a train ticket home.

4.6.3 Orthogonal design

A full factorial design is used for the simplest or smallest problem, as it considers every possible choice situation. We have a survey with 3 of 3 and 2 of 2 levels displayed in the table below (NR X), giving us a complete factorial of (3 * 3 * 3) * (2 * 2) = 108 possible combinations. With additional levels and attributes, this number increases exponentially (ChoiceMetrics 2018). In this thesis, we will not be using a full factorial, as asking respondents to answer 108 possible choice situations is not possible in order to ensure quality data. The respondents will get bored and discontinue the survey.

Table 5: Attribute, options and levels

	Option A	Option B
Attribute 1	Level 1	Level 1
	Level 2	Level 2
	Level 3	Level 3
Attribute 2	Level 1	Level 1
	Level 2	Level 2
	Level 3	Level 3
Attribute 3	Level 1	Level 1
	Level 2	Level 2
	Level 3	Level 3
Attribute 4	Level 1	Level 1
	Level 2	Level 2
Attribute 5	Level 1	Level 1
	Level 2	Level 2

Opposed to the full factorial design we have the more practical fractional factorial designs. Orthogonal design falls into this category. With fractional design the respondents only have to answer a subset of the full factorial. This can be chosen at random, however with orthogonal design we choose the subset in a more structured way in order to eliminate risks of biased outcomes. This is done by achieving attribute level balance. The design is orthogonal if it achieves this, together with the parameters being independently estimable. In other words, each attribute column in the design needs to be uncorrelated. The mathematically expression for this is:

$$\sum_{s=1}^{S} X_{j_1 k_1 s} * X_{j_2 k_2 s} = 0$$

Equation 1

$\forall (j_1 k_1) \neq (j_2 k_2)$ j: alternative k: attribute

This equation (1) tells us that the sum of the inner product of any two columns needs to be zero. In table 6 below this is illustrated.

Table 6: Orthogonal design with three attributes having two levels (ChoiceMetrics 2018).

S	A		B	C
1	-1	X	-1	-1
2	-1	X	1	1
3	1	X	-1	1
4	1	X	1	-1
$\sum = 0$				

When looking at table 6, notice that the inner sum equals zero. This continues to hold true even if we remove one of the attributes or columns, showing it is orthogonal. Only if we remove one of the four choice situations the design will stop being orthogonal (ChoiceMetrics 2018).

Even if the orthogonal fractional factorial design gives us less situations to work with than the full factorial design. It can still add up to be quite a lot of choices needed. A technique orthogonal design can utilize is “blocking”. Blocking means dividing up the number of choice situations into different blocks. Instead of having one survey giving 16 different choices to the respondents, you can make 4 surveys with 4 choice situations ($4 * 4 = 16$), or two surveys with

eight questions $(8 * 2 = 16)$. This can be coded in the Ngene software to best preserve orthogonality, and to ensure it across blocks. Blocking will make each survey less extensive, giving a higher probability of making respondents actually finish it and better ensure *quality* answers (ChoiceMetrics 2018).

4.6.4 Efficient design

The design should give as much information as possible from the data collected. Several researchers have addressed the problem of how to make a more efficient design and propose different methods that can be used. Market researcher are increasingly experiencing trouble when using long and complex questionnaires. There is a dilemma, the trade-off between quantity versus quality. Respondent boredom and fatigue because of lengthy questionnaires effect the data collected. A more efficient design make it possible to have fewer questions for respondents, and even reduce the number of respondents needed to have statistically robust data (Sandor and Wedel 2001).

It could be argued that orthogonal design is only sufficient if there are no data or knowledge of the parameters. If you have some previous knowledge, from e.g., a pilot study or previous literature, the design could be improved. Efficient design is closely related to an orthogonal design and is used not only to minimize the correlation in data for estimation, but also enables the researcher to get the lowest possible standard errors. The design uses the fact that if the parameters are known, we can derive the AVC matrix of the parameters. The root of the diagonal in this matrix is the asymptotic standard error (ChoiceMetrics 2018).

It is possible to generate an efficient design in different ways. Sandor and Wedel (2001) have proposed using a Bayesian approach in the design generation prosses. This entails relaxing the assumption of having perfect a priori knowledge of the parameters priors and testing the design over numerous draws from prior parameter distributions assumed in the generation of the design. The resulting Bayesian efficiency is calculated as the expected value of the measure of efficiency assumed in all the draws. Because of this, for the Bayesian approach to be used it first needs to be simulated. A software suitable for simulations like this and is capable of making such a design is Ngene. Using this kind of design can benefit researchers as it makes it possible to measure what effect each of the attribute included has on the total utility (ChoiceMetrics 2018).

The Bayesian efficient design cannot guarantee an optimal solution, but it can be more efficient. The reason for this is the use of constraints and heuristic search procedures that could exclude the most optimal design. This is why they are referred to as "improved efficiency" or "more efficient" designs and not optimal designs. However, the efficient design usually outperforms orthogonal design (Sandor and Wedel 2001).

When choosing between orthogonal or efficient design there are one important aspect that needs to be considered. As mentioned above, if the researcher already has information about the parameters that can be used to make the design an efficient design always outperforms the orthogonal design by providing as much as possible information from the choice situations.

4.6.5 Discrete choice modelling

In conventional microeconomic consumer theory, it is assumed that individual demand for a consumer is the result of their own utility maximization and that their decision variable is continuous. Given that this does not represent reality at all, researchers got to work to create many contributions to discrete choice theory (Wrigley 1982).

Discrete choice models based on random utility theory has been used for a long time. It is assumed that a person chooses deterministically and picks the option that maximizes their net personal utility (U_{jq}). This can be expressed with an equation that consists of two part. The systematic part (V_{jq}) and the random part (ε_{jq}). The systematic part is the function of the measured attributes, while the random part is the unobserved characteristics. The expression is as follows in equation 2:

$$U_{jq} = V_{jq} + \varepsilon_{jq}$$

Equation 2

$$j: alternative \quad q: individual$$

The systematic part has been simplified to assume that persons choose with compensatory behaviors and it is supported by clear microeconomic principles. More attention has been put towards the discrete choice random utility models and has incorporated more flexible structures, including things such as differences in taste, correlation and heteroscedasticy. It has led to more complex models such as mixed logit model and probit (Cantillo and Ortúzar 2006).

4.7 Choice experiment in context

Before surveying respondents with the choice experiments, the attributes that can affect the respondents' choice of delivery needs to be present. Table 7 presents the attributed identified in the early stages of research. These attributes were chosen as a result of the case described for Nimber. The different scenarios Nimber are able to provide serves as a guide for the choice of attributes that can be assessed. These are the attributes they are able to influence in some way or another performing deliveries.

Table 7: Attributes influencing choice.

Price of delivery The price the customer is charges for the service of delivering.
Possibility to choose a date The customers' ability to choose what date the delivery will be on.
Flexibility - date Flexibility for the customer to being able to change the date the delivery is performed.
Flexibility - delivery time Flexibility for the customer to being able to change the time the delivery is performed.
Time window Possibility for the customer to choose a time window for the delivery.
Punctuality Punctuality of the delivery (in respect to the time windows).
Lead time Short time from placed order to received products at home.
Sustainability Amount of C02 emitted per delivery.
Reliability (trust) Reliability of the company that perform the delivery.

Having all of these attributes included in the research would make the choice experiment too complex and implementation impractical. Because of this it is desired to only include the most important attributes that will have the most effect on the estimation model. To condense the

list, a survey was performed, together with interviews to determine which from the list of nine attributes consumers found most important in their choice of delivery. They had the option to choose up to five attributes. Once the results were reviewed in meetings together with the research team and input from NIMBER, the attributes were narrowed to the five presented in table 8.

Table 8: Attributed for the choice experiment.

Attribute	Number	Measurement
Price of delivery The price the customer is charges for the service of delivering.	X_1	**NOK**
Punctuality Punctuality of the delivery (in respect to the time windows).	X_2	Time window interval of delay
Lead time Short time from placed order to received products at home.	X_3	Days
Sustainability Amount of C02 emitted per delivery.	X_4	Ordinal, Color and level
Flexibility – change date and time Flexibility for the customer to being able to change the date and time the delivery is performed.	X_5	Boolean, yes or no

The attribute of flexibility of delivery time and delivery date are combined into one attribute. The attribute on the ability to choose a delivery date are removed, as in our case, as being able to set date and time is already a present feature all customer are able to utilize. This gives it only one level and will not make a difference in the model estimation. However, we include the attribute of the ability to change it.

Once the attributes are set, they need to have levels as this is an essential part of the experiment. X_1: price, X_3: lead time and X_4: sustainability/ CO^2 all have three levels, while the remaining two have two levels.

4.7.1 The design in effect

When levels and attributed are decided, to progress further, the choice between full factorial design or fractional factorial design must be made. Previously it was mentioned that a full factorial will be too complex for this thesis, as it will be unrealistic to expect respondents to answer lengthy questionnaires. This leads to the choice of an efficient design. However, in order to use this design, a prerequisite was that some data was known. The data needed was collected using an orthogonal simultaneous design for pilot testing. The efficient design had six choice situations per respondent.

Further, as we are using a Bayesian approach and working with a multinomial logit model, we estimate parameters using a maximum likelihood function. This involves two important steps. First one is developing a joint probability density function of the data collected, which is called the likelihood function. Second step is to estimate the parameter values that maximizes the function. The likelihood function of Q people having J alternatives is expressed in equation 3.

$$L(\beta) = \prod_{\forall q \in Q} \prod_{\forall j \in J} (Prob_{jq}(\beta)^{\delta_{jq}}$$

Equation 3

δ_{jq}: 1 *if chosen by individual q and* 0 *otherwise.*

$Prob_{jq}$: *Probobility that individual q chooses alternative j.*

We maximize the log-likelihood instead of the likelihood function itself as it is common to determine the first derivative of the likelihood function and set it to zero. This brings the same result and is perceived as easier.

4.7.2 Constructing the pilot survey

This subchapter explains the approach taken in regards to the pilot survey. The attributes are examined for their impact on utility. Even without extensive prior knowledge we can assess if the attributes will have a positive or negative impact on utility. Table DEI shows attributes, levels and their predicted effect on total utility.

Table 9: Attribute levels and predicted impact on utility.

ATTRIBUTE	LEVELS	UTILITY EXPECTATION
PRICE	460 550 610	Negative
PUNCTUALITY	Less than 30 min 30 min to 1 hour	Neutral
LEAD TIME	2 days 3 days 4 days	Negative
CO2 - SUSTAINABILITY	Green Yellow Red	Positive
FLEXIBILITY	Yes No	Positive

Next the attributes are presented with numerical values to transfer data between software seamlessly and to make them further useable in calculations and estimations. The questionnaire was as mentioned divided into blocks (blocking) in order to maximize completed responses. There were six blocks and six situations in each, having a total of 36 choice situations.

4.7.3 Validity and reliability

An important aspect of all data is to access if it valid and reliable. In a much cited article by Heale and Twycross (2015), they define validity as the extent to which a concept is accurately measured and reliability as to what extent a research instrument consistently produces the same results. This entails that it is replicable, providing the same results if done again under the same circumstances.

Three major types of validity entails

- Content validity
- Construct validity and
- Criterion validity.

Content validity examines whether the instrument sufficiently cover all content it should in respect to the variable, in this case the survey. A subset of content validity is face validity, where experts are asked about their input if the instrument is suitable for the intended concept of research.

Construct validity is about the ability to produce interference about test scores connected to the concept being studied. In other words if the research instrument is related to other instruments used to measure the same thing. One evidence of construct validity is convergence (Heale and Twycross 2015). This thesis show construct validity by following Gatta et al. (2018) which has a similar topic accessing impacts with a similar experimental design.

Lastly in regards to validity we have criterion validity, which is to what degree different instruments measure the same variable. It can be conducted correlations in order to determine this.

Further we need to look at reliability. There are three attributes that can be used to measure reliability, even though this can be difficult to measure. These are homogeneity or internal consistency, equivalence and stability. Heterogeneity implies to what extent all items on a scale measure one construct. Equivalence is the consistency among responses of multiple users of an instrument or among alternate forms of an instrument. Stability refers to the consistency of results using an instrument with repeated testing (Heale and Twycross 2015).

4.8 Data modelling

This work is about finding preferences and disaggregating possible behavioral patterns in order to predict behavior and likelihood of a given choice. The behaviors are viewed through statements given in hypothetical choice situations. However, since utility is used for these predictions, there first needs to be some assumptions present in regards to the respondents. All assumptions are being accounted for when model estimations are made.

Assumption 1 – All respondents act rationally and seek to maximize their utility. The individual will always choose the option granting highest utility.
Assumption 2 – Respondent are able to assign their own utility to each alternative given. They make their decision based on this utility.
Assumption 3 – Not all respondents have the same choice situations.
Assumption 4 – Total utility is given from the set of attributes presented and they each have their own distinct impact on utility.
Assumption 5 – Utility is measured in quantitative terms and relies on the selected attributes. (Louviere, Hensher, and Swait 2000)

4.8.1 The Multinomial logit model

For a discrete choice model, there are some specific assumptions that, when present, make the Multinomial Logit Model (MNL). These are as follows.

1. Error components have a Gumbel distribution (extreme-value).
2. Error components identically and independently distributed for alternatives.
3. Error components identically and independently distributed for observations/ individuals.

The MNL gives the choice probabilities of each alternative as a function of the systematic portion of the utility of all the alternatives. When choosing an alternative $i(i = 1,2, \dots J)$ from a set of J, it could be expressed mathematically as in equation 2

$$\Pr(i) = \frac{\exp(V_i)}{\sum_{j=1}^{J} \exp(v_j)}$$

Equation 4

$$\Pr(i) = The\ probability\ the\ decition\ maker\ chooses\ alternative\ 1.$$
$$V_j = \ is\ the\ systematic\ component\ of\ the\ utility\ of\ alternative\ j.$$

Further we see that the MNL is expressed as an exponential function and the relationship between $\exp(V_i)$ and V_i is depicted in figure 8. Note that $\exp(V_i)$ is always positive and strictly increasing (monotonically) with V_i (Koppelman and Bhat 2006).

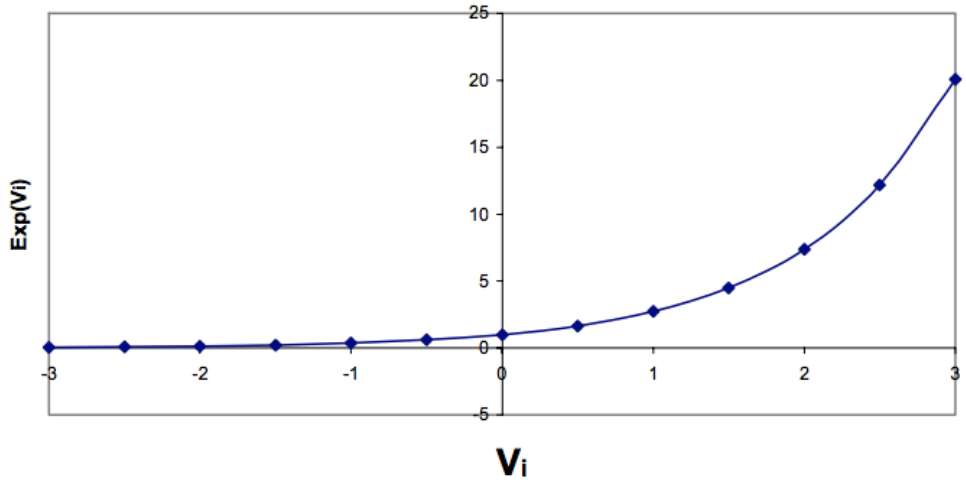


Figure 8: Relationship between exp(V_i) and V_i (Koppelman and Bhat 2006).

Introduced next is different alternatives, the equation needs to be modified to include these. This is shown in equation 5. The equation shows four alternatives (two notations), for situations with more simply include them until you hit J number of alternatives.

$$\Pr(i) = \frac{\exp(V_i)}{\exp(V_1) + \exp(V_2) + \exp(V_3) + Exp(V_4)}$$

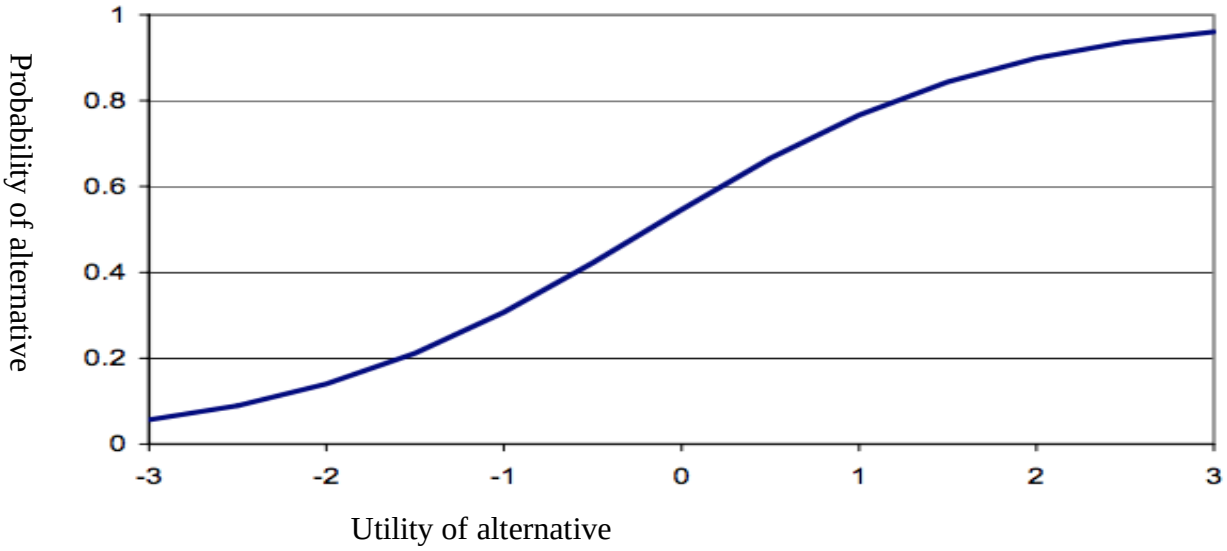
Equation 5

$$Pr(i) = \frac{exp(V_i)}{\sum_{J=1,2,3,4} exp\ (V_j)}$$

$$i = indication\ of\ the\ alternative\ for\ which\ the\ probability\ is\ being\ computed.$$

This formulation implies that if $\exp(V_i)$ increases, the overall probability will also increase. As well as if (V_1), (V_2) etc. increases the probability will decrease and vice versa. Another property is the probability of choosing an alternative is as a function of its own utility, creating a Sigmoid or S shape. This means that it limits the probability range between zero and one when the utility of the alternative is low or high respectively. This gives a steeper curve when the probability is close to one-half. What this tells us is that if the representative utility of one alternative is either very high or very low, a tiny increase in utility of this alternative will not grant a substantial effect on its probability of being chosen. Meanwhile if the utility is comparable to that of the combined utility of the other alternatives I could tip the balance and have the greatest effect on the probability of being chosen (Koppelman and Bhat 2006). Figure 9 illustrates this.

Figure 9: The S shape of MNL probabilities (Koppelman and Bhat 2006).



4.8.2 Model Estimation

To develop a logit model you need to formulate model specifications and estimate numerical values for parameters for the attributed specified. This is done in each utility function by fitting the MNL to the observed choice data. Key here is the selection of specification based on statistical measurements and judgments (Koppelman and Bhat 2006).

When at the stage where unknown parameter β is going to be estimated, it could be done by maximizing the Log-Likelihood function. First however, you need to conduct the stated preference experiment. In equation 6 the attribute levels are noted as x, sequence of choice situations S and respondents are q. $y_q \in R^{sj}$ and is the vector of choices by each respondent. y_{nsj} is one if the respondent chooses alternative j in situation s it gets the value 1, and if not 0 (Bliemer and Rose 2010).

$$\ell_Q(\beta|X_Q, Y_Q) = Y_Q' \, Log \, P_Q(X_Q|\beta)$$

Equation 6

$$\text{Where}^2 \quad X_Q = \begin{pmatrix} x_1 \\ . \\ . \\ x_Q \end{pmatrix} \quad Y_Q = \begin{pmatrix} y_1 \\ . \\ . \\ y_Q \end{pmatrix} \quad P_q = \begin{pmatrix} p_q \\ . \\ . \\ p_q \end{pmatrix}$$

Bliemer and Rose (2010) states that it could be useful to set up a matrix of the experimental design. The matrix shows the attributes level of respondent q in the experimental design. In addition to previously mentioned variables, the K variable signifies attribute values.

$$x_q = \begin{pmatrix} x_{q111} & x_{q112} & .. & x_{q11K} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ x_{q1j1} & x_{q1j1} & .. & x_{q1jK} \\ x_{q211} & x_{q212} & .. & x_{q21K} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ x_{q2j1} & x_{q2j2} & .. & x_{q2jK} \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ x_{qSJ1} & x_{qSJ2} & .. & x_{qSJK} \end{pmatrix}$$

Chapter 5

5. Findings

The data was acquired through a set of questionnaires with questions asking them to rate different statements and to select their preferences in order to obtain information from them. This resulted in a survey that was administered both face to face and online. The survey facilitates the interaction between researchers and respondents, as well as standardization in data collection, making every part of the experience the same for every entry or answer. This makes the data easy to compare. The survey was administered online by using QR-codes for respondents to scan and answer at their own convenience, as well as face to face interviews with the ones able to spare the time.

The questionnaire was separated into six blocks, giving respondents fewer alternatives to answer in the second part to prevent them from discontinuing due to it being too tiresome or by boredom. Each one of the questionnaires consisted of three parts. Before part one the questionnaire and what the data will be used for was explained, ensuring confidentiality. The first part of questions consisted of environmental question aimed to assess to what degree the respondents were environmentally conscious. The second part were the stated preference choice experiment, were the design were utilized to construct situations able to provide sufficient, quality information. The last part consisted of socioeconomic traits for each respondent.

The questionnaire was piloted and tested, as well as approved by the thesis supervisor and the research team. The necessary improvements were done before the data collection began and the survey were distributed on a larger scale. The questionnaire is designed to be easy to comprehend by all, regardless of their prior knowledge connected to the subject. It was precise and could be answered in a timeframe of about three to five minutes. The most sensitive questions such as income were placed last in order to not discourage respondents at the start.

Data Limitations

The sample size of 398 is small for a population as large as the one residing in the region in and around Oslo. The data includes however a broad range of people, both male and female in different levels of income, education and age. On the education level it was, due to an oversight not an option for skilled workers having a certificate of apprenticeship (Fagbrev), meaning they could only answer high school for highest completed education level.

5.1 Descriptive statistics

This section contains the descriptive statistics of the data collected from the surveys. It was collected data from 398 respondents in total. Figure 10 show how many answered each block. Some answers were discarded during the data cleaning due to the respondents residing outside the geographic scope of the model the data will be used for.

Table 10:Number of responses per survey block

Block number	Number of responses
1	65
2	59
3	65
4	59
5	81
6	69

5.1.1 Sociodemographic data

The data sample consists of 160 men and 237 women, as well as 1 who did not wish to answer what gender they defined as. This gives us approximately 60% women and 40% men. This is illustrated in figure 11 and 12.

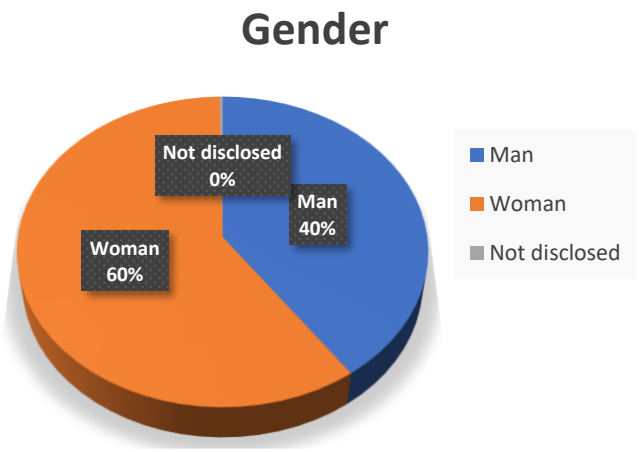


Figure 10: Gender

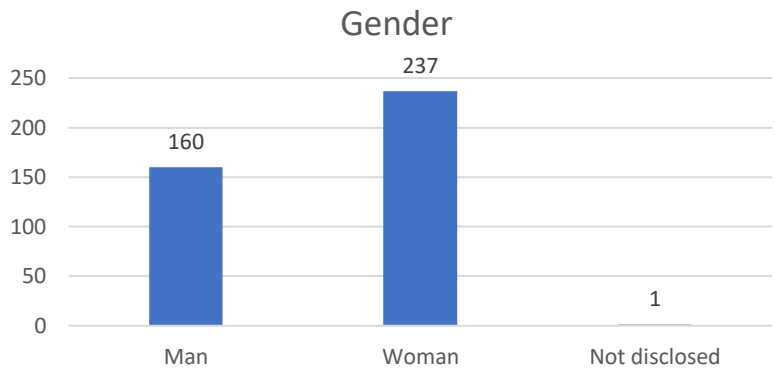


Figure 11: Gender bar chart

5.1.1.1 Age of respondents

The ages of respondents are presented in figures 13 and 14. It shows that we have a pretty good sample with respondent from all age groups represented. 10% is 70 or older, 21% are between

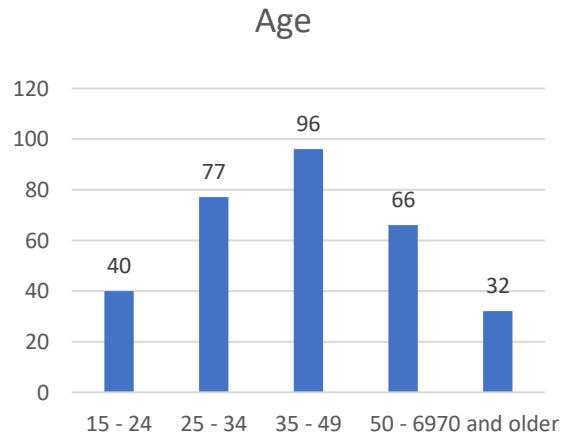


Figure 12: Age bar chart

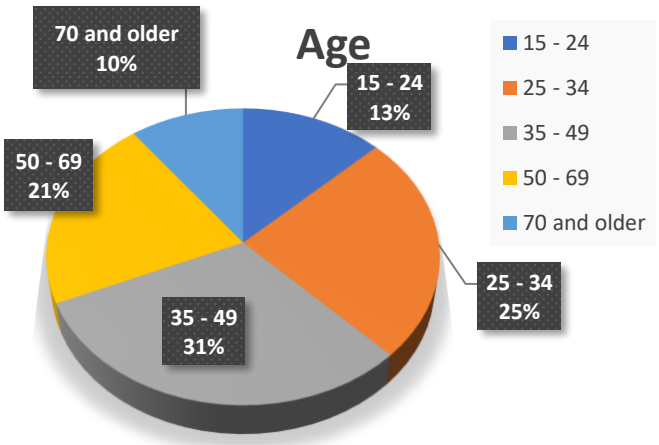


Figure 13: Age

the ages of 50 and 69, 31% between 35 and 49, 25% in the 25 to 34 range with 13% being between 15 and 24 years old.

5.1.1.2 Education level:

The highest level of completed education is displayed in figure 15 and 16. Primary school and Ph.D. both amounts to 3% each of the sample. 23% have completed high school and 43% have a bachelor's degree. Lastly, 28% of the respondents holds a master's degree.

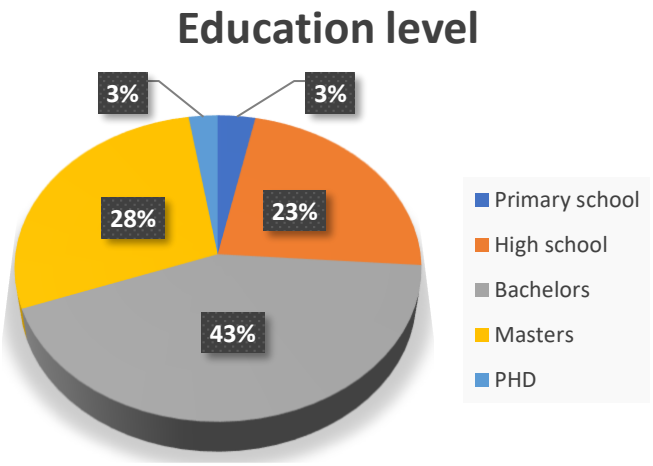


Figure 14: Education level

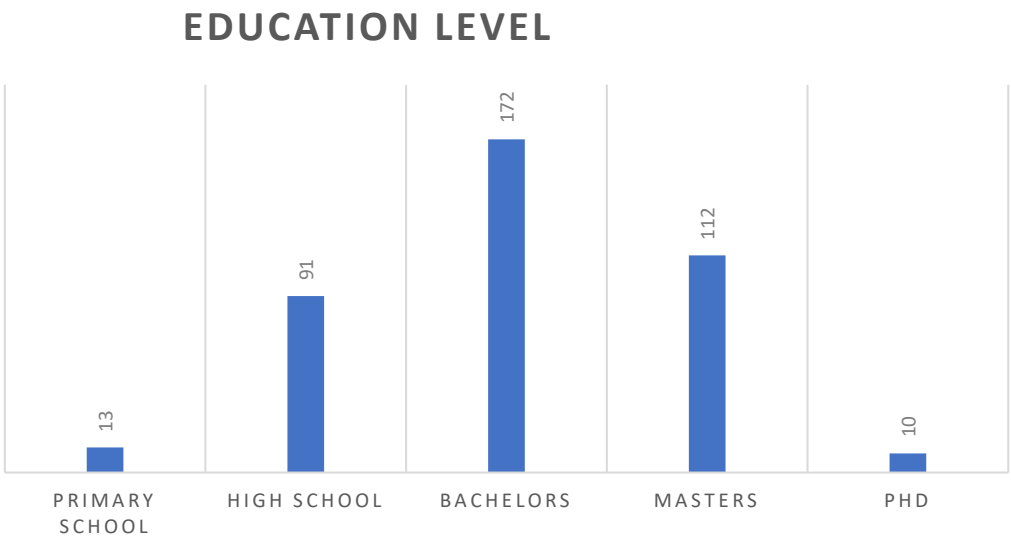


Figure 15: Education level, bar chart

5.1.1.3 Annual income

Next illustrations in figure 17 and 18 shows ranges of annual income for the respondents. 6% of respondents earn below 150.000NOK, 7% earn between 150.001 and 300.000NOK. Ten 10% have an income of 300.001 to 450.000NOK, 26% between 450.001 and 600.000NOK, 22% between 600.001-850.000NOK, 8% between 850.001 and 1.000.000NOK and the remaining 13 percent earn over 1.000.001 shown in the chart in three portions of five, four and four percent respectively. 8% or 33 respondents did not want to disclose their annual income.

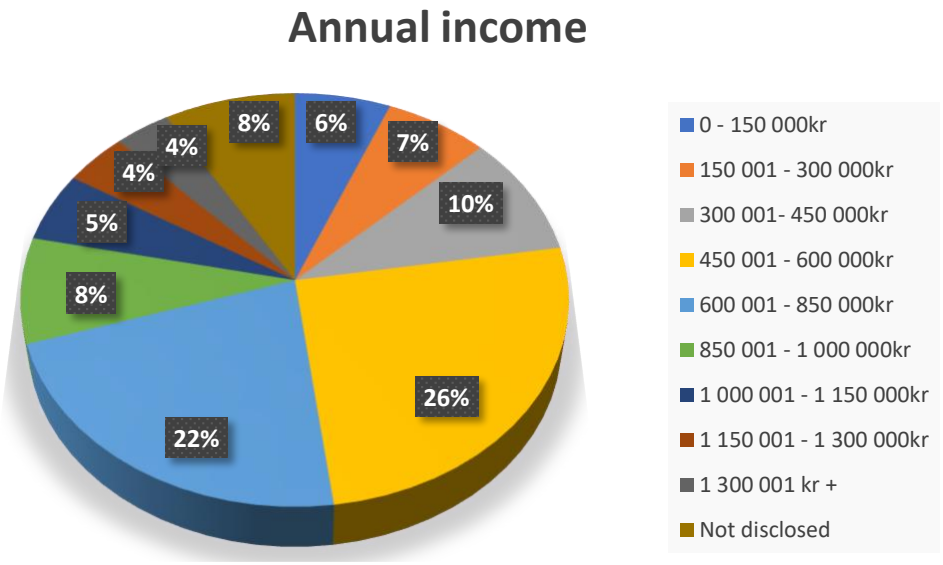


Figure 16: Annual income

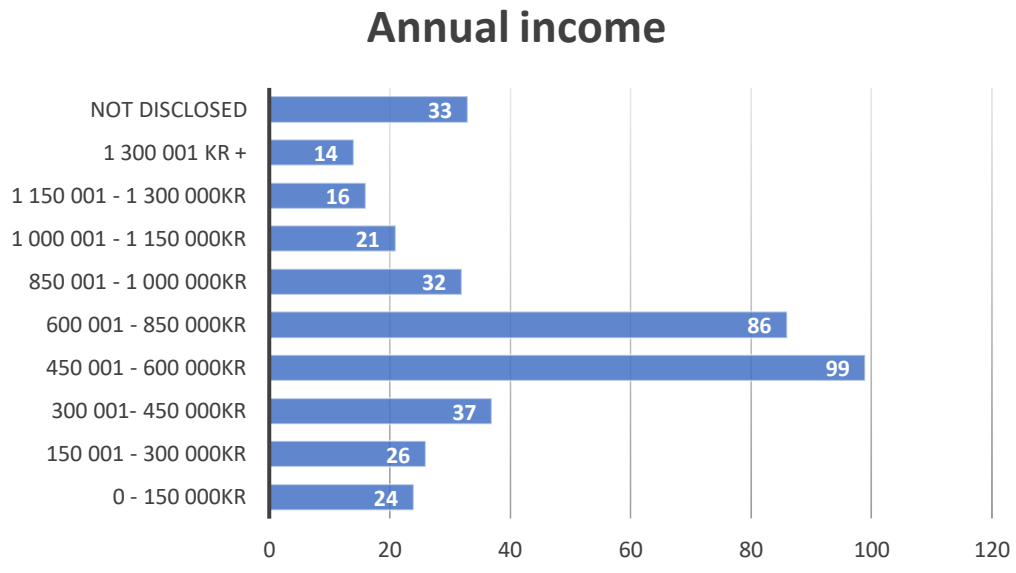


Figure 17: Annual income, bar chart

5.1.2 Environmentally cautious respondents

The respondents were asked different questions regarding their shopping habits and their opinions on various statements to see whether or not they are environmentally aware.

5.1.2.1 Occurrence of shopping online or using home delivery

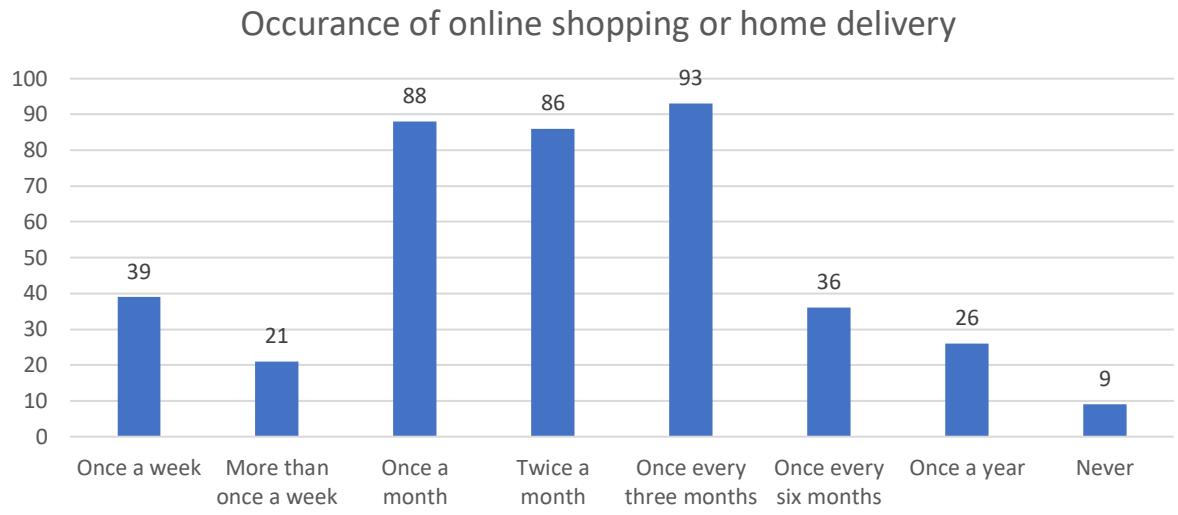


Figure 18: Occurrence of home delivery or online shopping, bar chart

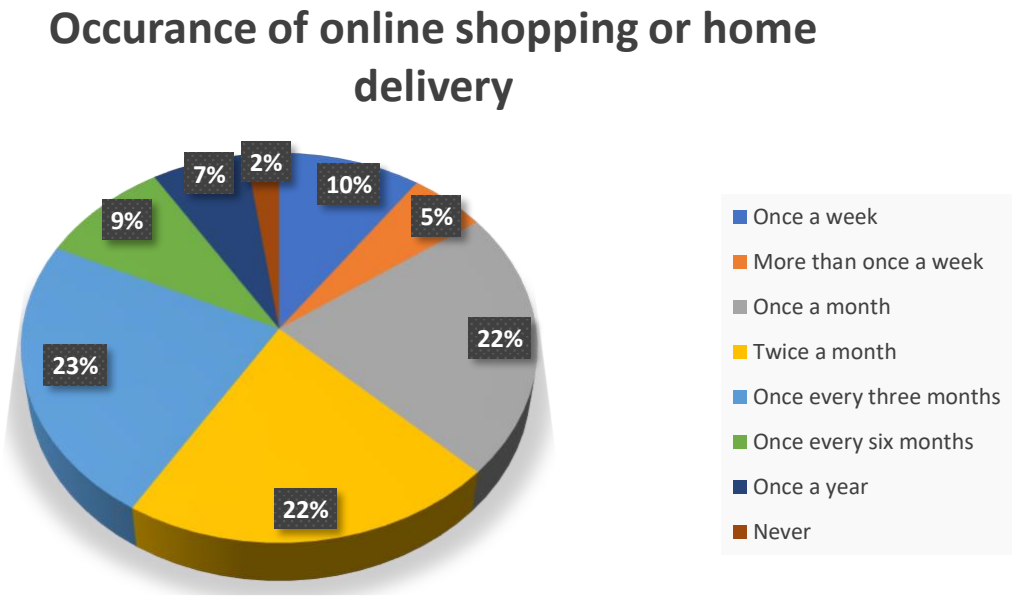


Figure 19: Occurrence of home delivery or online shopping.

Figures 19 and 20 shows the frequency of people shopping online or using home delivery when shopping. Seeing as online shopping usually end as a home delivery, that is the reason this

question is combined to one. 2% or nine respondents never uses this. 15% uses it once a week or more. 44% uses it once or twice a month, split as 22% and 22%. 23% has a frequency of once every three months. Once every nine months and once a year is at 9% and 7% percent respectively.

5.1.2.2 Respondents preference on methods polluting less than vehicles on fossil fuel

The respondents were asked if they preferred methods of transport that pollutes less than fossil fuel driven cars for their deliveries. They answered on a scale of five, from fully disagree to fully agree as shown in figure 21 and 22. The result shows that 153 or about 39% percent of the respondents fully agree to this statement. There were 76 (19%) of the respondents that somewhat agree and 128 (32%) that were indifferent and neither agreed nor disagreed. The remaining 41 respondents (10%) either fully disagree (4%) or somewhat disagreed (6%) with the statement.

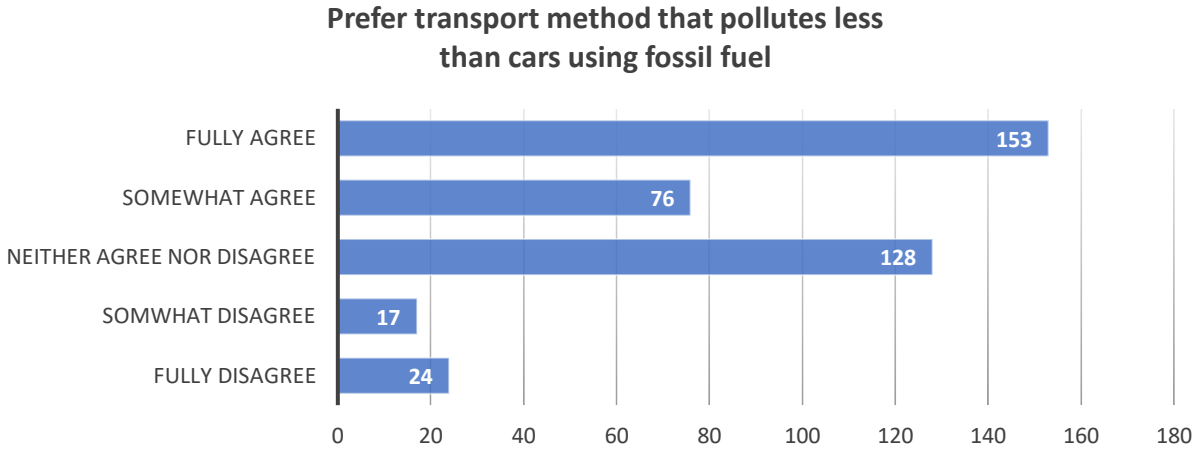


Figure 20: Preference of using lower polluting vehicles, bar chart

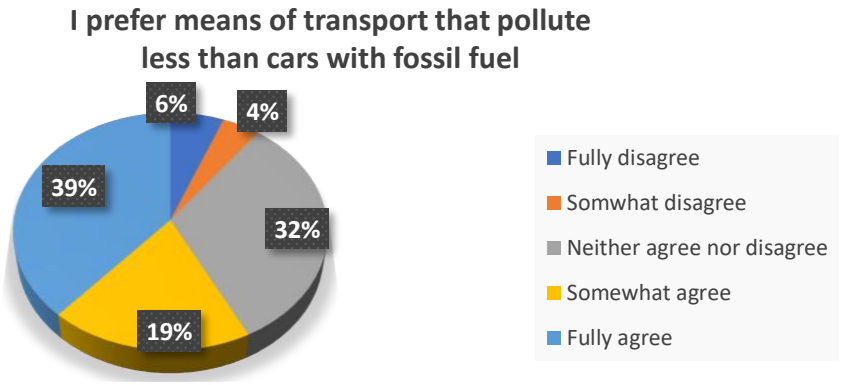


Figure 21: Preference of using lower polluting vehicles

5.1.2.3 Respondents willingness to pay a fee for environmentally friendly deliveries

All respondent was also asked a question about if they were willing to pay a small fee for a more sustainable delivery, similar to climate compensate for flying commercially. Answers were somewhat divided in the three categories. 164 of them, or about forty-one percent (41%) said that yes, they were willing. Twenty-five Percent, 101 respondents, answered that they were not willing. Thirty-four percent (34%), 133 respondents answered that maybe they would be willing. For graphical presentation, see figures 23 and 24.

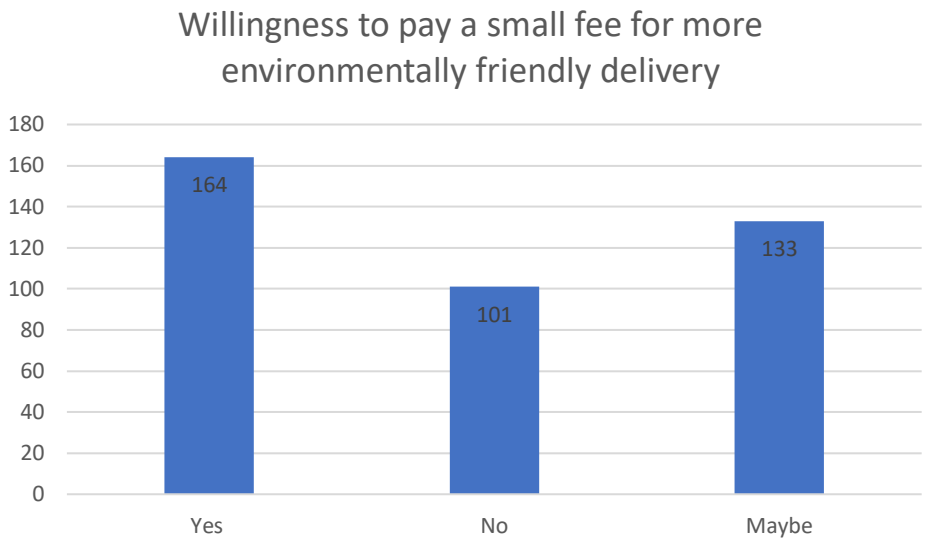


Figure 22: Willing to pay a fee for environmentally friendly delivery, bar chart

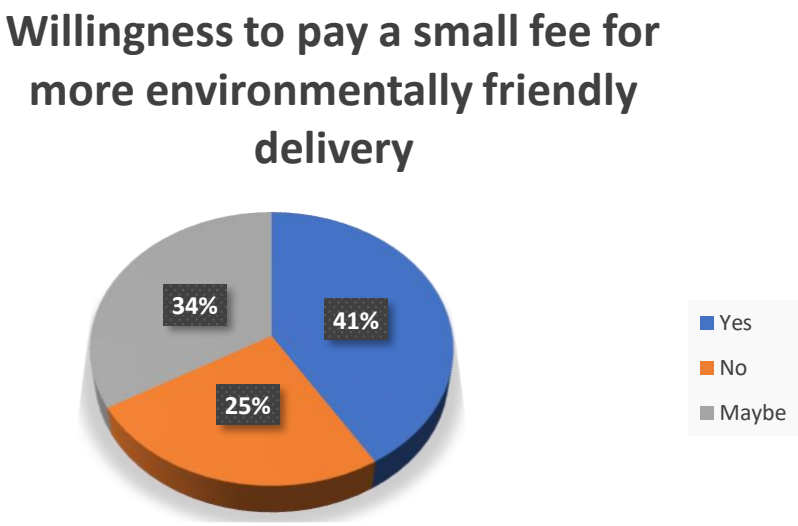


Figure 23: Percentages willing to pay a fee for environmentally friendly delivery

In order to properly understand the responses here, a follow up question was included for the ones answering “No” and “Maybe”, asking them under which circumstances they would be willing to pay such a fee. There were numerous valid arguments and reason for why people answered the way they did.

From the respondents answering maybe, a sizeable portion of the answers agreed that it is dependent on how much the fee were on and on the total price. People stating that things in general are getting more expensive, and that their personal finances do not leave room for paying more for the sake of the environment. Several respondents that answered maybe argued that was that lack of presented prof that the delivery is more eco-friendly and that it does in fact makes a difference, may prevent the resonant form paying a fee, this supports the findings by Bring Research (2019). The impact of the fee is nontangible, and with no way to ensure paying extra reduces the environmental impact, people are skeptical. Information of this should be easily available and trustworthy.

From some of the ones answering maybe, and even more from the respondents answering no, were the concern that the fee did not go towards bettering sustainability, but rather as a means “greenwashing” and to increase profits. A response that came multiple times were that this should not be put on the customer, but rather a duty by the service provider and included as a part of the service and price. From the “no” responders, there is a clear consensus that sustainable deliveries should be the norm. The reasoning was that with the policies already in place in Norway, such as reduced or removed tolls for electric vehicles and incentives for companies to run sustainably, it should make deliveries using sustainable methods the cheapest option. Others argued that fees, taxes and expenses are already too high, making them unwilling to pay. Lastly worth mentioning were arguments about their belief similarly to the maybe respondents. They do not believe that such a contribution has any effect, stating that it is not even a drop in a bucket in the bigger picture. Others, but surprisingly few stated that they simply did not care.

5.1.2.4 Sharing services:

Another question asked were if they thought it is a good idea to use sharing services such as car sharing or Airbnb. Most of the respondents were mainly positive, with forty-one percent (162 respondents) answering that they fully agree and thirty-three percent (133 respondents) saying they somewhat agree. Nineteen percent were undecided answering they neither agree nor disagree and only the remaining seven percent stating that they disagree or somewhat disagree to the statement.

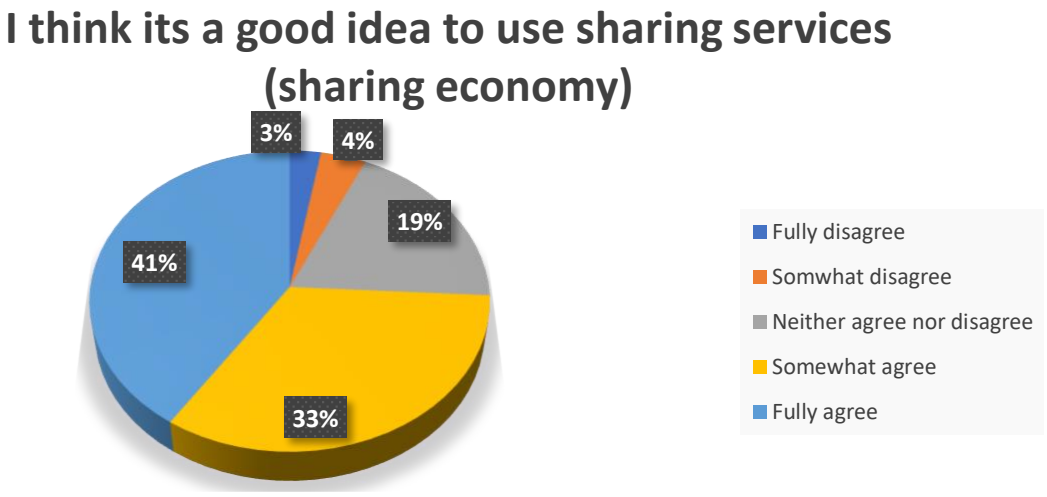


Figure 24: percentages of respondents thinking it is a good idea to use sharing services

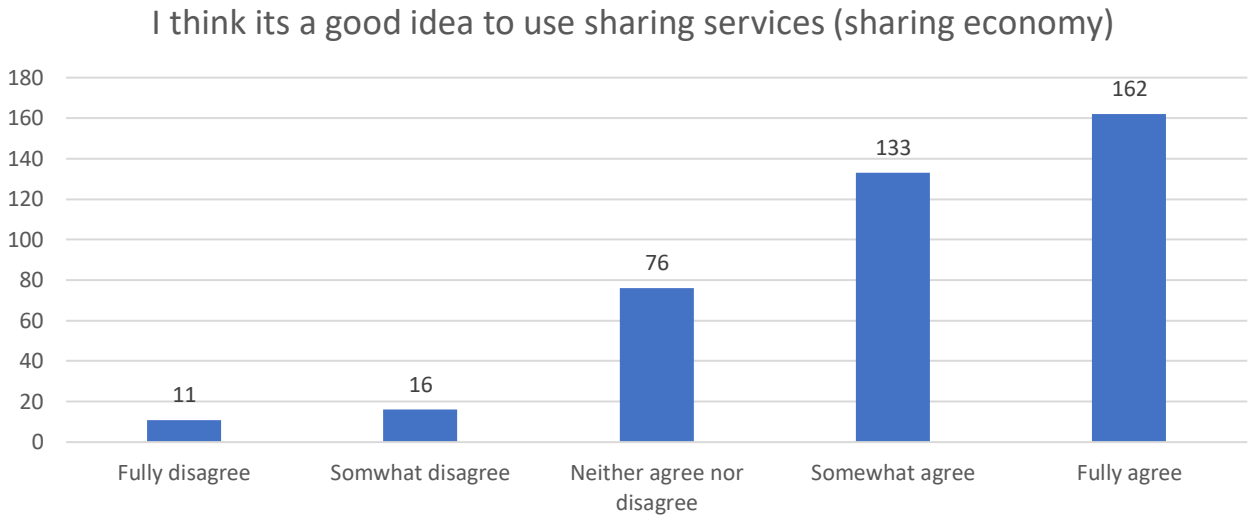


Figure 25: Respondents thinking it is a good idea to use sharing services, bar chart

5.1.2.5 Respondents views on deliveries performed by crowdshippers

Lastly a question asking if respondents would mind if a delivery to them would be performed using crowdshipping. With 282 respondents, 71% of the respondents said it would be fine for a crowdshipper to perform the delivery. 12% or 48 of the respondents expressed that they would not like it. 68 of them, the remaining 17% chose the undecided option and did not know whether or not they had anything against the delivery being performed by a crowdshipper.

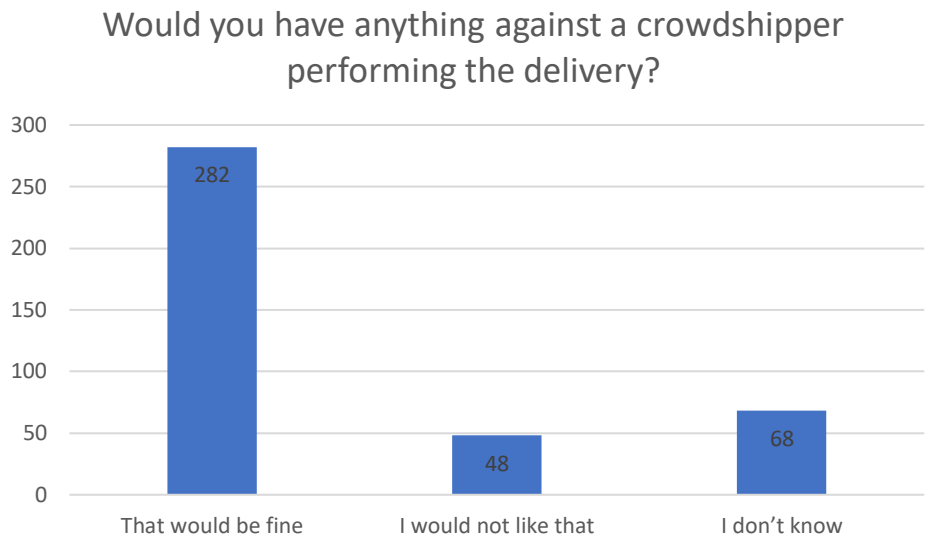


Figure 26: Weather or not the delivery can be performed by a crowdshipper, bar chart

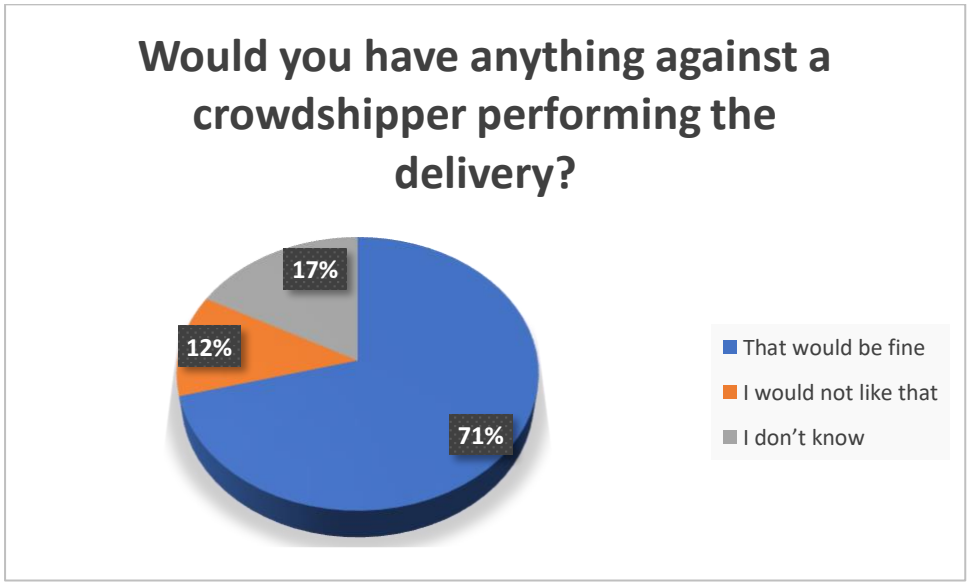


Figure 27: Percentages whether respondents mind having a delivery being performed by crowdshippers.

5.2 Econometric results

This part of the thesis will present the results and model for the estimations. All attributes and levels were included in the calculations. The first estimation includes all attributes and levels in the scenarios.

In estimating the coefficients of the model, the structure of the model considers two alternatives. Alternative 1 (alt1) and alternative 2 (alt2) and both are unlabeled alternatives. The utility function is presented in equation 7.

$$Utility_{alt1} = \beta_1 * Price_1 + \beta_2 * Punctuality_1 + \beta_3 * Lead\ Time_1 + \beta_4 * CO_{yy_1} + \beta_5 * CO_{g_1} + \beta_6 * Flexibility_1$$

Equation 7

$$Utility_{alt1} = \beta_1 * Price_2 + \beta_2 * Punctuality_2 + \beta_3 * Lead\ Time_2 + \beta_4 * CO_{yy_2} + \beta_5 * CO_{g_2} + \beta_6 * Flexibility_2$$

5.2.1 Presentation of model results

The table 11 shows the model for the overall sample of respondents considering all attributes.

Choice	Coefficients	Standard error	Z value	Probability |z|>Z*	95% interval	confidence
Price	-0.01620***	0.00102	-15.85	0.0000	-0.01821	-0.01420
Punctuality	0.01341	0.02312	0.58	0.5619	-0.03190	0.05872
Lead Time	-0.34880***	0.04377	-7.97	0.0000	-0.43458	-0.26302
CO_{YY}	0.24761***	0.04146	5.97	0.0000	0.16636	0.32886
CO_{G}	0.91437***	0.05739	15.93	0.0000	0.80188	1.02686
Flexibility	0.25981***	0.02406	10.80	0.0000	0.80188	0.30696
***,**,* ➔ Significance at 1%, 5%, 10% level.						

Output	Value
Number of observations	2388
Skipped observations	0
Estimation observations	2388
Log Likelihood	-1427.10603

Table 11: Result of the choice model.

The total number of observations done by the model is 2388, none were skipped as the model consider them all fit for use. Price, lead time, CO2 emissions and flexibility are all statistically significant. These are the one that has an impact on the independent variable, the choice. Punctuality is not statistically significant, meaning it cannot be determined if it has effect on the dependent variable choice from the data used for this model.

Now observing the values of the coefficients to what degree the utility of the respondents is affected by each specific attribute, first looking at price. The price is significant at the 1% level and is negative. The assumption that the utility of the respondents decrease with a higher price is therefore true and it will decrease their utility with a factor of -0.01620.

Punctuality is not statistically significant at any level. It being statistically unsignificant in affecting the utility does not tell that punctuality is not an important attribute. Even so, it cannot

be rejected that the value is zero. A plausible explanation as to why might be that the interval or variation of punctuality in the choice situations were too small, rendering them too equal to differentiate between them. Had the punctuality had a wider spread between the two options respondents were presented with could have led to it having a significant effect on their utility. The implication here could be that respondents still consider the largest delay of thirty minutes to one hour from agreed upon delivery time to be acceptable and not too late to affect utility in either direction in the given case.

Looking back to table 10, remark that led time also negatively affect the utility of the respondents, deduced from the negative sign in front of the coefficient. The expectation that with longer lead times the utility decreases is confirmed,. If the lead time increases the utility of the respondent will decrease by the factor of -0.34880.

Amount of CO2 emitted is expressed with two variables, CO_{YY} and CO_{G}. YY for the yellow level and G for the green. In later calculations, the red level is expressed as a combination of both and affecting utility negatively. The assumption is that people prefer a more environmentally friendly delivery, this holds true given the coefficients positive values. However it seems to have even greater impact than first anticipated, as the expected results of the research were that we would find this to hold true, but to a smaller degree.

When it comes to flexibility, the utility of a respondent will increase if there is an ability to change date and time, giving the coefficient a positive value. Flexibility is also statistically significant at the 1% level, meaning it can be confidently stated that the ability to change date and time will increase the utility by 0.25981, giving the assumption that people prefer to have flexibility merit.

When maximizing the utility of a respondent, the attributes that will have the most effect on utility is definitely price. Secondly the CO2 variable followed by lead time. The attribute among these with the least effect on the total utility is flexibility.

5.2.2 Attribute specific willingness to pay

Once you obtain the parameters of the model, you can then estimate the attribute specific willingness to pay (WTP) by dividing the coefficient of each attribute by the coefficient of the price attribute. These are usually given in dollar amount. Results from this research however is

in the Norwegian currency, NOK. Table 12 show the calculation of the WTP value for all the statistically significant attributes.

Attribute	Calculation	WTP value
LT	$\frac{-0{,}3488}{-0{,}01620} * (-1)$	- 21,5308642
CO_{YY}	$\frac{0{,}24761}{-0{,}01620} * (-1)$	15.2845679
CO_G	$\frac{0{,}91437}{-0{,}01620} * (-1)$	56,44259259
$FLEX$	$\frac{0{,}25981}{-0{,}01620} * (-1)$	16,03765432

Table 12: Attribute specific willingness to pay

The coefficients in the model explains the impact on choice in terms of utility measure. This could be somewhat confusing in terms of understanding their meaning. By calculating the WTP values, it can be extrapolated how much a customer is willing to pay for an increase or decrease of one attribute level. Lead time has a negative value and next is an example of how this relationship works. When all other attributes remain the same and by increasing the lead time from two to three days, the price must decrease, hence the negative sign, with 21,5308642NOK (WTP of LT) in order for have the same utility for both options. Figure 29 below depicts a simulation that show two configurations that have the same utility with the difference in lead time and price as explained. For a detailed understanding in how to read these figures, see subchapter 5.3.1 and return.

	beta_price	beta_Punct	beta_LT	beta_co_yy	beta_co_g	beta_flexibility
	-0,0162	0,01341	-0,3488	0,24761	0,91437	0,25981
Description	Price	Punct	LT	co_yy	co_g	Flex
U1 : Price - Lead Time WTP value	588,4691358	-1	3	1	0	-1
U2 : Base configuration	610	-1	2	1	0	-1

Description	U1	U2	exp(U1)	exp(U2)	P(1)	P(2)
U1 vs U2	-10,60521	-10,60521	2,47865E-05	2,47865E-05	50,00%	50,00%

Figure 28: Lead time WTP utility representation.

The U2 base configuration is a random configuration of attributes for a delivery. Changing the configuration of the other alternative, by increasing the lead time by one level and subtracting the WTP value for lead time led to *equal utility.* The probability of choice between these are 50/50 as they lead to the same utility for the respondent.

Given that the emission attribute is expressed with two variables, the WTP calculation will be a little different in such a simulation as with the lead time above. Example is moving from yellow (1,0) to red (-1,-1), entailing moving two down in CO_{YY}, and one down on the CO_g attributes. On the example price of 550, moving from yellow to red is, the new price consumers will be willing to pay is around 463kr.

$$\begin{aligned} & 550 - WTP_{CO_{yy}} - WTP_{CO_{yy}} - WTP_{CO_g} \\ &= 550 - 15{,}2845679 - 15{,}2845679 - 56{,}44259259 \\ &= 550 - 87{,}01172839 \\ &= 462{,}9882716 \end{aligned}$$

The attribute of flexibility is moving from 1 to -1 when going from a flexible to a non-flexible delivery. Giving the total impact on the price as $2 * WTP_{FLEX}$. Explained more precisely, when the delivery is flexible it increases is willingness to pay with 16NOK and when it is not flexible it decreases the willingness to pay with 16NOK.

5.3 Probabilities

The results of the model can be used to calculate the probabilities of being chosen for different configurations of delivery. Simulations can be performed to find the probability of an alternative being chosen instead of the other alternative. Taking the maximum utility scenario as the base case, where all attributes are chosen to maximize the utility for the respondent. If compared with itself we get a 50-50 split in probability of choice, as they are equal. Let's compare some delivery configuration and see how manipulating the attributes effect the probability of choice.

5.3.1 Maximized utility VS with reduced CO

The figure 30 and following similar figures show the probability configurations used in the calculations. The top line describes the attributes with the corresponding coefficients right below (beta_price, beta_ Punct etc..). For maximum probability of choice we expect the price to take on the lowest price tested at 460NOK. Punctuality is expressed as either 1 or -1 for less than thirty minutes delay and thirty minutes to one hour respectively. For maximum probability it takes the value of 1 indicating less than thirty minutes. Lead time is represented as (2; 3; 4) for the number of days for the delivery. in this case 0 for two days, here it takes on 2 for the fastest delivery. CO2 is expressed with two variables, in the following figures they are expressed as the following, (CO_{YY}, CO_G) = (0,1) means green, (1,0) represents yellow and (-1,-1) is Red. Here it takes on (0,1) in U1 and (-1.-1) on U2. This gives the cleanest delivery on the green level for maximum utility of the U1 configuration and the worst level of the attribute, red, for the U2 configuration. Lastly, flexibility is expressed the same as punctuality, expressed as 1 or -1. 1 representing the possibility to change delivery date and time, and -1 is not having the ability. This comparison takes the value 1, as being able to change date and time of the delivery yields the highest utility for the respondents and is present in both.

	beta_price	beta_Punct	beta_LT	beta_co_yy	beta_co_g	beta_flexibility
	-0,0162	0,01341	-0,3488	0,24761	0,91437	0,25981
Description	Price	Punct	LT	co_yy	co_g	Flex
U1 config.	460	1	2	0	1	1
U2 config.	460	1	2	-1	-1	1

Description	U1	U2	exp(U1)	exp(U2)	P(1)	P(2)
Max utility vs max with recreased co from green to red	-6,96201	-9,03836	0,000947191	0,000118765	88,86%	11,14%

Figure 29: Maximized utility vs with reduced sustainability.

Utilities U1 and U2 are calculated by finding the sum product of all coefficient variable values. Applying the natural exponential function to the utilities calculated (U1 and U2). The probabilities are then computed when dividing the exp(U) that is observed by the sum of all exp(U). An example is for P(1) = $\frac{\exp(U1)}{\exp(U1)+\exp(U2)}$ giving the answer of 88,86% probability that the first configuration will be chosen. The same is done for the P(2) and the probability of the second option where the attribute of emission levels are red is 11,14%. The sum of P(1) and P(2) will always add up to 100%. All these formulas are entered into excel to automatically calculate the probabilities when manipulating the attribute levels.

5.3.2 Maximized utility VS with increased price

Next up looking at what happened when changing the price instead of the emission level attribute. Figure 31 show the configuration and resulting from it.

	beta_price	beta_Punct	beta_LT	beta_co_yy	beta_co_g	beta_flexibility
	-0,0162	0,01341	-0,3488	0,24761	0,91437	0,25981
Description	Price	Punct	LT	co_yy	co_g	Flex
U1 config.	610	1	2	0	1	1
U2 config.	460	1	2	0	1	1

Description	U1	U2	exp(U1)	exp(U2)	P(1)	P(2)
Max utility vs max with increased price, 460 to 610	-9,39201	-6,96201	8,33877E-05	0,000947191	8,09%	91,91%

Figure 30: Max utility vs max with increased price, 460 to 610.

When applying this the result show that there is a 91,91% chance that the maximized utility configuration will be chosen, as expected this indicates that respondent heavily favors the scenario that has the lowest price.

5.3.4 Lowest price and minimized utility VS Highest price with maximum utility

An interesting comparison will be to check the probability of choice if the attribute price takes on the lowest score to maximize its impact on utility and having the rest of the attributes minimize utility. Comparing this to the reverse, where price is high and negatively effecting utility, but all the rest of the attributes are configured to maximize it. Figure 32 illustrates this issue.

	beta_price	beta_Punct	beta_LT	beta_co_yy	beta_co_g	beta_flexibility
	-0,0162	0,01341	-0,3488	0,24761	0,91437	0,25981
Description	Price	Punct	LT	co_yy	co_g	Flex
U1 config.	460	-1	4	-1	-1	-1
U2 config.	610	1	2	0	1	1

Description	U1	U2	exp(U1)	exp(U2)	P(1)	P(2)
Max utility vs max with increased price, 460 to 610	-10,2824	-9,39201	3,42303E-05	8,33877E-05	29,10%	70,90%

Figure 31: Lowest price and minimized utility VS Highest price with maximum utility.

The result provides valuable insight, probability of choice is 70,9% in favor of the option with the highest price. 29,1% probability going to the option where the price was lowest. This is indicative of the fact the price attribute does not outweigh the rest of the attributes combined. 70,9% would choose a higher price given that it arrives faster, pollutes less and has flexibility. Price is still a strong indicator, as if the other attributes were equal and only differing in price the picture would look different. The situation in figure 31 proves.

5.3.5 Lead time and co comparison

Next up, when keeping most attributes equal, but changing the lead time and co configuration, the resulting figure 31 is the result. The price, punt and flexibility are kept the same. The first configuration has a lead time of four days, the highest value and the middle value yellow for emissions. The second has the lowest value for lead time and the highest for emissions, red. Keep in mind that the red level for CO2 will have a negative impact on utility, while yellow and green gives positive.

	beta_price	beta_Punct	beta_LT	beta_co_yy	beta_co_g	beta_flexibility
	-0,0162	0,01341	-0,3488	0,24761	0,91437	0,25981
Description	Price	Punct	LT	co_yy	co_g	Flex
U1 config.	550	1	4	1	0	1
U2 config.	550	1	2	-1	-1	1

Description	U1	U2	exp(U1)	exp(U2)	P(1)	P(2)
lead time and co change	-9,78437	-10,49636	5,63251E-05	2,76369E-05	67,08%	32,92%

Figure 32: lead time and CO2 changes.

The resulting probabilities are 67,08% for option 1. Increasing lead time with two levels while decreasing the sustainability measure with 1 still yields the highest probability for the longest lead time option, indicating that lead time matters less than the emission attribute for choice probability. Another configuration of comparisons that corroborate this is shown in figure 34. This shows that a max level lead time with best CO2 versus a middle level on both attributes (3+1 in figure) yields a similar utility, almost as they cancel each other out. The option with the better sustainability still wins with 57,88% probability.

	beta_price	beta_Punct	beta_LT	beta_co_yy	beta_co_g	beta_flexibility
	-0,0162	0,01341	-0,3488	0,24761	0,91437	0,25981
Description	Price	Punct	LT	co_yy	co_g	Flex
1	550	1	3	1	0	1
2	550	1	2	-1	-1	1
3	550	1	4	0	1	1

Description	U1	U2	exp(U1)	exp(U2)	P(1)	P(2)
1+2	-9,43557	-10,49636	7,98333E-05	2,76369E-05	74,28%	25,72%
2+3	-10,49636	-9,11761	2,76369E-05	0,000109717	20,12%	79,88%
3+1	-9,11761	-9,43557	0,000109717	7,98333E-05	57,88%	42,12%

Figure 33: More lead time and CO2

Note that it is possible for the utility to be higher for option 1 described in figure 34 by further reducing the lead time one level to two days. That configuration is actually better than configuration 3 by a small margin and it leads to a 50,77% choice probability of option 1, making it 0.77% better.

5.3.6 Lead time and price comparison

From the result of figure 35 it is clear that price weigh than lead time. The third configuration beats both of the others in probability of choice. 75,2% probability for three compared to one, and 84,97% probability over two, even though the lead time is longer in both cases.

	beta_price	beta_Punct	beta_LT	beta_co_yy	beta_ co_g	beta_flexibility
	-0,0162	0,01341	-0,3488	0,24761	0,91437	0,25981
Description	Price	Punct	LT	co_yy	co_g	Flex
1	550	1	3	1	0	1
2	610	1	2	1	0	1
3	460	1	4	1	0	1

Description	U1	U2	exp(U1)	exp(U2)	P(1)	P(2)
1+2	-9,43557	-10,05877	7,98333E-05	4,28087E-05	65,09%	34,91%
2+3	-10,05877	-8,32637	4,28087E-05	0,000242049	15,03%	84,97%
3+1	-8,32637	-9,43557	0,000242049	7,98333E-05	75,20%	24,80%

Figure 34: Lead time and price comparison.

5.3.7 Case scenario comparison

Remembering back to the case description, the company Nimber has three specific scenarios they are able to provide. In the following figure 36 , the configuration and the choice probabilities between the choices are computed. The first scenario is delivery by E-vans only using E-vans from Nimber start to finish. This is the most expensive configuration, as it is more time consuming than being able to rearrange and conform deliveries at e.g. a micro hub or similar to increase efficiency of parcel delivery. For these reasons it also has the highest level of lead time. E-vans pollute less than vehicles using fossil fuel giving this a yellow or medium level on the environmental attribute. With the needed planning and the need for charging of the E-vans, this option does not give the ability to change date and time for the delivery, making it not flexible.

The second scenario is Nimber bringing the parcel to a micro-hub by E-vans, before it can be sorted for efficient deliveries to areas in close proximity. The delivery from the micro-hub is performed with dedicated bringers. This option takes on the middle price of 550NOK and is the fastest of the three scenarios, with only two days delivery time. It is also the most environmentally friendly delivery option, having the value green (0,1). The main reason being the ability to serve the same area in the same trips, reducing unnecessary travel time and costs. Due to the micro-hubs the company has better flexibility giving it the value 1, being able to change date and time for this option.

Case scenario three is similar to the second scenario, but this one also includes the use of crowdshippers for delivering from the micro-hub to the designated spot to the end consumer. It is the cheapest scenario, has the middle value of 3 days lead time and is flexible, however it has the red or high value for the sustainability attribute. This is due to the fact that it cannot be guaranteed that the delivery is performed in a sustainable manner when using crowdshippers.

	beta_price	beta_Punct	beta_LT	beta_co_yy	beta_co_g	beta_flexibility
	-0,0162	0,01341	-0,3488	0,24761	0,91437	0,25981
Config. description	Price	Punct	LT	co_yy	co_g	Flex
Case Scenario 1	610	-1	4	1	0	-1
Case Scenario 2	550	1	2	0	1	1
Case Scenario 3	460	1	3	-1	-1	1

Description	U1	U2	exp(U1)	exp(U2)	P(1)	P(2)
Scenario 1 vs Scenario 2	-11,30281	-8,42001	1,23382E-05	0,000220412	5,30%	94,70%
Scenario 1 vs Scenario 3	-11,30281	-9,38716	1,23382E-05	8,37931E-05	12,83%	87,17%
Scenario 2 vs Scenario 3	-8,42001	-9,38716	0,000220412	8,37931E-05	72,46%	27,54%

Figure 35: Case scenario configuration and computation.

The results from comparing all three scenarios against each other is as follows. When choosing between scenario 1 and 2, the choice probability of scenario 1 is 5,3% and scenario 2, 94,7%. This predicts that respondents would favor scenario two far better than one. Further we compare scenario 1 against scenario 3. This results in a choice probability of 12,83% for scenario 1 and 87,17% for 3. Lastly, let's introduce the result from comparing scenario 2 and 3. Between the choice of one or the other, the probability of choosing scenario 2 is at 72,46% and scenario 3 at 27,54%.

This leads to the ranking of the options, from the best to the worst.

1. Scenario 2, highest probability compared to both.
2. Scenario 3, lower probability than scenario 2 and higher than scenario 1.
3. Scenario 1, lowest probability compared to both.

Theory on Crowdshipping argues that it is a measure to improve sustainability, here it gets the lowest score in that attribute. Therefore we can run one more test with these scenarios, except we change the sustainability attribute for scenario 3 to be green. This is interesting to know, as if the assumption is that the pollutions that are a result of the travel by the crowdshipper already is being emitted by the journey said crowdshipper is taking anyway, we could for argument sake assume that there is no more pollution from the act of performing the delivery. Figure 37 illustrates this example.

	beta_price	beta_Punct	beta_LT	beta_co_yy	beta_ co_g	beta_flexibility
	-0,0162	0,01341	-0,3488	0,24761	0,91437	0,25981
Config. description	Price	Punct	LT	co_yy	co_g	Flex
Case Scenario 1	610	-1	4	1	0	-1
Case Scenario 2	550	1	2	0	1	1
Case Scenario 3	460	1	3	0	1	1

Description	U1	U2	exp(U1)	exp(U2)	P(1)	P(2)
Scenario 1 vs Scenario 2	-11,30281	-8,42001	1,23382E-05	0,000220412	5,30%	94,70%
Scenario 1 vs Scenario 3	-11,30281	-7,31081	1,23382E-05	0,000668276	1,81%	98,19%
Scenario 2 vs Scenario 3	-8,42001	-7,31081	0,000220412	0,000668276	24,80%	75,20%

Figure 36: Case scenario configuration and computation with adjusted scenario 3.

This yields an interesting result. Scenario 3 is now the best option. Having a choice probability of 75,2% when compared to option 2 as it is the cheaper option, and 98,19% when comparing with scenario 1.

Chapter 6

6. Implications of the research

This chapter towards the end of this thesis discusses the implications of the results and how it could be used for improvements for delivery, both from a managerial and policy perspective.

6.1 Managerial implications

Most companies are in business to make money and maximize their profits. For transport providers, having a competitive advantage and ensuring customer satisfaction is key to run the business successfully. To gain this, the right configuration of deliveries is important. This research assesses different attributes of home delivery to see how they affect consumers utility and choice of delivery.

The result show that consumers utility is dependent upon the price , lead time, sustainability and flexibility of the lead time. It gives insight into whether the customer chooses one type of delivery over the other. With this information, businesses, and specifically the case company Nimber, could be used as a guiding tool for decision making moving forward. Knowing what the customer want is not always an easy task, and with this work, you can easily compare the different scenarios.

The assumption is that the customer act rationally and will choose the option that maximizes their utility. The attributes mentioned effect the total utility of the respondent to a different degree. Keeping every level of the attributes of two options the same, the choice is fifty-fifty. However, changing one of the levels of the attribute to a better or worse will make the respondents heavily favor the one with the best utility, even if the deliveries are very similar. It is impossible to be a transport service provider that could always deliver the maximum utility option to every customer. This is why the research represent the whole population. Delivering the fastest and cheapest, as well as sustainable and flexible should be strived for, however very hard to do in a competitive market. The cost of being best on one attribute, often comes at a price for another attribute. Prime example of this is that express, fast deliveries cost more than regular ones. This is why this research is important from a managerial perspective, being able to compare the tradeoffs between delivery configurations and being able to make decisions accordingly.

Note that punctuality is not discussed in full above. The data of this attribute was not statistically

significant in the research, meaning it cannot be determined if it has an effect on the respondent utility or not, most likely due to the lack of variation of the attribute presented to respondents in the choice situations. With reasonable thought, it leads to the assumption that punctuality should be affecting utility to some degree. However, with the present and future service level Nimber is able to provide, given that the variation in delay is small and only amounting to half an hour, it could be assumed that from a managerial perspective this is not a relevant factor in determining choice.

The consensus of the data show that for Nimber, the scenario two from the given service levels they can provide will give the customers the highest utility between the options, having the highest probability of choice. It also shows what attributes to improve upon, to make the service level even better in the future.

6.2 Policy implications

Being able to improve the sustainability effects scenario three has on the environment would make this the absolute preferred choice. The analysis of the data clearly shows that sustainability measures are important for customers. Policy makers are already aware of the problem facing society connected to sustainability. Given the amount of pollution the transport sector is responsible for, further measures for improved sustainability are required. Policy makers can exploit the information here, justifying further measures for facilitating sustainable crowdshipping using the extensive public transport infrastructure present in Oslo.

Chapter 7

7. Conclusions

The purpose of this thesis was to determine what factors influence the choice of home deliveries in Oslo, and to what degree.

Demand for home deliveries have increased, with consumers having high expectation to the transport service provider. This research considered the population in Oslo, the most populated city in Norway as well as zones around where transport providers operate. With a high volume of e-commerce activities and well-developed transport infrastructure, together with the case presented made Oslo the most suited location.

7.1 Answer to the research question

The research question presented in the start has been the foundation for the research through every phase. The objective was to find out what are the factors influencing consumers choice of home deliveries, and to what degree. In addition, determining an appropriate way for measuring these factors. The five factors or attributes determined to be most importance on choice based on surveyed respondents, the case company and scholars were price, punctuality, lead time, flexibility and sustainability in terms of how much a delivery pollutes. A discrete choice experiment was performed to be able to model respondents answer in a multinomial logit model. This produces the attribute coefficients measuring attribute impact in the form of utility. Price and lead time have a negative effect on utility and the others a positive effect.

The result show that price is the most influential attribute, next was CO2 emission level followed by lead time. Flexibility is the least important among them, still having a significant effect. Punctuality was not statistically significant, and it cannot be determined if it has any influence on choice based on this research.

7.2 Limitations

This thesis considered five attributes for explaining the choice behavior of respondent, other attributes not considered in thesis may also influence the choice behavior of people, by not limiting the attributes to five may lead to different results.

Secondly is the setup of the survey. Asking respondents to answer question regarding sustainability right before the choice situation may have skewed the results in favor of this attribute, as respondents may want to appear more environmentally conscious then they really are.

The stated preference did not include alternative specific constant. So the respondent was not provided with the option to choose neither of the choice situation presented (opt out). Forcing them to answer, even if they would not want to use any alternatives. It may to some degree influence the realness of the result.

7.3 Suggestion for further research

With respect to the limitation mentioned for the sustainability questions, it would be interesting to do further research on the revealed preference to see if this research holds true to the actual actions of the respondents. They could for example include a version of "nudging" for half of the response collection and neutral on the other half, to see if this alters the results.

As discussed in the managerial implications, the punctuality is not significant. In order to conclusively determine if punctuality of the delivery has a measurable effect on the choice of delivery of the people of Oslo, a suggestion is to in later research increase the variation of the levels of the punctuality attribute. Meaning increasing the time of delay to differ more from each other. It could also be interesting to increase the number of levels in order to get bigger differences and data that can really tell if punctuality is indeed unsignificant for choice of delivery. In addition to this, including other attributes apart from the ones mentioned here would be beneficial for better determining choice behavior.

Generally including an alternative specific constant is recommended for the choice situations.. Seeing as it creates higher real-life estimation, by adding this for future research it can either bring a more realistic result or support the findings of this study.

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Appendix

Appendix 1 – All choice situations

1	Option 1	Option 2
Price	460	610
Punctuality	Less than 30min	More than 1h
Lead.Time	3	3
CO2	Red	Green
Flex	No	Yes

2	Option 1	Option 2
Price	460	610
Punctuality	Less than 30min	More than 1h
Lead.Time	3	3
CO2	Red	Green
Flex	Yes	No

3	Option 1	Option 2
Price	550	550
Punctuality	Less than 30min	More than 1h
Lead.Time	3	3
CO2	Red	Yellow
Flex	No	Yes

4	Option 1	Option 2
Price	460	610
Punctuality	Less than 30min	More than 1h
Lead.Time	4	2
CO2	Red	Green
Flex	Yes	No

19	Option 1	Option 2
Price	460	460
Punctuality	Less than 30min	More than 1h
Lead.Time	3	3
CO2	Yellow	Red
Flex	No	Yes

20	Option 1	Option 2
Price	550	460
Punctuality	More than 1h	Less than 30min
Lead.Time	2	4
CO2	Green	Yellow
Flex	No	Yes

21	Option 1	Option 2
Price	550	460
Punctuality	More than 1h	Less than 30min
Lead.Time	2	4
CO2	Green	Yellow
Flex	Yes	No

22	Option 1	Option 2
Price	610	610
Punctuality	More than 1h	Less than 30min
Lead.Time	4	2
CO2	Yellow	Red
Flex	Yes	No

5	Option 1	Option 2
Price	610	550
Punctuality	Less than 30min	More than 1h
Lead.Time	4	2
CO2	Green	Red
Flex	No	Yes

23	Option 1	Option 2
Price	550	550
Punctuality	Less than 30min	More than 1h
Lead.Time	2	4
CO2	Red	Yellow
Flex	No	Yes

6	Option 1	Option 2
Price	550	610
Punctuality	More than 1h	Less than 30min
Lead.Time	2	4
CO2	Red	Yellow
Flex	Yes	No

24	Option 1	Option 2
Price	460	610
Punctuality	More than 1h	Less than 30min
Lead.Time	3	3
CO2	Red	Green
Flex	No	Yes

7	Option 1	Option 2
Price	550	550
Punctuality	More than 1h	Less than 30min
Lead.Time	3	3
CO2	Green	Red
Flex	No	Yes

25	Option 1	Option 2
Price	550	610
Punctuality	Less than 30min	More than 1h
Lead.Time	4	2
CO2	Green	Yellow
Flex	Yes	No

8	Option 1	Option 2
Price	460	610
Punctuality	More than 1h	Less than 30min
Lead.Time	4	2
CO2	Red	Yellow
Flex	No	Yes

26	Option 1	Option 2
Price	460	550
Punctuality	More than 1h	Less than 30min
Lead.Time	2	4
CO2	Red	Green
Flex	No	Yes

9	Option 1	Option 2
Price	610	460
Punctuality	More than 1h	Less than 30min
Lead.Time	3	3
CO2	Yellow	Red
Flex	Yes	No

27	Option 1	Option 2
Price	460	610
Punctuality	More than 1h	Less than 30min
Lead.Time	4	2
CO2	Yellow	Green
Flex	No	Yes

10	Option 1	Option 2
Price	610	460
Punctuality	Less than 30min	More than 1h
Lead.Time	2	4
CO2	Yellow	Red
Flex	No	Yes

28	Option 1	Option 2
Price	460	610
Punctuality	More than 1h	Less than 30min
Lead.Time	3	3
CO2	Red	Yellow
Flex	Yes	No

11	Option 1	Option 2
Price	610	460
Punctuality	Less than 30min	More than 1h
Lead.Time	2	4
CO2	Yellow	Red
Flex	Yes	No

29	Option 1	Option 2
Price	460	460
Punctuality	Less than 30min	More than 1h
Lead.Time	4	2
CO2	Green	Yellow
Flex	Yes	No

12	Option 1	Option 2
Price	610	550
Punctuality	More than 1h	Less than 30min
Lead.Time	4	2
CO2	Green	Red
Flex	No	Yes

30	Option 1	Option 2
Price	550	550
Punctuality	More than 1h	Less than 30min
Lead.Time	3	3
CO2	Red	Yellow
Flex	Yes	No

13	Option 1	Option 2
Price	550	610
Punctuality	More than 1h	Less than 30min
Lead.Time	4	2
CO2	Green	Yellow
Flex	Yes	No

14	Option 1	Option 2
Price	610	550
Punctuality	More than 1h	Less than 30min
Lead.Time	2	4
CO2	Yellow	Green
Flex	No	Yes

15	Option 1	Option 2
Price	610	460
Punctuality	Less than 30min	More than 1h
Lead.Time	2	4
CO2	Green	Red
Flex	Yes	No

16	Option 1	Option 2
Price	610	550
Punctuality	Less than 30min	More than 1h
Lead.Time	3	3
CO2	Green	Red
Flex	No	Yes

31	Option 1	Option 2
Price	550	550
Punctuality	More than 1h	Less than 30min
Lead.Time	4	2
CO2	Green	Red
Flex	No	Yes

32	Option 1	Option 2
Price	460	550
Punctuality	Less than 30min	More than 1h
Lead.Time	4	2
CO2	Yellow	Green
Flex	Yes	No

33	Option 1	Option 2
Price	610	460
Punctuality	Less than 30min	More than 1h
Lead.Time	2	4
CO2	Green	Yellow
Flex	No	Yes

34	Option 1	Option 2
Price	460	550
Punctuality	Less than 30min	More than 1h
Lead.Time	4	2
CO2	Yellow	Green
Flex	No	Yes

17	Option 1	Option 2
Price	610	460
Punctuality	More than 1h	Less than 30min
Lead.Time	2	4
CO2	Yellow	Red
Flex	Yes	No

18	Option 1	Option 2
Price	610	610
Punctuality	Less than 30min	More than 1h
Lead.Time	3	3
CO2	Red	Green
Flex	Yes	No

35	Option 1	Option 2
Price	550	460
Punctuality	Less than 30min	More than 1h
Lead.Time	3	3
CO2	Yellow	Green
Flex	Yes	No

36	Option 1	Option 2
Price	550	460
Punctuality	More than 1h	Less than 30min
Lead.Time	2	4
CO2	Yellow	Green
Flex	Yes	No

Appendix 2 - Design of the questionnaire in Norwegian. (Block 1)

Spørreundersøkelse - Hjemmelevering

Hver dag gjør samfunnet tiltak for å beskytte miljøet. Crowdshipping er et nyttig konsept for å forbedre bærekraften. Crowdshipping er en alternativ måte å levere varer på, ved at pendlere brukes til å levere
pakker på reiser som de uansett ville tatt. Dermed reduseres trafikkbelastning og forurensing.

Vår forskning har som mål å forbedre bærekraftige hjemleveringer i Oslo. Denne undersøkelsen representerer ulike transportscenarier. Vi ønsker å finne ut hvilke egenskaper/ attributter som påvirker forbrukerne mest når de velger leveringsalternativer.

Spørreundersøkelsen tar 3-5 minutter.

Dette spørreskjemaet er en del av LEAD-prosjektet (www.leadproject.eu) utført av en forskergruppe fra Høgskolen i Molde. Informasjonen som samles inn her vil bli behandlet som konfidensiell og vil ikke bli avslørt og/eller brukt til andre formål enn rent akademiske. Mer informasjon kan fås på epost cana@himolde.no

*Må fylles ut

Synspunkter på utslipp og Eco-løsninger

Vi ønsker å vite ditt syn på noen miljø- og transportrelaterte spørsmål. Hvordan vurderer du følgende utsagn?

1. 1.1 Hvor ofte handler du på nett eller bruker hjemlevering? *

Markér bare én oval.

- ◯ Mer enn en gang i uken
- ◯ En gang i uken
- ◯ To ganger i måneden
- ◯ En gang i måneden
- ◯ En gang hver tredje måned
- ◯ En gang hver sjette måned
- ◯ En gang i året
- ◯ Aldri

2. 1.2 Jeg foretrekker transportmiddel som forurenser mindre enn biler på fossilt brensel for å transportere pakken min. *

1 - helt uenig, 2 - litt uenig, 3 - verken enig eller uenig, 4 - litt enig, 5 - helt enig

Markér bare én oval.

	1	2	3	4	5	
Helt uenig	◯	◯	◯	◯	◯	Helt enig

3. 1.3 Er du villig til å betale en liten avgift for en mer miljøvennlig levering? *

Markér bare én oval.

- ◯ Ja *Hopp til spørsmål 5*
- ◯ Nei
- ◯ Kanskje

Dersom du svarte "Nei" eller "Kanskje"

Vil du være villig til å betale en liten avgift for en mer miljøvennlig levering?

4. Vennligst utdyp hvorfor du ikke er villig eller i hvilke tilfeller du kan være villig til å betale en liten avgift for en mer miljøvennlig levering.

Synspunkter på utslipp og Eco-løsninger

Vi ønsker å vite ditt syn på noen miljø- og transportrelaterte spørsmål. Hvordan vurderer du følgende utsagn?

5. 1.4 Jeg tror det er en god idé å bruke delingstjenester (bildeling, Airbnb, ...). *

1 - helt uenig, 2 - litt uenig, 3 - verken enig eller uenig, 4 - litt enig, 5 - helt enig

Markér bare én oval.

	1	2	3	4	5	
Hetl uenig	◯	◯	◯	◯	◯	Helt enig

6. 1.5 Har du noe imot om pakken din ble levert av en crowdshipper (privatperson), * som uansett reiser samme vei, i stedet for en person fra for eksempel PostNord?

Crowdshipping er en alternativ måte å levere varer på, ved at pendlere brukes til å leverepakker på reiser som de uansett ville tatt.

Markér bare én oval.

- ◯ Det hadde jeg ikke likt
- ◯ Det hadde gått fint
- ◯ Jeg vet ikke

Stated Choice

Under vil du bli presentert for to alternativer, 1 og 2, med ulike attributter/egenskaper knyttet til en hjemlevering av større volum. Eksempel på volum illustrert under.

Velg alternativet du foretrekker av de to tilgjengelige.

Se for deg du for eksempel har kjøpt ett skap på en møbelforretning og skal få det fraktet hjem.

7. 2.1 Av disse to alternativene, hvilken ville du valgt? *

Valgsituasjon	Alternativ 1	Alternativ 2
Pris for levering	460kr	610kr
Punktligheten av leveransen (forsinkelse)	Mindre enn 30 min	30 min - 1t
Tid fra bestilling til mottatt vare (ledetid)	3 dager	3 dager
Mengde CO2 utslipp per leveranse	HØY	LAV
Fleksibilitet (mulighet for å endre tid og dato)	Ja	Nei

Markér bare én oval.

- ◯ Alternativ 1
- ◯ Alternativ 2

8. 2.2 Av disse to alternativene, hvilken ville du valgt? *

Valgsituasjon	Alternativ 1	Alternativ 2
Pris for levering	460kr	610kr
Punktligheten av leveransen (forsinkelse)	Mindre enn 30 min	30 min - 1t
Tid fra bestilling til mottatt vare (ledetid)	4 dager	2 dager
Mengde CO2 utslipp per leveranse	HØY	LAV
Fleksibilitet (mulighet for å endre tid og dato)	Ja	Nei

Markér bare én oval.

- ◯ Alternativ 1
- ◯ Alternativ 2

9. 2.3 Av disse to alternativene, hvilken ville du valgt? *

Valgsituasjon	Alternativ 1	Alternativ 2
Pris for levering	550kr	610kr
Punktligheten av leveransen (forsinkelse)	30 min - 1t	Mindre enn 30 min
Tid fra bestilling til mottatt vare (ledetid)	2 dager	4 dager
Mengde CO2 utslipp per leveranse	HØY	MEDIUM
Fleksibilitet (mulighet for å endre tid og dato)	Ja	Nei

Markér bare én oval.

- ◯ Alternativ 1
- ◯ Alternativ 2

10. 2.4 Av disse to alternativene, hvilken ville du valgt? *

Valgsituasjon	Alternativ 1	Alternativ 2
Pris for levering	610kr	550kr
Punktligheten av leveransen (forsinkelse)	30 min - 1t	Mindre enn 30 min
Tid fra bestilling til mottatt vare (ledetid)	4 dager	2 dager
Mengde CO2 utslipp per leveranse	LAV	HØY
Fleksibilitet (mulighet for å endre tid og dato)	Nei	Ja

Markér bare én oval.

- ◯ Alternativ 1
- ◯ Alternativ 2

11. 2.5 Av disse to alternativene, hvilken ville du valgt? *

Valgsituasjon	Alternativ 1	Alternativ 2
Pris for levering	550kr	460kr
Punktligheten av leveransen (forsinkelse)	30 min - 1t	Mindre enn 30 min
Tid fra bestilling til mottatt vare (ledetid)	2 dager	4 dager
Mengde CO2 utslipp per leveranse	LAV	MEDIUM
Fleksibilitet (mulighet for å endre tid og dato)	Nei	Ja

Markér bare én oval.

- ◯ Alternativ 1
- ◯ Alternativ 2

12. 2.6 Av disse to alternativene, hvilken ville du valgt? *

Valgsituasjon	Alternativ 1	Alternativ 2
Pris for levering	460kr	550kr
Punktligheten av leveransen (forsinkelse)	30 min - 1t	Mindre enn 30 min
Tid fra bestilling til mottatt vare (ledetid)	2 dager	4 dager
Mengde CO2 utslipp per leveranse	HØY	LAV
Fleksibilitet (mulighet for å endre tid og dato)	Nei	Ja

Markér bare én oval.

- ◯ Alternativ 1
- ◯ Alternativ 2

Opplysninger om deg som svarer

Informasjonen som etterspørres nedenfor vil bli behandlet konfidensielt og vil kun bli brukt til akademiske formål.

13. 3.1 Hva er din aldersgruppe? *

Markér bare én oval.

- ◯ 15 til 24 år
- ◯ 25 til 34 år
- ◯ 35 til 49 år
- ◯ 50 til 69 år
- ◯ 70 år eller eldre

14. 3.2 Hva er ditt høyeste fullførte utdanningsnivå? *

Markér bare én oval.

- ◯ Barneskole
- ◯ Ungdomskole
- ◯ Videregående
- ◯ Universitet/høgskole, bachelor
- ◯ Universitet/høgskole, master
- ◯ Phd
- ◯ Ingen

15. 3.3 Hva er din årsinntekt før skatt? *

Markér bare én oval.

- ◯ 0 - 150 000kr
- ◯ 150 001 - 300 000kr
- ◯ 300 001- 450 000kr
- ◯ 450 001 - 600 000kr
- ◯ 600 001 - 850 000kr
- ◯ 850 001 - 1 000 000kr
- ◯ 1 000 001 - 1 150 000kr
- ◯ 1 150 001 - 1 300 000kr
- ◯ 1 300 001 kr +
- ◯ Vil ikke oppgi

16. 3.4 Er du...? *

Markér bare én oval.

- ◯ Kvinne
- ◯ Mann
- ◯ Vil ikke oppgi

17. 3.5 Hva er postnummeret der du bor? *