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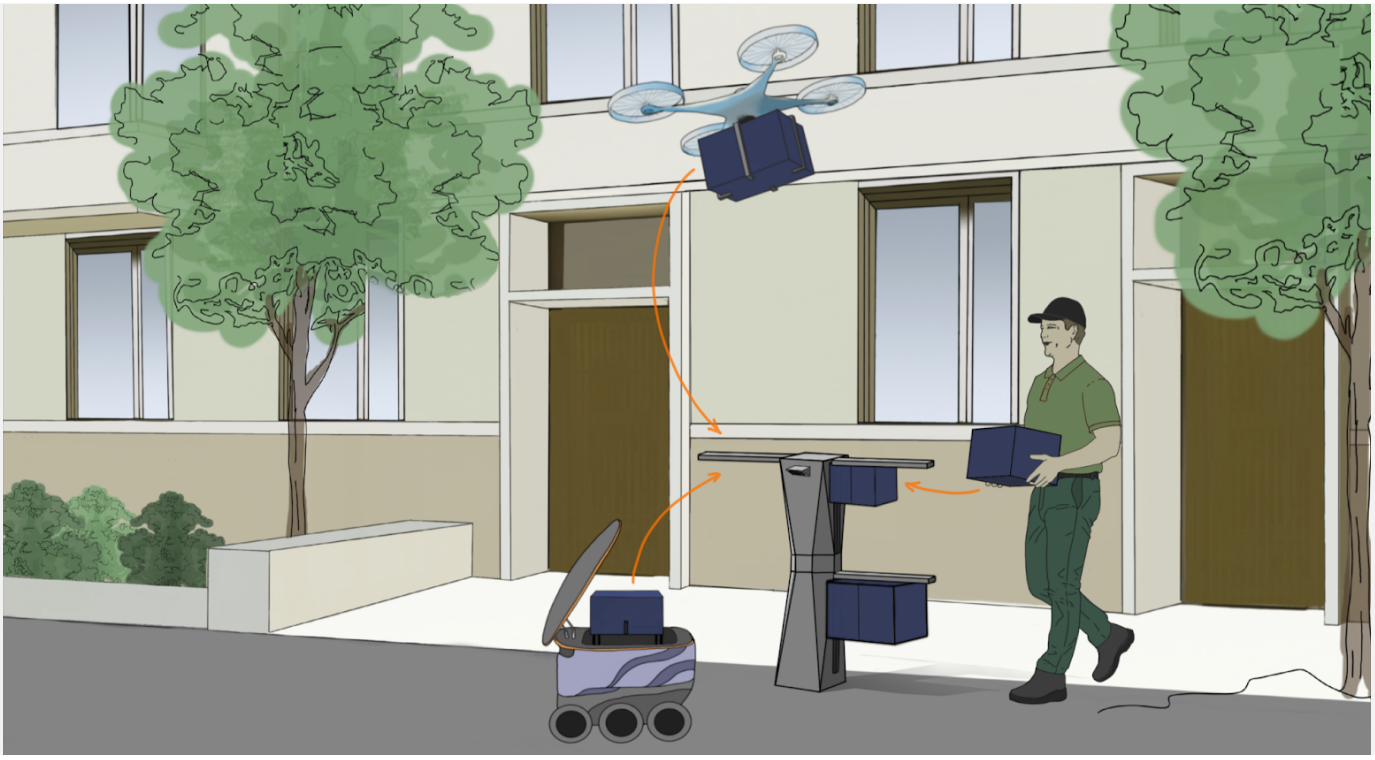
MASTER THESIS



An illustrative concept solution for future Last-mile Deliveries

A development process focusing on the recipients' experience of their LMD process

Master of Science Thesis

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Gothenburg, Sweden 2022
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Master of Science Thesis IMSX30

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Master of Science Thesis in the Master Degree Program, Product Development

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Print: Chalmers digitaltryck

ABSTRACT

Last-mile deliveries (LMD) are costly and account for about 50% of the total delivery cost, indicating the importance of it being done as smoothly and precisely as possible. In combination with its operational complexity, the consumers are placing higher demands on their deliveries as e-commerce becomes more popular and increases yearly. Recipients require a flexible delivery solution allowing them to receive their parcels within a short distance. Today, there is generally no solution where both of these factors are offered.

The aim of this project was to develop an illustrative concept solution fulfilling the needs and requirements recipients place on their LMD process. The illustrative concept solution was developed with the main focus on the recipient's needs and requirements. When the final concept was chosen, improvements were made in order to facilitate the LMD process for both the logistics personnel as well as for the postal office personnel.

Collected data from interviews, focus groups and a questionnaire, performance of two empirical ideation sessions and many iteration sessions resulted in a final concept. My Placed Parcel is a concept solution that can be implemented in today's LMD process offering the recipients both high flexibility and deliveries within a short distance as parcels are distributed to connection points. My Placed Parcel consists of physical products, a digital communication system and system routines.

ACKNOWLEDGEMENTS

This master thesis project was performed by me, Clara Malmsten, during my final semester at the Chalmers University of Technology. In 2020 I received my BSc degree in Industrial Design Engineering, an education that gave me knowledge of the product development process. 2020 - 2022 I spent my time at the Industrial and Materials department attending the Product Development master. To gain experience and knowledge from another area, I applied for Schenker's SMEDS program in 2021. The program gave me the possibility to get an insight into the logistics industry and increase my interest in logistics. When searching for a master thesis project where my prior knowledge and experience could be useful in the logistic industry, this project came into my mind and caught my interest.

During this project, I received help and support from many talented people. Thank you, Fredrick Ekman, for being the best supervisor. Thanks for always supporting me throughout this project by giving me feedback, the possibility to discuss my work, and helping me in the right direction. Thank you Mikael Johansson for being my supervisor at the finalization of the project and for giving me feedback on my work and the dissemination phase of the project. Thank you Per Christoffersson for giving me insight into Schenker's way of working with LMD and being there to guide and provide me with relevant and needed information. Thank you, Lars-Ola Bligård for examining this master thesis project and for giving relevant feedback on the mid-term presentation.

To all participants during interviews, focus groups and questionnaires, a huge thank you! I could not have performed a better outcome in this project without your insights, opinions and feedback. Thank you Björn Södahl for explaining your future vision of a sustainable LMD process by using watercourses. Thank you Sofia Malmsten for being the best sister, always supporting me no matter what and thank you, Olivia Molander, for giving me relevant input on my report and final presentation. Thank you Ebba Einarsson for reading my report, listening to my presentation and giving me relevant feedback.

After a challenging and amazing spring, I am happy and glad to say that I have finished this chapter of my life, and will now continue to work with problem-solving out in the real world, beyond Chalmers.

CONTENTS

CHAPTER ONE

INTRODUCTION

This chapter contains information regarding the background and the origin of the project, aim and purpose, delimitations, research questions, users included in this project as well as the process description.

1.1 Background

In logistics, they talk about "the last mile challenge", the challenge logistics companies face when it comes to the last part of the logistics chain and how goods can be delivered to the recipient in an efficient, fast and precise way. Last mile deliveries (LMD) are costly and account for about 50% of the total delivery cost, which indicates the importance of it being done as smoothly and precisely as possible. Problems that can arise with LMD are related to, among other things, the "not-at-home" phenomena, i.e. recipients who are not at home at the time of delivery, resulting in unnecessary runs. Other problems are related to unprofitable runs (many miles for small and few parcels) and "empty running", i.e. driving with virtually empty vehicles for longer distances (Gevaers et al., 2009).

As a result of the rapidly growing e-commerce, today's consumers place high demands on logistics companies in terms of flexibility, time and quality of their deliveries and solutions for returns. With an increasing parcel distribution, it is important to increase the level of satisfaction for all users involved, there among recipients, logistics personnel and postal office personnel. Both traditional logistics service providers (LSP) and various start-ups are trying to address the challenge through more refined and customized delivery services based on new technological opportunities in order to meet the recipient's requirements.

1.2 Purpose and aim

The purpose of this master thesis project was to develop an illustrative concept solution of the LMD process that increases the recipients', postal office personnel's and logistics personnel's level of satisfaction.

To achieve this, the aim was firstly to identify the recipient's, logistics personnel's and postal office personnel's needs and requirements placed on LMD. Secondly, identify what changes LSP needs to consider to satisfy those needs and requirements.

1.3 Research questions

1. What are the main issues with LMD for the recipients, postal office personnel and logistics personnel?
2. What needs and requirements must be fulfilled to satisfy the recipients' needs, whilst at the same time increasing the logistics personnel's and postal office personnel's experience of the new concept solution?
3. How could a new concept solution be designed to fulfill the earlier identified needs and requirements?

1.4 Users

Recipients - The one ordering and receiving the parcels
Logistics personnel - Working for the LSP. Transport parcels to recipients or to collection points
Postal Office personnel - Working at the postal office, an intermediary agent before the parcel reaches the recipient
Logistics service providers (LSP) - companies specialized in providing logistics solutions.

1.5 Key terms

ADV - Autonomous delivery vehicle
EV - Electric vehicle
HD - Home delivery
LMD - Last-mile delivery
LSP - Logistics service providers

1.6 Delimitations

This work focuses on the last part of the logistics chain and is thus limited to the process from loading at the terminal, i.e. placement of goods in the truck, to delivery at the parcel offices and further to the recipient. This work is also delimited to parcels of larger sizes, meaning parcels that fit into the mailbox are not included in this work. This thesis project is also delimited to cities with more than 350k inhabitants, with a focus on their urban areas. In this work, Gothenburg city will be used as a pilot.

1.7 Process description

The process for this project was divided into six major phases, see figure 1.1 below.

In the first phase, the pre-study phase, primary and secondary data were collected. A literature study was performed resulting in a problem statement, which later could be used as input to the collection of primary data. Primary data was collected through the execution of interviews, focus groups, a questionnaire and observations. The pre-study resulted in an understanding of the recipient's, logistics personnel's and postal office personnel's needs and requirements placed on the LMD process.

In the second phase, the development phase, two group based ideation sessions and one individual ideation session were performed with the aim of creating ideas, and further concepts, solving the recipient's needs and requirements.

In the third phase, the evaluation phase, the generated concepts were evaluated both theoretically and empirically resulting in one final illustrative concept solution.

In the fourth phase, the selected concept was improved based on the findings from the evaluation as well as with respect to the other two user groups' needs and requirements. The final concept was at the end of this phase illustrated in 2D sketches.

In the fifth phase, the final illustrative concept solution was validated against earlier identified needs and requirements.

In the last phase, the dissemination phase, this development project was presented through a written report and a final presentation.

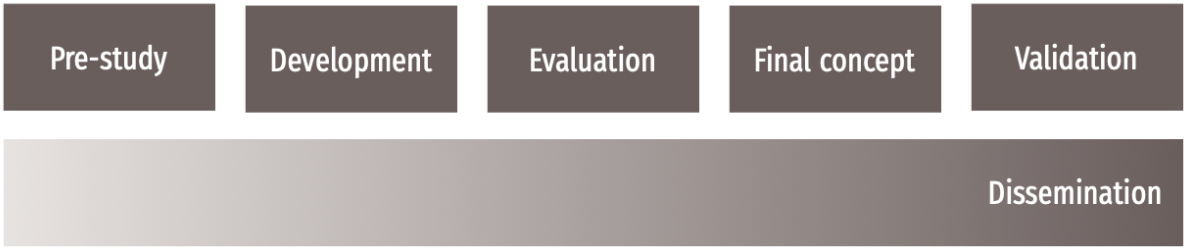


Figure 1.1. The six phases of this master thesis project

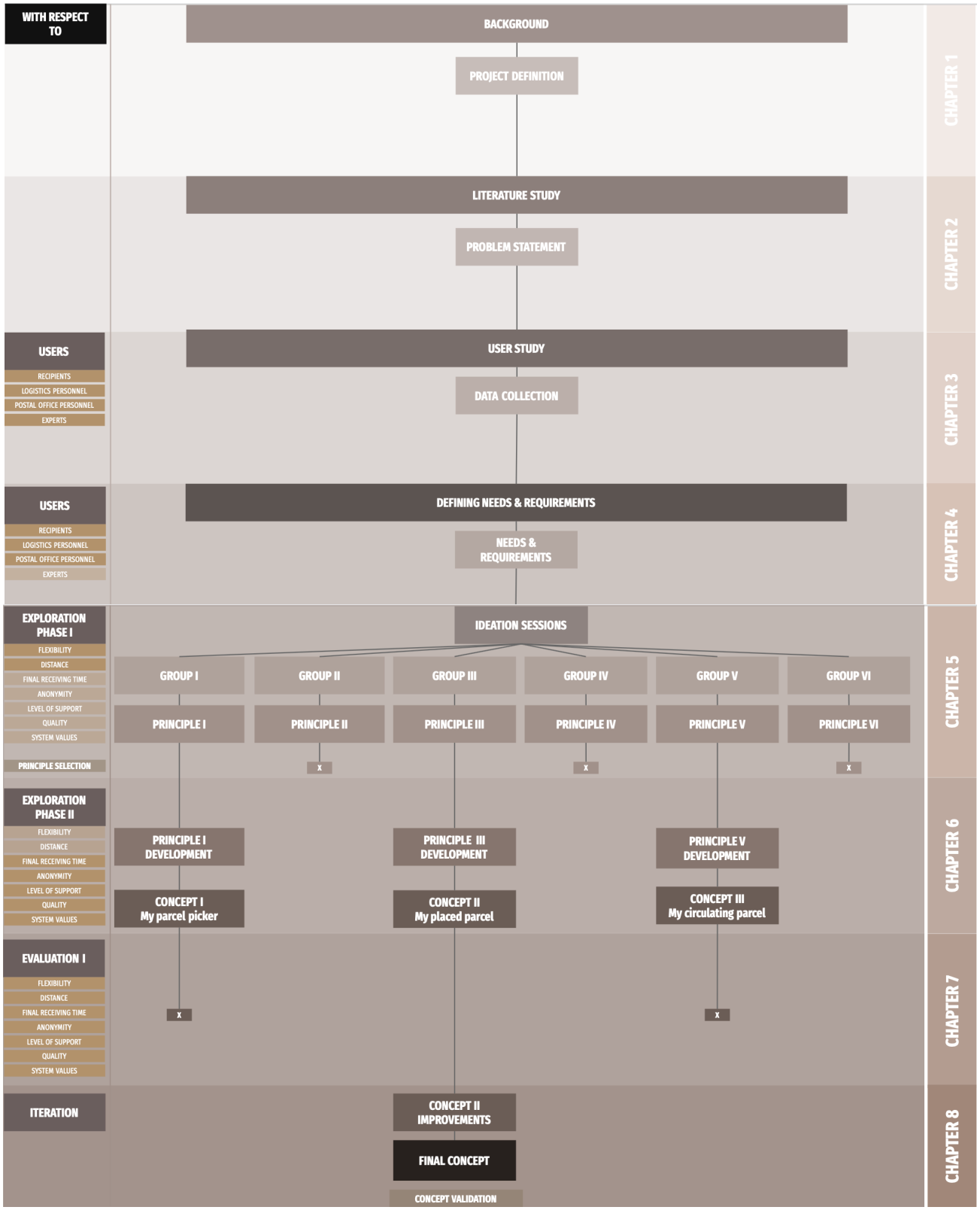


Figure 1.2. Detailed illustration of this master thesis project

2

CHAPTER TWO

FRAME OF REFERENCE

This chapter provides information regarding LMD; what it is, how it is conducted today and which parts are included. Further, this chapter includes a summary of the current LMD challenges, trends, and innovations and finally a problem statement including both operational challenges as well as changes in expectations from the recipients' point of view.

2.1 Aim

This phase of the project aimed to gain knowledge of the topic, knowledge that later could be used further in the process.

2.2 What is LMD?

LMD is the final part of the logistic distribution network consisting of couriers, express and LSP transporting goods from the final terminal to the end recipient (Heid et al., 2018; Gevaers et al., 2011). It constitutes the link between the LSP and the consumer as it includes the physical handover of the purchased goods to the recipient (Lim & Winkenbach, 2019). It is the delivery service whereby goods are delivered either to the recipient's doorstep or to a collection point, from which the recipient can receive their parcels. Figure 2.1 below is a schematic illustration of the delivery process where the LMD is highlighted.

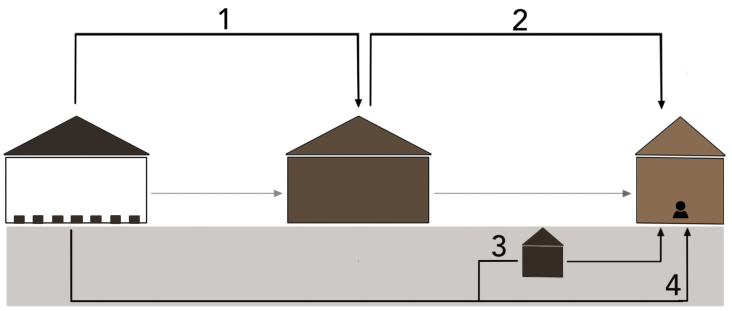


Figure 2.1. 1, 2) Goods are transported the "traditional way", from a final terminal to a retailer whereby the consumer buys their goods. 3) LMD service through a collection point 4) LMD service to the recipients doorstep

2.3 History of LMD

The history of LMD dates back to the first century with its origin from the "Cursus Publicus", the state-supervised courier service for the Roman Empire. This concept evolved into each country having its own postal company owned by the state, followed by private courier

companies establishing on the market. In the next generation of logistics, the development of global companies, such as DHL, FEDEX, etc., could be witnessed and during the 20th century, the focus was on expanding following globalization (Akhai, 2020).

During the 21st century, the development of LMD expedited with variants of companies establishing on the market when time and cost became trade-offs for the recipients while selecting LSP.

The technology development led to companies building the capacity to support their own business, this by establishing and expanding their delivery services (Amazon, Alibaba, etc.). Live tracking, a feature offering visibility for the recipient, as well as for analytic software, helping LSP to drive down costs through optimization of time and distance, was also possible due to technological development.

Over the last years, LSP has had its focus on offering recipients deliveries through collection points to provide the recipients the option to choose from various modes of convenience, when and where to receive the parcel. As recipients value a short distance, focus on LMD has over the years also been on the development of HDs, but also contact-less delivery options, e.g. parcel lockers, minimizing human interaction at the event of delivery (Akhai, 2020).

2.4 LMD Today

How is LMD conducted?

According to Onfleet (2020), a company providing LMD solutions, the LMD process could be categorized and described in five significant steps. In the first step, the consumer's order is digitally entered into the LSP's centralized system. In the second step, the consignment reaches the transportation center and is prepared for further distribution to the recipient. In the third step, all orders are assigned to different trucks/vans based on routes and the address of their final destination. In the fourth part of the LMD process, the orders are scanned and further loaded into the delivery vehicle. When scanning the order, the recipient gets a status update on its consignment. In the fifth and last step of the LMD process, the consignment successfully reaches the recipient.

In the last step of the LMD process, LSP offers four main delivery options to the recipients. The first two options are represented by Click and Collect (C&C), where the recipients pick up their parcel at a certain collection point. The collection point could be either a parcel locker or a postal office. The last two alternatives are both represented by home delivery

(HD), but could be executed in two ways; either attended or unattended. In the first mentioned, the recipient receives the parcel in person, unlike the second alternative where the parcel is left outside the recipient's door and no interaction occurs (Arouk & Murtadha, 2021). The four delivery alternatives are illustrated below in figure 2.2. Further, as illustrated in the figure, these delivery alternatives could be categorized into two groups based on the movement of the recipient and the parcel. In the first two alternatives, the recipient moves towards the parcel, whilst in the last two alternatives, the parcel moves towards the recipient. Over the last few years, more parcels are being delivered to collection points since consumers order more online, but tend to not be at home when the delivery occurs (Blanquart et al., 2014).

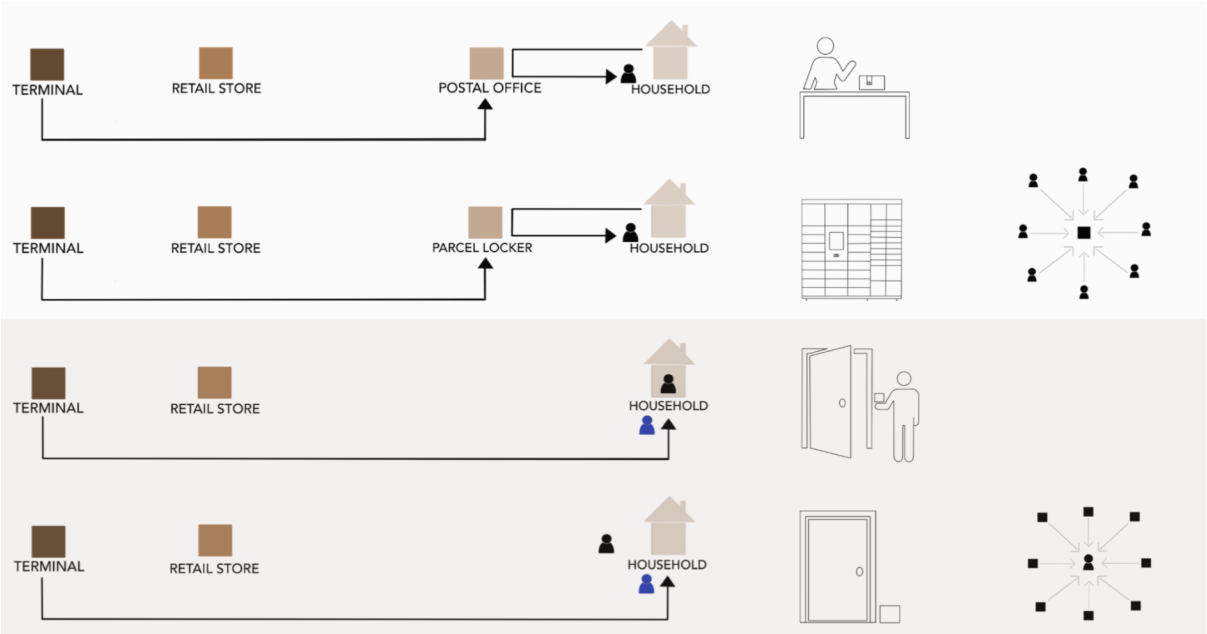


Figure 2.2. Illustration of the four delivery alternatives. Starting from the top: Postal office, Parcel locker, Attended HD and Unattended HD.

2.5 E-commerce

E-commerce has an unsolicited influence on the LMD as it has altered the way of purchasing, from traditional shopping to online shopping, resulting in a boom in parcel deliveries (Weiss & Onnen-Weber, 2019). Over the last years, e-commerce has increased tremendously worldwide as the digitization and simplicity of ordering online have increased (Buldeo Rai et al., 2019). When the Corona pandemic broke out in early 2020, e-commerce accelerated sharply as consumers' buying habits transferred from shopping in physical

stores to online purchasing. The industry of e-commerce grew by 40 percent in 2020. The year after, e-commerce managed to grow another 20 percent. The fact that e-commerce continued to increase in 2021 has a potential explanation in the extension of restrictions, but also Swedes being accustomed to shopping online and will continue to the same extent in the future. The graph in figure 2.3 shows the development of e-commerce from 2006 until the end of 2021 (Handelsfakta, 2022).

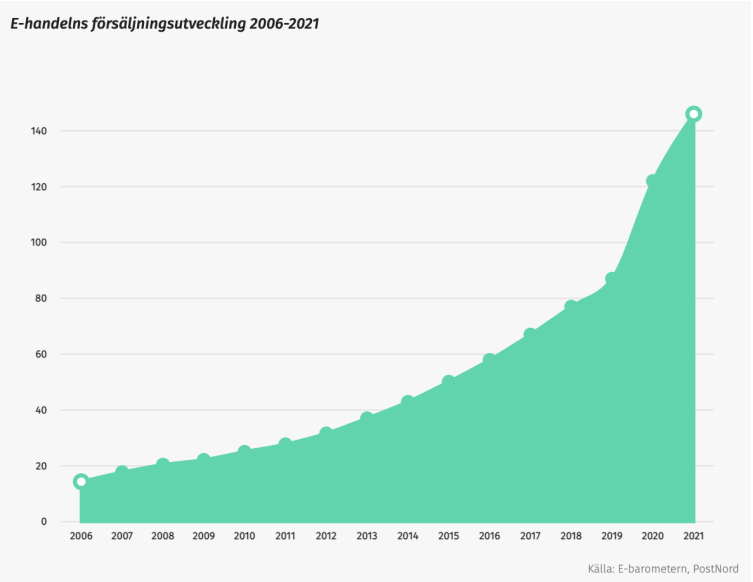


Figure 2.3. Development of e-commerce 2006 - 2021

Coming along with increased e-commerce, consumers place higher demands on their deliveries. They require a customized delivery and have high expectations of the delivery service, such as flexible and narrow delivery windows and delivery within a short distance (Joerss et al., 2016). Prior studies show that 65% of recipients nowadays demand delivery flexibility, 61% demand maximum speed of their delivery and 51% demand real-time visibility (Last Mile Logistics, 2018). These factors are all crucial elements in the expectation of consumers' e-commerce and delivery experience (Joerss, Neuhaus, et al., 2016; Vakulenko et al., 2019).

2.6 LMD challenge

LMD and its operational complexity, together with environmental requirements, increased e-commerce and consumers placing higher demands, creates the LMD challenge. See figure 2.4 below.

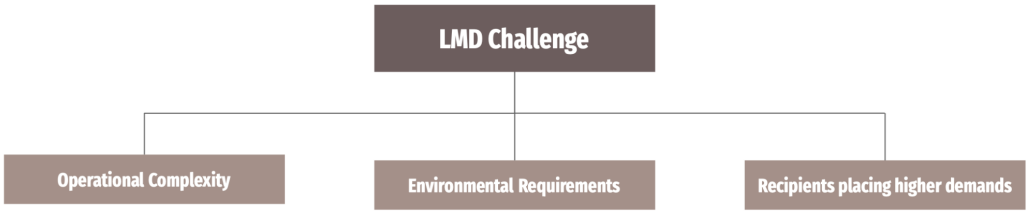


Figure 2.4. LMD challenge divided into three main parts.

Firstly, LMD has a challenging target service level with its small dimensions of orders in combination with a high level of dispersal of destinations. This makes LMD the least efficient and most expensive leg of the entire delivery process (Macioszek, 2018), accounting for approximately 50% of the total transportation costs (Capgemini, 2021). In addition, the complexity increases within LMD due to its many stakeholders (Homme & Chung, 2009). Figure 2.5 below illustrates the level of dispersal of destinations within LMD.

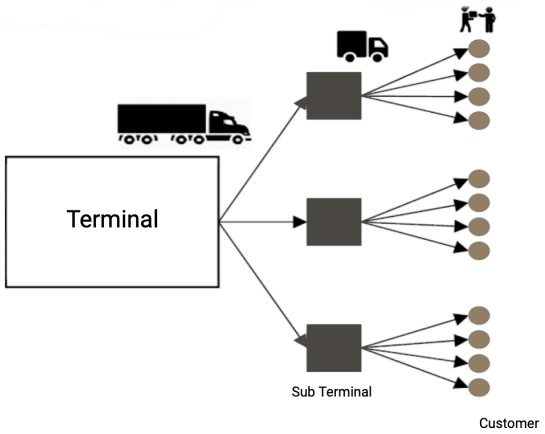


Figure 2.5. From left to the right: Line-haul from terminal to sub terminals and then LMD deliveries from sub terminals to the parcel's final destination. The figure illustrates the operational complexity of LMD with ist level of dispersal of destinations.

Apart from its operational complexity, recipients place high demands for their deliveries. They require specific delivery windows and deliveries within a short distance (Lim & Winkenbach, 2019). Further, requirements from the recipients include extensive delivery information, real-time order tracking, and options in delivery customization (Nguyen et al., 2019). The recipients' needs and requirements have to be taken into account when developing a new illustrative concept solution as it affects the entire e-commerce experience for the recipients (Joerss, Neuhaus, et al., 2016). In addition, e-commerce grows

yearly making LMD, not just the least efficient and most expensive, but also the highest growing sector within the logistics industry.

In addition, environmental requirements are forcing the LSP in a more sustainable direction as a result of environmental awareness. LSP has to consider more sustainable and environmentally friendly solutions in the future.

2.7 The future of LMD

LMD trends

As mentioned, LSPs are trying to address the challenge by applying technology-supported innovative methods, by transforming technological opportunities into new LMD trends. Today, we are observing not only various examples of technology being piloted and tested, but also witnessing the beginning of series productions and up-scaling of technology innovations worldwide (Heid et al., 2018). One significant trend within LMD is automation due to its efficiency. Autonomous delivery vehicles (ADVs) are, and will be, the dominant technology in this regard, having the possibility to reshuffle the entire logistic industry. To stay competitive, action is needed for the LSP. This by preparing for immediate use of new technologies that can be applied in LMD, for solving the operational challenges as well as meeting the recipient's requirements.

Today, the technology opportunities and their implementation has reached different levels of maturity. Below is an illustrative picture of technology concepts, developing technologies and scalable innovations showing their maturity within LMD, see figure 2.6. These are described more in detail further in the report.

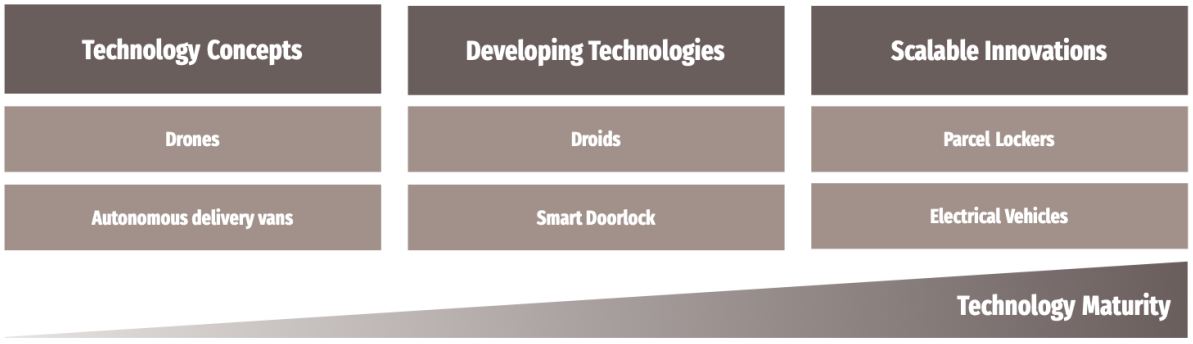


Figure 2.6. Illustration of LMD trends and its Technology Maturity.

Technology Concepts

ADVs aim to solve the challenge of the ecological footprint of parcel deliveries and reduce the high cost of the last mile (LMAD, 2021). Further, recipients require quick delivery, but with that comes two main problems for the LSP; the availability of drivers and the cost of these drivers. Implementation of ADVs can solve both of these issues, electric transportation for the environment and autonomous vehicles as it does not require drivers (Packagex, 2021). ADVs used in LMD can be split into three groups; Autonomous delivery drones, Autonomous delivery vans and Autonomous delivery robots whereby the first two mentioned could be categorized as technology concepts.

Autonomous delivery drones, see figure 2.7 below, is an efficient solution when road access is limited or goods need to be delivered in an emergency situation. Due to functional and legal constraints, (e.g., landing area, security, consignment load, permission to land and fly, etc.) drones are not to be expected at scale in dense urban areas (Heid et al., 2018). However, what one might experience is drones supporting vehicles in more rural areas or in emergency situations when regulations and permission are less strict.

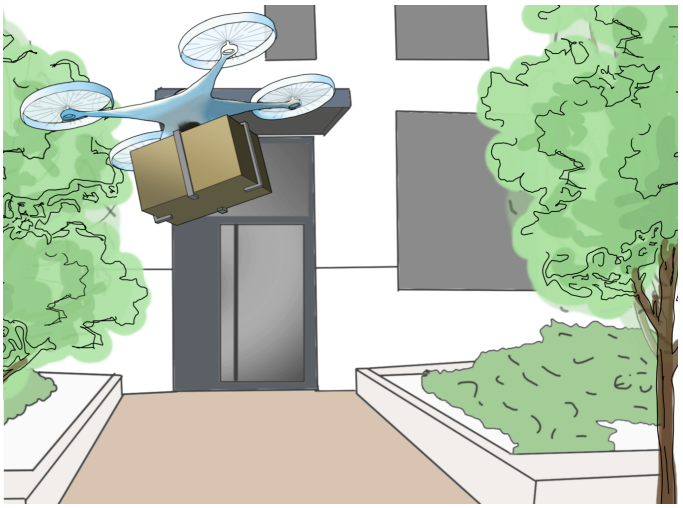


Figure 2.7. Parcel being delivered by a drone

The next group of ADVs consists of autonomous delivery vans. These delivery vans can park on, or next to, the street allowing recipients to receive their parcels from a locker by using their smartphone.

Developing Technologies

Smart door locks is a technology that potentially could solve the "not at home"-phenomenon when it comes to HD. Companies are therefore examining the design of a smart door lock to solve that issue. This technology has the potential to make life easier for both logistics personnel as well as the recipients as fewer deliveries would fail. However, this technology brings some issues mostly related to trust issues, integrity and safety. According to the literature, these issues would be minimized if the smart door lock could be supported by comprehensive insurance, assigned personnel, or the ability to communicate (Bjartmar & Söderberg, 2017).

Further, a rising trend within LMD is smaller electrical ADVs, so-called droids. These droids are operating at a lower speed and are equipped with different sensors to sense the environment and react to obstacles as they follow a pre-set navigation path (LMAD, 2021). Studies show that droids could lead to significant operational cost savings, whilst improving the environmental impact of LMD. Even though there exist both operational and environmental savings, potential social sustainability shortcomings exist in terms of both safety and equity (Garus et al, 2022).

Scalable innovations

An implemented and scalable trend within LMD is various electric vehicles (EV), vehicles that run on electric motors. These are developed and implemented due to their low emission, but at the same time manage the distribution in urban areas. Today there exist two types of EVs; All-electric vehicles that run solely on electricity and Plug-in hybrid EVs that run partly on fuel and electricity (Locus, N.D.).

A few years back EV was still in its pilot stage, but today we are seeing their series production. Their development and scalability are a result of environmental awareness and sustainability requirements placed on LSP. As cities tighten their emissions standards, the logistics industry is forced to the implementation of EV (Heid et al., 2018).

Another rising and implemented trend within LMD, supporting the EVs, is cargo bikes. These are smaller vehicles distributing goods in urban areas increasing the efficiency, decreasing the environmental impact and lowering the cost of LMD (Last mile, 2018).

In addition to EV and cargo bikes, parcel lockers have been implemented in the LMD process to facilitate the distribution. Parcel lockers facilitate the delivery process in two

ways; firstly consolidation of goods is possible as the driver does not have to go to the recipients' homes, but instead delivers all parcels to the same location. Secondly, parcel lockers lead to a reduction in delivery failures as the solution allows delivery in the recipient's absence. For the recipients, parcel lockers offer them the possibility to receive their parcels conveniently 24/7 and thereby providing a delivery service with more flexibility compared to HD (Vidal, 2021). The accessibility and speed of service make the parcel lockers an advantage in comparison to the existing postal offices as these collection points have limited opening hours. Parcel lockers are preferable for the recipients, but face some challenges regarding installation on public land. To achieve good proximity to the recipients, parcel lockers have to be placed on public land, but are then suffering from legal constraints and the necessity for permits (Van Amstel et al., 2020).

2.8 Problem statement

LMD and its operational complexity, together with environmental requirements, increased e-commerce and consumers placing higher demands, creates the LMD challenge. Various technological trends arise to tackle the challenge and a lot is happening, and has to happen, in this area.

As the recipient's level of satisfaction placed on their LMD process affects their entire e-commerce experience, it is of high importance that the recipient's needs and requirements are fulfilled. The operational complexity of LMD is difficult to solve, but a good system could facilitate the delivery process for all users involved. It is therefore important to firstly search for the recipient's needs and requirements, develop a solution based on that, and then modify the final solution to facilitate the event of delivery for the personnel.

3

CHAPTER THREE

USER STUDY

This chapter describes the user study phase. It describes all methods that have been used, how the user study was conducted as well as the findings.

3.1 Aim

With the literature study as a basis, the aim of the user study was to gain a deeper understanding of recipients', logistics personnel's and postal office personnel's experience of LMD and the problems related. The understanding was later used to define their needs and requirements of LMD. The aim of the user study was also to gain insight into the experts' vision of the logistic future, this by interviewing two experts.

3.2 Method

Semi-structured interviews

In this master thesis project, semi-structured interviews were conducted in four rounds with four different user groups; recipients, logistics personnel, postal office personnel and experts within LMD.

Recipients

In the first round, 21 recipients were interviewed. All interviews were held personally and lasted between 45 and 60 minutes. The focus in this round was to reach a deeper understanding of their experience of LMD, an understanding that further could transform their situation into a problem statement that later could be used in the execution of a requirement specification.

The interviewees had ages ranging from 20 to 65 and different types of accommodations, such as apartments, townhouses and villas. All of the 21 recipients were located in the urban area of Gothenburg and ordered online on a regular basis, the interviewees were therefore considered relevant users within this segment.

The focus was on how they receive their parcels today, which out of the four delivery methods they prefer and why the other alternatives were considered less preferable.
The interview script being used throughout this round is found in appendix I. The interview script contained four sections:

1. Initial questions
   In order to validate and reach an understanding for the interviewee, the first part contained questions regarding their LMD experience level and e-commerce habits.

2. Open questions
   In the second part, the recipients had the possibility to freely express their opinions on today's LMD process. Open questions were asked in order to not influence their answers.

3. Today's situation
   In this part of the interview, more specific questions related to the LMD process were asked. The recipients had the possibility to express their perspectives on today's available delivery methods.

4. Desired scenario
   In the last part of the interview, the recipient had the possibility to freely describe their desired LMD scenario.

The interviews followed an interview script, but were carried out in a semi-structured manner. The interview script had 24 questions, but depending on the recipient's answers, probing was applied, i.e. clarifying questions were asked, to reach a deeper understanding of their answers. During these interviews, two mediating objects were used to support the interview sessions. The mediating objects being used were (i) a schematic picture over today's existing LMD alternatives and (ii) a map over Gothenburg city, a map the interviewee could use while explaining their situation.

Logistics personnel

In the second round of interviews, logistics personnel were interviewed. Four interviewees participated being either former or current employees at a LSP. The main focus of this round was to gain an understanding of their perspective on LMD, explaining what problems logistics personnel face while delivering goods to recipients. The four interviewees had various levels of experience ranging from 2 months up to 2 years. This round had the same layout as the interviews with the recipients, but the questions were slightly different and the answers reflected another perspective. The interview script is found in appendix II.

Postal office personnel

In the third round, postal office personnel were interviewed. Two former postal office personnel were interviewed, both with major experience working in the business. This round had a different interview script compared to the previous ones, see appendix III. The

interviews in this round were semi-structured with elements of probing included in order to reach a deeper understanding. The layout of this interview contained three parts:

1. Experience and knowledge
   In the first part of the interviews, questions related to the personnels work experience were asked. This was done in order to validate the interviewees as potential candidates for the interviews.

2. Today's situation
   In this part, the interviewees had the possibility to express themself about today's situation. In this part of the interview, questions were initially open ended in order to not influence the interviewees. The answers explained what the postal office personnel consider as problematic and less problematic in today's situation.

3. Desired situation
   In the third and final round, the interviewees had the opportunity to describe their desired scenario.

Experts

The fourth and final round of interviews included interviews with experts. Two experts with deep knowledge from different areas within LMD were interviewed. These interviews had more of an open character with just a few prepared questions in order to give space for discussion and give the experts the possibility to lead the session in the right direction.

Focus groups

In addition to the semi-structured interviews with recipients, two focus groups were conducted. These sessions had four participants each with the focus to allow the recipients to express their opinions and start a discussion, building upon the others' opinions.

Online survey

To reach out to a broader population, an online questionnaire was created. The survey was sent out in various groups targeting recipients living in urban parts of Gothenburg. 75 recipients participated in the survey with ages ranging from 20 to 70. The questionnaire aimed to reach out to more recipients in order to (i) validate the results from the interviews as well as (ii) ask clarifying questions based on the result from the interviews where uncertainties occurred. The questionnaire, and its result, is found in appendix IV, V.

Observations

As an issue stated by the recipients during the interviews was related to the final receiving time, observations were performed to get a deeper understanding of the situation. 29 Concealed observations including two self-observations were conducted at ICA Focus in Gothenburg. The observations were conducted in order to get a perspective of the final receiving time difference between postal office delivery and parcel locker delivery. 10 observations were conducted on parcel locker deliveries and 19 on postal office deliveries.

Analysis

To summarize all collected data, a thematic analysis was performed in three rounds, one for each of the first three target groups. The method used was a KJ-analysis. In each round, the thematic analysis was performed in three steps. In the first step, data was written down on small pieces of paper including both quotes and statements. The second part of the analysis was performed by placing these papers on a board one by one. The notes were placed after meaning, forming groups as they were placed. In the final part of the thematic analysis, each group was analyzed, a category name was created and their meaning was written down, see figure 3.1 below.

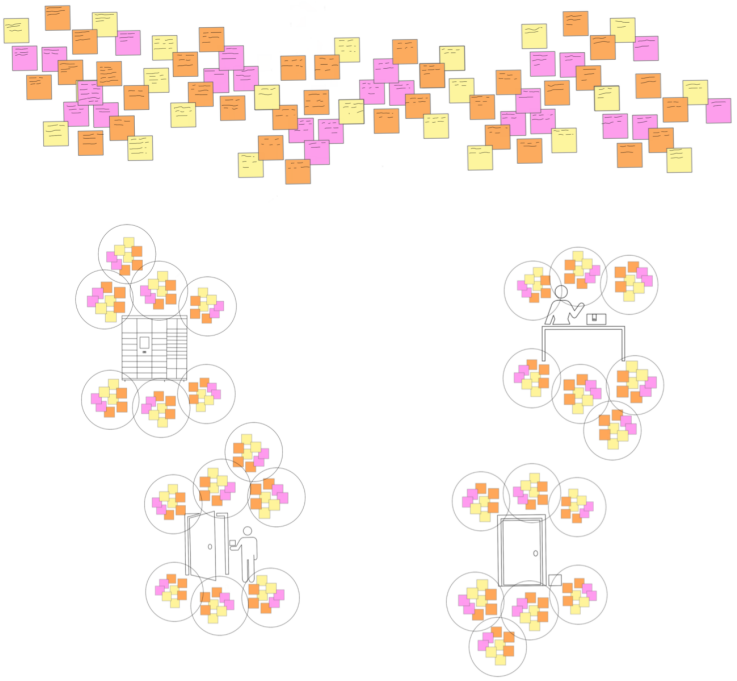


Figure 3.1. Illustration of the KJ-analysis

3.3 Findings

In this part, all findings from the user studies are presented. The first findings presented are from the conducted interviews and the questionnaire performed on the recipients. Thereafter, the findings from the logistics personnel and postal office personnel are presented, and finally insights from the experts.

Perspectives from the recipients

The conduction of interviews, focus groups and a questionnaire performed on recipients resulted in qualitative findings. The expressed values and concerns that were put into the thematic analysis resulted in six main factors having the most impact on the recipient's experience of LMD. These factors were as follows; Flexibility, Distance, Final receiving time, Anonymity, Level of support and Quality, see figure 3.2. These factors and their meaning are presented below.

Figure 3.2. Six factors within LMD increasing the recipient's level of satisfaction

Flexibility

A high level of flexibility appears when the recipient receives their parcel with no critical time window, a delivery independent of time. After reflection, a high level of flexibility could appear in two different ways; (i) the parcel is in the same place over a longer time period, or (ii) the parcel appears at one specific location after an "in near time" decision made by the recipient.

"I like generous opening hours"

"The most important is when I don't have to adapt my everyday life after my parcel delivery"

"When the delivery system is flexible"

"When the delivery options fits my situation"

"When I can receive my parcel at any time"

"When it is easy to pick-up the parcel and when the delivery suits me"

"When it is many delivery alternatives to choose between"

"When I can influence the delivery process"

Distance

Recipients value a short distance, i.e., the distance between the parcel's final destination and the place where the recipient receives the parcel.

"When my parcels are delivered to a collection point near my home"

"When I do not have to carry my parcels for longer distances"

"When it fits into the mailbox"

"Deliveries within a shorter distance"

Final receiving time

The time it takes for the recipient to receive its parcel at the very last part of the chain, either at the collection point or when HD occurs.

"When the pick up takes no time"

"When there is no queue at the collection point"

"Fast service at the collection point"

"Predictable time spent at the postal office while receiving my parcels"

"Fast identification"

Anonymity

The level of anonymity the recipient has while receiving the parcel. This factor includes showing ID as well as interacting with other people, e.g. logistics personnel or postal office personnel.

"When the postal office personnel recognizes me, that is embarrassing"

"When I have to interact with other people, I do not like that"

"When the pick-up/returns are anonymous, i.e. no interaction with other people"

Level of support

When the recipient's relatives or friends are able to support the delivery process by receiving each other's parcels.

"When my husband and I can receive each other's parcels, it makes our everyday life easier"

"When my relatives can pick-up my parcels"

Quality

Recipients value when the goods and its parcel remains its quality, this by not being stolen or damaged.

"When the parcel, and the goods, remains its quality"

"When my parcel is delivered in a safe way, with no risk of being stolen"

Taking these six factors into consideration and concerning what the recipients expressed, the following could be identified in today's situation and its available alternatives for delivery, see figure 3.3 below. As can be seen, none of today's delivery alternatives scores high concerning all six identified factors.

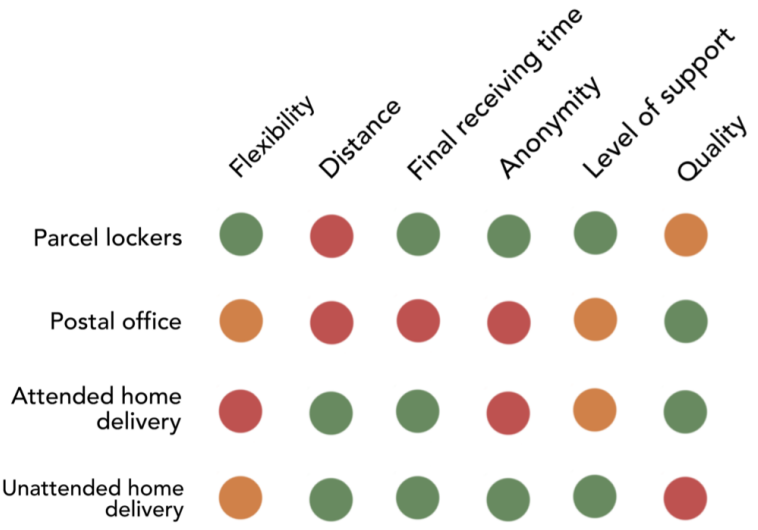


Figure 3.3. Illustration over today's delivery alternatives with respect to the six factors

Furthermore, when reflecting back upon the existing LMD alternatives, the two main groups identified in the background only solve one out of the two main factors Flexibility and Distance, see figure 3.4 below. The first group contains collection point delivery and the second group both types of HD. What could be identified is that the first mentioned offers flexibility, but not a delivery within a short distance, while the other group offers the other way around.

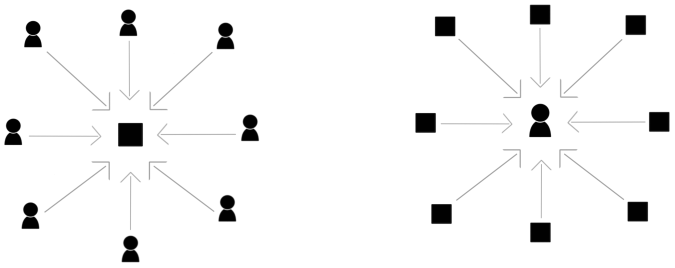


Figure 3.4. Illustration of collection point delivery and HD

The performed observation confirmed what the recipients had stated. The graph below illustrates the final receiving time difference between parcel locker delivery and postal office delivery. As one could see, the final receiving time offered by the postal office (illustrated in black) is more uneven and thereby more unpredictable. It has its peaks between 17.30 and 20.00 caused by high customer presence as well as near to the store opening and closure, due to absent staff, see graph 3.1.

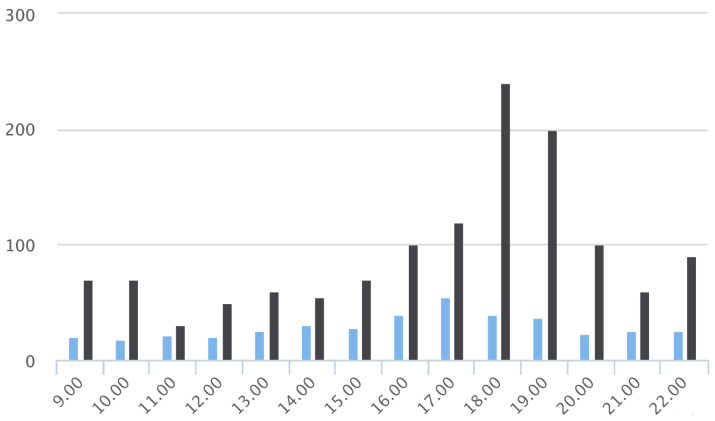


Figure 3.5. Final receiving time difference between postal office (black) and parcel lockers (blue).

Desired scenario

In the last part of the interviews, the recipients had the possibility to express their desired LMD situation. The expressed scenarios had their main focus on the two factors Flexibility and Distance indicating those factors' importance. Summarizing what the recipients expressed, the following could be presented.

- Parcel delivery to my mailbox
- Home delivery that is more flexible, agreed delivery time close to delivery
- Parcel lockers within 100m open 24-7
- Drive through collection points
- Delivery to a mailbox that could be attached to my home / items near my home
- Into my apartment
- Parcels being dropped at my balcony by a drone
- Attended home delivery with a short and precise time window
- Delivery to locations along my daily movement pattern

To get an understanding for the recipients' overall experience of LMD, the recipients rated their level of satisfaction from 1 - 5, 1 being not satisfied at all and 5 being satisfied. The result could be presented as below in graph 3.2. The result indicates that recipients in general are satisfied, but implementations of improvements within the process are necessary.

Figure 3.6. Recipient's level of satisfaction related to the LMD process

In both the questionnaire and the interviews, a question was asked related to the frequency of parcel deliveries. The majority of the participants receive more than one parcel a month. When analyzing the data based on a division of the recipient's ages, one could see that 87% of the participants ordering more than one parcel a month were represented by the age interval 16 - 30 indicating that younger people order more online, but also placing higher requirements as they dominated the lower level of satisfaction in the earlier presented graph.

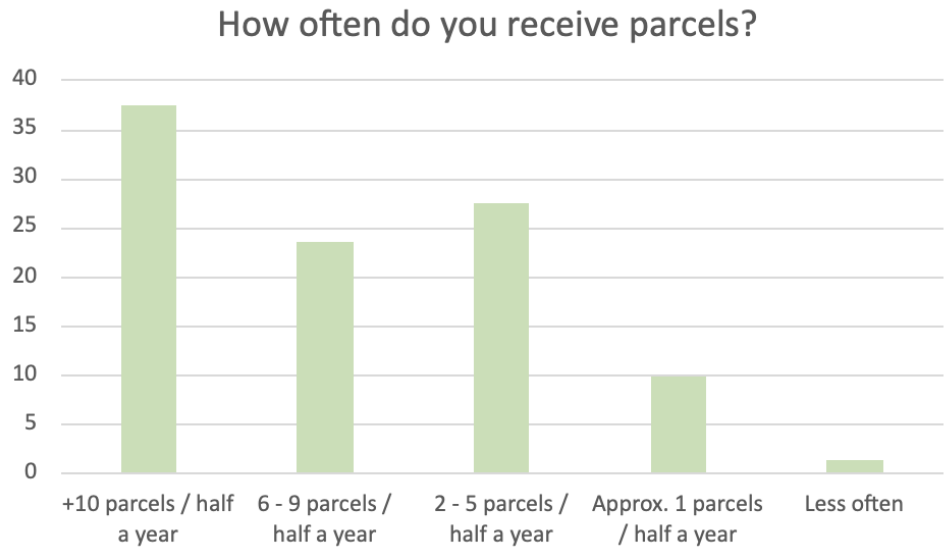
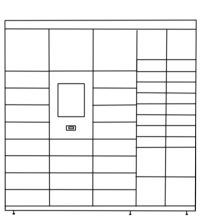
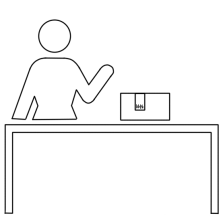


Figure 3.7. Recipient's frequency of parcel deliveries

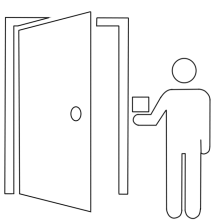
To the question "what delivery method do you prefer?", the following result could be presented. 50% of the total 96 participants (75 from the questionnaire and 21 from the interviews) prefer parcel lockers, 27% postal office delivery, 9% attended HD and 14% unattended HD. This means that 77% prefer delivery to collection points and 23% HD, a result that indicates the importance of flexibility in a LMD process as recipients select that over a short distance.



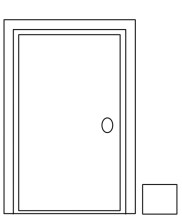
50% Parcel lockers



27% Postal Office



9% Attended HD



14% Unattended HD

Further, to the question "At what time do you prefer to pick-up/receive your parcel?", the following result could be presented. Recipients want their parcels to be delivered / the receiving events to occur mainly between 16 - 19. However, some recipients prefer to receive their parcels later, a result that could be correlated to the shorter final receiving time later in the evening as well as better access with a car.

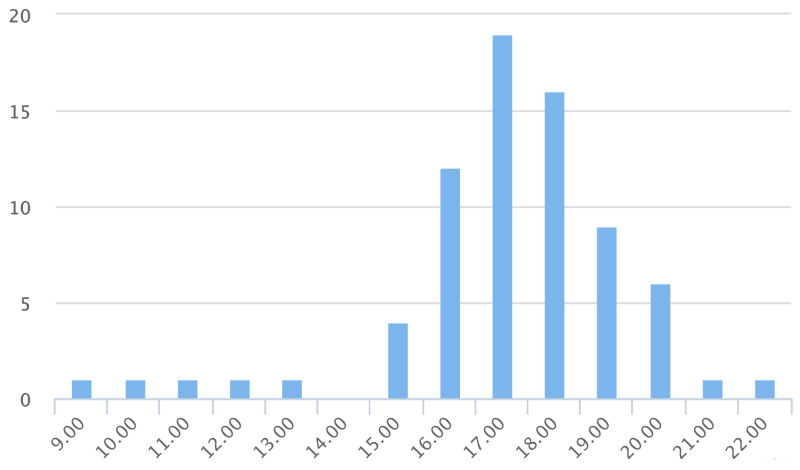


Figure 3.8. Preferred pick-up time

Perspectives from the Logistics personnel

When analyzing the result from the logistics personnel's interviews, the following concerns could be presented.

Expressed concerns:

- Recipients are difficult to reach, lack of good communication
- Delivery locations are difficult to find
- Parking could be tricky
- Dysfunctional entrance codes
- Lack of entrance systems with code/call system
- No available parcel lockers at collection points
- Time consuming deliveries
- "Not at home"-phenomena, delivery failures
- Lack of trust, i.e. recipients feel suspicious against the personnel
- Parcels has to be anchored in the car, otherwise they move around
- Parcels are sometimes difficult to find in the car
- A lot of time is spent on contacting the recipients
- Parcels has to be delivered during rush hours

Perspectives from the postal office personnel

When analyzing the result from the postal office personnel's interviews, the following concerns could be presented.

Expressed concerns:

- Customers have various of errands, confusing
- Parcel deliveries peaks during 3 hours, uneven workload
- Customers arriving minutes before closing time
- Customers complaining about not generous opening hours
- Customers arriving to unattended front desks, stressful
- Many different actors dropping of parcels
- Parcel batches could be standing due to customer attendance
- Different systems depending on actors
- Recipients arriving before the parcels are ready for delivery
- Recipients not being prepared with ID-cards etc.

Input from experts

The expert interviews both resulted in a deeper knowledge of how experts see the future of LMD. Experts see consolidation between different actors, i.e. a LMD process containing a distribution of goods from different LSP, as one major factor within logistics in combination with sustainable transport. One of the experts stated that the best LMD solutions may be in LSP responsible for specific areas, instead of all providers delivering to all areas. However, this solution is today not realizable due to regulations regarding collaborations between competing actors.

One of the experts investigates how water channels can be used in the LMD process to reach a more sustainable distribution. This expert interview, therefore, resulted in knowledge regarding alternative ways of how goods can be transported in the future.

3.4 Conclusion

From the user study, six main factors could be identified as important for the recipients. When summarizing what the recipients expressed, what they found as most valuable and what was the underlying meaning of their desired scenario, Flexibility and Distance could be identified as the most important factors, out of the six identified, for the recipients.

Further, as 77% prefer collection-point delivery and 23% HD, Flexibility could be considered the most important of those two. A new concept solution must therefore include high values in terms of both Flexibility and Distance.

The four remaining factors are also important for the recipients, but not to the same extent as Flexibility and Distance. What further could be discussed is the fact that these factors could be applied and improved within any selected and developed solution. When reflecting upon the last factor, Level of support, this factor is considered important due to today's inadequate system, but should not be necessary in a successful LMD solution. The fact that none of the available delivery alternatives offer both short distance in combination with high level of flexibility, "Level of support" is considered as important. However, even if the final illustrative concept solution offers both of these factors, Level of support is still considered beneficial as it could increase the flexibility even more.

Further, a conclusion that can be drawn is that the recipients chose their delivery method based on which factor they value the most. All six identified factors are important for the recipients, but not all can be fulfilled at the same time in today's LMD situation.

The six factors and their level of importance are illustrated in figure 3.9 below.

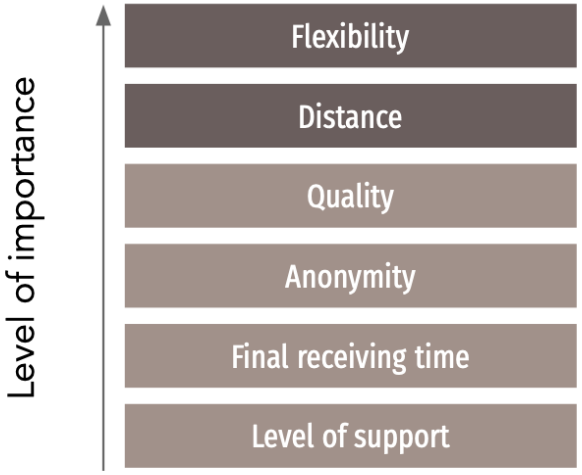
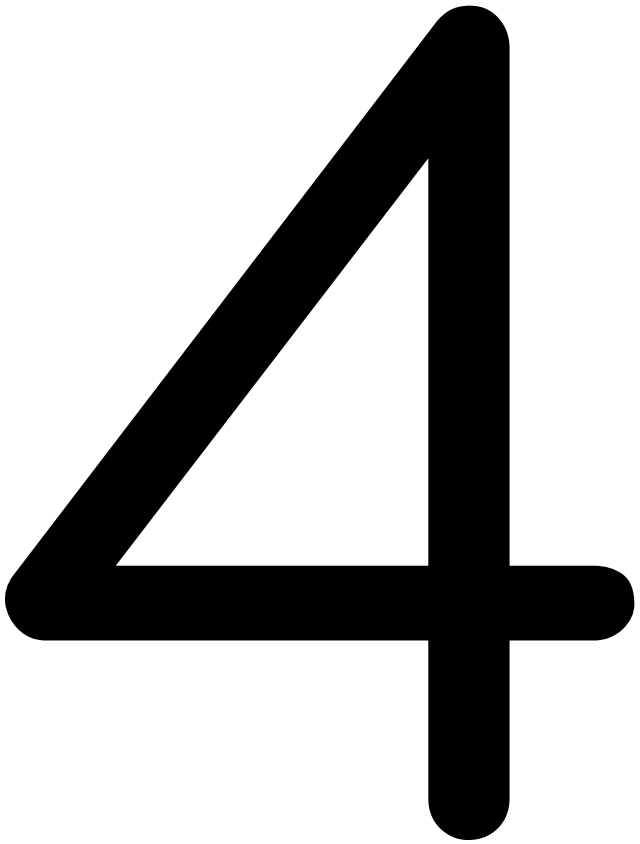


Figure 3.9. The six identified factors with respect to their level of importance

The demands from the involved user groups are more than often contradictory within the LMD process. As the main focus within this project is set to fulfill the recipient's needs and requirements, needs and requirements from the other target groups will not be taken into consideration in the first round of ideation sessions. However, their needs and requirements will be taken into account when the final concept solution is chosen and its final development takes place.



CHAPTER FOUR

DEFINING NEEDS & REQUIREMENTS

In the previous chapter, six factors were identified and considered important for the recipients. Within this chapter, these factors are taken further into the process as needs and requirements are being identified related to each of them.

4.1 Aim

This phase of the project aimed to define what needs and requirements the recipient places on the LMD process on a more detailed level. The aim was further to determine whether these needs and requirements are categorized as desired or necessary. The identified needs and requirements were expressed as functions and were later used as a basis during the development phase to develop a successful illustrative concept solution. The result from this phase was later used when evaluating the final concept as well as used as the basis for the execution of the requirement specification to the final illustrative concept solution.

4.2 Method

In this section, all methods that have been used within this part of the project are described.

Personas

The results from the user study made it possible to create four personas representing characteristic groups of recipients. The purpose of a persona is to create a fictive description of a person based on collected data from multiple individuals (Dam & Siang, 2018). The personas were created to support the formation of the requirement specification, but were mostly used in the first ideation phase as well as in the evaluation phase.

Functional analysis

In the previous part of the project, a thematic analysis was performed. The KJ-analysis highlighted six factors the recipients value the most as important findings were grouped. These factors, together with their origin findings, were the input to a functional analysis. Expressed needs and requirements were translated into functions in the execution of the functional analysis. The idea of the analysis was to formulate what the final illustrative concept solution should achieve, but also to steer away from thinking in existing solutions during the ideation session (Landqvist, 1994). The functions were expressed in noun+verb format and defined as either necessary or desired depending on their importance for the recipients.

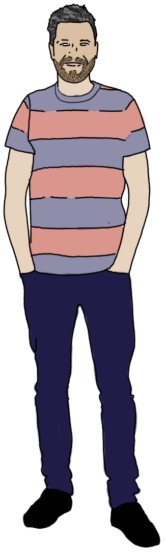
4.3 Findings

In this section, all findings from the needs & requirements chapter are presented and described.

Personas - Jonas, Stephanie, Hans & Charlie

Even though there is no specific recipient within the LMD process, the collected data made it possible for the creation of four characteristic personas. The creation of the personas was based on patterns that could be identified based on the results of the user study. Consumers ordering online are represented of various ages and have various accommodations and lifestyles. The personas were therefore created to represent the broad user group. Further, the four personas are summaries of the result from the user study, meaning no persona is based solely on one person.

Jonas, 45 years



Jonas is a 45-year-old man. He lives together with his wife, two children and their dog in a house on the outskirts of Gothenburg Center. He works as an engineer at a big industrial company on the other side of the town. He spends a lot of time at work, driving his children to various football games as well as hanging out with his friends, giving him almost no time for shopping in town. Jonas, therefore, orders a lot online as he could do it while the children are asleep later in the evenings. Today, Jonas prefers to receive his parcels at the postal office due to its location. He lives approximately 800 meters from the postal office and drives past the postal office on his way home from work. The postal office gives him the possibility to receive the parcels whenever he wants and within an acceptable distance. Jonas likes today's system and how it works, but would prefer a shorter distance and better opening hours so that he can receive his parcels later when the children are asleep and the pick-up time is shorter. He would also appreciate a system allowing his wife to support him by receiving his parcels, and the other way around. In between, he selects the unattended HD option, mostly when he orders something with a lower value. Sometimes Jonas considers selecting the same delivery method with goods of higher value as he trusts his neighbors, but since he does not trust people passing by the house randomly and fears the product's quality to be affected, he never chooses this delivery method.

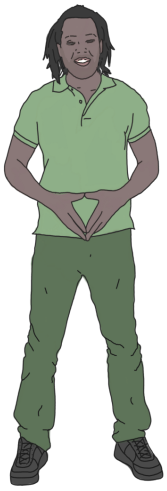
Stephanie, 27 years

Stephanie is a 27-year-old single woman living in an apartment in Gothenburg city. She graduated from the Chalmers University of Technology last semester and is now working full-time as a consultant. She is working a lot and in her time off, she wants to meet both family and friends. Stephanie, therefore, prefers online shopping as it is not as time-consuming as physical shopping. She would prefer HD and the comfortability it brings to her, but as she does not know her weekly schedule she rather selects delivery to a parcel locker. The parcel locker is located 400 meters from her apartment and has both better opening hours and shorter final receiving time compared to the postal office, bringing her to that decision. Stephanie orders quite a lot on the internet and finds it embarrassing to receive and return as many parcels as she does. Stephanie, therefore, prefers a delivery method with no interaction. The delivery method she would prefer the most is unattended HD, but as her front door has no code, that alternative is not considerable for her.

Hans, 72 years

Hans is a 72-year-old man living together with his wife. They both retired several years ago and are now spending time appreciating life and what it has to offer. They spend a lot of time together with friends doing various activities such as golf and shorter weekend trips. Hans likes to go shopping in the town, but sometimes in between shops online. When shopping online, he prefers attended HD as it offers the shortest distance and thereby does not require him to carry anything heavy for a longer distance. He would consider his deliveries to a collection point if there would have been any located within a shorter distance, but carrying parcels for more than 250m is not considerable for Hans. The attended home delivery is working fine for him as he is retired and has the possibility to schedule his week after when the delivery is planned. However, he would prefer a more flexible and predictable LMD solution.

Charlie, 32 years



Charlie is a 32-year-old man living in a house in the central part of Gothenburg. He likes to hang out with his friends and they use to work out a lot together to stay in shape. Charlie works as a doctor, a work that comes along with irregular working hours giving him an unpredictable weekly schedule. During his time off, Charlie is most of the time exhausted from work, bringing him to the decision of online shopping as it is more comfortable and less time-consuming compared to traditional shopping. When doing an online purchase, Charlie selects "postal office" as delivery method due to its location and its level of flexibility in terms of pick-up time. However, he would consider delivery to a parcel locker if any would have been located within a shorter distance and the interaction with the parcel locker would have been easier. The parcel locker would fulfill more of his demands as it has a shorter receiving time and is an anonymous alternative.

The needs and requirements of the personas are summarized below. Their needs are considered as either very important, appreciated, or less important related to the six factors, see figure 4.1 below.

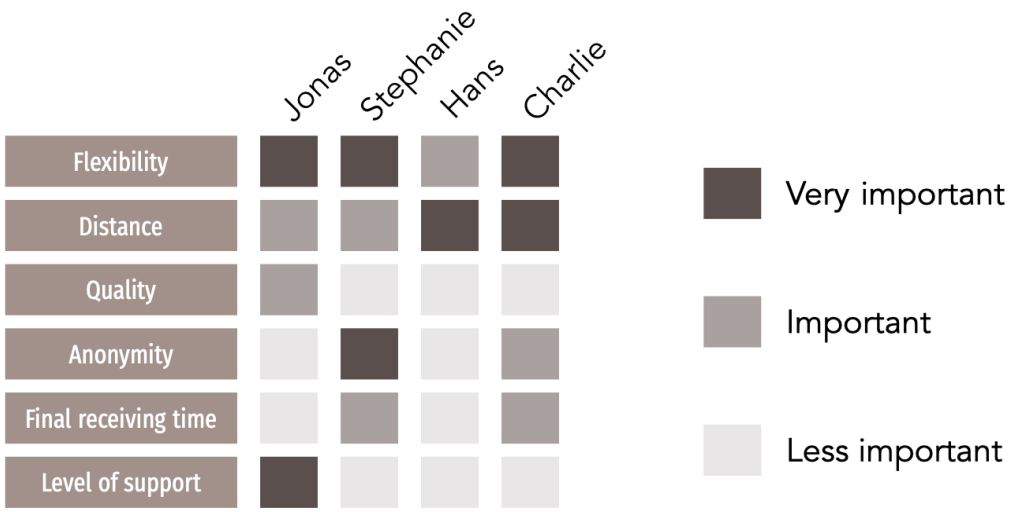


Figure 4.1. Results of the presonas' needs and requirements with respect to the factors.

Recipients' needs and requirements

The functional analysis resulted in a table of functions. These functions are represented by one main function and several sub-functions divided into six parts, one for each of the

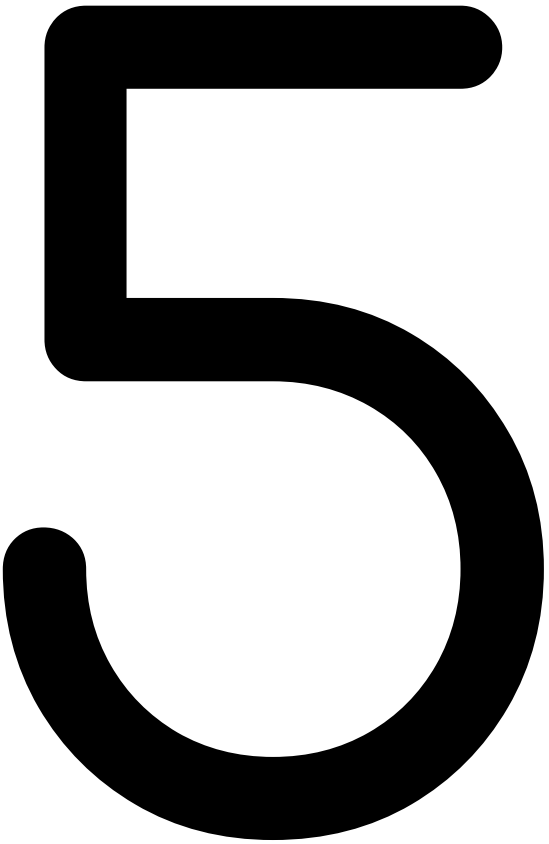
earlier identified factors. Parts included in the functional analysis were at this stage general as navigation within the project had not taken form yet.

Verb	Noun	Necessary (N) / Desired (D)	Comments
Main Function			
Provide	parcel deliveries	N	
Sub Functions			
Offer	flexibility	N	
Offer	a generous pick-up time	N	System availability
Offer	pick-up around the clock	D	System availability
Offer	pick-up 08.00-20.00	N	System availability
Provide	a decision of delivery within short notice	(N)	If not parcel placement during a longer period of time
Allow	decision the same day	D	For parcels being delivered
Allow	decision within 5 hrs	D	For parcels being delivered
Offer	parcel placement during a longer period of time	(N)	If not decision within short notice
Allow	Pick-up during 3 days	N	Storage of parcels
Allow	Pick-up during 7 days	D	Storage of parcels
Offer	delivery within a short distance	N	
Allow	Pick-up within 200m	D	
Allow	Pick-up within 500m	N	
Provide	deliveries with high quality	N	
Minimize	risk of theft	N	
Withstand	circumstances affecting the product's quality	N	
Minimize	risk of defective products	N	
Offer	a short final receiving time	N	
Avoid	requirements on membership	D	
Encourage	preparations before receiving	D	
Allow	fast interaction with the system	N	
Offer	anonymity	N	

Allow	E-legitimation	N	
Offer	anonymous ID-identification	D	
Offer	offer a non-interactive receivement	D	
Offer	support within the LMD process	N	
Allow	trusted people to receive the recipient's parcel	N	

4.4 Conclusion

More detailed needs and requirements related to each factor could be identified. To offer the recipients a good illustrative concept solution, the presented functions in table 4.1 must be taken into account in the development phase. However, all factors do not need to be fulfilled as some functions support the same need.



CHAPTER FIVE

EXPLORATION PHASE I

In this chapter, the first exploration phase is described. The execution of the sessions are described as well as methods that were used. At the end of this chapter, findings from this exploration phase are presented as well as analysis and further development of the findings.

5.1 Aim

This phase aimed to explore different solutions covering the entire design space that potentially could deliver high values to the factors Flexibility and Distance, suitable for the intended user group of recipients. The reason why only these two factors were taken into consideration has its root in their level of importance. The generated ideas will at a later stage take the remaining four factors into consideration.

This exploration phase had two aims; (i) to create as many ideas as possible related to how a high level of Flexibility and Distance could be achieved and (ii) to reach a deeper understanding and search for more needs and requirements that were not addressed in the user phase.

5.2 Method

This exploration phase consisted of two ideation sessions with recipients and one individual ideation session, each presented below.

Ideation session 1

During the first session, four prior design engineering students participated. The session started with an introduction of the topic consisting of an explanation of LMD, what parts are included, how it is conducted today and available delivery methods. In order not to influence the participants, only necessary concerns expressed in the user study were shared.

Methods used: Brainstorming, Brainwriting 3-6-5 & Quick sketching
Mediating object: Map over Gothenburg
Materiel: Pen, paper and post-IT sheets

After the topic introduction, each participant got a paper with 10 empty squares. The task was to create quick sketches illustrating an idea in each square, the time limit was set to 20 seconds for each idea. This session was done in two rounds, firstly with a focus on Flexibility and secondly with a focus on Distance. The quick sketching ended with a joint session where each participant explained their ideas.

After the individual session, a joint brainstorming session was performed. All participants had the possibility to come up with creative ideas, either new ones or adding features/functions to the ideas created during the first session. To support the creativeness and get an understanding of each other's ideas, a map over Gothenburg was used as a mediating object.

The last method used during this session was brainwriting 3-6-5, a method where the participants had the possibility to generate ideas based on the others' ideas.

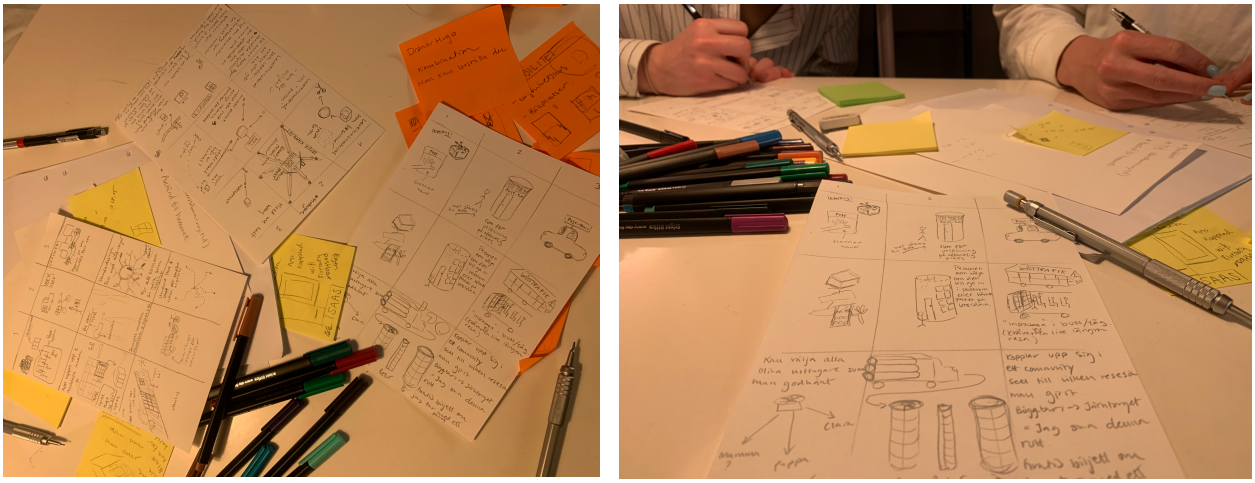


Figure 5.1. Photos from ideation session 1

Ideation session 2

During the second session, three experienced recipients participated. As in the first ideation session, this session started with an introduction of the topic as well as an explanation of today's problems related to LMD.

Methods used: Brainstorming, brainstorming with personas and analogies.
Mediating objects: Map over Gothenburg city, a cube representing the parcel, one household, a van and two persons representing the recipient and the logistics personnel.

This session began with traditional brainstorming. The participants had a common discussion while using the mediating tools. Ideas were continuously written down.

The next brainstorming session was supported by personas. The reason for using personas was to generate more ideas, not only from the participants' perspective, but from the entire user group. Using personas in the ideation session supported the creation of various ideas from many perspectives.

This brainstorming session was introduced by a description of one out of the four personas. The mediating tool representing the persona was placed on the map indicating the persona's accommodation type and its location. Further, the persona's daily situation was described by placing the parcel according to their selection of delivery method. When the mediating objects had been placed on the map, the brainstorming session started. This brainstorming session was performed in four rounds, one for each persona.

The last part of the second ideation session was a brainstorming session supported by analogies. Various objects drawn on cards were placed on the table with the aim to generate more discussions. In each round, two cards were placed on the table to either be combined or to generate ideas individually. Analogies being used were as follow;

Electric scooter, Styr & Ställ, Rubik's cube, Lego, Public transportation, Taxi and an ant hill.

Individual ideation session

The main focus of the individual ideation session was to use the strengths of the existing delivery alternatives and investigate if a combination of those would be a possible solution fulfilling the recipients' needs and requirements. This was done by firstly creating four spider diagrams, one for each delivery alternative, secondly identifying their strengths and weaknesses related to the six factors and finally searching for combinations based on their strengths. It turned out that Parcel locker and Unattended HD created the best combination potentially fulfilling high levels within all factors, see figure 5.2 and 5.3 below.

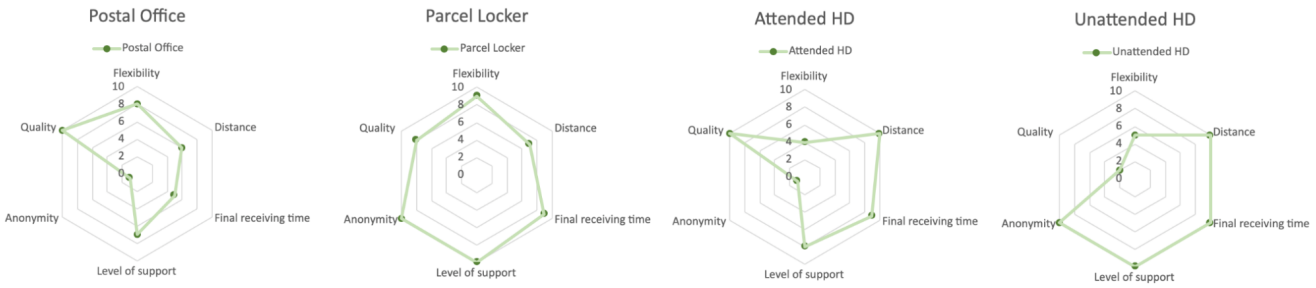


Figure 5.2. Spider diagrams showing how the delivery alternatives score according to the different factors

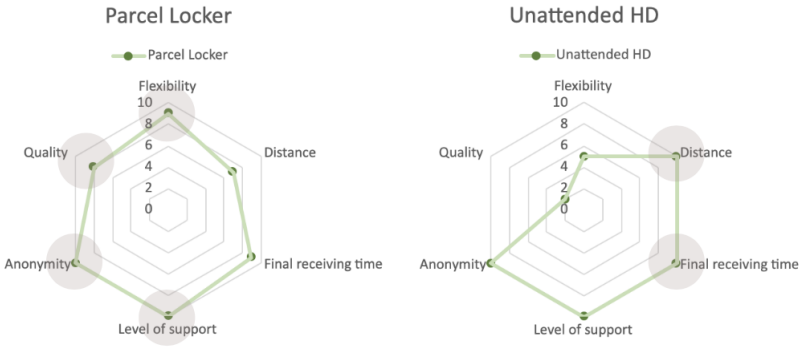


Figure 5.3. Indication of what a combination between parcel locker and unattended HD might be a good solution

By performing a theoretical ideation session investigating if the best solution might be a combination of the already existing delivery alternatives, in combination with two ideation sessions with no limitations, the entire design space was potentially explored.

5.3 Findings

In this section, all findings from exploration phase I are presented.

Potential solutions for Flexibility & Distance

The ideation sessions resulted in a lot of ideas being possible solutions for high level of flexibility and delivery within a short distance. The focus was on generating ideas related to those factors, however, some of the ideas were not within this scope, meaning they did not solve either flexibility or distance. These ideas were still saved, for further analysis of what the recipients value within their LMD process.

The generated ideas were different from each other, but similarities occurred. When analyzing the ideas, six main groups of ideas could be created. After analyzing each group, six principles of how the LMD process could be performed were created. The principles were created to further be able to navigate within this development process and select the best principles for further development. These principles were later evaluated against each other based solely on the two factors Flexibility and Distance as these two were considered most important for the recipients.

Principle 1 - External parcel pickers

Ideas within this group

The first group contains ideas related to external individuals offering to deliver parcels in order to facilitate the LMD for the recipients, see figure 5.4 below. It could for instance be taxi drivers, food couriers or unknown private persons picking up the parcel at a collection point for further transportation of the parcel to the recipient. This is an add-on feature to the already existing LMD situation.

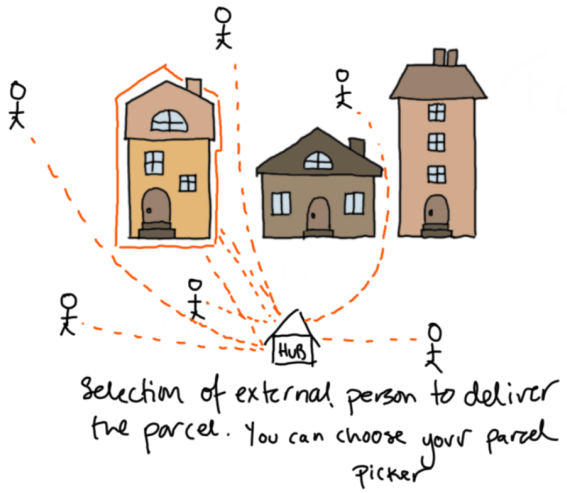


Figure 5.4. Idea representing group 1

Principle Description

The parcel is being distributed to a collection point of the recipient's selection. When the parcel has been delivered to the collection point, the recipient has two options, either to (i) collect the parcel on his/her own, or (ii) connect to a parcel picker system. When connecting to the parcel picker system, available parcel pickers are shown offering the recipient a time for delivery. The recipient has the decision to either accept one of the offers or try again later. Figure 5.5 below illustrates the first principle schematically.

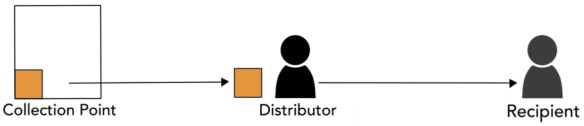
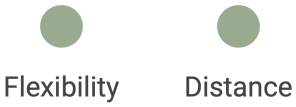


Figure 5.5. Principle 1

Principle Evaluation

This principle is considered to have high values in terms of both flexibility and distance. This is as the recipient has the opportunity to select a parcel picker that will, after a decision within short notice, deliver the parcel to the recipient's home.



Principle 2 - Pick-up along recipient's daily movement pattern

Ideas within this group

The second group contains ideas related to a LMD service delivering parcels along with the recipient's daily movement pattern, see figure 5.6 below. This could for instance be deliveries to kindergartens, public transportation stations, the office reception, or a drive-through system on the way home.

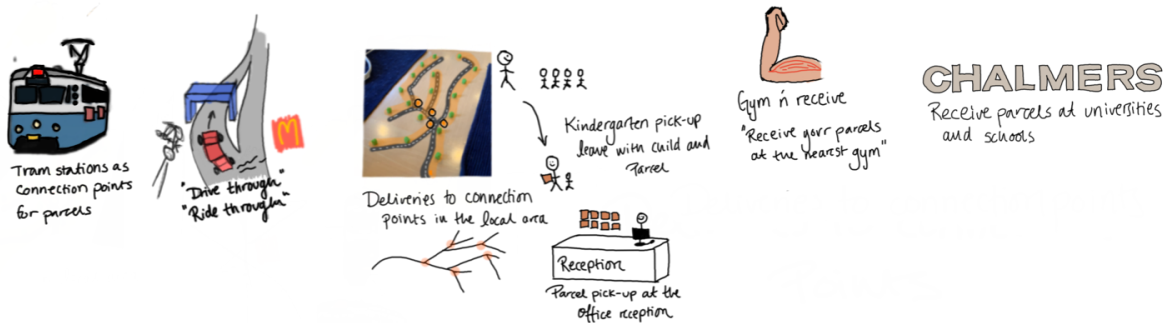


Figure 5.6. Representation of ideas from group 2

Principle Development

After analyzing locations recipients pass by in their daily movement pattern, the location of public transportation stations was considered to be the best and most suitable location for parcel pick-up. This as it reaches the broadest groups of users and has various locations

covering the entire urban area of Gothenburg. Based on the recipient's selection, the parcel will be delivered to a preferred public transportation station. The recipient will thereby be able to receive its parcel along his/hers daily movement pattern and thereby avoid any extra distance required in the LMD system. To maximize the flexibility, the parcel will be located at the collection point over a longer period. Figure 5.7 below illustrates the second principle.

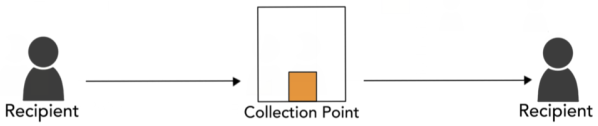


Figure 5.7. Principle 2

Principle Evaluation

This principle has a high value in terms of flexibility as the parcel is located at the same location over a longer period. However, this principle does not score as high when reflecting on the distance. The recipients may have to carry the parcel for a long distance even if the pick-up occurs along with their daily movement pattern. Additionally, the location may not be located along with all recipients' movement patterns as not all use the public transportation system, meaning the distance may not suit all recipients.

Principle 3 - Near home deliveries

Ideas within this group

The third group contains ideas related to near-home deliveries, see figure 5.8 below. This group includes ideas such as individual parcel lockers placed in or outside of the recipients' households. It also includes shared parcel lockers within a shorter distance from the recipients' homes, drone delivery to the recipients' balconies, doors with an integrated parcel delivery system, etc.

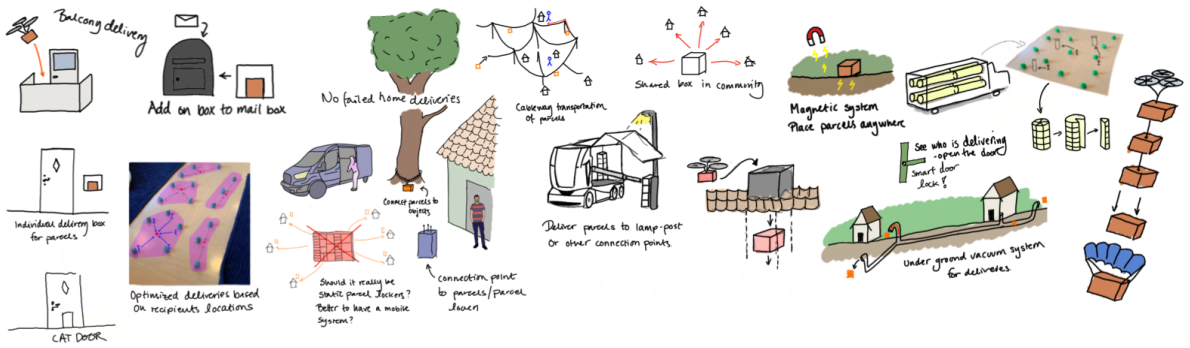


Figure 5.8. Ideas representing group 3

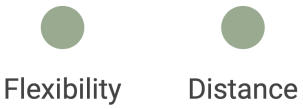
Principle Development

The recipient has within this principle two options; either to (i) collect the parcel on his/her own at the postal office or (ii) choose a near-home delivery service whereby the postal office personnel delivers the parcel near to the recipient's home. After the parcel has been delivered, it is located there over a longer period to increase the level of flexibility for the recipient. The 5.9 below illustrates the third principle.

Figure 5.9. Principle 3

Principle Evaluation

This principle scores high in terms of both flexibility and distance as the parcel is being delivered to a location near the recipient's home in combination with placement of the parcel at the same location over a longer period.



Principle 4 - Parcel community

Ideas within this group

The fourth group contains ideas related to a supportive community consisting of known and well trusted individuals, see figure 5.10 below. As the first group, this group of ideas is added on as a feature to facilitate the existing LMD system. This could for instance be neighbors, family, and friends helping each other to receive and return parcels.

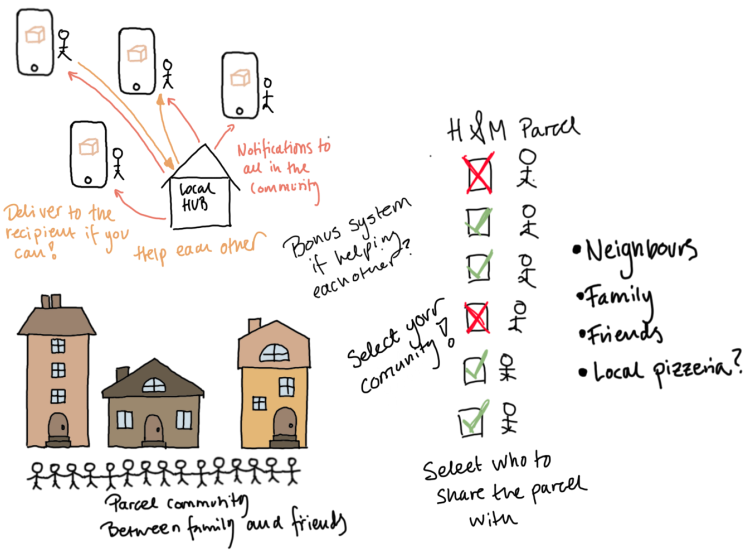


Figure 5.10. Ideas representing group 4

Principle Development

The fourth principle is based on that the recipient selects trusted individuals for his/hers parcel community. The parcel community can consist of family members, neighbors, friends, etc. Once the parcel arrives at the collection point or the LSP appears for HD, a notification is sent out to all members of the parcel community. Thereafter, it is up to the community members to support the recipient. Figure 5.11 below illustrates the fourth principle.

Figure 5.11. Principle 4

Principle Evaluation

The fourth principle scores low in terms of distance as there are no changes implemented, the distance remains the same. The distance may be shorter for the recipient, but instead transferred to another member of the parcel community. The level of flexibility is considered as moderate as the parcel is located at the same place over a longer period as well as increases the level of flexibility as a high level of support is implemented.

Principle 5 - Circulating deliveries

Ideas within this group

The fifth group contains ideas related to a circulating delivery system, see figure 5.12 below. It could be parcel lockers on wheels or vehicles circulating in the local area. What they do have in common is that the recipient has many possibilities of receiving their parcels within a short distance as the vehicle circulates.

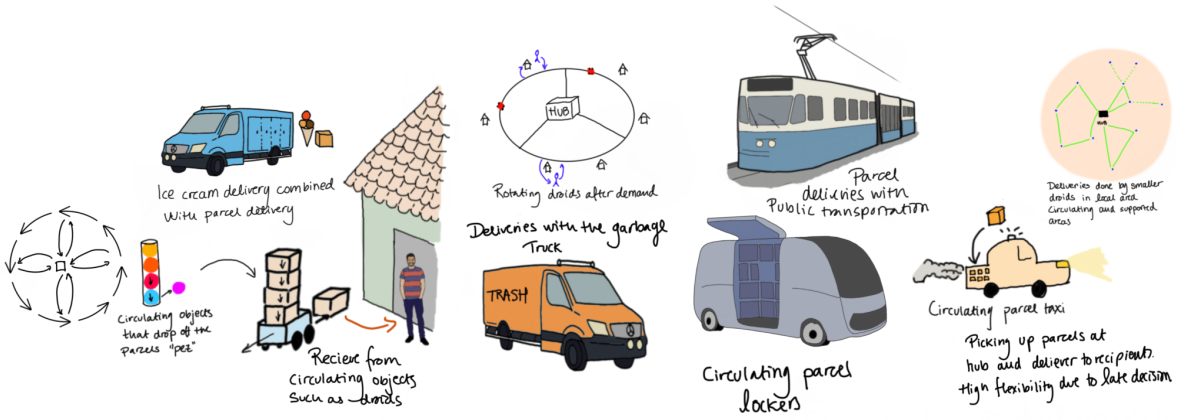


Figure 5.12. Ideas representing group 5

Principle Development

The fifth principle is represented by a local circulating delivery system. When the parcel has arrived at the local postal office, the recipient can place an order informing the postal office personnel to place the parcel on the local circulating delivery service system. If the

recipient's order is placed before a specific time, the parcel can be distributed the same evening, otherwise the following day if suitable for the recipient. Once the parcel is circulating, the recipient will have multiple possibilities to receive the parcel within a short distance. Figure 5.13 below illustrates the fifth principle.

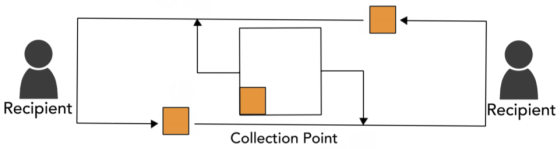
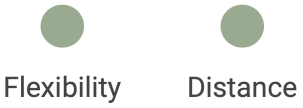


Figure 5.13. Principle 5

Principle Evaluation

This principle's scores are high in terms of both flexibility and distance. The level of flexibility is high as the parcel passes by the recipient household multiple times and the recipient has the decision when to execute the parcel pick-up. Additionally, the pick-up will take place near the recipient's household meaning a high score in terms of distance.



Principle 6 - Flexible collection points

Ideas within this group

The sixth and last group is represented by ideas related to transforming collection-points, see figure 5.14 below. This could be a parcel locker system changing from a non-mobile to a mobile system, a postal office that at the end of the day offers home deliveries, or a postal office offering around-the-clock deliveries by implementing an automated delivery system in the outer wall.

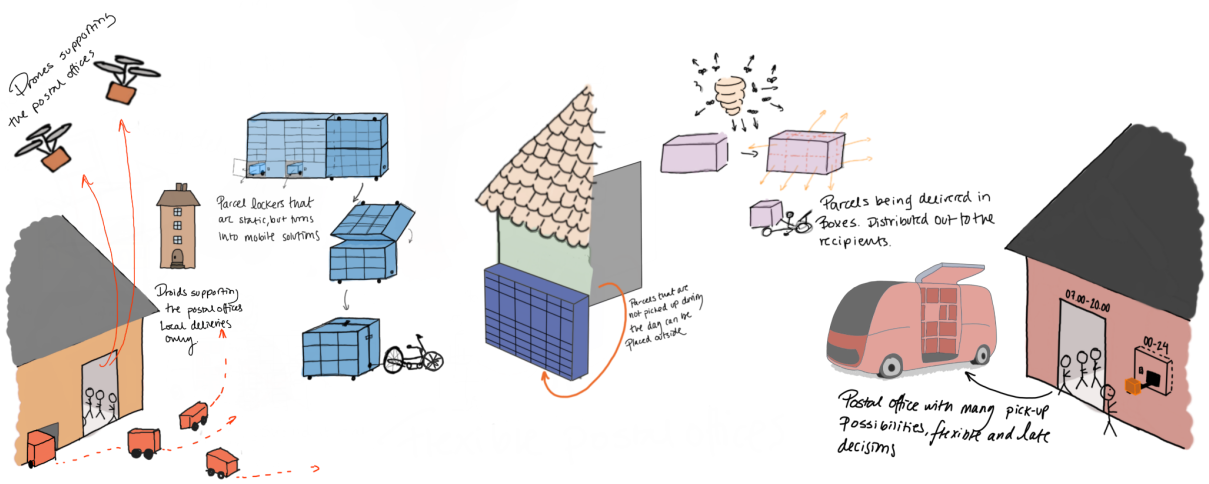


Figure 5.14. Ideas representing group 6

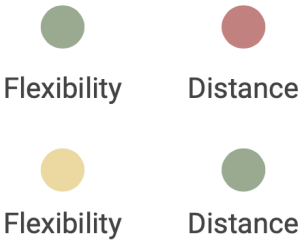
Principle Development

The sixth principle is represented by a collection point transforming from a non-mobile to a mobile collection point. The recipient has the possibility to receive its parcel from the non-mobile parcel locker solution during a specific period of the day. If the parcel has not been received, a second option is offered as the collection point transforms into a mobile solution. The collection point will at the end of the day offer HD in its local area. All recipients could therefore select HD based on a decision within short notice. Figure 5.15 below illustrates the sixth principle.

Figure 5.15. Ideas representing group 6

Principle Evaluation

The last principle scores high in terms of flexibility as the parcel is placed at the same location for a longer period. However, the distance related to the high flexibility is not optimum. Additionally, when the postal office offers HD, a shorter distance is offered, but comes along with a lower score of flexibility as the recipient has to match the delivery.



Principle selection

Based on the evaluation, only three of the principles scored high in terms of both flexibility and distance. These principles will be taken further in the development process and be used as the basis in the creation of concepts. The selected principles are principle one, three, and five.

Principle one: External parcel pickers
Principle three: Near home deliveries
Principle five: Circulating deliveries

Value identification

After reflection, more needs could be identified. It turned out that the ideas generated by the participating recipients contained one or several of the following; Customization, System adaptability, System predictability, Information exchange and/or high level of influence within the delivery process. These needs will further be named as system values, and are described more in detail below.

Customization

The recipients highlighted the importance of a high level of customization. This could for instance be a LMD system where the recipients have the possibility to create their profile with their settings including selection of communication systems, level of notifications and

creation of their default scenario i.e. a system where the recipients could communicate how they prefer their deliveries and "what if" scenarios.

Adaptability

Recipients value a LMD system that is adaptable as a lot of things can change within a short amount of time. If a recipient is not at home or can not receive a parcel at the agreed time, the system should work thereafter coming up with creative solutions. A high level of adaptability makes it possible to tackle upcoming unpredictable events in the recipients everyday life.

Predictability

The recipients want a polite system that is predictable. This means that a LMD system must include a high level of routines, increasing the system's predictability. This could for instance be routines such as "*If the recipient selects HD before time X, the delivery is possible the same day*" or "*If the recipient is not at home at the point of delivery, the parcel returns to the postal office and a new offer is sent to the recipient*".

Information exchange

Good communication is of high importance. The recipients want a system communicating the parcel's status and location expressed through notifications/updates. They want a "fixed" communication system between the recipient and the LSP facilitating the delivery process. This "fixed" system should communicate the recipient's home address, door code, phone number, etc., information that remains the same independent of delivery.

Recipient's influence

The recipients want to have many options and an influence on their delivery process. They want to select delivery location, delivery time, etc. A high level of options increases the level of flexibility as the recipient has the possibility to influence the LMD service.

5.4 Conclusion

From these exploration sessions, a lot of ideas were generated. The generated ideas could, after analysis, create six main groups. These groups contain ideas for a possible LMD solution offering the recipients a delivery within a short distance and/or with high flexibility. The groups, and their containing ideas, helped in the creation of six principles describing how future LMD could be performed.

Based on the evaluation, three principles are taken further into the development process. The selected principles are principle one, three, and five.

Principle one: External parcel pickers
Principle three: Near home deliveries
Principle five: Circulating deliveries

Further, five system values were identified and are, in addition to the earlier identified factors, important to the recipients. It turns out that the recipients are looking for a LMD system offering a high level of flexibility, within a short distance, with a high parcel quality, offering pick-up in an anonymous way, with a short final receiving time and high level of support in combination with a system offering high levels of customization, adaptability, predictability, information exchange, and influence within the LMD process, see figure 5.16.

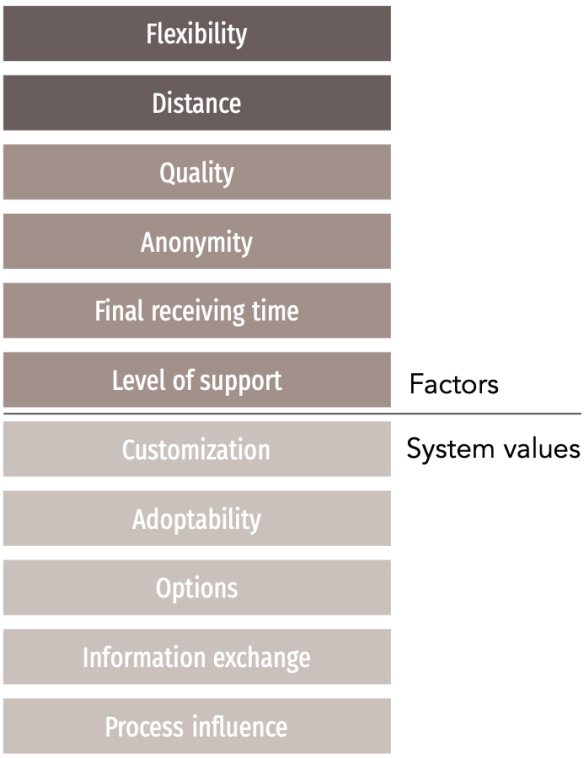


Figure 5.16. Illustration of the six factors and five system values

In the background, the LMD process could be broken down into five significant steps. The last step of the LMD process is when the consignment successfully reaches the recipient. To further be able to perform a successful development process, it is of interest to break down this last step to determine the occurrence of the importance of the six factors and five system values for the recipients, concerning the LMD timeline. Therefore, the process was broken down into three parts; Before Receiving, While Receiving & After Receiving.

To connect the identified factors and system values to these parts, the factors and system values were written down on three pieces of paper each. Thereafter, two recipients had the possibility to place these according to where they find the factors and values as important during the process. In addition, prior knowledge and statements from the user study were used when identifying the occurrence of importance concerning time.

The six factors and five system values were important in one or several of the three parts. Figure 5.17 below illustrates the result.

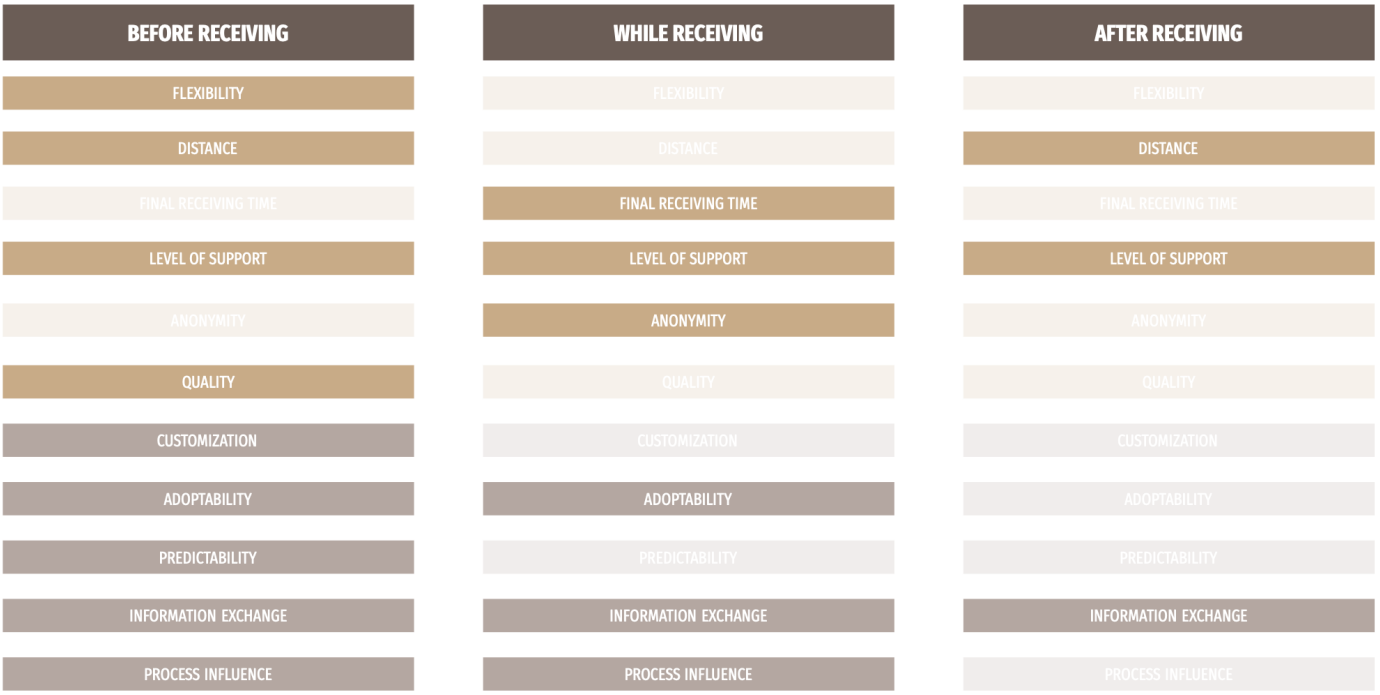


Figure 5.17. LMD process divided into three parts, Before receiving, While receiving and After receiving. Factors and system values important in each part are highlighted.

When the three selected principles are to be further developed into concepts, figure 5.17 above will support the creation as it is being used as a template during the upcoming ideation session.

CHAPTER SIX

EXPLORATION PHASE II

In chapter 5, the final part of the LMD process was broken down into three main parts; Before receiving, While receiving, and After receiving. The six factors and five system values were all related to one or several of these parts. In this chapter, exploration phase II is described. It contains information on the used methods, the performance of the exploration as well as the result.

6.1 Aim

This exploration phase aimed to further develop the three principles into three concepts. The development was based on the four remaining factors and the five system values concerning their importance related in time to fulfill the recipients' needs and requirements in each part of the LMD process.

6.2 Method

Using prior knowledge and insights from the user study, an individual ideation session was performed. One by one, each of the three remaining principles was further developed as brainstorming sessions were performed. Each brainstorming session was divided into and performed in three parts; Before receiving, while receiving, and after receiving. The aim was to generate ideas reaching high levels of the factors and system values related to each part of the process. Figure 5.17 was used as a template during the brainstorming sessions.

6.3 Findings

The development of three remaining principles resulted in three concepts; My Parcel Picker, My Placed Parcel & My Circulating Parcel. Each and every one of these concepts is described in detail below. When the concepts offer one of the factors/system values, the following notations will be used.

(F) Flexibility
(D) Distance
(T) Final receiving time
(S) Level of support
(A) Anonymity
(Q) Quality
(C) Customization
(Ad) Adoptability
(P) Predictability
(I) Information exchange
(Pi) Process influence

Concept 1 - My Parcel Picker

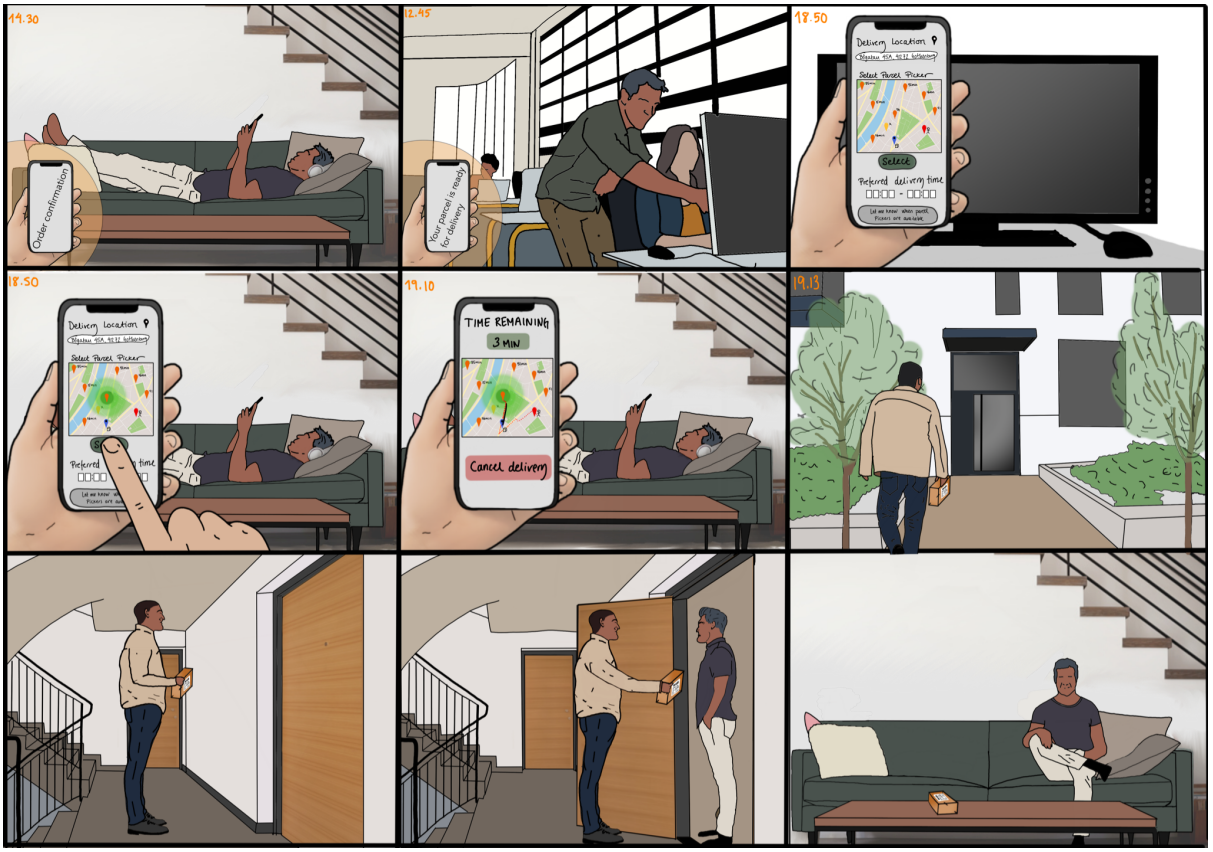


Figure 6.1. Illustration of concept 1, My Parcel Picker

Before receiving:

When the recipient is about to order something online, he/she gets the possibility to download a digital communication system. The digital communication system allows the recipient to create (C) its parcel community (S), select (Pi) frequency and level of notifications (I), and fill in useful information such as an address, phone number, etc.

When the goods have been ordered, the consignment is automatically added (P) to the digital communication system. The recipient will then have the possibility to add trusted people to support his/her LMD process, this by selecting people (Pi, C) within the created parcel community. Added people will receive notifications (I) regarding the consignment as well as have the possibility to receive the parcel to support (S) the recipient.

When the parcel is loaded on the truck at the terminal, the recipient, and the selected people within the parcel community, get notified (I) that the parcel is on its way. When that information reaches the recipient, he/she knows that the parcel will be ready for delivery that, or the upcoming, day (P) depending on the time of loading. When the parcel successfully reaches the postal office, the recipient and the parcel community will automatically get a notification (I) as the parcel is being scanned by the personnel. The parcel will be stored at the postal office for one week (F).

When the recipient knows he/she is ready to receive the parcel, he/she can open the digital communication system in order and search for available parcel pickers. Available parcel pickers are communicated (C) with the information of the time for delivery. The recipient will then have the possibility to select (Pi, F) one of the parcel pickers. If a parcel picker offers a time for delivery and the recipient selects that parcel picker, the order is placed immediately (P), and the parcel picker can not cancel or postpone the time for delivery (P). However, if the recipient wants to cancel the delivery, it is possible (Ad) if the parcel picker has not picked up the parcel (P) at the postal office.

If the recipient does not find any suitable time for delivery, he/she has the possibility to select (Pi) either (i) (F) ask the parcel community (C) for help (S), (ii) (F) create a notification (I) when available parcel pickers between time X and X (C) are available or (iii) (F)pick-up the parcel at the postal office.

When a parcel picker has been selected, live tracking (I, P) of its position is possible. The parcel community will also get information that a parcel picker has been successfully selected and is on its way to the recipient. When the parcel picker is on its way to the postal office, the recipient has the possibility to communicate (I) and inform relevant information about the consignment. Relevant information could for instance be fragile, sensitive, or expensive. By informing this, the risk of the goods' quality being affected will be minimized (Q).

When the parcel picker reaches the postal office, the event of the handover occurs as the postal office personnel gives the parcel picker the parcel. When this event takes place, a notification is sent automatically to the recipient if he/she selected (C) to receive that information (I).

When the parcel picker is near, a notification (I) is sent to the recipient.

While receiving:

When the parcel picker successfully reaches the recipient's front door, the parcel picker can open the communication system to see useful information (I). Information about the apartment floor and apartment no. could be communicated as well as the door code/call number, facilitating the event of delivery. As the recipient has communicated this information, he/she knows that (P) the event of delivery starts as the parcel picker reaches the recipient's door (T).

When the parcel picker is outside, he/she either rings the doorbell or sends a notification depending on (I) what the recipient has selected (Pi). When the recipient opens the door, the parcel can successfully be delivered (T) as the parcel is handed over.

After receiving:

When the parcel has been handed over, the parcel community receives a notification regarding the success of the delivery. As the parcel has been delivered, the recipient does not have to carry the parcel anywhere as the parcel has reached its final destination (D). If the parcel has been delivered to someone within the parcel community (S), communication can further be exchanged through the communication (I) system until the parcel reaches the recipient.

My parcel picker consists of the following parts; Parcel pickers, Postal office personnel, Postal office, Recipient, digital communication system, Routines, and a Parcel community.

Concept 2 - My Placed Parcel

Figure 6.2. Illustration of concept 2, My Placed Parcel

Before receiving:

When the recipient is about to order something online, he/she gets the possibility to download a digital communication system. The digital communication system allows the recipient to create (C) its parcel community (S), select (Pi) frequency and level of notifications (I), and fill in useful information such as an address, phone number, etc.

When the goods have been ordered, the consignment is automatically added (P) to the digital communication system. The recipient will then have the possibility to add trusted people to support his/her LMD process, this by selecting people (Pi, C) within the created parcel community. Added people will receive notifications (I) regarding the consignment as well as have the possibility to receive the parcel to support (S) the recipient.

When the parcel is loaded on the truck at the terminal, the recipient, and the selected people within the parcel community, get notified (I) that the parcel is on its way. When that information reaches the recipient, he/she knows that the parcel will be ready for delivery that, or the upcoming, day (P) depending on the time of loading. When the parcel successfully reaches the postal office, the recipient and the parcel community will

automatically get a notification (I) as the parcel is being scanned by the personnel (P). The parcel will be stored at the postal office for one week (F, P).

When the recipient knows when he/she wants to receive the parcel, he/she can open the digital communication system and inform (I) the postal office personnel about a day and place for delivery by selecting (Pi) preferred connection point. When the recipients open the digital communication system, all connection points are communicated and highlighted on a map. The distance between the parcel's final destination and all connection points is communicated (I, D). The recipient can select a connection point from the map.

If the postal office personnel receives the order before time X, delivery is possible during the same day (P). When the postal office receives the order, the parcel is placed in a delivery box, which later is connected to the selected connection point. At time X, the postal office personnel distribute all boxes to the connection points within their responsible area. When the delivery box is attached to the connection point, a notification is automatically sent to the recipient (P, I). Selected people within the parcel community receive the same information (S).

The recipient has then the possibility to receive its parcel when it suits him/her (F). The delivery box is available 24/7, offering the recipient the possibility to receive whenever he/she wants (F). If something unexpected happens, the recipient could either ask someone within the parcel community to receive the parcel or send a request to the postal office giving them the order to retake the parcel to the postal office for further storing (Q, Pi, F, Co, S, A).

While receiving:

When the recipient is about to receive the parcel, he/she can first navigate to the connection point with help from the communication system (I). The navigation might just be necessary the first time as the delivery location further in time will remain the same (P).

When the recipient has arrived at the connection point, he/she can interact (I) with the connection point through the communication system. The recipient can scan the available QR code on top of the connection point (T). When scanning the QR code, the communication system always sends the recipient for e-legitimation (P). When the recipient has been identified, the delivery box opens successfully and the parcel can be collected anonymously (T, A). If the recipient does not have a smartphone, it is possible to receive an individual code over text (Pi), the customer will be informed (I) that that alternative might not be the best choice as it is not as safe (Q). When the parcel has been collected, the

recipient closes the box and leaves. When the box is closed, the postal office personnel automatically receives the information that the parcel has been collected (P, I).

If a person within the parcel community is about to support the process, he/she can either send the QR code to the recipient for e-legitimation or ask the recipient for an individual code (Pi, I).

After receiving:
When the parcel has been received, the parcel community receives a notification of a successful delivery (I). If the parcel has been received by someone within the parcel community (S), communication can further be exchanged through the communication (I) system until the parcel reaches the recipient.

My placed parcel includes the following parts: Recipient, Parcel Community, Digital communication system, postal office, postal office personnel, routines, physical connection points, and physical delivery boxes.

Concept 3 - My Circulating Parcel

Figure 6.3. Illustration of concept 3, My Circulating Parcel

Before receiving:
When the recipient is about to order something online, he/she gets the possibility to download a digital communication system. The digital communication system allows the recipient to create (C) its parcel community, select (Pi) frequency and level of notifications (I), and fill in useful information such as an address, phone number, etc.

When the goods have been ordered, the consignment is automatically added (P) to the digital communication system. The recipient will then have the possibility to add trusted people to support his/her LMD process, this by selecting people (I, C) within the created parcel community. Added people will receive notifications (I) regarding the consignment as well as have the possibility to receive the parcel to support (S) the recipient.

When the parcel is loaded on the truck at the terminal, the recipient, and the selected people within the parcel community, get notified (I) that the parcel is on its way. When that information reaches the recipient, he/she knows that the parcel will be ready for delivery that, or the upcoming, day (P) depending on the time of loading. When the parcel successfully reaches the postal office, the recipient and parcel community will automatically get a notification (I) as the parcel is being scanned by the personnel. The parcel will be stored at the postal office for one week (F).

When the recipient knows he/she is ready to receive the parcel, he/she can open the digital communication system and give the postal office personnel the information to load the parcel on the circulating vehicle (I). If the order is placed before time X, the parcel will be placed on the circulating vehicle that current day (P). When the parcel is loaded on the vehicle, a notification is sent automatically (P, I).

The circulating vehicle will later circulate in the local area with all its orders. The recipients will then have the possibility to meet the main vehicle along its path, or order a supportive vehicle for delivery within a shorter distance (Pi, D). The main vehicle always has the same path, but can make stops all along the path after the request from the recipients (P, A, Pi). As the main vehicle circulates, the recipients will get multiple options when to receive the parcel (Pi, F, P). If the recipient needs support, selected people within the parcel community can receive it from the circulating vehicle (S, Pi). If a member of the parcel community lives in the same area, he/she can receive from the nearest location as the system offers stops anywhere (A, Pi).

While receiving:
When the recipient reaches the main path/meets the supportive vehicle, he/she can stop the vehicle through the communication system (I). The recipient will then have the

possibility to interact with the vehicle by scanning a QR code that is placed on the vehicle. The recipient will then, after scanning, be sent to an identification system to be verified, and once identified, the main/supportive vehicle opens a box containing the parcel (T). As no interaction with persons occurs, the delivery is anonymous (A). If the recipient does not have a smartphone, a code can be sent over text (A), a code that can be communicated through an interface system with the vehicle (Pi).

If, for some reason, the parcel has not been collected, the parcel returns to the postal office for further storage (A, P). The recipient will thereafter have other possibilities for delivery.

After receiving:
When the parcel has been collected, the parcel community receives a notification regarding the success of the delivery, the postal office receives the same information (I).

If the parcel has been delivered to someone within the parcel community (S), communication can further be exchanged through the communication (I) system until the parcel reaches the recipient.

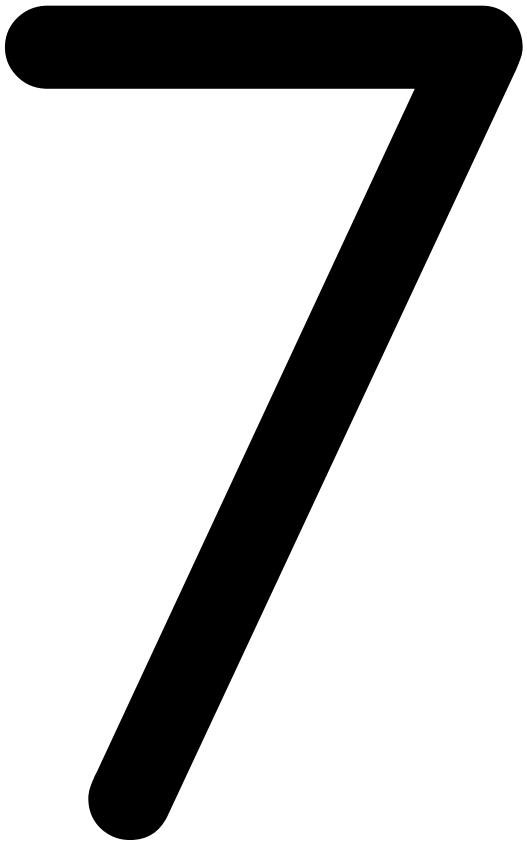
If the recipient has received the parcel in person, it is just to carry the parcel home (D).

My Circulating Parcel consists of the following parts; Main circulating vehicle, supportive vehicles, parcel community, postal office personnel, routines, digital communication system, and predefined circulation paths.

6.4 Conclusion

The three principles could successfully be further developed creating concepts. These concepts were developed based on the factors and system values, concerning their time of importance.

These concepts are now on such a detailed level that they could be evaluated both theoretically and empirically.



CHAPTER SEVEN

EVALUATION PHASE

In chapter 6 the three principles were further developed into three concepts. In this part of the project, these three concepts are evaluated against each other based on the recipient's needs & requirements making it possible to select one final concept for further development.

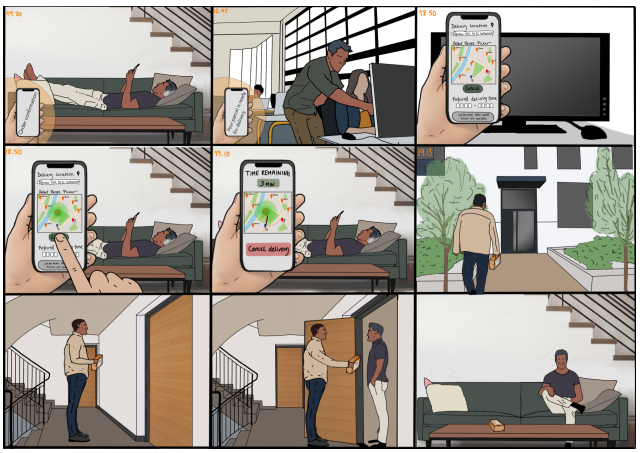
7.1 Aim

This evaluation phase aimed to evaluate the three remaining concepts, My Parcel Picker, My Placed Parcel, and My Circulating Parcel in order to select the final concept.

7.2 Method

This evaluation consisted of two main parts, (i) empirical evaluation and (ii) theoretical evaluation.

To evaluate the three concepts against today's solutions, a baseline scenario was created based on the result from the user study. As 77% chose to collect their parcels from a collection point, the baseline concept was represented by a local HUB from where the recipient receives the parcel. To evaluate the concepts on an equivalent level, this scenario was also expressed by a cartoon scenario sequence. The baseline was during this evaluation presented as one of the concepts to perform an equal evaluation.



My Parcel Picker

My Placed Parcel

My Circulating Parcel

My Local Parcel

Empirical evaluation

12 recipients participated in the empirical evaluation, in 12 individual evaluation sessions. The 12 participants order online regularly and were therefore considered relevant participants for this evaluation. Some of the chosen participants were already involved in the LMD process as they took part in the user study as interviewees. However, none of the participants selected for the evaluation had participated in the ideation sessions, to avoid opinions related to ideas that they had created or already were familiar with. The evaluation had four steps; firstly to evaluate each concept separately, secondly to compare them against each other, thirdly evaluate against today's scenario, and finally to ask follow up questions based on the results from part one, to gain knowledge of how to improve and develop the final concept further. For the full evaluation script, see appendix VII.

Each evaluation session was introduced by a short description of the project and what to expect during the upcoming evaluation session. The evaluation session consisted of three parts;

In the first part, one of the four concepts was described with its cartoon scenario sequence. For each picture, the evaluation leader read up a script explaining the illustration. The same script was used throughout all evaluation sessions to perform an equal evaluation. To support the understanding of each concept, the illustrative map was shown as the concept was being described. After the concept had been described, the participant got three questions related to the concept.

1. Explain your thoughts related to this concept!
2. What strengths does this concept have?
3. What weaknesses does this concept have?

After these questions, the participants had the opportunity to rate the concept on six rating scales. Each rating scale was related to one of the six factors recipients value in the LMD process.

The first part was repeated four times, one for each concept. To achieve an equal evaluation, the order of the concepts varied as participants tend to evaluate upcoming concepts based on the previously explained ones.

Figure 7.1. A photo from one of the evaluation sessions

In the second part, the recipients evaluated the concepts against each other. This evaluation was performed by giving the recipients four cards, each card representing one of the four concepts. The recipients were then ordered to place these cards in a sequence, starting with the concept they liked the most to the concept they liked the least and to give a short explanation as the cards were being placed.

My Parcel Picker

My Placed Parcel

My Criculating Parcel

My Local Parcel

The last part contained follow-up questions based on the result from the first part. By looking at the rating scales, questions were asked about those factors the recipients had rated as low. This was performed to understand what must be improved further with the final concept.

Theoretical evaluation

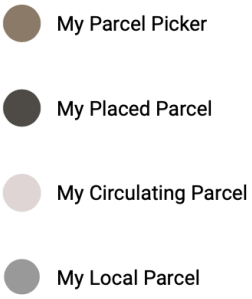
The theoretical evaluation had two aims; (i) to identify how the three concepts potentially could fulfill the six factors and (ii) to identify what should be improved in the final concept. The execution of the theoretical evaluation was based on prior knowledge as well as analyzing and reflecting upon how well the concepts achieve the factors.

7.3 Findings

In this section, findings from the evaluation sessions are presented. Initially the results from the individual concept evaluation part are presented followed by the result from the part where all concepts were rated against each other.

The results from the likert scale are presented below in figure 7.2. What could be identified was that all concepts had their strengths and weaknesses, and whatever concept taken further into the process needs improvements within one or several areas.

What further could be identified was the fact that My Placed Parcel achieved a high overall result with respect to all factors, and that My Parcel Picker had either a very high or low score. If taking My Parcel Picker further into the development process, improvements must be made to increase its level of anonymity. Both My circulating Parcel and My Local Parcel had moderate / high results with respect to all factors, meaning small improvements must be considered within all areas. See the result from the likert scales below in figure 7.2.



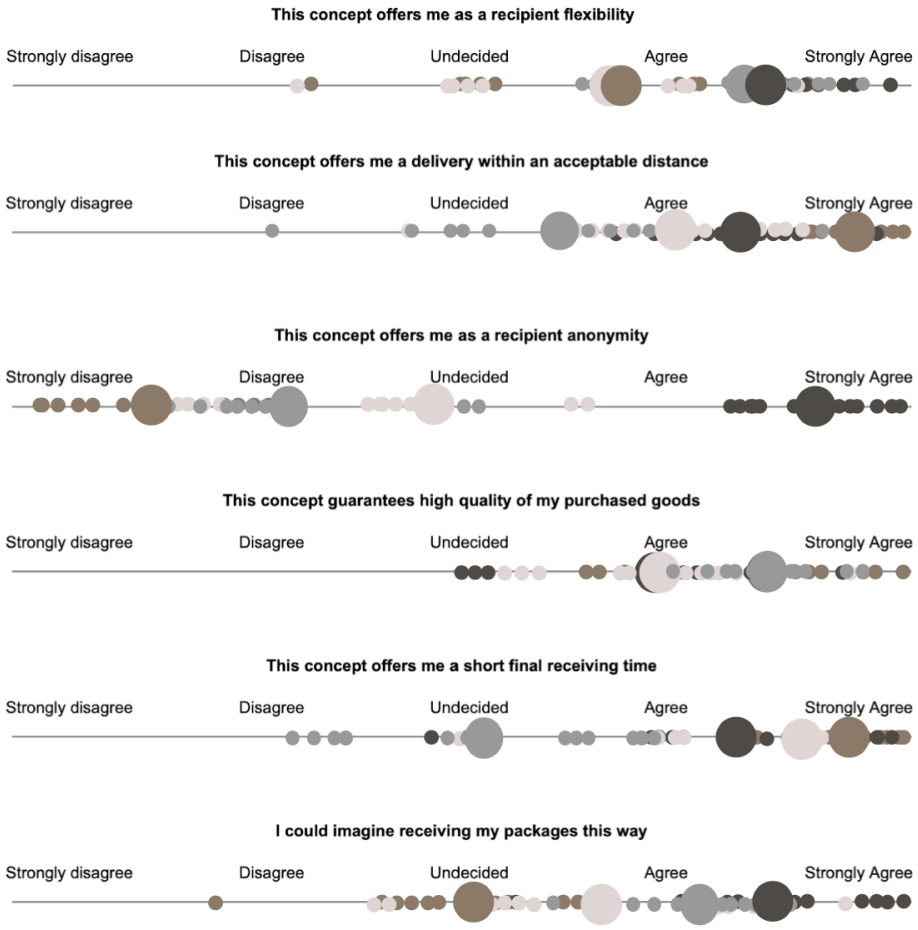


Figure 7.2. Result from the grading scales

The result from the individual evaluation sessions, with respect to both the likert scales and the statements from the recipients, could be summarized as below in figure 7.3. The spider diagrams illustrate the result with respect to each factor and where improvements must be considered when taking the selected concept further into the development process.

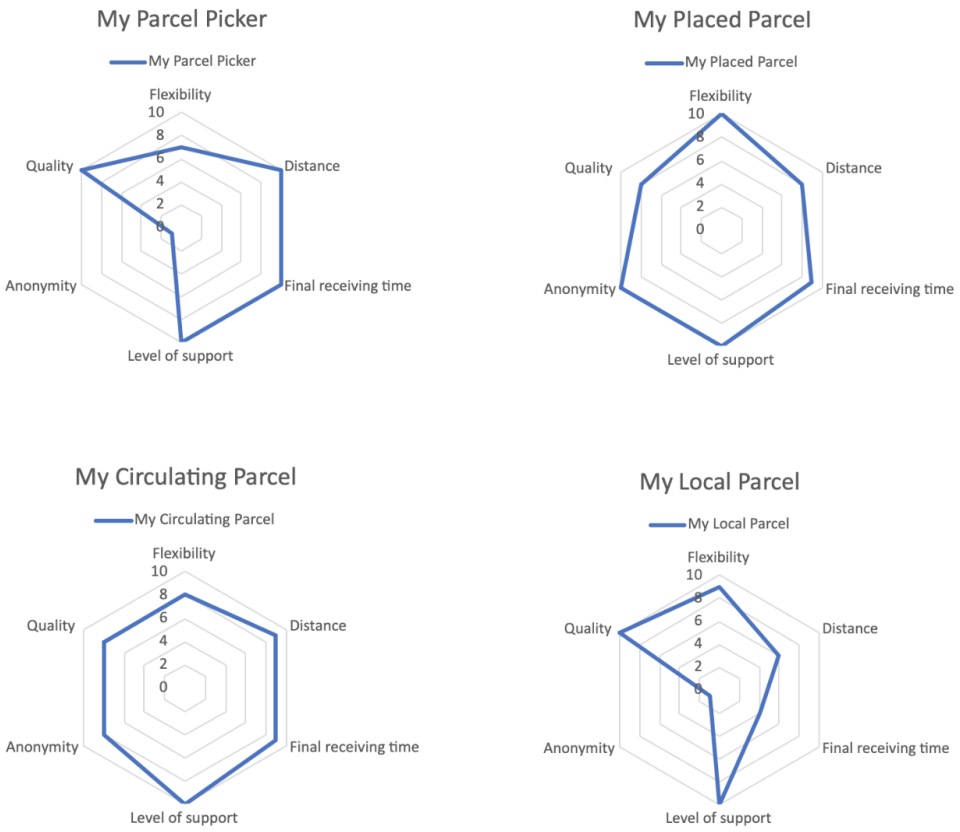


Figure 7.3. The four concepts with respect to the six factors.

When the recipients were about to rate the concepts against each other, the result could be presented as below in figure 7.4. The concept being highest ranked by the participants was "My Placed Parcel" followed by "My circulating parcel" and "My local parcel". The concept being ranked as the lowest was "My Parcel Picker". This concept was ranked as the least appreciated as the recipients saw some uncertainties with the availability of the parcel pickers. Further it could be discussed that the participants rated "My Local Parcel" as high as they are familiar with that concept.

Depending on how the concepts were rated, a score between 1 and 4 was given. Each vertical line represents the result from one participant. The final result is presented to the right indicating My Placed Parcel as the most appreciated concept.

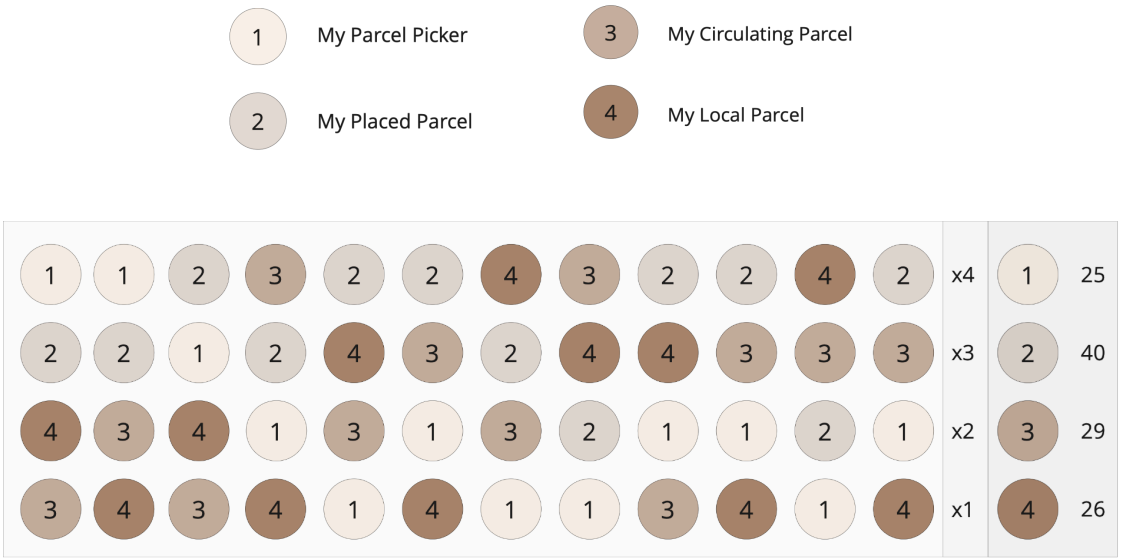


Figure 7.4. Result from the comparison of the four concepts

7.4 Conclusion

When reflecting upon the result from the evaluation session, the decision was made to take "My Placed Parcel" further into the process selected as the final concept. This decision was based on the fact that this concept was ranked as the highest by the recipients when all concepts were rated against each other as well as promising results in the rating scales as well as in the theoretical evaluation.

However, "My Placed Parcel" must be further developed with its main focus on quality as the evaluation indicated a lower score with respect to this factor. Also, the location of the connection points must be investigated further, where should the connection points be located to reach as many recipients as possible in combination with the shortest distance possible?

8

CHAPTER EIGHT

MY PLACED PARCEL

In this chapter, My Placed Parcel is described and illustrated. The vision of My Placed Parcel is stated as well as parts included in the system. Further, the future vision of My Placed Parcel is described. My Placed Parcel is also described from the logistics personnel's point of view.

My Placed Parcel is the new and innovative solution facilitating your parcel delivery process. My Placed Parcel offers you as a recipient the possibility to receive parcels within a short distance, with a high level of flexibility in an anonymous way. The system offers you as a recipient the possibility to choose both when and where to receive your parcels, within a short notice of time. Through a digital communication system, My Placed Parcel offers you as a recipient the possibility to connect your parcels to a parcel community increasing the level of support as well as enable information exchange with the logistics personnel. My Placed Parcel is a system allowing you to communicate relevant information regarding your parcel, and thereby ensure the goods remain its quality.

8.1 Vision of My Placed Parcel

The vision of My Placed Parcel is to reach a higher level of satisfaction for the recipients when ordering online. Recipients must no longer choose between Flexibility and Distance as My Placed Parcel offers both. Further, the vision of My Placed Parcel is to simplify the delivery process for all involved, by offering a digital communication system as well as a parcel community where friends and relatives can support each other. The vision of My Placed Parcel is to associate the delivery process with a high level of satisfaction, this by offering delivery with high flexibility within a short distance. Further, the vision of My Placed Parcel is to support the future of logistics, by acting as an intermediate as new technologies enter the market.

8.2 Parts included of My Placed Parcel

My Placed Parcel is a concept consisting of many abstraction levels. My Placed Parcel consists of three main parts, (i) physical products represented by connection points and delivery boxes, (ii) a digital communication system, and (iii) routines.

Physical products

My Placed Parcel includes non-mobile connection points, see figure 8.1 below. These connection points are located in the urban area of cities allowing logistics personnel to attach/detach delivery boxes as parcels are being distributed or have been received. When several delivery boxes are about to be connected, the connection point can be extended to enable space for more boxes. To facilitate the distribution for the logistics personnel, the connection points are located near roads for easy access. Further, as the connection points have fixed locations, the logistics personnel will find it easy to navigate as the locations will be a part of their daily delivery routine. When a box is attached to a connection point, a notification is directly sent to the recipient informing that his/hers parcel is ready to be received. This feature is something that facilitates the event of delivery for the logistics personnel as the information is sent automatically. When the recipient arrives, a QR code placed on the connection point can easily be scanned sending the recipient further to the E-legitimation system.

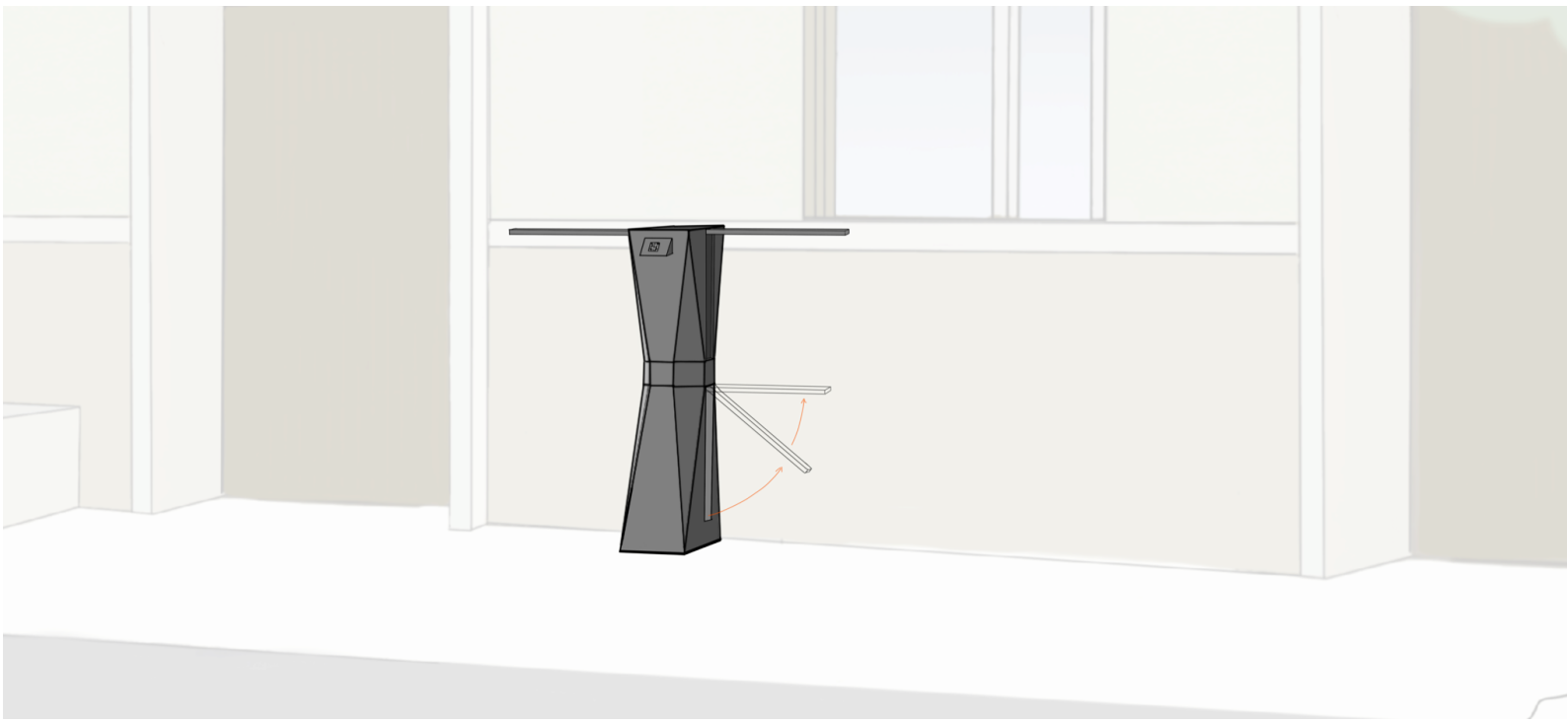


Figure 8.1. Connection point

As mentioned, the connection points are located at specific places making it possible for the postal office personnel to support its local area during the day as the delivery boxes can be distributed.

In addition to the connection points, My Placed Parcel includes delivery boxes, see figure 8.2 below. These can easily be attached/detached to the connection points after the

recipients' request and demand. The delivery boxes come in three different sizes; S, M, and L making it possible for the logistics personnel to optimize the size of the box after the size of the parcel, see figure 8.3 below.

As goods can be of high value or sensitive to external circumstances, the boxes come in three variants; normal box, temperature-sensitive box, and safety box. The communication system makes it possible to inform the logistics personnel which box is suitable for the delivery.

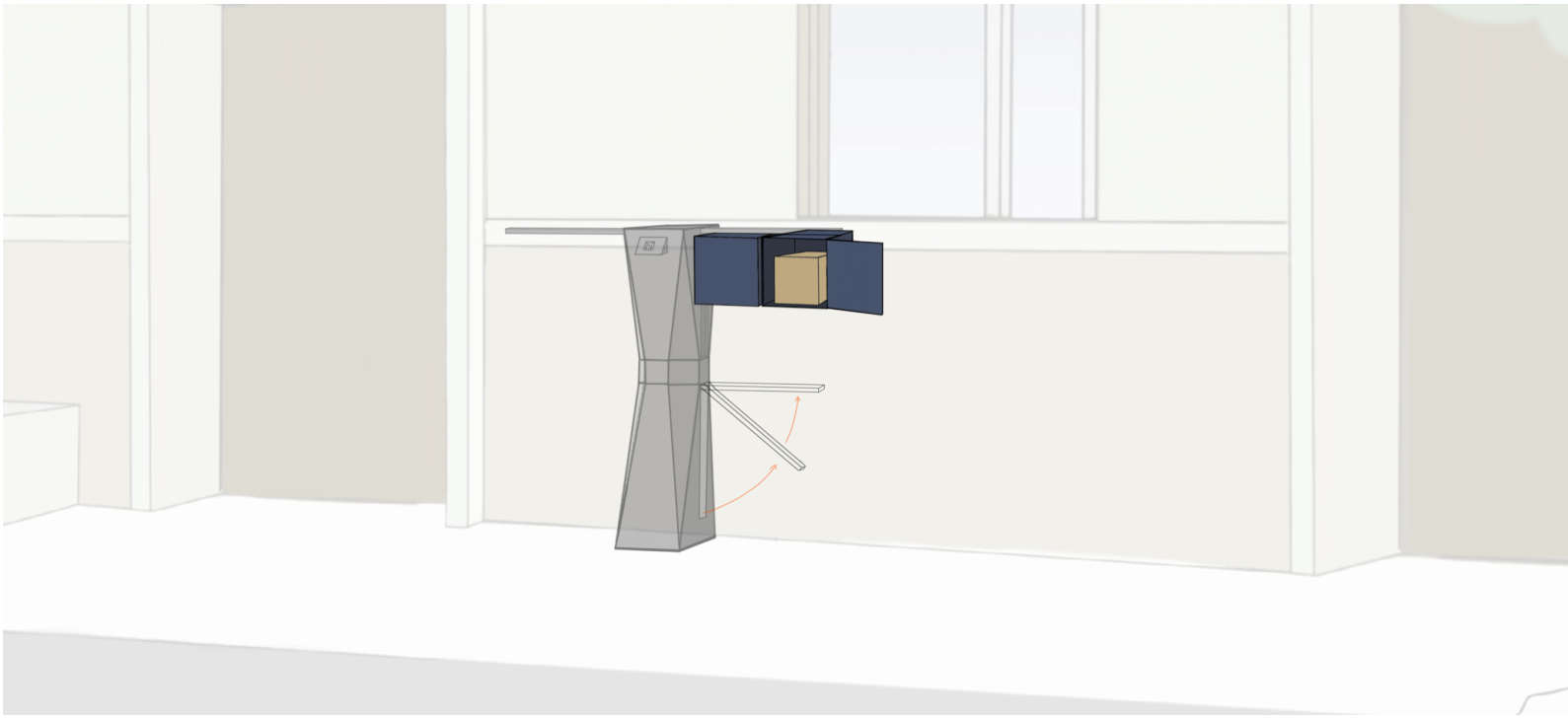


Figure 8.2. Delivery boxes attached to a connection point.

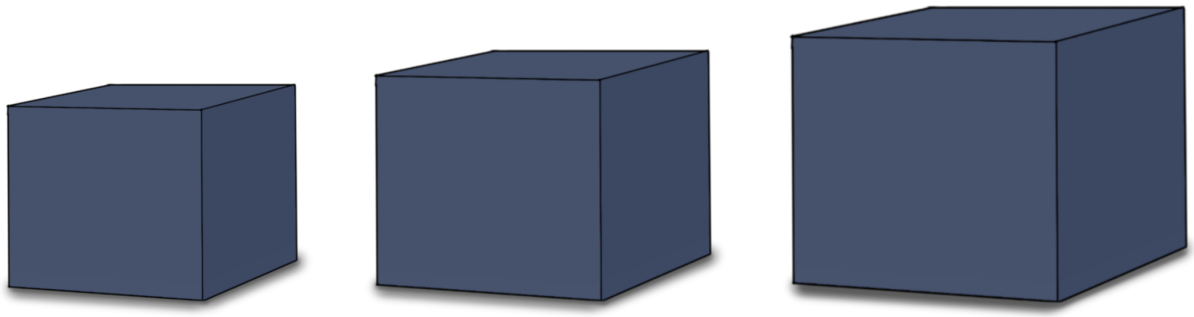


Figure 8.3. Delivery boxes in three different sizes.

Digital communication system

In addition to the physical products, My Placed Parcel includes a digital platform acting as a communication system between the recipient, logistics personnel, parcel community and the connection point. When the parcel arrives at the postal office, the recipient can open the digital communication platform and choose the preferred day, and location of delivery.

The system communicates all available connection points allowing the recipients to select both delivery day and location by choosing a suitable connection point, see figure 8.4 below.

Figure 8.4. The digital communication system

Further, the digital communication system allows the recipients to create a parcel community. Selected and trusted people of the recipient's selection could be added to the

community. For each parcel delivery, the recipient has the possibility to ask the community for support by selecting members for that specific delivery, see figure 8.5.

Figure 8.5. Digital communication system illustrating the parcel community

The digital communication system further allows the recipient to interact with the connection points as each connection point has a QR-code, see figure 8.6. When the QR-code is scanned, the recipient is sent further to an E-legitimation system allowing the recipient to receive his/hers parcel in a fast and anonymous way without interaction.

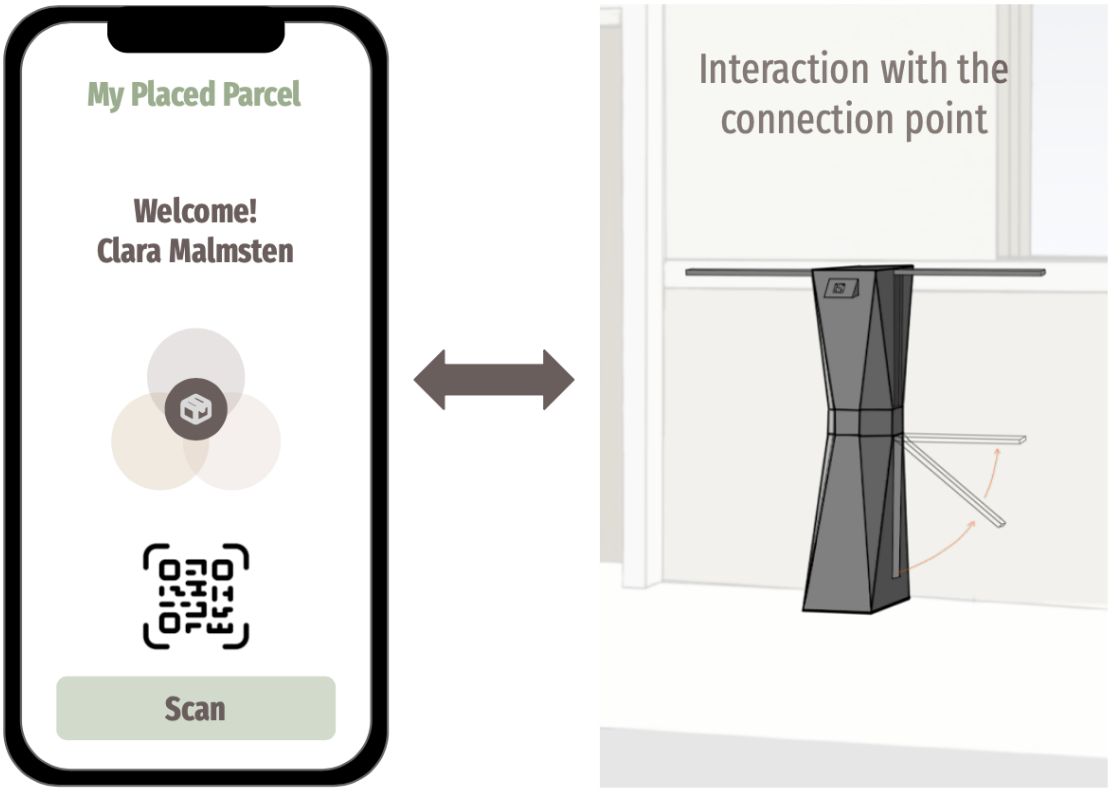


Figure 8.6. The digital communication system allowing the recipients to interact with the connection points

System routines

As in almost all systems, My Placed Parcel includes a level of routines. These routines are related to time, location, communication as well as performance. The routines increase the level of predictability within the LMD system.

Time

- The recipient has the possibility to place an order for delivery on the same day before 16.30. After 16.30, the postal office personnel no longer have the possibility to distribute the parcel the same day as goods have already been loaded in their vehicle.
- The parcel is placed in a distributed delivery box for three days, thereafter the personnel collect the parcel and return it to the retailer.
- The parcel is being stored at the local hub for 7 days. If no delivery information has been received after 7 days, the parcel returns to the retailer.
- The distribution always starts at 18.00

Location

- The connection points are non-mobile. Therefore, the pick-up always takes place at the same location (if the same connection point is chosen).

Communication

- When the parcel is loaded on the truck, a notification is automatically sent to the recipient
- When the parcel arrives at the local hub, a notification is automatically sent to the recipient as the personnel scans the parcel
- When the delivery box is attached to the connection point, a notification is automatically sent to the recipient
- All communication is performed through the digital communication system

Performance

- If a recipient ordered home delivery, but is not at home of the event for delivery, the logistics personnel could use My Placed Parcel as plan B if the recipient has agreed to that.

8.3 My Placed Parcel from the Logistics personnel's perspective

As stated in the result from the user study, the logistics personnel encounter difficulties in their daily work as parcels are distributed and delivered. The result indicated difficulties related to communication with the recipients, entering apartment buildings, finding the locations of delivery as well as an uneven flow of deliveries during the day resulting in a stressful situation.

My Placed Parcel allows the logistics personnel to distribute parcels without communicating / interacting directly with the recipients. Further, My Placed Parcel allows the logistics personnel to deliver parcels within an acceptable distance without entering any buildings as the connection points are located outside. As the locations of the connection points are fixed, the logistics personnel will in a short amount of time remember each location facilitating the distribution process. My Placed Parcel also enables distribution whenever it is suitable for the logistics personnel making the level of distribution more even and predictable over the day.

8.4 Future vision of My Placed Parcel

As stated in the background, the LMD process is constantly under development and new technological solutions arise on the market within this area. Regardless of which technology will deliver parcels in the future, one can discuss the level of flexibility when two mobile parts must interact with each other at a specific time as parcels are being delivered. To extend the level of flexibility, My Placed Parcel could act as an intermediate, to all implemented technologies in the future. With My Placed Parcel acting as a non-mobile intermediate, less distribution vehicles will be needed as distribution can be performed with an even flow, and not just when the recipients are available. Further it will bring a decreased risk of failed deliveries as no critical pick-up time will take place, see figure 8.7 below.

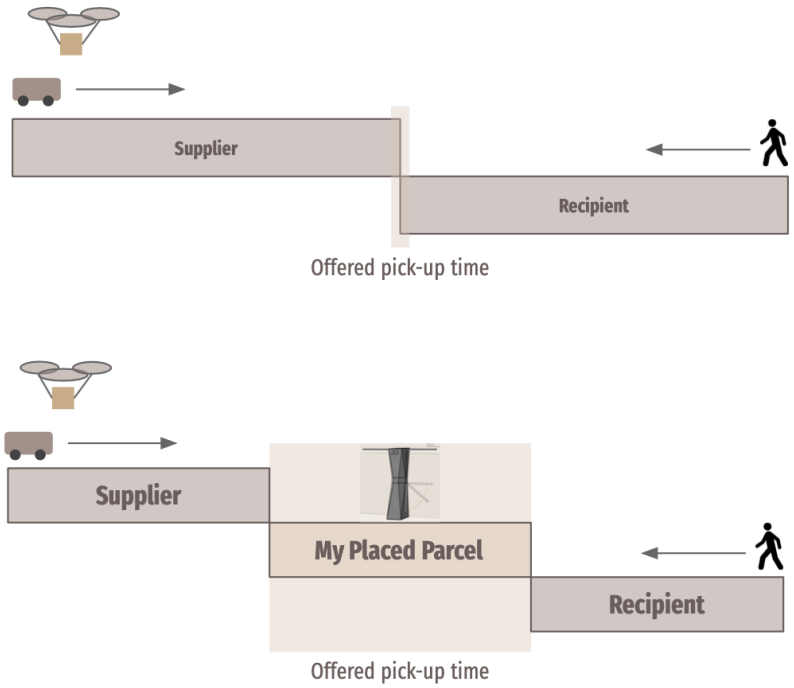


Figure 8.7. My Placed Parcel acting as an intermediate

My Placed Parcel could act as an intermediate to almost all future solutions. In figure 8.8, the future vision of My Placed Parcel is illustrated showing various technologies interacting with the system. The figure illustrates how both humans, drones and droids are able to distribute delivery boxes to the connection points. This means that My Placed Parcel is not

only a solution developed based on today's situation, but also taking future technological opportunities into account.

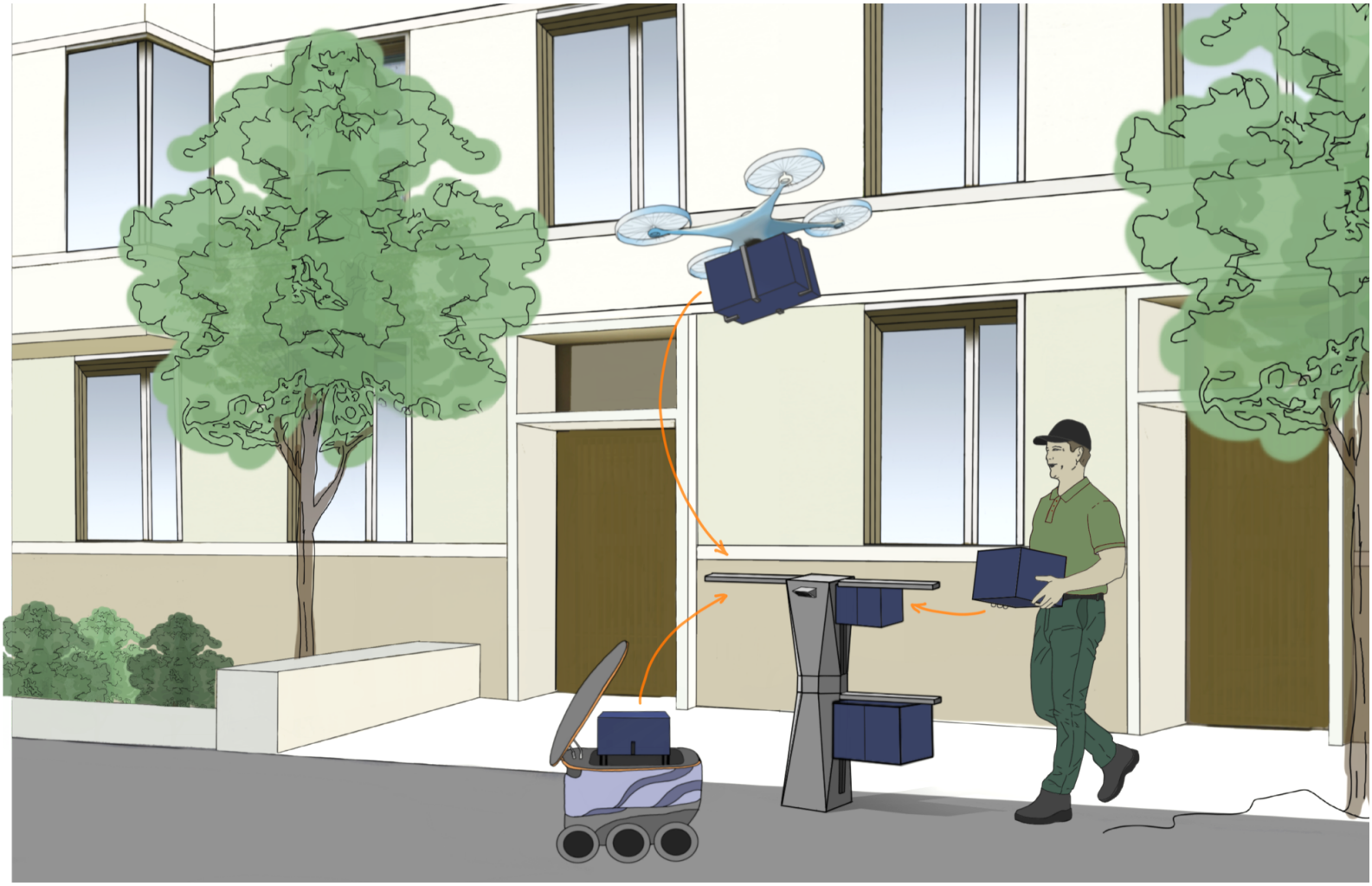


Figure 8.8. Various technologies interacting with My Placed Parcel.

As stated by one of the experts, future LMD could include water distribution by using urban watercourses. As illustrated in figure 8.9, My Placed Parcel could at specific locations act as an intermediate allowing this type of distribution.

Figure 8.9. Parcel distribution by using urban watercourses

CHAPTER NINE

DISCUSSION & CONCLUSION

This chapter includes a discussion on the project's process, used methods, and selection of participants. This chapter also includes reflection upon the result, further work and sustainability, and ethical aspects. The chapter ends with a conclusion reflecting on the research questions stated in the introduction.

9.1 Discussion

The process leading to the final concept

When this master thesis project started, the perception was to be able to perform a traditional product development process and use the same attitude on how to approach the problem and the process. It took a while before realizing that this development project was about navigating and finding what is the best solution, rather than developing an already defined solution on a more detailed level. It was, at the beginning of the project, difficult to accept that this development project ends where my prior project used to start. Before accepting that, the project felt overwhelmed as I wanted to end up on the same detailed level as I was used to.

The level of detail was, however, something that was a repeated issue during this project. When needs and requirements were defined, those had to be on an overall level rather than a detailed one. This as the needs and requirements were used for navigation at this stage. Requirements on a detailed level could be set first when the final solution was found, as detailed needs and requirements are solution-dependent.

Further, as this project included a lot of process navigation, many things were performed during the project that did not provide a specific result. This happened mainly at the beginning of the project, in the pre-study phase when searching for literature. Even if what was performed was not used as a result, the performance was still necessary as it supported the understanding of what was the right direction.

Another aspect to discuss is the fact that I was considered as a main user as I order online regularly. In prior development projects, I have been able to enter my projects without being influenced, but here I was familiar with today's delivery situation meaning I had knowledge, but also an opinion, when starting this project. This was beneficial in situations where I needed to understand the LMD system, but not always as preferable in the ideation phase as it was easy to judge the ideas and not give them a proper chance. However, as I realized this early in the project, all ideas were given a chance.

What also needs to be discussed is the setup of the project group. It was only me. In all product development processes, discussions are a key to success. Further, many methods require more than just one participant, making it difficult to spontaneously perform a method if needed. However, one positive aspect was the fact that almost all of my friends, relatives, and study partners were considered relevant users as they order online regularly. This made it possible for me to easily find participants for discussions, ideation sessions, or/and evaluation sessions.

In the project planning phase, observations of Schenker's LMD process were intended to be performed, but as the Corona pandemic still affected the business, no observations could be performed. It was therefore difficult to find the logistics personnel's "unexpressed needs and requirements" as these often are found through observations. However, what I did instead was to search for prior works/studies within that area with the aim of finding those needs and requirements in the literature instead.

At the beginning of this project, my goal was to develop a solution that fulfills the recipients', logistics personnel's, and postal office personnel's requirements. When I realized that these user groups have contradictory demands placed on the LMD process, a prioritization of the user groups had to take place. The project then took a turn as the recipients became prio one. That turn was good in many ways, not just only because of the contradictory demands, but also because the project became more delimited and defined, helping me in the right direction and easier decision making.

Even if the project became more delimited, the scope was still broad as the LMD process is extensive. The breakdown of the process into three parts; Before Receiving, While Receiving, and After Receiving, helped me to focus on one part at the time making sure that each part fulfilled the recipients' needs and requirements.

Why not just a non-mobile parcel locker?

One of the most frequently asked questions I got when presenting My Placed Parcel was "Why not just a non-mobile parcel locker?". The answer to this question includes a lot of aspects. Firstly, My Placed Parcel's floating box system makes it possible to distribute parcels within a short distance both when the demand is high and low. With a traditional parcel locker, a lot of lockers are needed and to prepare for both high demand and short distance, the parcel locker system must be large. With My Placed Parcel, boxes are only distributed after demand decreases the level of empty boxes.

Another aspect is the fact that today's parcel lockers require permission to be installed and according to the web, it might be easier to get permission for installation of My Placed Parcel rather than traditional parcel lockers. Additionally, My Placed Parcel is a more attractive design solution for the local environment.

Finally, My Placed Parcel is developed not just taking today's situation into account, but also arising technologies within the area. My Placed Parcel will, as mentioned, be able to act as an intermediate to future technologies enabling parcels to be distributed in a secure way, within a short distance and with a high level of flexibility.

Methods and selection of participants

Within this development project, several methods were used to reach a final concept solution for LMD. Selected methods within this work supported each other making it possible to triangulate the problem from different perspectives. When different methods indicated the same result, the outcome became more reliable. This happened both in the user study when performing both focus groups, interviews, and a questionnaire, as well as in the ideation session phase. For example, methods used during that phase gave similar results making it possible to conclude that a major part of the design space was covered.

What further needs to be discussed is the fact that even though this development project had a more holistic approach, the same methods that I have been using earlier could be used. This indicates that there is not a major difference between a holistic and detailed development process, it is more related to the project group's attitude.

A method I wanted to use while generating concepts was a morphological matrix, but as it was difficult to break down the LMD system into sub-systems the execution of a morphological matrix was difficult to perform. A morphological matrix would be suitable when further developing My Placed Parcel.

During this project participants could easily be found as both study partners, colleagues, friends, and relatives are considered as main users. Participants selected for the user study and concept evaluation were both people I know as well as people I do not know. One could argue that people I know might say what they want me to hear, but as their opinions reflected the unknown individual's opinion, that aspect could be excluded.

What further needs to be discussed is the fact that the participants found it difficult to generate ideas within an area that they were familiar with. All participants order online on a regular basis meaning they were all influenced by today's situation. If I would have been able to re-do the ideation session, I would consider users with less experience in order to

exclude limitations that experienced users might have identified. To support the ideation session, personas were used as one of the methods. It was a great idea as the participants were able to think from multiple perspectives representing the entire user group as well as leaving their everyday situation when generating ideas.

Validation from the recipients' point of view

There are a lot of users within the LMD process, all having different needs & requirements meaning it is difficult to satisfy all users with one specific solution. When reflecting upon the personas' needs & requirements the system scores high in terms of all factors considered as very important. It scores high in terms of both flexibility, distance, anonymity and level of support. When it comes to the important factors, one could identify that the system has a high score in terms of final receiving time, but quality is still the most critical factor. The implementation of safety boxes and temperature sensitive boxes increased the level of quality, but further improvements must be considered, see figure 9.1.

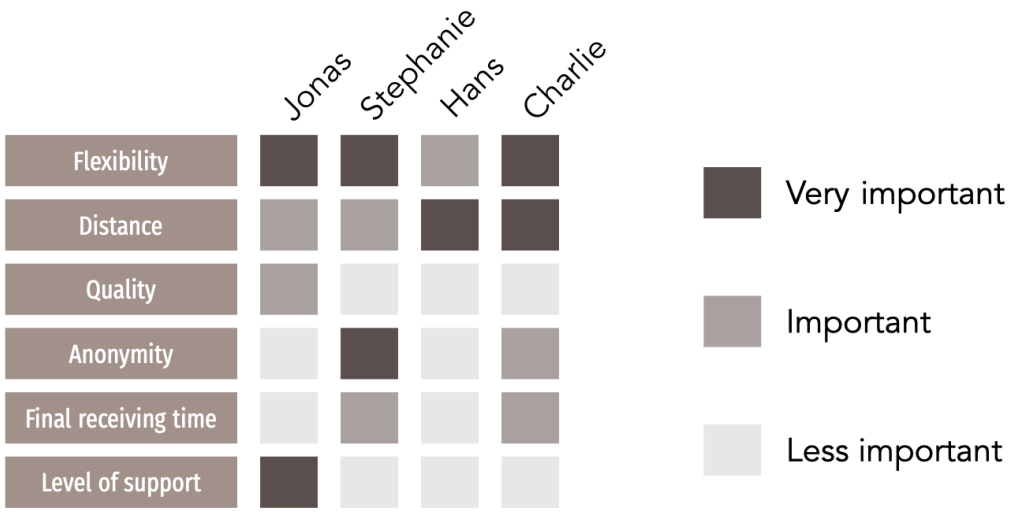


Figure 9.1. The personas' needs & requirements

In addition, My Placed Parcel's location must be investigated further in order to identify where the optimum locations reaching most recipients within a short distance, see figure 9.2 and 9.3.

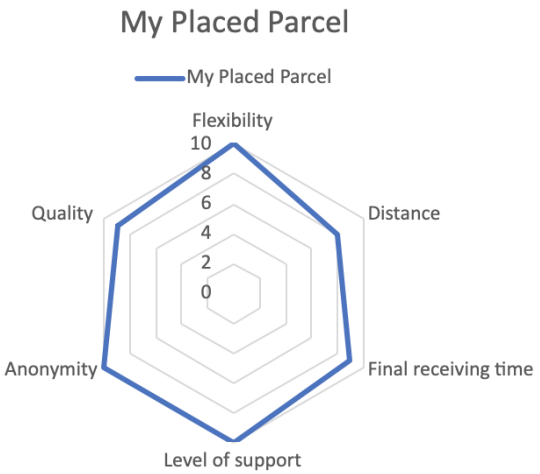


Figure 9.2. My Placed Parcel with respect to each factor

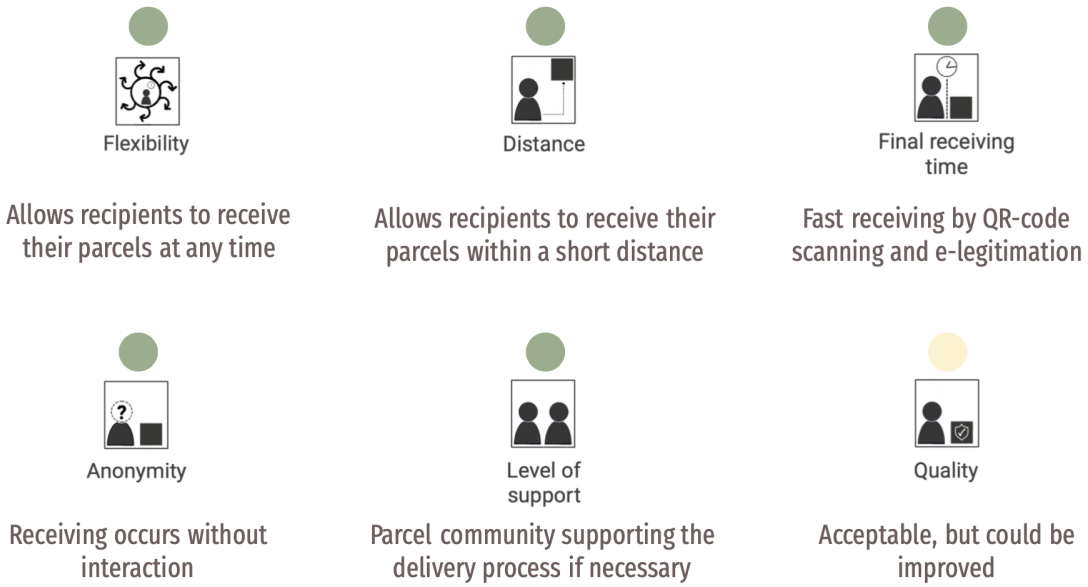


Figure 9.3. My Placed Parcel with respect to each factor and short explanation

The location of My Placed Parcel will still result in an operational complexity as it has dispersal of delivery destinations. But as the efficiency of LMD can be improved in at least two ways: decreasing the distance from the distribution center or reducing the number of failed deliveries, My Placed Parcel could be considered as a beneficial system as it reduces the level of failed deliveries. Further, the distance between final storage and delivery location is reduced as parcels are being stored at the postal office.

Validation from the logistics personnel's point of view

Below, 11 concerns from the user study expressed by the logistics personnel are presented. Under the expression, an explanation of how My Placed Parcel tackles that issue is described.

"Recipients are difficult to reach due to lack of good communication" & "A lot of time is spent on contacting the recipients"

My Placed Parcel has no physical interaction between the logistics personnel and the recipients as parcels are being distributed to connection points. This excludes the need for critical communication between the personnel and the recipient. Necessary information is communicated before the event of delivery takes place. If relevant information has not been communicated, the process for delivery wont start.

"Delivery locations are difficult to find"

As the connection points are located at fixed positions, the logistics personnel will remember their locations after a few rounds of distribution. This means that logistics personnel will no longer find the delivery locations difficult to find.

"Dysfunctional entrance codes" & "Lack of entrance systems with code/call system"

With My Placed Parcel, there is no need for entrance codes / call systems as no deliveries take place inside a building complex.

"Not available parcel lockers at collection points"

Lack of available delivery boxes is something that hypothetically could happen. However, this is something that is detected earlier in the process as the parcels are being placed in a box before the distribution takes place. This means that miles will be driven unnecessarily.

"Time consuming deliveries"

To facilitate the deliveries for the recipients, parcels have to be distributed within an acceptable distance for them. This means that the distribution event will be time consuming for the personnel. However, as no interaction occurs, the delivery locations are easier to find and located near the roads, the overall distribution is less time consuming compared to traditional attended / unattended HD.

"Not at home"-phenomena, delivery failures

This is no longer a problem as parcels could be distributed in the absence of the recipients.

"Lack of trust, i.e. recipients feel suspicious against the personnel"
As parcels are distributed in delivery boxes, the trust issue will decrease from the recipients point of view. However, what could be discussed is the fact that the delivery box may be empty when the receiver opens it. It then becomes words against words. However, if this is repeated, the LSP can contact the logistics personnel due to independent sources reporting the same thing.

"Parcels has to be delivered during rush hours, only time recipients are home"
With My Placed Parcel, the logistics personnel have the possibility to distribute the parcel before rush hour. Delivery boxes could be attached at any time during the day.

"Parcel deliveries peaks during 3 hours, uneven workload"
With My Placed Parcel, logistics personnel have the possibility to distribute parcels during the day, and thereby create a more even workload.

Further work

As explained earlier, this product development project ends where other product development projects start. The outcome of this project is the navigation towards the best solution, but this solution has to be developed on a more detailed level in order to meet needs and requirements from the recipients as well as other stakeholders involved.
What needs to be done is to create a detailed requirement specification of how My Placed Parcel should be designed and work. The requirement specification should have one section for each part of the system. To be able to generate this requirement specification, a new round of user studies must be performed with the aim of collecting more detailed needs and requirements. The user study should be performed with the aim of answering the following example questions;

- How should the digital communication system be designed and what features must be included?
- How should the connection point's interface be designed?
- How should the attachment points be designed in order to facilitate attachment/detachment?
- How should the connection points be designed?
- How should the delivery boxes be designed in order to facilitate the event of pick-up, attachment, detachment as well as transportation?

When the requirement specification is generated, another round of ideation sessions has to be performed coming up with ideas of how these needs and requirements should be fulfilled. When developing the final concept of My Placed Parcel, one has to have a sustainable approach. This by taking aspects such as design for maintenance, shared

functionalities, long lasting design, and a lightweight design into account when developing further. Materials also have to be selected with respect to both the product's requirements, but also sustainability.

As new technologies arise on the market, the final development of My Placed Parcel should also take these technologies into account. This as My Placed Parcel should be able to act as an intermediate between those future technologies and the recipient. Further development of My Placed Parcel should also contain ideas on how to increase the level of quality.

When My Placed Parcel has reached its final development stage, one has to investigate where the most optimum locations are. This research should answer the following question "Where should the connection points be located in order to (i) reach as many recipients as possible (ii) within a short distance as possible as well as (iii) giving the logistics personnel easy access while distributing the consignments.

The last part of My Placed Parcels further work is related to profitability for the LSP. What pricing strategy must the LSP select in order to remain profitable after implementing My Placed Parcel?

Sustainability aspects

In this project, the recipients' needs and requirements have been the one in focus when developing. What should be discussed is the fact that those needs and requirements lead towards a solution that is not the most sustainable. I am referring to the requirement regarding a delivery within a short distance. What should be discussed is the fact that today, the distribution may be considered as more sustainable as parcels are being distributed to collection-points. When calculating the environmental impact, all transportation distances have to be taken into consideration, both performed by the LSP and the recipients.

Further sustainability aspects to discuss is the fact that the more recipients using My Placed Parcel, the more sustainable. This as more goods can be delivered within the same distribution route. In addition, an aspect to investigate further is the possibility for the system to allow returns of goods. By integrating a system for returns My Placed Parcel could be even more sustainable as the least sustainable and most expensive freight is air.

Ethical, environmental & societal factors

What needs to be discussed is what ethical, environmental, and societal factors My Placed Parcel might deal with. First of all, My Placed Parcel might not be the most suitable solution for rural areas where the distance requirement does not meet the delivery capacity. To meet the recipients needs and requirements regarding distance, a lot of connection points will be

needed. This means that the solution is not suitable for all locations, and that some recipients might be excluded.

The system also requires a smartphone, this in order to interact with the connection point as well as placing the order of delivery. All recipients may not have a smartphone or might not be able to manage one. This is an aspect that may result in users feeling excluded. What could be investigated to minimize the risk of this factor, is the potential of alternative communication channels and interaction methods with the connection points.

In addition, one could discuss integrity and GDPR as data might be necessary to store. It is therefore important to inform the recipients what data is stored and for what reason.

Further, My Placed Parcel is a system in need of electricity as the system must be able to interact with the logistics personnel as well as with the recipients. Electricity consumption is something affecting the environment. It is therefore important to develop My Placed Parcel with an energy-saving mode excluding unnecessary energy consumption in absence of users.

9.2 Conclusion

Today, the three user groups face various issues in their LMD processes. Recipients value flexibility, distance, short final receiving time, anonymity, level of support, and quality high, but none of the available solutions offer high values in terms of all of these factors, forcing the recipients to choose a delivery method based on what they place as priority one.

The logistics personnel face issues related to lack of good communication with the recipients, difficulties to enter buildings, as well as difficulties regarding navigation resulting in a time-consuming parcel distribution. Further, parcels need to be delivered when the recipients are available resulting in an uneven flow of deliveries with its peak later in the evenings, making it costly for the LSP. Finally, when distributing parcels using unattended HD as the delivery method, the logistics personnel struggle with a lack of trust from the recipients.

The postal office personnel face issues related to unprepared recipients, consumers having various errands, and an uneven flow of consumers' appearance resulting in an uneven workload during the day.

In order to meet the three target groups' needs and requirements, a LMD system must offer high levels of flexibility, distance, final receiving time, anonymity, level of support and quality. In addition, the LMD system must include the five identified system values; customization, adoptability, predictability, information exchange and process influence to increase the recipients' level of satisfaction. After analyzing these six factors and five system values, flexibility and distance could be identified as the most important aspects within a LMD system.

There exist six principles of how a LMD system could be performed to achieve high scores in terms of flexibility and distance. After further analysis, three of these principles were considered to potentially be able to achieve high scores, not just high in terms of flexibility and distance, but also in terms of the four remaining factors as well as the five system values. These principles generated one concept each and after evaluation, a final concept was selected, My Placed Parcel.

My Placed Parcel, is an illustrative concept solution representing how parcels can be distributed and delivered in the future, developed by taking both the six factors and five system values into account. My Placed Parcel is a concept solution developed after today's needs and requirements, but also with respect to emerging technologies and future visions within LMD.

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APPENDICES

APPENDIX I - Interview script, Recipients

Intervjuledare: Clara Malmsten
Intervjuobjekt:
Hushållstyp: Lägenhet / Villa
Område:
Frekvens av näthandel:

Inledning:

Jag skriver nu mitt examensarbete inom sista milen leveranser av paket med fokus på slutmottagarens upplevelse. Sista milen leveranser är sista delen av logistikkedjan, dvs. paketens logistik och flöde från terminal tills dess att de når sina slutmottagare.

Jag kommer ställa ca 15 frågor och intervjun uppskattas till att ta ca 30 minuter. Dina svar är anonyma. Om du har några frågor under intervjutillfället, tveka inte att avbryta mig.

Jag ber dig svara så sanningsenligt som som möjligt för att studien ska få ett så trovärdigt resultat som möjligt.

Inledningsfrågor

1. Hur ofta beställer du paket på nätet?
2. Vad för typ av varor brukar du beställa när du beställer på nätet?

Öppna frågor

1. Berätta om din upplevelse utav paketleveranser
2. Vad gör att du är nöjd med hur dina paket levereras idag? Beskriv
3. Vad gör att du är mindre nöjd med hur dina paket levereras idag? Beskriv

Dagens leveranser

1. Vilket leveranssätt av de som finns möjliga föredrar du?
    a. Varför väljer du detta leveranssätt?
    b. Vad är anledningen till att du väljer bort övriga leveranssätt?
2. Vad är din erfarenhet utan paketboxar?
    a. Vad ser du för fördelar med denna lösning utav paketleveranser?
    b. Vad ser du för nackdelar med denna typ av lösning?
    c. Tycker du att boxarna idag är placerade på optimala ställen?
        i. Om nej, var hade du velat att de skulle vara placerade?
3. Vad är din erfarenhet utav hemleverans?
    a. Vad ser du för fördelar med denna lösning utav paketleveranser?
    b. Vad ser du för nackdelar med denna typ av lösning?
4. Vad är din erfarenhet utav leverans av paket till ombud?
    a. Vad ser du för fördelar med denna lösning utav paketleveranser?
    b. Vad ser du för nackdelar med denna typ av lösning?
    c. Tycker du att ombuden är placerade på ett bra sätt? Om nej, var hade du velat att dessa skulle vara placerade?
5. Vad är din erfarenhet utav drop-off hemleverans?
    a. Vad ser du för fördelar med denna lösning utav paketleveranser?
    b. Vad ser du för nackdelar med denna typ av lösning?
6. På vilket sätt tror du att dagens leveranser skulle kunna förbättras?

Problematik med dagens leveranser

1. Har du tidigare haft mindre bra upplevelser av en paketleverans, vad hände då?
    a. Om ja, hur tror du att en sådan händelse skulle kunna undvikas?

Önskat scenario

1. Hur vill du ha dina paket levererade? Tänk helt fritt!
2. Vilken tid på dygnet vill du helst ha dina paket levererade?
3. Hur vill du hämta ut/motta ditt paket?
4. Idag är leveranser av paket kopplat hemadress, föredrar du att det är på detta sätt eller önskar du en annan leveransplats?
5. Vill du alltid att dina paket ska komma till samma position?

Framtiden

1. Hur ställer du dig till att få dina framtida paket levererade på annat sätt än av människor?
2. Hur tror du att vi kommer få paket levererade år 2050?
3. Om du får tänka helt fritt, hur skulle du då vilja få dina framtida paket levererade?

Viktigt för mottagaren

1. Vad är viktigast för dig sett till när du väljer leverans
    a. Kort leveranstid
    b. Att leveransen är miljövänlig
    c. Att jag kan hämta mitt paket när jag vill
    d. Leveransen har ett lågt pris
    e. Levereras med ett kort avstånd till mitt hem
2. Hur långt är du varit villig att ta dig för att hämta ut dina paket sett till att du inte har bil.
3. Hur mycket kan du tänka dig att betala för en leverans?

4. Är du villig att betala mer för en leverans som är miljövänlig?

Appendix II - Interview script, Postal Office Personnel

Erfarenhet

1. Hur länge har du arbetat med paketleveranser?
2. Vad är/var din roll inom paketleveranser?

Generella frågor

1. Kan du berätta lite om hur paketen kommer till er och hur själva flödet av paket ser ut?

Problematik

1. När paketen kommer till ombudet, hur går det till?
    a. Är det några delar som fungerar mindre bra? Om ja, beskriv?
2. När paketen sorteras in hos ombudet, hur går det till?
    a. Är det något som fungerar bra / mindre bra? Beskriv
3. När slutmottagaren kommer till ombudet, hur går den processen till sett från ombudets sida?
    a. Vad fungerar bra / mindre bra vid överlämning av paket?
4. Är det något annat i processen du vill lyfta fram som problematiskt, om ja, vad?
5. Finns det några problem du hört kunder lyfta fram under dina år inom paketindustrin?
6. Finns det några problem du hört leveranspersonalen lyfta fram inom paketindustrin?

Olika aktörer

1. Skiljer sig leveransprocessen åt sett till vilken aktör som levererar paketet?
    a. Någon aktör som har ett smidigare leveranssätt? Beskriv
    b. Någon aktör som har ett mindre smidigt leveranssätt? Beskriv

Logistik på ombud

1. Hur är logistiken på ett ombud?
2. Är det svårt att hitta paketen?
3. Hur tror du att logistiken hos ombuden skulle kunna förbättras?

Boxar

1. Vad är din erfarenhet utav boxar?
2. Har du någon gång sorterat in paket i dessa boxar?
    a. Om ja, berätta om den processen

Appendix III - Interview script, Logistics Personnel

Erfarenhet

3. Hur länge har du arbetat med paketleveranser?
4. Vad är/var din roll inom paketleveranser?

Generella frågor

2. Kan du berätta lite om hur paketen distribueras och hur flödet av paket ser ut?

Problematik

7. När paketen lastas i bilen, hur går det till?
    a. Är det några delar som fungerar mindre bra? Om ja, beskriv?
8. När du kör din distribueringsrutt, hur går det till?
    a. Är det något som fungerar bra / mindre bra? Beskriv
9. När du når leveranspunkten och paketet ska levereras, hur går det till?
    a. Vad fungerar bra / mindre bra vid överlämning av paket?
10. Är det något annat i processen du vill lyfta fram som problematiskt, om ja, vad?

Olika aktörer

2. Skiljer sig distribueringsprocessen åt sett till vilken aktör man arbetar för?
    a. Någon aktör som har ett smidigare leveranssätt? Beskriv
    b. Någon aktör som har ett mindre smidigt leveranssätt? Beskriv

Logistik i fordon

4. Hur är paketen placerade i fordonet?
5. Är det svårt att hitta paketen?
6. Hur tror du att detta skulle kunna förbättras?

Boxar

3. Vad är din erfarenhet utav boxar?
4. Har du någon gång sorterat in paket i dessa boxar?
    a. Om ja, berätta om den processen

Appendix IV - Questionnaire Layout

Hej,

Mitt namn är Clara och jag skriver nu mitt examensarbete på Chalmers Tekniska Högskola om sista milen leveranser - sista delen av logistikkedjan innan paketen når sin slutmottagare. Arbetet handlar om hur vi som mottagare upplever våra paketleveranser; vad är bra sett till hur vi mottar våra paket idag, vilka problem kan identifieras och hur kan dessa minimeras eller undvikas?

Enkäten består av 20 frågor och tar cirka 10 minuter att besvara.

Tack för din medverkan!
Clara

Del 1

1. Hur gammal är du?
    a. Under 30 år
    b. 30 - 50 år
    c. 51 - 70 år
    d. Över 70 år
2. Vilken bostadstyp har du?
    a. Lägenhet
    b. Hus
3. Hur ofta beställer du paket på nätet?
    a. 10 paket eller mer / halvår
    b. 6 - 9 paket / halvår
    c. 2 - 5 paket / halvår
    d. Ca 1 paket / halvår
    e. Mer sällan
4. Hur mycket brukar paketen du beställer väga?
    a. 0 - 2 kg
    b. 3 - 5 kg
    c. 6 - 8 kg
    d. 9 kg eller mer
5. Vilken tid på dygnet föredrar du att hämta ut ditt paket? (Sett till att du inte väljer hemleverans)

6. Jag är nöjd med hur mina paket levereras idag (1 - 5)

7. Vilket av följande leveranssätt föredrar du?
    a. Ombud
    b. Paketbox
    c. Hemleverans, drop off
    d. Hemleverans, överlämnande

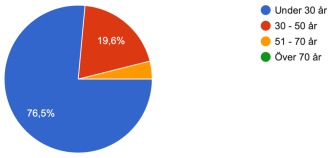
8. Varför föredrar du X?
9. På vilket sätt skulle X kunna förbättras?
10. Varför väljer du det här leveranssättet före de övriga?
11. Ser du det som fördelaktigt att INTE ha personlig kontakt med någon när du mottar dina paket?
    a. Ja
    b. Nej
    c. Kanske
12. Varför föredrar du att inte ha personlig kontakt när du hämtar ut dina paket?
13. Har din åsikt i den här frågan förändrats efter pandemin?
    a. Ja
    b. Nej
14. Jag väljer olika leveransalternativ beroende på vilken typ av vara jag köpt
    a. Ja
    b. Nej, jag tar alltid samma oavsett vilken vara jag köpt
15. Beskriv kort vilka typer av varor du kopplar till de olika leveranssätten
16. Vad värderar du mest när du ska motta ett paket? Välj MAX 3 stycken
    a. Flexibilitet när jag kan hämta ut / motta mitt paket
    b. Jag vill ha leverans så nära mitt hem som möjligt

c. Jag vill att uthämtandet ska gå snabbt
d. Jag vill att folk i min närhet ska kunna hämta mitt paket
e. Jag vill undvika personlig kontakt
f. Jag vill aldrig riskera ett defekt paket

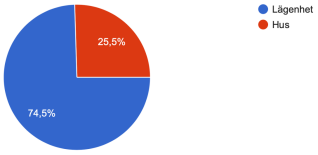
17. Hur långt har du ungefär till ditt närmaste postombud?
    a. 0 - 250 meter
    b. 250 - 500 meter
    c. 500 - 750 meter
    d. 750 - 1000 meter
    e. Mer än 1000 meter
18. Hur långt har du ungefär till ditt närmaste boxsystem?
    a. 0 - 250 meter
    b. 250 - 500 meter
    c. 500 - 750 meter
    d. 750 - 1000 meter
    e. Mer än 1000 meter
19. När du ska hämta ut ett paket, vilket färdmedel använder du då?
    a. Cykel
    b. Bil
    c. Jag går
    d. Kollektivtrafik + går
20. Hur långt är du villig att ta dig för att hämta ut ditt paket?
    a. 0 - 250 meter
    b. 250 - 500 meter
    c. 500 - 750 meter
    d. 750 - 1000 meter
    e. Mer än 1000 meter
21. Vart vill du helst få dina paket levererade?
    a. Till mitt hem / så nära mitt hem som möjligt
    b. Någonstans längst mitt vardagliga rörelsemönster
    c. Till mitt jobb / universitet eller så nära det som möjligt
22. Om du får tänka helt fritt, hur skulle du då vilja ha dina paket levererade? Önskat scenario

Appendix V - Questionnaire Result

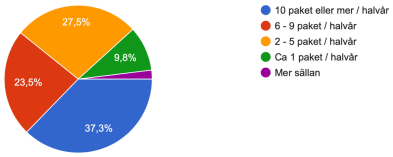
Hur gammal är du?



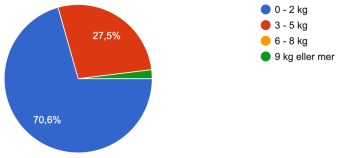
Vilken bostadstyp har du?

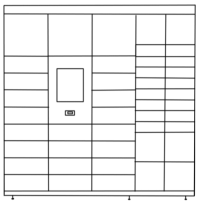


Hur ofta beställer du paket på nätet?

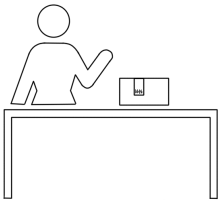


Hur mycket brukar paketen du beställer väga?

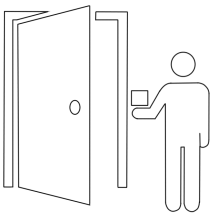




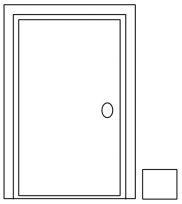
50% Parcel lockers



27% Postal Office

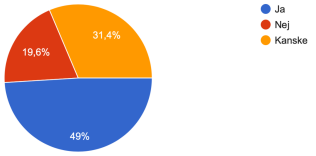


9% Attended Home Delivery

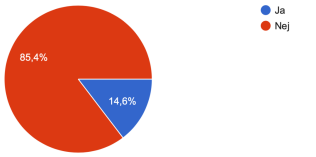


14% Unattended Home Delivery

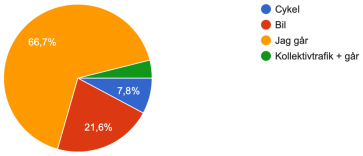
Ser du det som fördelaktigt att INTE ha personlig kontakt med någon när du ska hämta ut ditt paket?



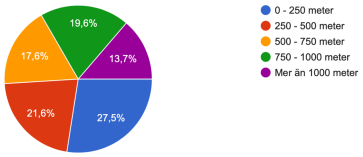
Har din ställning i den här frågan ändrats på grund av pandemin?



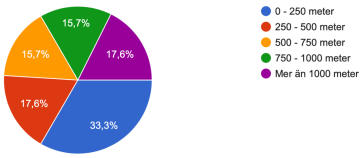
När du ska hämta ut ditt paket, hur transporterar du dig då?



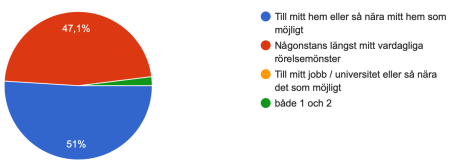
Hur långt har du ungefär till ditt närmaste postombud?



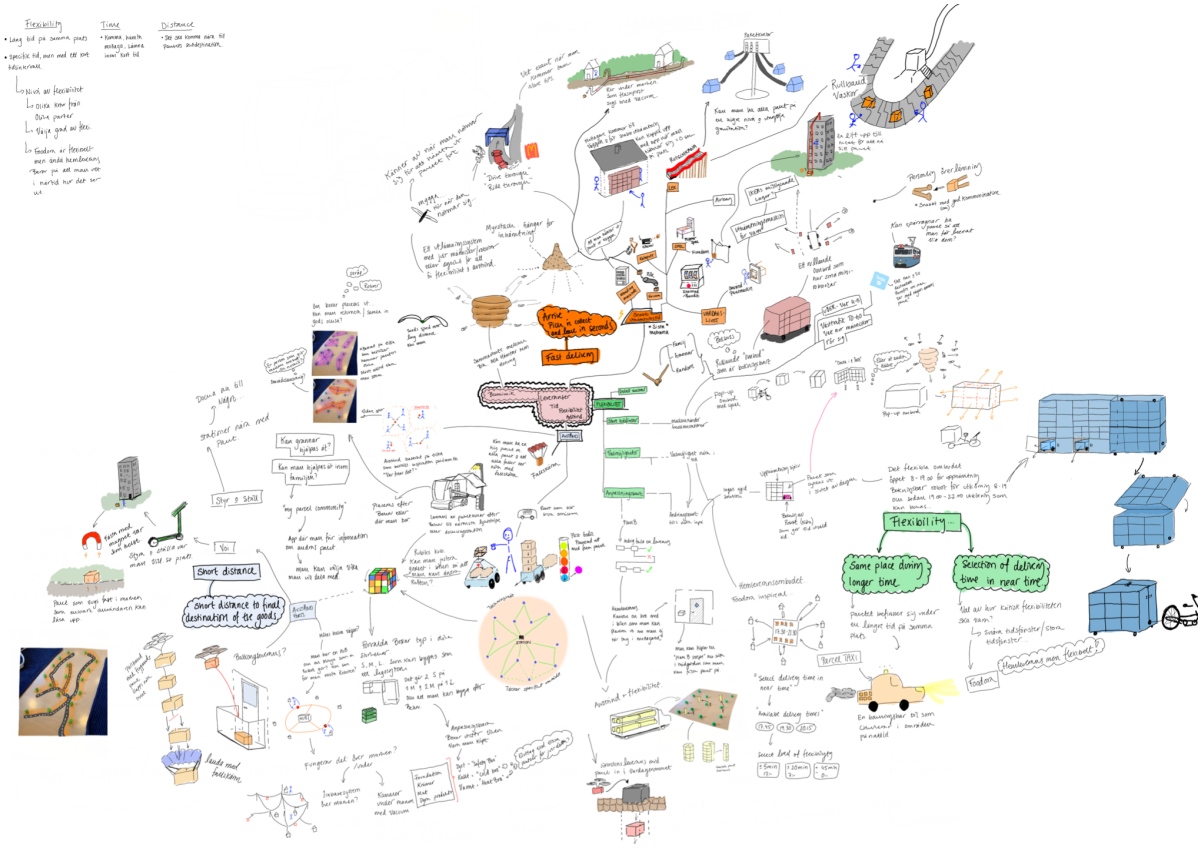
Hur långt har du ungefär till din närmaste paketbox?



Vart vill du helst få dina paket levererade?



Appendix VI - Ideas from first ideation session



Balcony delivery
Add on box to mail box
No failed home deliveries
Cableway transportation of parcels
Shared box in community
Magnetic system
Place parcels anywhere
Individual delivery box for parcels
Optimized deliveries based on recipients locations
Should it really be static parcel lockers? Better to have a mobile system?
Connect parcels to objects
Connection point to parcels/parcel lockers
Deliver parcels to lamp-post or other connection points
See who is delivering - open the door
Smart door lock?
Underground vacuum system for deliveries
CAT DOOR
Near home deliveries
Tram stations as connection points for parcels
"Drive through"
"Ride through"
Deliveries to connection points in the local area
Kindergarten pick-up
leave with child and parcel
Gym 'n receive
"Receive your parcels at the nearest gym"
CHALMERS
Receive parcels at universities and schools
Deliveries to connection points
Parcel community
H&M Parcel
Reception
Parcel pick-up at the office reception
Parcel picker
Ice cream delivery combined with parcel delivery
•Neighbours
•Family
•Friends
•Local pizzeria?
Select your community
Bonus system if helping each other?
Parcel community between family and friends
Select who to share the parcel with
Selection of external person to deliver the parcel. You can choose your parcel picker
HUB
Rotating droids after demand
Parcel deliveries with public transportation
Deliveries done by smaller droids in local area. Circulating and supported areas
Deliveries with the garbage truck
TRASH
Circulating objects that drop off the parcels "pee"
Recieve from circulating objects such as droids
Circulating parcel lockers
Circulating parcel taxi
Picking up parcels at hub and deliver to recipients. High flexibility due to late decision
Circulating deliveries
Drones supporting the postal offices
Parcel lockers that are static, but turns into mobile solutions
Droids supporting the postal offices. Local deliveries only
Parcels being delivered in boxes. Distributed out to the recipients.
Postal office with many pick-up possibilities, flexible and late decisions
07.00-20.00
00-24
Flexible postal offices

APPENDIX VII - Evaluation I

Medverkande: Utvärderingsledare & Utvärderare:
Boendetyp:
Område:
Erfarenhetsnivå av paketleveranser:

Material som krävs:
Illustrativa bilder över de tre koncepten & base line

- My parcel picker
- My placed parcel
- My circulating parcel
- My local parcel

Kartor som supporterar beskrivningen av de tre koncepten samt "base line"
Fyra kort som representerar tre koncepten samt "base line"

Introduktion, läses högt!
Inledningsvis vill jag säga TACK för att du ställer upp i min studie. Studien syftar till att identifiera vilka problem mottagare upplever med sina paketleveranser för att sedan formulera mottagarnas behov och krav. Dessa krav låg sedan till grund vid utvecklandet av fyra nya koncept som idag kommer att utvärderas utav dig.

Utvärderingen består av fyra olika delar

1. I den första delen kommer ett av koncepten att beskrivas. Därefter kommer fyra frågor att ställas relaterat till detta koncept följt av rankning enligt vissa parametrar. Det här repeteras för var och en av de fyra koncepten.

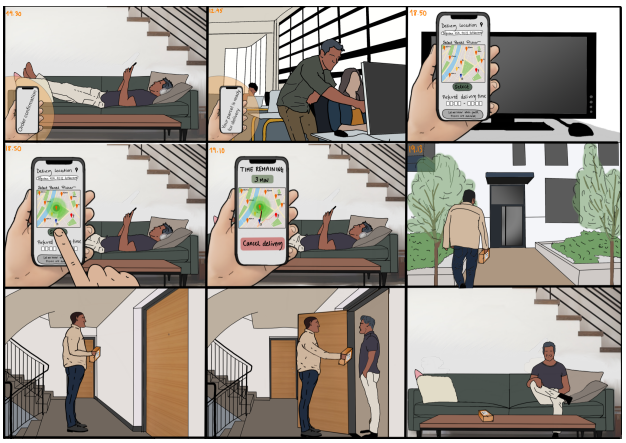
2. I den andra delen, när alla koncept har utvärderats enskilt, kommer koncepten att jämföras mot varandra. Detta görs genom en rankning av de olika koncepten.

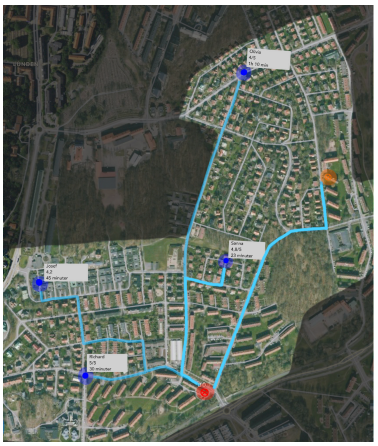
3. Den sista delen baseras på svaren från del 1, mer om del tre senare.

Jag vill att du svarar så sanningsenligt som möjligt, alla åsikter är viktiga för min studie.

Om du har några frågor under utvärderingen är det bara att avbryta mig.
Då kör vi igång!

Koncept 1 - My parcel picker





Jag kommer nu att beskriva det tredje konceptet för dig, My Parcel Picker.

Bild 1:
I förrgår när du var hemma bestämde du dig för att beställa ett par skor online. Du har fått information om att dessa skor är packade hos leverantören och att försändelsen är på väg till dig som mottagare.

Bild 2:
När du väl är på arbetet får du en notis om att ditt paket anlänt till din lokala distributionsanläggning.

Bild 3:
Ditt paket är redo för leverans och du får ett val att ta ställning till, vilken dag vill du att ditt paket ska levereras? Du fyller i önskad leveransdag och leveransplats.

Bild 4:
Efter att du valt leveransdag & leveransplats får du ytterligare ett val att ta ställning till, vem vill du ska leverera ditt paket. Du får upp en karta över tillgängliga parcel pickers. På kartan syns information om vem det är, vilket betyg han/hon har samt när personen i fråga kan tänkas leverera ditt paket.

Du väljer parcel picker X.

Bild 5:
Du får nu upp en kartvy över var du befinner dig, var ditt paket befinner sig samt var din parcel picker befinner sig samt hur hen har tänkt att röra sig. Överst i rutan ser du beräknad tid kvar tills leverans.

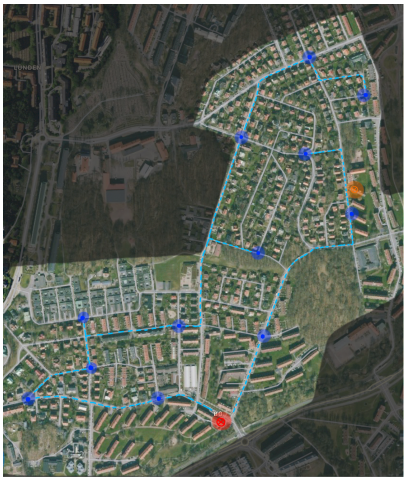
Bild 6:
Din parcel picker anländer med ditt paket

Bild 7:
Han har tagit sig upp till din dörr

Bild 8:
Du möter ditt paket vid din ytterdörr

Bild 9:
Du öppnar ditt paket och blir glad för dina nya skor.

Koncept 2 - My Placed Parcel



Jag kommer nu att beskriva det andra konceptet för dig, My Placed Parcel.

Bild 1:
I förrgår när du var hemma bestämde du dig för att beställa ett par skor online. Du har fått information om att dessa skor är packade hos leverantören och att försändelsen är på väg till dig som mottagare. Du lämnar ditt hem i hopp om att skorna ska levereras idag.

Bild 2:
Du är nu på jobbet och får en notis om att ditt paket anlänt till din lokala distributionsanläggning. Du får nu två val att ta ställning till. Det första valet avser leveransdag. Du kan välja att få ditt paket levererat idag alternativt någon annan dag inom den kommande veckan. Det andra valet avser leveransplats, en karta visar tillgängliga leveranspunkter. Du valde att få ditt paket levererat idag till leveranspunkten som ligger vid utanför din bostad.

Bild 3:
Ditt val av leveransdag och leveransplats har nu nått logistikpersonalen som kan förbereda alla paket som ska levereras under dagen. Logistikpersonalen tar nu fram alla försändelser som ska levereras idag.

Bild 4:
Logistikpersonalen placerar nu försändelserna i olika boxar optimerade utefter paketens storlek. Boxarna placeras sedan på fordonet baserat på distrubieringsruttens olika stopp.

Bild 5:
Logistikpersonalen har nu placerat alla boxar på fordonet och påbörjar sin distribueringsrunda.

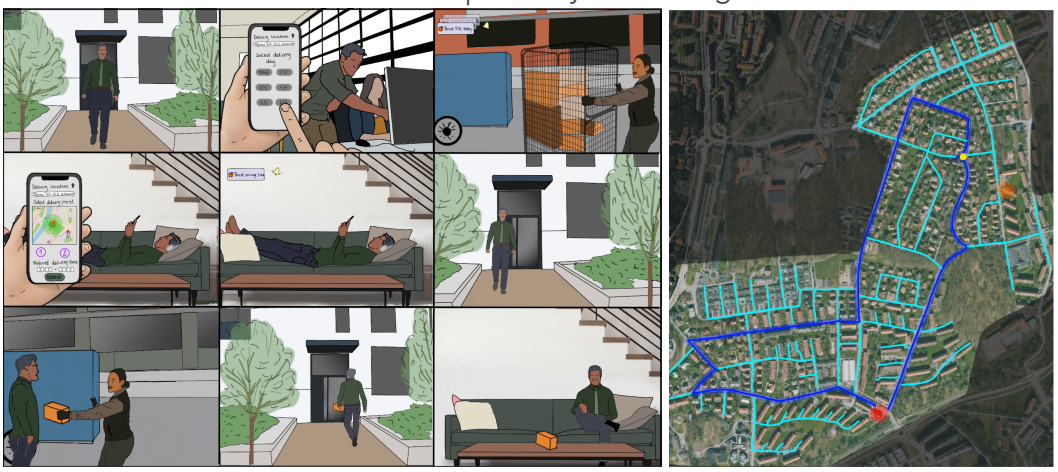
Bild 6:
Lofistikpersonalen har kommit till din leveranspunkt och dockar an boxen till connection pointen. När boxen dockas an skickas en notis till dig som mottagare att försändelsen kommit fram.

Bild 7:
Du kommer hem från jobbet och ser att din box befinner sig på connection pointen. Du går fram till din box, kopplar upp dig mot boxen på ett smidigt sätt, boxen öppnas och du kan motta din försändelse.

Bild 8:
Efter att du mottagit ditt paket beger du dig hemåt.

Bild 9:
Du öppnar ditt paket och blir glad för dina nya skor.

Koncept 3 - My Circulating Parcel



Jag kommer nu att beskriva det första konceptet för dig, My Circulating Parcel.

Bild 1:
I förrgår när du var hemma bestämde du dig för att beställa ett par skor online. Du har fått information om att dessa skor är packade hos leverantören och att försändelsen är på väg till dig som mottagare.

Bild 2:
När du väl är på arbetet får du en notis om att ditt paket anlänt till din lokala distributionsanläggning. Du får då ett val att ta ställning till: Vilken dag vill du att ditt paket ska levereras? Du har nu som mottagare valmöjligheten att välja att få ditt paket levererat idag, alternativt vid annat tillfälle inom kommande veckan.

Du valde att få ditt paket levererat idag.

Bild 3:
Ditt val av leveransdag skapade en order hos lokala distributionsanläggningen. De förbereder nu ditt paket för leverans. Logistikpersonalen tar fram ditt paket och placerar det på ett fordon som kommer att cirkulera i ditt område under kvällen.

Bild 4:
När du senare under dagen kommit hem från jobbet får du en notis om att din försändelse befinner sig i din lokala cirkulationsbana. Du får nu två val att ta ställning till. Det första valet avser var och hur du vill möta din leverans. Vill du 1: möta försändelsen på den stora cirkulerande banan, eller 2: att försändelsen gör en avstickare från den cirkulerande banan för att möta dig som mottagare närmare ditt hem.

Nästa val att ta ställning till handlar om leveranstid. Baserat på ditt tidigare val kommer ett antal alternativ att presenteras för dig som mottagare. Alternativen du får är baserade på ruttens planering i relation till ditt hem samt ditt val av var/hur du vill möta din försändelse.

Du valde att möta ditt paket på den stora slingan vid tidpunkt X.

Bild 5:
Några minuter innan tidpunkt X får du en notis att din försändelse är nära.

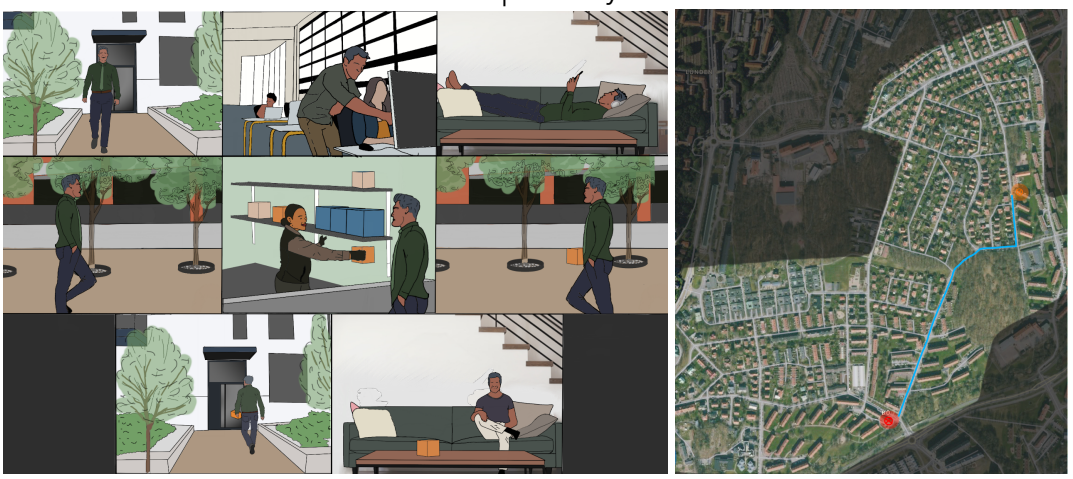
Bild 6:
Du lämnar din bostad för att möta ditt paket vid den cirkulerande slingan.

Bild 7:
Du anländer till platsen där du ska möta din försändelse. Logistikpersonalen ser dig, stannar och levererar ditt paket.

Bild 8:
Efter att du mottagit ditt paket beger du dig hemåt igen.

Bild 9:
Du öppnar ditt paket och blir glad för dina nya skor.

Koncept 4 - My Local Parcel



Jag kommer nu att beskriva det fjärde konceptet för dig, My Local Parcel.

Bild 1:
I förrgår när du var hemma bestämde du dig för att beställa ett par skor online. Du har nu fått information om att dessa skor är packade hos leverantören och att försändelsen är på väg till dig som mottagare.

Bild 2:
När du är på arbetet får du en notis om att ditt paket anlänt till din lokala distributionsanläggning. Du arbetar vidare på kontoret och tar tag i din paketleverans när du väl är hemma.

Bild 3:
Du anländer hem och kollar distributionsanläggningens öppettider och plats. Du reflekterar över när och hur du ska hämta ditt paket.

Bild 4:
Du bestämmer dig för att hämta ditt paket under eftermiddagen och beger dig till distributionsanläggningen.

Bild 5:
Du anländer till distributionsanläggningen och visar upp ett referensnummer. Logistikpersonalen tar fram ditt paket och ger det till dig.

Bild 6:
Du lämnar distributionsanläggningen och beger dig hemåt med ditt paket i handen.

Bild 7:
Du anländer till din bostad och beger dig upp till din lägenhet.

Bild 8:
Du öppnar ditt paket och blir glad för dina nya skor.

Del 1 - Frågor till varje koncept

Koncept:_____

Beskriv vad du tyckte om det här konceptet?
Vilka styrkor ser du med det här konceptet?
Vilka svagheter ser du med det här konceptet?
Vilka ytterligare faktorer måste det här konceptet erbjuda för att tillfredsställa dig som mottagare?

Del 1 - Skalor

Koncept:

This concept offers me as a recipient flexibility

Strongly disagree | Disagree | Undecided | Agree | Strongly Agree

---

This concept offers me a delivery within an acceptable distance

Strongly disagree | Disagree | Undecided | Agree | Strongly Agree

---

This concept offers me as a recipient anonymity

Strongly disagree | Disagree | Undecided | Agree | Strongly Agree

---

This concept guarantees high quality of my purchased goods

Strongly disagree | Disagree | Undecided | Agree | Strongly Agree

---

This concept offers me a short final receiving time

Strongly disagree | Disagree | Undecided | Agree | Strongly Agree

---

I could imagine receiving my parcels this way

Strongly disagree | Disagree | Undecided | Agree | Strongly Agree

---

Del 2 - Placering av kort

My Parcel Picker

My Placed Parcel

My Criculating Parcel

My Local Parcel

Del 3 - Följdfrågor till varje koncept

Hur tror du att man kan säkerställa att detta koncept erbjuder mottagaren;
Hög flexibilitet:
Kort avstånd till sin leverans:
En god produktkvalitet:
En hög anonymitet:
En snabb uthämtningstid:
Hög anpassningsbarhet:

DEPARTMENT OF INDUSTRIAL & MATERIALS SCIENCE
Division of Design & Human Factors
CHALMERS UNIVERSITY OF TECHNOLOGY
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