

A self-service design concept for last mile delivery: The solution for retail stores in urban environments

Lisa Johansson and Matilda Holmqvist

DIVISION OF PACKAGING LOGISTICS | DEPARTMENT OF DESIGN SCIENCES
FACULTY OF ENGINEERING LTH | LUND UNIVERSITY
2021

MASTER THESIS



A self-service design concept for last mile delivery: The solution for retail stores in urban environments

A product development project in collaboration with
IKEA, creating a concept for city centre stores

Lisa Johansson and Matilda Holmqvist



LUND
UNIVERSITY

A Self-service design concept for last mile delivery: The solutions for retail stores in urban environments

A product development project in collaboration with IKEA, creating a concept for city centre stores

Copyright © 2021 Lisa Johansson, Matilda Holmqvist

Subject: Packaging Logistics (MTTM10)

Division: Packaging Logistics

Supervisor: Klas Hjort

Examiner: Yulia Vakulenko

Abstract

The world is constantly changing, and business strategies are changing with it. Companies are offering new delivery options and technologies for customers globally when doing purchases. IKEA, a global furniture retailer, is expanding their touchpoints by opening retail stores in city centre locations in order to become more accessible.

The ways customers travel in urban areas are more varied including public transport, on foot or by bike. As their transportation changes so do their need for a solution on how to bring goods home from retail stores. This master thesis, in collaboration with IKEA, investigates and proposes a solution for customers to bring goods home themselves in a city centre environment.

The aim of the project is to research trends within last mile delivery, investigate the self-service offer on the market today and the customer needs within different markets globally. Furthermore, to present a self-service delivery solution for customers without access to a car. It shall add another option of delivery for the customer and by that, reach out to more people.

Research and interviews were conducted as a foundation of the project, used to set product requirements. Based on this, concepts were developed and evaluated. The iterative development process resulted in a concept called Packsäck, which enables customers to carry packages and items in various sizes. Packsäck is flexible in terms of volume and is proposed to be carried on the back, to enable the preferred means of transport. It is presented as a prototype with all characteristics included. The solution has a minimalistic design and is sustainable, low-price and adaptable.

Further developments are described in the thesis to enable implementation of the product at city located furniture retail stores in the near future.

Keywords: retail store, market study, urban environment, last mile delivery, self-service, product development

Sammanfattning

Världen förändras ständigt och företagsstrategier förändras med den. Företag erbjuder nya leveransalternativ och teknologier för kunder globalt vid köp av varor. IKEA, ett globalt möbelföretag, utökar sina ”touchpoints” genom att öppna butiker i stadscentrum för att bli mer tillgängliga.

De sätt som kunder reser i urbana områden är mer varierade inklusive kollektivtrafik, till fots eller med cykel. När deras transportsätt förändras så ökar även deras behov för lösningar att ta hem varor från butiker. I detta examensarbete, i samarbete med IKEA, undersöks och föreslås en lösning som underlättar för kunder att ta hem varor själv i en stadsmiljö.

Projektets syfte är att undersöka trender inom sista milen leveranser, undersöka erbjudandet inom självbetjäning på marknaden idag samt kunders behov inom olika marknader globalt. Dessutom att presentera en självbetjänings-leveranslösning för kunder utan tillgång till bil. Med syftet att utöka leveransalternativen för kunder och inkludera fler personer.

Datainsamling och intervjuer genomfördes som en grund för projektet som användes för att sätta upp produktkrav. Baserat på detta utvecklades och utvärderades olika typer utav koncept. Den iterativa utvecklingsprocessen resulterade i konceptet Packsäck, som gör det möjligt för kunder att transportera paket och föremål i olika storlekar. Packsäck är flexibel med avseende på volym och föreslås bäras på ryggen för att möjliggöra det transportmedel som föredras. Den presenteras som en prototyp med alla inkluderade egenskaper. Lösningen har en minimalistisk design och är hållbar, har lågt pris och är anpassningsbar.

Ytterligare utveckling beskrivs i arbetet för att möjliggöra implementering av produkten i stadsmöbelbutiker inom en snar framtid.

Nyckelord: butik, marknadsstudie, stadsmiljö, leverans för sista milen, självbetjäning, produktutveckling

Acknowledgments

We would like to thank Lunds Tekniska Högskola (LTH), especially our supervisor, Klas Hjort for first of all introducing us to this master thesis as well as contributing with valuable feedback and knowledge.

We would also like to thank IKEA and IKEA DIN Fulfilment of Services Core Team for their engagement in our project. A special thanks to our company supervisor Brooke Lemke who has always got our backs, provided us with valuable information and helping us get in contact with employees within IKEA.

Thank you to all people contributing to this thesis via interviews, e-mail exchanges and discussions. This project would not have been possible without you.

Lund, June 2021

Lisa Johansson & Matilda Holmqvist

Table of contents

1 Introduction	1
1.1 Conditions for the thesis	1
1.2 Goal and problem formulation	2
1.3 Scope and delimitations	3
1.4 Company description	3
2 Background	5
2.1 Customer store interaction	5
2.1.1 Customer journey and customer experience	5
2.1.2 IKEA touchpoints	8
2.2 Stores of interest	8
2.2.1 Paris – IKEA La Madeleine	8
2.2.2 Tokyo – IKEA Harajuku & IKEA Shibuya	9
2.2.3 New York City – IKEA Queens	9
2.3 Supply chains and last mile delivery	10
2.3.1 Sustainability in supply chains	10
2.3.2 Last mile logistics	12
2.3.3 The current IKEA delivery solutions	13
3 Methodology	16
3.1 Human-centred approach	16
3.2 Sustainable design	16
3.3 The double diamond model	17
3.4 The design process	18
3.4.1 Research method	19
3.4.2 Data collection method	19
3.4.3 Idea generation method	20

3.4.4 Concept evaluation method	20
4 Discover A	22
4.1 Research	22
4.1.1 Macro trends	23
4.1.2 Self-service	28
4.2 Data insights	29
4.2.1 Customer insights	30
4.2.2 Benchmarking	34
4.2.3 Portable range	37
5 Define A	39
5.1 Mission statement	39
5.2 Analysis of research and data insights	40
5.3 Final brief	42
5.4 Product requirements	43
6 Develop A	44
6.1 Method	44
6.2 Idea generation	45
6.3 Main concepts and evaluation	46
6.3.1 Carry over one shoulder	46
6.3.2 Carry on the back	48
6.3.3 Wheels	49
6.4 Final choice of concept	50
7 Discover B	51
7.1 Ergonomics	51
7.2 Back carrying solutions	52
7.3 Buckles	53
8 Define B	54
8.1 Product requirements	54
9 Develop B	56
9.1 Brainstorming	56

9.2 Concept development and evaluation	57
9.3 Development and evaluation of selected concepts	60
9.3.1 Concept 1	61
9.3.2 Concept 5	63
9.4 Selection	64
9.4.1 Buckle selection	64
10 Deliver	65
10.1 The process	65
10.2 Function and Characteristics	65
10.3 The final prototype – Packsäck	69
10.3.1 User description	72
10.3.2 Prototype in use	75
10.3.3 Second use	76
10.4 Economic aspect	77
10.5 Further development of the concept	77
11 Discussion	79
11.1 Research evaluation	79
11.2 Process evaluation	80
11.3 The concept	81
12 Conclusion	83
References	85
Appendix A Interview guide	92
Appendix B Six Thinking Hats	94
Appendix C Concept Pictures	97
Appendix D Concept Evaluation	99

1 Introduction

This chapter includes the conditions for the thesis, the goal and problem discussion, scope and delimitations as well as a company description, to introduce the master thesis.

1.1 Conditions for the thesis

Cities are changing and by 2050, the majority of the population in the world will live in urban areas (United Nations, 2019). The urbanisation trend changes travelling behaviour, among other things, around the world. Within urban areas, the transportation means vary and car ownership decreases. This also reflects the way people do purchases as well as how they use transport when doing so (Moss & O'Neill, 2012). Digitalisation is growing, including the e-commerce market and have accelerated when the virus covid-19 started to spread globally. For brick-and-mortar stores to stay relevant in comparison to a growing e-commerce market, convenient locations for the customers are needed, especially in the retail business (Toy, et al., 2020, p. 35). There is a trend among retail companies to create more touchpoints in city centres, with smaller format stores. The customers demand for several options when doing their purchases has put pressure on companies to deliver products and services dependent on customer preferences (Amstel, 2017). It is important to fulfil customers demand and expectations during their customer journey to maintain a good relationship. The customer journey is defined as, a customer's complete experience connected to a certain brand (Lemon & Verhoef, 2016). A demand that customers have an increased interest in is the sustainability aspect connected to companies. There is a lot of sustainable market potential within last mile logistics for the future. The need for huge investments and regulations regarding transportation and pollution in city centres are limiting an implementation of certain delivery solutions e.g., electrical vehicles and drones (Toy, et al., 2020, pp. 47, 67). Therefore, an interesting approach to sustainable delivery is a self-service solution, which will be investigated in this project.

This master thesis together with Inter IKEA Systems Service AB will focus on ways for the customers to bring home goods themselves from stores in a city centre environment. The thesis was accompanied by IKEA Development & Innovation

Network (DIN): Fulfilment of services Core Group with representatives from different locations globally.

1.2 Goal and problem formulation

The aim of the thesis is to develop a low-price self-service delivery solution for customers without access to cars to take home both larger and smaller goods from stores in a city centre environment. The desirable solution is not available in the IKEA range at the moment, and their current solutions will be presented in section 2.3.3. Within this area novel solutions will be investigated along with identified needs in different markets.

The focus is on city centre locations in North American, European and Asian cities, where the markets were analysed in order to interpret customer needs. Existing solutions and future trends within last mile delivery as well as competitors are explored. The solution should be sustainable, qualitative and could range from purchase, to rental to leasing and by that enable the customers to take goods home themselves at a low cost.

The goal is for the solution to be delivered as a concept with recommendations for further development and improvements. The recommendations will include aspects related to implementation and testing. An implementation will give a competitive advantage by providing instant gratification to the customers. Thus, the findings will contribute to IKEA's knowledge base. This project and the knowledge it will provide can potentially be beneficial in an application for the company and for future projects within IKEA.

In order to reach the project goal, three strategic questions were established. The questions represent the approach of the master thesis together with the *Scope and delimitations* in section 1.3, and the *Methodology* in section 3. They are presented below.

1. *What are the trends within last mile delivery today and in the near future?*
2. *Which solutions are available today regarding self-service for last mile transportation?*
3. *What are the markets' needs at city centre store locations and what solution is suggested?*

1.3 Scope and delimitations

This thesis focuses on developing a low-price self-service solution and therefore investigates existing and future trends within last mile delivery. The main theme is on solutions to do yourself and a brief description of trends that affects this area.

The scope of this research is limited based on mainly two parameters, namely the range of products that the solution is specified for and geographical limitations. Regarding range of products, it is limited to articles included in the Cash & carry range, for direct take away. This range has major deviations regarding weight and dimensions some are therefore disregarded. This is explained further in section 4.2.3. The range of products is also limited due to the ergonomic aspect.

Regarding the geographical limitations, the project is limited to three markets in three different regions. The chosen ones are North America, Europe and Asia, and are regions where IKEA stores are established, and IKEA is expanding. In each region a specific city and specific stores are chosen, which are New York, Paris and Tokyo. In each of these cities, IKEA has opened stores in urban areas with the concept of a city centre store. These locations are selected to give a global perspective as well as providing relevant customer needs.

1.4 Company description

IKEA was founded in 1943 in Älmhult, Sweden by Ingvar Kamprad and is today one of the largest and most well-known home furnishing brands in the world (IKEA (a), 2021). Kamprad's first business idea was within mail-ordering sales but in 1958 IKEA switched direction and began to sell furniture in retail stores instead. By starting as a mail-order sales business Kamprad realized the importance of optimising the packages to minimize cost and by that, the idea of implementing flat packages and self-assembly furniture came to life. IKEA is well known for its low price, flat-packs, quality and sustainable mindset, with the business idea “to offer a wide range of well- designed, functional home furnishing products at prices so low that as many people as possible will be able to afford them” (IKEA (b), 2021). For this to be achievable IKEA is focusing on developing methods and products that are both cost-effective and innovative. This idea is not only applied to home furnishing but also to the rest of the world by supporting the communities where IKEA source the materials. The aim is also to create a more sustainable life at home through the products and thereby encouraging customers to live more sustainable. The company’s success is built on the concept of ”democratic design”, which implies creating sustainable products with beautiful design, good function and good quality with a low price. (IKEA (c), 2021)

The original IKEA concept is based on customers planning their visit in beforehand and driving with their own cars to the IKEA brick-and-mortar store. There they have a look at the products and showrooms, grab something to eat at the restaurant and at the end of the visit collect the flat-packed furniture before reaching the check-out point. The customers then load their cars with the newly bought items, drives home and assembles the furniture themselves. By making the customer do their part of the work the costs and prices can be kept down. This do-it-yourself (DIY) strategy characterizes IKEA (IKEA (d), 2021). The DIY experience can create both self-expression and self-realization but is mainly an economic driven action from a company's side, and a possibility to cut costs. The self-service and consumer markets are on an upward trend (Khademi-Vidra & Bujdosó, 2020).

According to IKEA Systems B.V. there are 456 IKEA stores within 61 markets. In 2020, Inter IKEA Group reached the total revenues of 23,6 billion euro and retail sales of 39.6 billion euro (Inter IKEA group, 2020). In figure 1.1 the system of companies that make up IKEA are shown. Inter IKEA Systems B.V. (Core Business Franchise) is the owner and franchisor of the IKEA concept which consists of the trademarks, the product range, services, food products and the retail system. Each company is a different IKEA franchisee with separate owners but all of them work for the IKEA brand (IKEA (e), 2021).

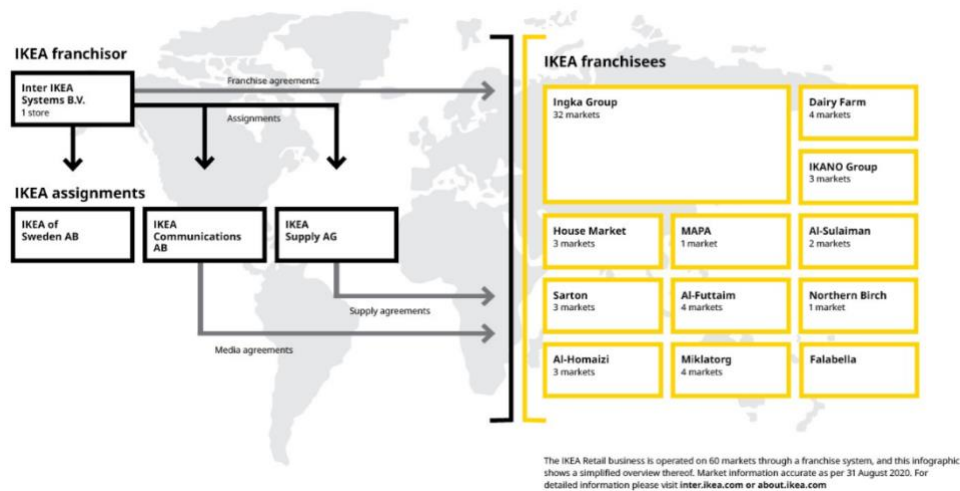


Figure 1.1 Simplification of the IKEA franchise systems (IKEA (e), 2021).

2 Background

In the following chapter, background information is presented on customer store interaction. The customer journey together with customer experience is clarified with touchpoints and city centre stores. Additionally, the targeted stores in the exploration cities are presented with background knowledge. Theory about supply chains and specifically last mile logistics and current delivery solutions at IKEA is presented.

2.1 Customer store interaction

The interaction between the store and the customer has an essential role in this project. The customer demand requires changes of stores and companies as a whole, and they need to adapt to stay relevant. To understand the customers' decisions, as well as the point where the customer interacts with the brand, also called touchpoint, the customer journey and the customer experience, are described in section 2.1.1 below. Further on, IKEA's touchpoints are described due to that the brick-and-mortar concept as well as the city centre store concept is the focus of this project, see section 2.1.2.

2.1.1 Customer journey and customer experience

For organizations, it is essential to understand both the customer experience and the customer journey and its relation over time. The importance of a strong customer experience has been noticed by management and is a prioritized agenda for many executives. Therefore, several global firms have introduced specific chiefs and managers responsible for the customer experience. The opportunities for firms to benefit from creating and maintaining a strong customer experience today was pointed out by Gilmore (1998). The importance of customer experiences was emphasized by Schmitt (1999) and was one of the first scholars with that acknowledgement. Prior to this, the literature within customer management mainly focused on customers' value for firms instead of value creation for customers. Schmitt (1999) made one major accepted definition of customer experience as a

multidimensional view with five identified types of experiences; “sensory (sense), affective (feel), cognitive (think), physical (act) and social-identity (relate)”. More recent business practices include the company offer and any kind of contact with the customer in the definition including everything from advertising to packaging, to product and service features, reliability and usability. The customer experience, including design, delivery and management, can be viewed from different perspectives and can be seen as multidimensional in that sense as well. Moreover, specific aspects as brand and technology may also be related to the customer experience, where touchpoints between the firm and the customer are created (Lemon & Verhoef, 2016).

More complex customer journeys are created due to the customer’s interaction with several touchpoints in numerous channels and media, which puts more focus on the customer experience. Throughout the entire customer journey, the customer experience is having a multidimensional basis of cognitive, emotional, behavioural, sensorial, and social responses. Since omnichannel management exertion has increased and is now the norm, firms have experienced fragmentation challenges with media and channel acceleration. Furthermore, customer behaviour on social media has brought both challenges and opportunities through customer-to-customer interaction for companies. For firms, this has resulted in less control over the customer journey and the customer experience, where peer customers are influencing each other. For companies to offer a positive customer experience with multiple touchpoints there is a need for integration of functions within the business, including information technology (IT), logistics, marketing, service operations as well as external partners. The reduced control is still a fact and the solution for firms to manage and control both the journey and experience of every customer is complex (Lemon & Verhoef, 2016).

Measurement and conceptualising of the customer experience have mainly been done exploratory in research today. Customer experience is a research challenge that will continue to increase in terms of both complexity and importance. The complexity and number of customer touchpoints together with the performance of the customer journey will be affecting factors. The customer journey performance depends on customer loyalty and word of mouth. Customer experience has become a commonly used buzzword in marketing recently, but similar initial marketing expressions have been seen before. The root of the concept made its entrance in the 1960s and have in different periods been researched within areas such as customers buying behaviour process model, customer satisfaction, service quality, customer relationship management (CRM), customer centricity and customer focus (Lemon & Verhoef, 2016).

When conceptualizing the customer experience, the purchasing cycle includes several touchpoints for a firm over time, mentioned as a customer journey. The total customer experience is objectified as a dynamic process with the three phases: prepurchase, purchase and postpurchase. The iterative and dynamic process also interacts with external factors and past experiences. At each phase of the process

interaction of touchpoints are made between customer and firm, some without control of the firm. In figure 2.1 below the process is summarized and modelling the customer experience with functions of the customer's journey over time. (Lemon & Verhoef, 2016).

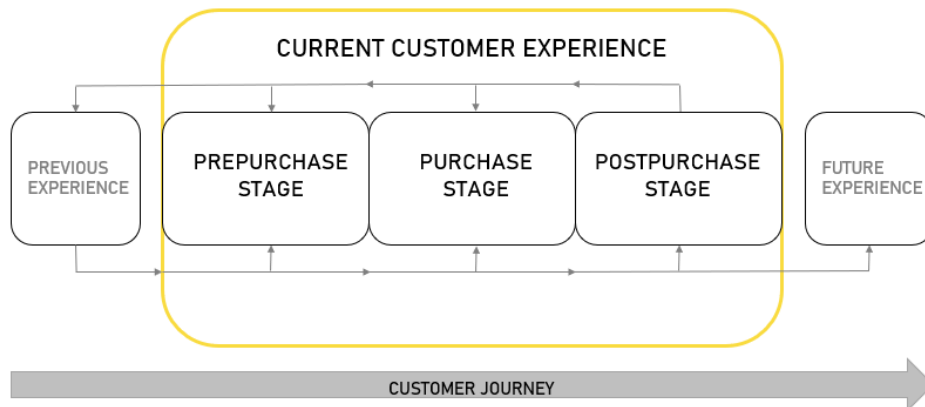


Figure 2.1 Simplified process model for customer journey and customer experience (Lemon & Verhoef, 2016).

The first phase prepurchase, includes the customer interaction with the brand, category and environment in different aspects. This incorporates behaviour such as need identification, search and reflection. The next stage is the purchase, the phase of the actual purchase transaction distinguished by the choice and ordering behaviour. Post-purchase is the final stage and is characterized by the steps after the purchase such as use, consumption, engagement and service. At this phase, the product becomes a critical touchpoint due to the customer relationship with the product/service or the brand. Firms need to understand the customer journey to seek improvement of the aspects, elements or touchpoints that prevents the customer from entering the next phase in the buying process. Within the stage's different types of touchpoints, categories have been identified and are brand owned, partner-owned, customer-owned and social or external. Examples of touchpoints are a website, advertising, packaging, other customers and independent information sources. There are also different ways to interact with the touchpoints during the customer journey where the options and decisions of the customers are made (e.g., service, online channels and mobile channels). To create a strong customer experience, it needs to be seamless across channels and through channel integration (Lemon & Verhoef, 2016).

2.1.2 IKEA touchpoints

One of IKEA's goals as a company is to reach out and be accessible to "the many people". This combined with IKEA's curiosity for innovative solutions has opened the door to various store formats around the world. Today six physical touchpoints are available, namely the traditional IKEA store, IKEA small store, IKEA shop, IKEA plan and order point, IKEA pick-up point and IKEA pop-up store (INGKA, 2020). The store formats are touchpoints between the customers and the company. The focus for this thesis, is towards city centre stores which included IKEA small stores and IKEA shops.

2.1.2.1 City centre stores

The formats of interest, namely the smaller format store and the IKEA shops are both city centre located with public transport opportunities and walking distances, in contrary to the traditional IKEA store. The main difference between the two formats is that the small store offers the total range of products, services and food while the shop offers a specific segment of the range. Further in this project, the small store and the shop are both referred to as city centre stores since the small difference does not affect this thesis work (INGKA, 2020).

The city centre store is like the traditional IKEA but more space efficient and smaller in size. It has no self-serve furniture area or owned parking. Customer can bring home their goods themselves or have them delivered through different services. Products that are not in store or available for direct take-away can be picked up from another location or delivered home. By this, IKEA wants to create convenience by being available where people live (INGKA, 2020).

2.2 Stores of interest

In this section, the selected city centre stores are presented together with background knowledge regarding the stores. It is decided that the main focus is on the stores located in the city centres of Paris, Tokyo and New York City and these cities represents each region.

2.2.1 Paris – IKEA La Madeleine

IKEA Paris La Madeleine is a small store XS located at 23 Boulevard de la Madeleine, Paris right next to the metro. It opened May 6th, 2019, and is the first official IKEA XS store in IKEA's prioritized cities. It has a total unit size of 7300 m² with 1500 Cash & carry articles. There are eight stores in Ile-de-France where IKEA Paris La Madeleine is the only Paris city centre store, located in a city

environment. Additionally, on June 23rd, 2021, IKEA Décoration will open which is a new store concept focusing on interior accessories located on 1144 Rue de Rivoli in Paris (Guillemet, 2021) (IKEA, 2019).

2.2.2 Tokyo – IKEA Harajuku & IKEA Shibuya

The first IKEA store in Japan opened 15 years ago and in 2020 IKEA is a household name with 9 IKEA stores placed in 4 major regions in Japan. In greater Tokyo, there are four large IKEA stores in the suburbs, one IKEA Business Plan and Order point in Shibuya and the two city centre stores that are of interest for this project, namely IKEA Harajuku which opened June 8th, 2020, and IKEA Shibuya which opened June 18th, 2020. IKEA Harajuku is located at Jingumae 1-14-30, Shibuya-ku, Tokyo within the With Harajuku shopping mall. The store is easily reached via metro and does not own a parking lot however, With Harajuku do. (IKEA (f), 2021) It has a total unit size of 2500 m² with 1000 Cash & carry articles (IKEA (a), 2020). IKEA Shibuya is located at 24-1 Udagawa-cho, Shibuya-ku, Tokyo, Takagi Building 1st-7th floors. It has a total unit size of 5167 m² with 1800 Cash & carry articles (IKEA (b), 2020). No parking for cars and bicycles, is provided and the customers are recommended to travel by train (IKEA (g), 2021).

2.2.3 New York City – IKEA Queens

The IKEA Queens store is located at 96-05 Queens Blvd, Queens, NY 11374 within the Rego Center shopping mall (IKEA (h), 2021). It is the first small format store in the United States with a unit size of 10684 m² offering the full range of products. The store is a block away from two bus stops and close to the Rego Park subway station which facilitates for the customer to travel to and from the store (IKEA (i), 2021).

2.3 Supply chains and last mile delivery

A supply chain has a series of steps that involve the customer receiving a product or a service. It is often a set of several independent firms passing material forward from manufacturing to the end-user. Members in the supply chain include everyone from raw material and component producers, product assemblers, retailers to transport companies. A supply chain can therefore be defined as an alignment of firms with the purpose to bring a product or service to the market (Mentzer, et al., 2001). Last mile is the last step in the supply chain and will be explained further in section 2.3.2. Within supply chains globally an evolved effort, due to set requirements from governments, is put on the sustainability aspect. This aspect is presented more in detail in section 2.3.1 below. The current IKEA delivery solutions are presented in section 2.3.3.

2.3.1 Sustainability in supply chains

According to The Brundtland Commission, the definition of sustainability is “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987). Sustainability is part of everyday life in society today. Around the world commitments and agreements are set to act for sustainable development globally, written down into sustainable development goals (SDGs). According to the UN 2021, these goals are the blueprint to achieve a better and more sustainable future for all. Many of the issues connected to these are urgent matters and include challenges as poverty, inequality, climate change as well as environmental degradation, peace and justice (United Nations, 2021). The definition of sustainability differs among research, but all include three aspects which are environmental, social and economic.

A dominant concept for describing sustainability in research has been The Triple Bottom Line (TBL). It received wider recognition in 1998 due to a publication. The concept is commonly defined as “an accounting framework that incorporates three dimensions of performance: social, environmental and financial”. The aspiration is to treat all the aspects with equal importance and therefore the TBL is used as a synonym for sustainability. The problem identified with that is the lack of control and limitations for the company to prioritise one aspect over the others. For example, the customer choice can be that excuse, where the company can argue that they cannot make the customers buy more sustainable products. This is where they tend to emphasize the economic aspect of the TBL (Montabon, et al., 2015). An important aspect is the perception of the who has the responsibility for sustainable choices, is it the company or the customer? For companies to embrace the sustainability challenges regarding customers, it is important with reliability and transparency. The term greenwashing refers to when misleading information is used

to make products or services seem more environmentally friendly (Parguel, et al., 2015).

Previously the focus on a sustainable supply chain has been on the instrumental logic that addresses sustainability by asking “how can a supply chain benefit from addressing environmental or social issues” instead of “how can a supply chain become more sustainable”. The interest when using this logic is the link between economic performance and being more sustainable, where sustainability is not the goal itself. Instead of using this win-win logic, an alternative logic can be used for the aim of true sustainability in supply chains (Montabon, et al., 2015). The Ecologically Dominant logic can be seen in figure 2.2 below.

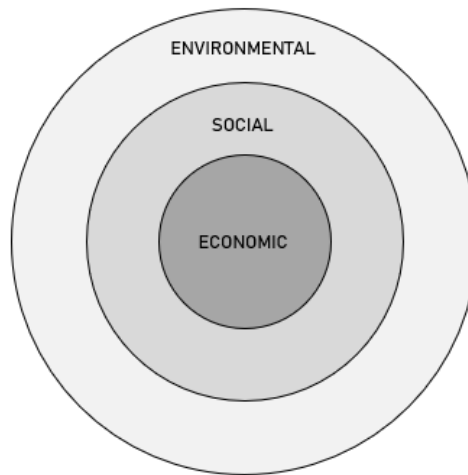


Figure 2.2 Illustration of the Ecologically Dominant logic (Montabon, et al., 2015).

The logic expresses the priorities when trade-offs occur and therefore have the priority to protect the environment. The social and economic issues are placed inside to aim for a truly sustainable supply chain. This logic where other issues are nested into the environment is norm changing but also a necessary gamechanger for a sustainable future. One main issue with the instrumental logic is that it focuses on profits when reducing the harm of other sustainability aspects. The second issue is the fact that the main perspective of sustainability-related performance is on the focal firm and excluding the community and other members of the chain. The goal with the new logic is to implement it for supply chains to overcome these issues and in the future by society at large (Montabon, et al., 2015). The Ecologically Dominant logic will be used to ensure true sustainability, focusing on environmental sustainability, throughout this project.

2.3.2 Last mile logistics

Last mile logistics is considered an emerging area and has several definitions. A shared view is that it consists of the last part of the supply chain distribution. Depending on the set up of the supply chain the last mile logistics, from the last distribution centre to the customer contact point, vary. The emerging trend for last mile logistics in research has a connection to growth within areas such as omnichannel, e-commerce, innovation, urbanisation, customer demand and sustainability. This is due to their correlation to the subject. Last mile often has a great impact on the supply chain performance in terms of economic share, efficiency and carbon footprint, because of the required resources. From an economic point of view, last mile is often expensive compared to the rest of the supply chain and is partly connected to the efficiency of the process. Inefficiency can be caused by several factors such as various sizes of shipments and goods, the density of customers, time window and fragmentation of the delivery. From a sustainability point of view, the air pollution is high which includes greenhouse gas emissions for transport. It is also noteworthy that sustainability is not only linked to the environmental aspect. The importance of looking at last mile logistic connected to all three elements namely the economic, environmental and economic aspects is evident (Olsson, et al., 2019).

In the literature, last mile logistics have interrelated names such as last mile distribution, last mile fulfilment, last mile transport and last mile delivery. In a literature study by Olsson, Hellström and Pålsson (2019), the differences between the mentioned terms are discussed. Last mile logistics can be described as a term of a more strategic character as it refers to planning, implementing and controlling. On the other hand, last mile distribution excels by the various channels that the handling, movement and storage are done with to the point of consumption, within a distribution system. Furthermore, last mile fulfilment is the process of getting the orders ready for delivery, last mile transport focuses on the movement of goods and last mile delivery is associated with the activities necessary for the final destination. Last mile fulfilment, transport and delivery are often used in combination due to their interrelation. City logistics is another used concept but cannot be used interchanged with last mile logistics. It focuses on the transportation of goods in urban areas and externalities where e.g., congestion, safety and environment are central (Olsson, et al., 2019).

The definition last mile logistics includes both purchases Business-to-consumer (B2C) and Business-to-business (B2B) but are often limited in different contexts. It also includes all types of channels and not only single channels as well as both being relevant for e-commerce and brick-and-mortar retail. For brick-and-mortar retail the customer shopping trips are important where the execution of last mile delivery is carried out by the customers themselves (Olsson, et al., 2019).

2.3.3 The current IKEA delivery solutions

The current delivery solutions for IKEA are represented in figure 2.3. The first decision the customer makes when doing a purchase, is between three delivery options. The first one is whether to pick up the goods at the store themselves, secondly, pick up the goods nearby at a pick-up point or third, get the goods delivered to an address of choice. When picking up goods at an IKEA store the options are Cash & carry or Click & collect (IKEA (j), 2021). For the option to pick the items in the store, both for Cash & carry and Click & collect, available options are to rent a van, a cargo bike or electric bike trailers. These services are not provided by all IKEA stores, but differ depending on store location. For example, the rental service of cargo bikes was introduced by IKEA Spain when there was a need for customers to be able to take home their goods without a car from the Goya store in the Madrid city centre. In Germany, electric bike trailers were introduced and can be used with a bicycle or pulled by hand supported by an electric motor (INGKA (b), 2020). Drive through, is also available for Click & collect in some stores, which has been proven useful during the Corona pandemic to reduce customer contact. When picking up goods nearby, an external pick-up point is used to deliver either by truck or as a parcel. The decisive factor between the last two options is the size and weight of the delivery. For the option deliver goods to an address of choice, the options are truck delivery or parcel delivery. This delivery service is provided by either an outsourced delivery or an inhouse service provider. With express delivery, the customer can choose a wished day and time slot when they are available (IKEA (j), 2021).

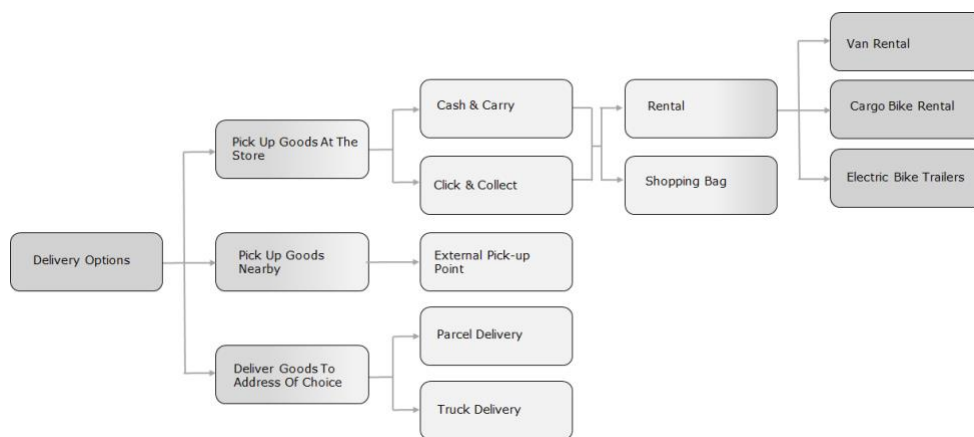


Figure 2.3 Delivery options for the IKEA customers (INGKA (b), 2020) (IKEA (j), 2021).

The focus of this project is the option picking up goods at the IKEA store and proceed with the purchase through Cash & carry. For brick-and-mortar retail, shopping bags are a common way to carry small goods home, at IKEA a medium sized paper bag is an option (IKEA (k), 2021). For customers to get home bigger, and heavier items Frakta articles, shown in figure 2.4, can be used. The Frakta

Carrier bag, in size large has a volume of 71 l, is a prominent choice when purchasing many or large items through Cash & carry at IKEA, see the first bag in figure 2.4. The price on the Swedish market is 0.69 EUR and it is made of propylene and has a 60% minimum possibility for recycling. The two different lengths of straps make it possible for the user to carry the bag in different ways, either on the shoulder or by hand (IKEA (l), 2021). The carrier bag also comes in a size smaller with a volume of 36 l, see the middle article in figure 2.4. The price for the medium Carrier bag is 0.49 EUR. The maximum load for both bags is 25 kg (IKEA (m), 2021).



Figure 2.4 From left to right; Frakta Carrier bag, large, blue 71 l (IKEA (l), 2021), Frakta Carrier bag, medium, blue 36 l (IKEA (m), 2021), and FRAKTA Trunk for trolley, blue 76 l (IKEA (n), 2021).

The Frakta Trunk and trolley is a set consisting of the trunk with a volume of 76 l and a trolley, where both can be folded flat, see figure 2.5. The base material and the handles are made of polypropylene, the thread is polyester, and the zipper is polyamide plastic. The bag can be carried either by the handles, on the back using the long straps over the shoulders or attached to the Frakta Trolley. The trolley's tubular frame, panel and wire mesh are made of steel and epoxy/polyester powder coating. The wheels are made of polypropylene plastic and synthetic rubber. The maximum load for the trolley is 30 kg and 25 kg for the trunk. The price for the products is 2.87 EUR for the trunk and 9.79 EUR for the trolley. When bought together the price is 12.66 EUR (IKEA (n), 2021) (IKEA (o), 2021).



Figure 2.5 Shows FRAKTA Trolley with trunk and the different ways to transport goods using it (IKEA (n), 2021) (IKEA (o), 2021).

The presented transport and carrying solutions are reusable and considered multi-purposed products, since they are both useful for bringing goods home and can also be used at home. For example, when doing laundry or going to the beach.

Another carrying solution that is part of IKEA's range is a bag called Plugghäst, see figure 2.6. It is an all-round and everyday bag that can carry a volume of 72 l for a price of 3.83 EUR. The bag can be folded to minimize the storage space when it is empty. It is equipped with carrying straps, made of polypropylene to both carry by hand and on the back. The shoulder straps are adjustable and have buckles made of acetal plastic. When packing the bag, the zinc zipper that runs along the long side is opened. The fabric is made of polypropylene as well and the usage area varies from laundry to groceries, to recycling material (IKEA (p), 2021).



Figure 2.6 Shows Plugghäst bag 71 l (IKEA (p), 2021).

3 Methodology

In the following section, the approaches used during the project are presented as well as the project's overall methodology, the design process model Double Diamond. This design process model was then modified according to the nature of the project. The period of the entire project was set to 20 weeks of execution. The methods for conducting research, data collection, idea generation and concept selection are also presented.

3.1 Human-centred approach

A human-centered approach was used throughout the project. The concept is based on the logic that one must understand the user needs and pay attention to the environment and the different tasks, which is the idea of focus-on-user. The human-centred approach is useful to include all elements when designing and setting up requirements. Otherwise, there could be a misinterpretation of the data where patterns and underlying information is not included. Usability is especially important when developing interactive designs and is also the property of being usable from a human centred perspective. It has many application areas and is here used to fulfil user goals in a specific setting (Kulyuk, et al., 2007).

3.2 Sustainable design

The tool that is used to maintain an environmentally sustainable approach is The Ten Golden Rules developed by Luttrupp and Lagerstedt (2006). This tool is a summary of already existing guidelines. This tool was used to integrate environmental demands into the product development process and used as a guideline where the user of the tool decides which rules to use and how. Below are the selected rules presented that was kept in mind during the project:

“TWO Minimize energy and resource consumption in the production phase and transport through improved housekeeping.

THREE Use structural features and high quality materials to minimize weight ... in products ... if such choices do not interfere with necessary flexibility, impact strength or other functional priorities.

FOUR Minimize energy and resource consumption in the usage phase, especially for products with the most significant aspects in the usage phase.

[...]

SIX Promote long life, especially for products with significant environmental aspects outside of the usage phase.

SEVEN Invest in better materials, surface treatments or structural arrangements to protect products from dirt, corrosion and wear, thereby ensuring reduced maintenance and longer product life.

[...]

NINE Promote upgrading, repair and recycling by using few, simple, recycled, not blended materials and no alloys.” (Luttrupp & Lagerstedt, 2006, p. 1401).

3.3 The double diamond model

The model chosen for the thesis was the double diamond process. This process was compared with the concept development process stated by Ulrich and Eppinger (2014) but was ultimately chosen due to the interest in a more iterative process with a human-centred approach and innovation focus. The double diamond is a relatively new model yet a well-known methodology. The model was chosen to give a structure to the process within the set time frame. It originates from Design Council and was developed and then launched in 2004 and consists of four phases, see figure 3.1 (Ball, 2019). The phases are Discover, Define, Develop and Deliver in the order from beginning to end. The diamond shape is used to illustrate both wide (divergent) and focused (convergent) thinking along the process depending on the phase. The process is not as linear as the figure shows, instead some learnings may lead back to the beginning. The focus is on feedback on different ideas and how they are working, to iteratively improve along the process (Design Council (a), 2021).

Discover- The starting point of this phase is an initial brief. During the phase, the understanding of that problem becomes clear by researching the issue (Design Council (a), 2021) It is a phase of research within the market and the users by collecting information (Design Council, 2007).

Define- With the insights gathered in the first phase the challenge can be defined with a new perspective (Design Council (a), 2021). The interpreted needs are aligned into a clear business objective, in the project development, to understand the context (Design Council, 2007).

Develop- This is the start of the second diamond, where a broad view is taken to find inspiration and answers from different people (Design Council (a), 2021). This is an iterating process to design concepts and test them in the right settings and improving the methods (Design Council, 2007).

Deliver- The deliver phase includes trying out different solutions and generating them. Reject the one that does not work and improve the others (Design Council (a), 2021). At this stage a result is proposed for launching as well as an evaluation and the received feedback of it (Design Council, 2007).

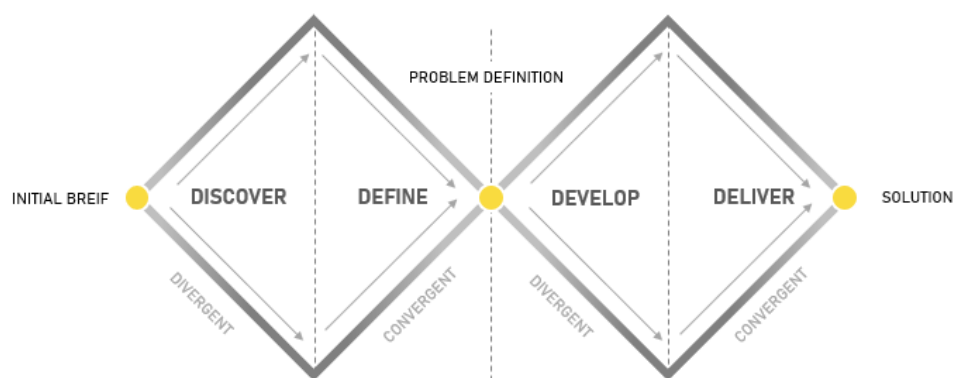


Figure 3.1 The illustrated double diamond design process and its different phases (Design Council (b), 2021).

3.4 The design process

Due to the broad initial problem formulation, the project's design process has two *Discover* phases, *Define* phases and *Develop* phases. The different parts of the design process are illustrated in figure 3.2. The first *Discover*, *Define* and *Develop* phases narrowed the project down to a specific category. During the *Define* phase product requirements were set and ranked according to M = main feature, N = necessary feature and D = desirable feature.

The second *Discover*, *Define* and *Develop* phases investigated opportunities and obstacles with such a solution to once again, narrow it down into a final concept using more specific product requirements presented in the second *Define* phase. The *Deliver* phase then developed this concept further and a prototype was delivered together with recommendations of further development. This was an iterative process involving improvements along the way.

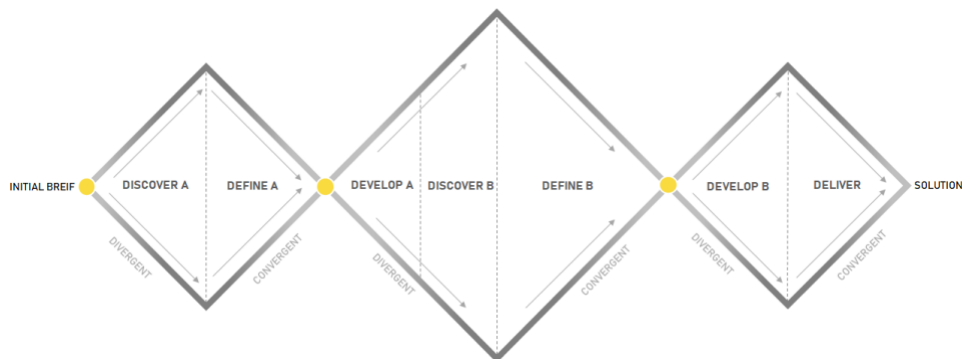


Figure 3.2 The design process.

3.4.1 Research method

Throughout the *Discover* phases, research was established to get a deeper understanding of the subject to be able to answer the strategic questions. The search engine used for that was Google, Google Scholar and Lund University Library (LUB) search.

3.4.2 Data collection method

Data collection necessary for this thesis was established through interviews with representatives from different parts of the IKEA organization. Since IKEA is a big and global company the interviewees were reached by email and through the DIN community. They were asked to participate in terms of possessed knowledge in the chosen markets. One representative from each market became the main contact in and the process consisted of one video interview and follow-up questions and insights communicated through e-mail. Interviews were used as a research method to gain more knowledge through contacts with expertise about the customer needs in relation to the selected stores. Also, the interviews gave the opportunity to collect the contacts subjective opinions and perceptions to get a better understanding of the markets. Through the interviews, secondary data were collected as well. An example of such data is the product range for Cash & carry at the city centre stores, competitors as well as follow-up reports after store openings. The chosen method is semi-structured interviews which is a blend of closed- and open-ended questions and that allows the interviewer to ask follow-up, why or how questions (Adams, 2015). The interview guide can be found in Appendix A.

3.4.3 Idea generation method

During the development phases prototypes underwent the procedure shown in figure 3.3. The prototype was evaluated and tested, and based on that, modified or chosen not to move forward with.

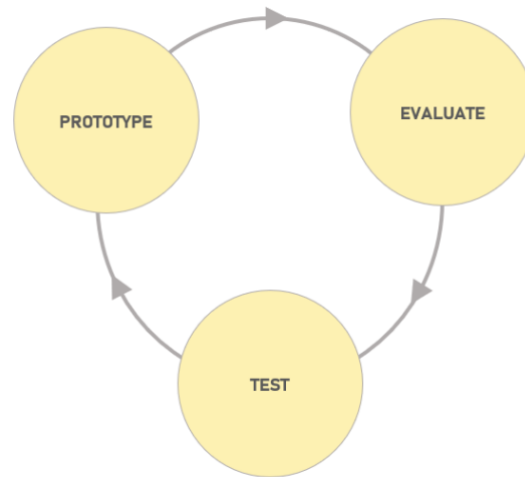


Figure 3.3 Procedure for developing the prototype.

The development of concepts was done in several steps. The first step of the process was to gather inspiration from previous solutions and solutions in other contexts. After that, an idea generation was conducted using the XYZ method. The XYZ-method also called the Idea Exchange method. It is a method used to create and exchange ideas through sketching and then switch papers between each other after a short period of time. The steps are the following:

- X number of people are gathered where each of the team members receives a mission statement.
- The members then develop Y proposals that are illustrated.
- After Z minutes the proposals are handed over to the next person who adds comments or proposals.
- The swap of sketches is repeated until the group is satisfied (Motte, 2019).

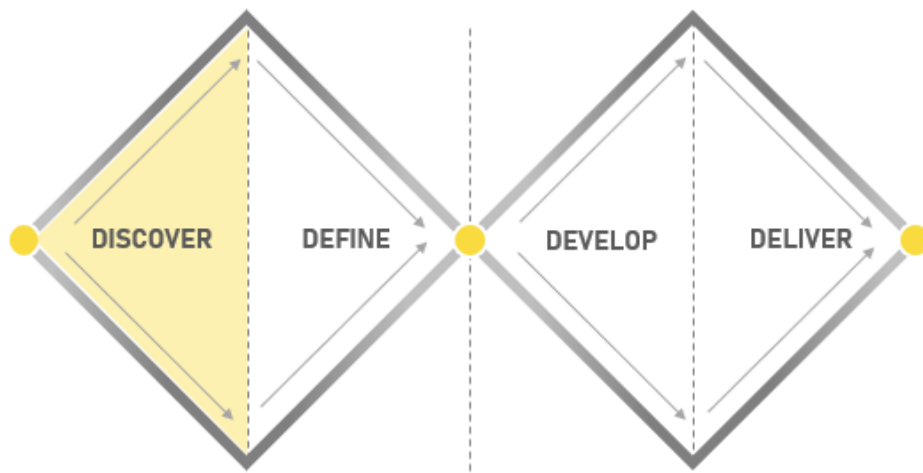
3.4.4 Concept evaluation method

For the evaluation of the first concepts the method, Six Thinking Hats was used. The method articulated by Edward de Bono is a tool for brainstorming and innovation and aims to break down thoughts into different areas. Each hat focuses

on one perspective to structure the thinking process (Bono, 2000). This method is used together with the product requirements and evaluated by using pros and cons.

When selecting the final concept to move forward with, each concept was scored based on satisfaction: 1-5 (5=not able to make it better, 4=good but space for improvements, 3=average, 2=less good, 1=bad) against importance of the product requirements on a scale of 1-3.

4 Discover A



The Discover phase includes research and data insights. During this phase, the most collection of data is established and will be the basis of the project. It will support the entire process of the thesis with insights as well as contribute with knowledge to be able to answer the strategic questions, see section 1.2.

4.1 Research

Research was conducted as the first part of the Discover phase and it includes research of trends in society, affecting last mile operations. Furthermore, investigation of self-service within the aspects; trends, behaviour and transportation, are presented. The purpose was to gain knowledge to be able to answer the strategic questions, specifically number one and two, see section 1.2.

- 1. What are the trends within last mile delivery today and in the near future?*
- 2. Which solutions are available today regarding self-service for last mile transportation?*

4.1.1 Macro trends

In the following section identified trends will be presented in a macro perspective, meaning that the point of view is global and outside any organization or company. The macro trends are investigated related to this project in last mile fulfilment and the relevant impacts. The discussed topics are Urbanisation and Urban areas, Environmental sustainability, Digitalisation and Technology, Customer-centred focus, and Effects of Covid-19. Within the different areas, the focus is on the trends right now as well as the upcoming trends within five years.

4.1.1.1 Urbanisation and urban areas

There has been and is still a global trend where people are moving into the cities as mentioned in the introduction of this thesis. Urbanisation is one of the most noticeable trends in the global environment today. Ever since a few years back, most of the population in the world lives in the cities and the developing countries urbanisation is expanding. Within a couple of years, the majority of the people in the developing countries will live in cities as well, which will be the first time in the history of such an event. According to the UN the degree of urbanisation in Asia is estimated to reach 54% where both China and India contribute with an acceleration change in this area. With this urbanisation process, several challenges are included. This for instance concerns infrastructure as well as catering to the demand for goods and services. These challenges require structured planning and logistic- and transportation solutions. Another central challenge related to urbanisation is the extended pressure on the environment that follows the economic growth as well as the increasing population and the expanding cities. Many of the challenges become even more prominent in the largest cities with more than ten million inhabitants, also called megacities. Most of the megacities are located in developing countries and is also where the new ones are expected to appear. In 2025 the UN expect 36 megacities globally in total (28 at the latest calculation), and the majority will appear in Asia (Regeringskansliet, 2014).

Urban areas bring new behaviour and way of life for the population. In larger cities car ownership is becoming less necessary, more commonly for single households and couples without children. Generally, single households have fewer resources for car ownership and in the twenty-first century, many young people do not need cars for social interaction. As well as car ownership does not limit access to cars where car-sharing services can be used instead. Travelling can also be done by public transportation, taxis, scooters, bike or on foot (Moss & O'Neill, 2012). In many cities today, some services offer vehicles for hiring both regular bikes as well as electric scooters (Zarif, et al., 2019). By avoiding cars, the trouble of looking for a parking space with high parking tickets is not an issue. The parking lots in cities have a lot of devoted space especially in urban areas in the U.S. (Moss & O'Neill, 2012). Many cities are moving towards private car-free zones due to regulations and in order to minimize the traffic in urban areas (Chung Kwik, 2015). An urban

railway transport system is established in many large cities around the world. Around the globe, they are addressed with different names, for example, Subway, Metro, U-Bahn, Underground, Rail transit or called the Tube, but have the same purpose (Railway Technology, 2014). Not only do they generate a necessary transportation mode but is also essential for the sustainable development in urban areas due to the relatively low ratio of consumed energy per transport capacity (González-Gil, et al., 2013).

Within urban areas, there is increasing customer demand for same-day delivery. This creates a trend among companies to include city distribution centres and (micro) hubs in the logistics flow. This can be done by building a new space or by taking advantage of urban warehouse space. Other spaces within the city, such as city hubs, micro hubs and shopping areas are an important part of changing from the common way of distributing on larger scales and slow mobility. To fulfil the customer demands these spaces can be used to develop smaller scale mobility that is personalised for the customer. When establishing new residential areas in the cities, there is a great opportunity to rethink the possibilities of mobility for both goods and people and to plan these neighbourhoods based on these trends. (Amstel, 2017). This is the opposite of what has been done for the past 30 years in European cities, where the logistic centres are placed outside of town. Now when the truckloads are getting smaller, and the delivery is required more frequently, the solution is to fit the logistics back into the cities again (Amstel, 2016).

4.1.1.2 Environmental sustainability

As mentioned in the introduction sustainability is on the agenda worldwide. One of the most urgent challenges regarding environmental sustainability is the global warming. The Paris agreement was introduced in 2015 where all countries agreed to keep the global temperature rise below 2 degrees and preferably below 1,5 degrees. This agreement was a historical event and a deal to continue the climate conversion and create a sustainable future. In 2020, 5 years after the agreement was placed, the global temperature is gaining new heights towards a 3 degree rise even though managers and politics globally are taking action. The Paris agreement is connected to the UN climate convention to prevent climate change (Naturvårdsverket, 2021) (Regeringskansliet, 2020). The developing countries will probably stand for a big part of the carbon dioxide emissions increase due to the high energy demand but is also highly relevant to consider in all countries. The increase in emissions in China will have a great impact on if the goals in the Paris agreement are reachable. This is because China under the period 2000-2010 represented 57% of the total carbon dioxide emissions and are still increasing (Regeringskansliet, 2014).

To counteract the emissions, clean air zones and ultra-low emission zone are introduced. This encourages companies to invest in solutions and vehicles that emit low or zero emissions. In the upcoming years, similar restrictions will likely be placed in different cities which will encourage local governments and companies to decrease their emissions. This is very applicable for last mile delivery where

financial initiatives will be important for new digital solutions as well as zero-emission vehicles. In urban areas, this topic continues to trend with zero-emission transport modes. The objective is to create last mile delivery without noise and with no pollution and therefore e-mobility is appearing. Electrification of cargo vans, trucks as well as cargo bikes is put on the city streets. Light electric freight vehicles are established due to the great flexibility and relatively low cost (Amstel, 2017). Zero-emission transport fleets will have a great impact due to that the transportation sector is one of the biggest producers of green gas emissions. Companies like DHL, Amazon, FedEx and UPS have announced plans of introducing electrical vehicles (Toy, et al., 2020, p. 47).

The sustainability drive goes beyond the concerns for greenhouse gas emissions. Around the world, scrutiny of the effects of solid waste is increasing, especially when it comes to plastics. In many regions, restrictions have been introduced, since a few years back, banning single-use plastic products (SUPs) (Toy, et al., 2020, p. 12). In the EU these restrictions will take effect on 3 July 2021 to become a forerunner in the global fight against marine litter and plastic pollution and reduce both the volume and impact of certain plastic products on the environment (Europeiska kommissionen, 2021). The SUPs have increased during the crisis of the coronavirus pandemic due to the usage of masks, gloves, and other personal protective equipment's and are therefore still an issue on today's agenda. The customer demand for reducing the waste from packaging has increased. That as well as new regulations are caught by companies today and they are putting future goals in place for reusability and recyclability of packages. Today secondary packaging is under rising scrutiny since the increased usage, due to an accelerating e-commerce shopping behaviour (Toy, et al., 2020, p. 12). For the logistic industry, packaging is fundamental and have several functions as it makes products safer, easier to handle, and protection along the supply chain (Toy, et al., 2020, p. 36). To improve the sustainability of the e-commerce supply chain new options are explored by companies, such as bio-based, compostable material and closed-loop returnable packaging systems (Toy, et al., 2020, p. 12). Packaging systems are practically universal in the logistic industry and plays an important role along the supply chains. Industry leaders are seeking development and innovation to improve them, hence rethinking packaging is becoming a trend (Toy, et al., 2020, p. 19).

A survey conducted by DHL reveals that across all sectors packaging is moving up on corporate agendas. The result showed that 9 out of 10 customers expect the relevance of packaging to increase shortly (Toy, et al., 2020, p. 36). With a growing demand for more sustainable solutions companies, governments and customers are decreasing and eliminate harm to the environment. Green logistics investments in technology, as well as supply chain changes, are necessary to create an upswing and competitiveness for greener alternatives (Toy, et al., 2020, p. 47). In a study by Bianca Ignat and Stanislav Chankov, they investigated the customer preference regarding last mile delivery for e-commerce with additional information on environmental and social sustainability for the options. The survey result showed

that displaying the sustainable impacts generally impact the e-commerce customers to choose a more sustainable last mile delivery. This shows, inter alia, that transparent information sharing is important for customers to make sustainable choices and impacts the customer behaviour (Ignat & Chankov, 2020).

4.1.1.3 Digitalisation and Technology

Robotics and automation technologies are becoming increasingly commonplace and are key innovative technologies. Automated processes in the logistics industry boost throughput, cut costs and meets the growing customer demand. Robots will continue to adapt to more roles in the supply chain such as warehousing, transportation and activities within last mile delivery. Artificial intelligence (AI) solutions are a great asset in combination with robots and automation. For these technologies, micro-fulfilment is a centrepiece because of the small-scale warehouse facilities concept in urban areas. These distribution hubs can provide instant and short-term delivery to many customers. In the urban areas where the land is more expensive, the instant demand, as well as the profitability of the concept, is through automated systems and integrated robotics technologies (Toy, et al., 2020, pp. 8, 67).

Internet of things (IoT) already has an impact globally through smartphones and other smart devices being connected to the internet. There has been a rapid growth of IoT technologies connecting billions of objects and with the next-generation wireless technologies emerging to bring everything and everyone online, all over the world. These technologies together with the development of IoT will create increased transparency and quality of service for both operations and customers as well as contribute to total visibility in supply chains (Toy, et al., 2020, p. 8). A key opportunity for IoT is a connection in real-time which not only improves the service quality but also optimises assets and shorten the response time for operational support. Today an increased area of use for sensors have been identified and the costs have waned due to accommodating regulations and investments which have brought up the attractiveness significantly (Toy, et al., 2020, p. 62).

Data is now claimed as one of the world's most valuable commodities. For the logistics industry data is especially essential because of the data-rich environment. Logistic players handle a lot of data regarding pieces of information about orders from customers, movement of shipments and both condition and location of assets. Data analytics have in several supply chain organizations become a top strategic priority. The difficulties lay in the efficient and systematic use of the data and therefore smart analytics techniques, for example, for planning optimisation, are expanding in interest (Toy, et al., 2020, p. 7). Data-driven insights and datasets are of value for, and driving, the development of AI and machine learning, which can fulfil customers' demands for personalisation and services with context. In supply chains, real-time process optimisation and simulation are becoming important tools for efficiency in a global setting in terms of everything from warehouse operations, like utilisation and inventory level, to optimising and exploring new supply chain models (Toy, et al., 2020, p. 54).

Other technologies with market potential that are appearing with enthusiastic response are unmanned aerial vehicles, drones for delivery and self-driving vehicles. The biggest concern today regarding those are regulatory framework which does not correlate with the technical development. The safety of logistic transports with self-driving vehicles are explored actively in the industry due to the extraordinary result it would bring for the future (Toy, et al., 2020, p. 12). One huge benefit is if this can fulfil the Zero Vision approach and eliminate the number of traffic related injuries and deaths (Trafikverket, 2020). The last mile delivery opportunities with drones have had an accelerated development during Covid-19 because of worker shortage and with less wanted human contact. Some believe that they will revolutionise the industries like manufacturing and mining in the future (Toy, et al., 2020, p. 71).

4.1.1.4 Customer centred focus

The customer's demands are changing, and their expectations are high. Customers want to have several options and we can see that more touchpoints are created to fulfil the demand. Companies are adapting by offering several delivery options as, home delivery, same-day delivery, time window delivery, neighbourhood stores and parcel lockers. With this, they also want to offer easy and customer-centric return processes and packages. The expectations are also regarding transparency and knowledge throughout the different fulfilment processes, providing the customers with real-time and prognostic information. The customer requirements are high with a delivery expectation of 100% on-time and in-full (OTIF) (Amstel, 2017). It reflects the delivery performance and meaning the degree delivered at the requested date to destination and with the right order quantity (Davies, et al., 2019).

Omni-channels are one way to provide a seamless customer experience. The progress of the omni-channel model has reached 2.0 and provides cross channel quality and high competence. The traditional omnichannel activities consisted of several separate channels to provide a good customer experience by integrating the supply chains. All coordination was done through one single platform, from retail, inventory, distribution and returns. The omnichannel business model has only been implemented successfully by a few major companies. That is due to the issues like legacy systems, siloed cultures, visibility of inventory and customer experience disruption, that have limited the success. The use of omnichannel business models has accelerated during Covid-19 and will continue to do so in the upcoming years. In order to benefit from this and satisfy the customers, information sharing as well as breaking down silos in the organization is key. With rising customer expectations and customer behaviour, delivery is a focus for omnichannel. The flexible delivery options are driven by increasing e-commerce and have normalized delivery within two days and are striving for faster and faster delivery (Toy, et al., 2020, p. 35).

Mass personalisation refers to offering products or services to meet individual demands from customers with mass-production efficiency. This challenges the traditional view on mass-produced with the “one size fits all” model and is

performed by industry players that bases decisions on customer preferences, profiles and past interactions. Mass customisation is on the other hand done by the customers themselves when making choices. In logistics, it often refers to the selection of delivery time, location, insurance and type of packaging. AI lies behind many consumer-focused innovations and other software tools as well as big data from users help companies that customises their offers to make the customers feel unique. In a context like for consumer goods, the use of different filters is one way for customers to include individual preferences when doing purchases online. For logistics providers, mass personalisation will drive greater demand in distribution centres and in the last mile for value-added services. Offers that could be included with logistic services could be greener alternatives such as cargo bikes, recyclable packaging or solutions including insurance or security. Some requirements are set in addition to the individual needs of customers and are flexibility, visibility and proximity of the services for customers (Toy, et al., 2020, p. 30).

4.1.1.5 Effect of COVID-19

The global pandemic caused by the coronavirus in 2019 has turned the world upside down from the beginning of 2020. It has brought challenges for everyone including governments, healthcare and other businesses. During this crisis logistic operations and supply chain have been exposed while handling essential supplies, following restrictions and volatility in supply and demand. On the other hand, the pandemic has acted as a catalyst when trying to overcome difficulties where innovative solutions were embraced. Examples of those are wearable technology and contactless operations in order to maintain a safe distance (Toy, et al., 2020, p. 10). As discussed earlier in this chapter Covid-19 is affecting the world in many different aspects as accelerated e-commerce and less travelling, not only by public transport. What will happen post-pandemic and what solutions and impacts will follow, is yet to be seen.

4.1.2 Self-service

This project aims to develop a self-service solution. When investigated the macro trends affecting last mile fulfilment no obvious trends within self-service transportation was found predominant. To get even more hands-on, trends that could be in the direction of a solution, inspiration or tendencies was discovered.

Within self-service today and when it comes to customers bringing home purchases from the store, customers use different kinds of bags, plastic bags, paper bags or reusable bags, like the Frakta Carrier bag. With new regulations from the EU (Gustafsson, 2019) and due to the environmental sustainability focus, also mentioned as a macro trend, the use of reusable bags has increased in some regions. This is done by people that are conscious about the environment and has concerns about the future. Another tool for bringing goods home is by a trolley or a sack cart, mostly used by elder people (Nyhlin, 2018). For larger items carrying tools such as

straps are used for lifting heavier furniture and similar when for example moving. These tools often require two people when using (Lippi, 2021).

Regarding transportation together with self-service a trend on the market today is the e-scooters. The demand for micro-mobility vehicles has had rapid growth over only a few years. This has a correlation with people moving into urban areas and the need for quick and easy transportation (Zarif, et al., 2019). Smart mobility is also taking other directions. Both car sharing and bike commuting are growing and are powered by economy sharing business models. Ridesharing works best in urban settings since availability is of importance for these services (Viechnicki, et al., 2015). Electric bikes and shared bikes provide a connection between the public transport systems and the peoples' destinations while travelling and at the same time in a more environmentally way than by private cars (Fishman, et al., 2020). Public transport is an important option to tackle emissions especially in urban areas and needs to be an easy choice. It is therefore essential that these transport systems to develop in terms of efficiency as well as in direction to meet new passenger demand and requirements (Salpeter, 2018).

Some markets are at the forefront of new technologies, also mentioned as a macro trend, not the least within last mile delivery. Amazon is one of the companies globally that have made a huge impression on the customers. They offer quick and on-time deliveries with free delivery when reaching a checkout basket of a certain amount. They have been in the frontline of the e-commerce development in terms of what the customers now expect. They started in the US and are now expanding (Andersson, 2020). On the other side brick and mortar retailers are introducing self-service checkouts where more responsibility and work effort is put on the customer. These systems have had an increase in demand and have only become more popular due to Covid-19. The customer has become accustomed to more and more self-service systems for example self-check-in at airports and self-ordering at e.g., McDonald's (Mordor Intelligence, 2021).

Some interesting findings were found among trends for different types of self-services even though it was not necessarily required to have that stamp from the beginning. There is on the other hand no solution or concept today that could be applied directly to the purpose of this project. Therefore, in the continuous work, the focus will be on solutions in other areas and at other types of markets. Furthermore, to have an innovative approach when defining a solution.

4.2 Data insights

In order to get a better understanding of the IKEA customers, the three markets, and the portable range, data was collected through interviews, secondary data and complementary research. One part of the data collection consisted of interviews with contacts located at the targeted cities Paris, Tokyo and New York. Information and

secondary data were collected through these contacts. An example of such data is the product range for Cash & carry for the city centre stores as well as follow-up reports after store openings. The following sections is related to strategic question number three, from section 1.2.

3. *What are the markets' needs at city centre store locations and what solution is suggested?*

Below, the insights from the interviews and additional sources are presented.

4.2.1 Customer insights

The customer insights were collected mainly through interviews with contacts as well as secondary data received from them. The contacts for the Paris market were the Fulfilment Sourcing Manager for IKEA France, and the Market Manager, for City centre Paris. The contact for Tokyo was the Country Customer Fulfilment Manager for IKEA Japan. Lastly, representing IKEA USA and New York city, the Insights leader was interviewed. During the time of collecting market and customer data, the contacts were contributing with insights by video call and/or email and they can all be seen in table 4.1 below.

Table 4.1 Market contacts within IKEA

Market area	Title
Europe/ Paris	Market manager, City centre Paris
Europe/ Paris	Fulfilment Sourcing Manager, IKEA France
Asia/ Japan	Country Customer Fulfilment Manager, IKEA Japan
North America/ New York	Insights Leader, IKEA USA

4.2.1.1 Paris

Most customers who visit La Madeleine store in Paris are females in their 40s. They are living in single households or together with a partner or a roommate, without children. The living spaces are small and car ownership is considered rare, therefore the effort of travelling to the stores in the suburbs is too high for the customers. The most common ways of travel are by metro followed by walking, biking, grabbing an electric scooter or using Uber. The average number of items per ticket is lower than at the traditional IKEA stores and Cash & carry is preferred. Customers in Paris think that the effort is too high when renting tools to deliver the goods home themselves compared to home delivery, even though it is cheaper and gives instant gratification. Environmental sustainability is of great value to Parisian customers, and they see IKEA as like-minded. Additionally, IKEA is well known for its affordability and Scandinavian style which is also highly valued. A summary of the customer profile is presented in table 4.2 below (IKEA, 2019) (Ali, 2021) (Westerberg, 2021).

Table 4.2. Customer profile for IKEA La Madeleine Paris, France

Gender	Female
Age	40s
Living situation	Single household Small living space (avg. 45 m2) No car
Travel pattern	Metro (majority), walk, bike, scooter, Uber
Preferred check-out option	Cash & Carry

4.2.1.2 Tokyo

The customer profile for the IKEA Harajuku store and the IKEA Shibuya store are similar and are therefore presented together. Most of the IKEA customers in Tokyo are females in their 20s living in small single households. This differs from the customer at traditional furniture store in Japan, where the main customers are in their 30s to 40s living with children. IKEA customers travel mostly by metro or train but walking and biking are also popular ways of transportation. Owning a car is not as common as outside the city and people who own a car rarely use it in the city area since public transport is more convenient due to lack of space (IKEA (f), 2021) (IKEA (g), 2021) (Hofer, 2021).

Among the targeted customers, there is a high interest in digital, health and environmental trends. Also, fashion trends play a big role, and the IKEA logo is considered attractive. There have been two successful launches of the limited collection EFTERTRÄDA which is IKEA’s first merchandise collection. This launch was made specifically for the people of Tokyo with the official IKEA logo and a barcode printed on clothing and accessories (IKEA (q), 2021). The launch had great social media and influencer exposures that created a sell-out of the first drop in 3 days, at the Harajuku store (IKEA (f), 2021) (IKEA (g), 2021) (Hofer, 2021).

The share of Cash & carry is 82.1% compared to customer order through e-commerce 6 months after the opening of the Harajuku store. The customer order is 70% parcel and 30% home delivery. According to the Country Customer Fulfilment Manager, services are more preferred in the Asian market compared to Europe. The concept of self-service hardly exists on the market and services like assembly and delivery in general are more common than in Europe. Additionally, it is mentioned that the public transportation system is often crowded and hectic where there is no room for anything else but the travellers themselves (IKEA (f), 2021) (IKEA (g), 2021) (Hofer, 2021).

The average ticket and the number of items per ticket is for Cash & Carry is low compared to the bigger stores. Top sellers in Tokyo are resealable plastic bags, a sheepskin, a trolley, a nightstand and the EFTERTRÄDA bag. These items are

either accessories or small furniture which are considered to be within the portable range. A summary of the customer profile is presented in table 4.3 below (IKEA (f), 2021) (IKEA (g), 2021) (Hofer, 2021).

Table 4.3 Customer profile for IKEA Harajuku & IKEA Shibuya Tokyo, Japan

Gender	Female
Age	20s
Living situation	Single household Small living space (avg. 60 m2) No car
Travel pattern	Metro & train (majority), walk, bike
Preferred check-out option	Cash & Carry (82.1%)

4.2.1.3 New York City

Before store opening in Queens, New York City exploratory research was made by Whitman Insight Strategies (WINS). It was conducted to better understand the preferred shopping behaviours for home furniture and furnishing, explore competitors and evaluate the different store concepts for IKEA.

The IKEA Queens customer profile are females around their 20s living in small single households. IKEA have the highest share of sales when the customers travel to the store, car is the preferred option (Dominguez, 2021). See table 4.4 for the allocation data of travel methods (Brorough, 2019). The preferred travel method when buying furniture versus furnishing has no significant difference and the use of an own vehicle is dominant. In addition, 62% of all households in Queens own a car (NYCEDC, 2018).

Table 4.4 WINS 2019 delivery transportation data of NYC Queens methods (Brorough, 2019).

Travel methods to the physical store for buying:	Furniture	Furnishing/accessories
My own car	61%	58%
Train	17%	18%
Cab/taxi	14%	13%
Subway / metro	26%	32%
UBER/LYFT	18%	14%
Rent a car/van/truck	12%	7%
Bus	16%	22%
Walk	18%	25%
Carpool with friends/family	16%	17%
Ride a bike	3%	7%
Ferry	3%	6%
Other Specify	1%	0%

For Cash & carry the average ticket and number of items in NYC Queens is considered low and there is a need to increase both parts. A list of 135 prioritized items for Cash & Carry was provided from IKEA Queens. These items have been identified as small furniture items that IKEA Queens want Cash & carry customers to buy more of. Since the store is located in a mall it is of importance for them to attract mall shoppers visiting other stores or restaurants as well and unplanned visits to IKEA. The customer journey differs from the big stand-alone stores and the Insights Leader, mentioned that there is a need for a solution that makes it easy for the customers to walk around at the mall and transport their items on transit, on foot, or by bike. A summary of the customer profile is presented in table 4.5 (Dominguez, 2021).

Table 4.5 Customer profile for IKEA Queens NYC, USA

Gender	Female
Age	20s
Living situation	Single household Small living space 55% of the customers does not own a car
Travel pattern	See table 4.4.
Preferred check-out option	Cash & Carry

4.2.2 Benchmarking

Benchmarking in the targeted regions were conducted to get an idea about the IKEA competitors and what type of delivery solutions they offer. The regions were investigated separately due to that the competitors differ dependent on region and are therefore presented in individual sections below. In general, the competitors are home furnishing stores or chains with both physical stores and online sales, just like IKEA. The chosen competitors were partly based on insights from the conducted information at the interviews, who IKEA themselves consider as competitors. It was chosen to investigate service delivery as well as self-service solutions today. Three different options of services were considered the most common ones in the logistic industry today, in store Click & collect, home delivery and delivery to pick-up point. When researching the self-service alternatives, the most common ones on the market are reusable bags as well as paper bags. In the tables 4.6-4.8 the competitor's delivery options are presented. The option *Other* leaves room for specific solutions and innovations from the actors. Due to the timeframe of this project the method for conducting competitor information was done via internet search and interviews with IKEA contacts and no contact with the external companies. The result presented in the sections below is aiming to get an overview of the existing market today but does not show in-depth differences, for example prices for the different options.

4.2.2.1 Competitors - Paris

The competitors of IKEA La Madeleine store in Paris and their delivery offers were mapped in table 4.6 below. The most relevant competitors for IKEA France according to interviewees are the large French retailer brands and global companies But, Conforama and Leroy Merlin. A newer but also French furnishing chain mentioned as competitors are Maisons du Monde as well as Alinéa. As the table presents, the companies are similar in their offer of both services and self-service delivery. Notable is that La Madeleine will offer a click and collect services in the future due to the high demand but lacks space at the moment (Ali, 2021). Among services is, Click & collect is a common service used by the remaining retailers as

well as home delivery is covered by all companies and delivery to pick-up point is used frequently with an exception from But. As mentioned in section 4.2.1.1, IKEA France offer a rental service but it is not very popular according to the Fulfilment sourcing manager. For the competitors no other options for self-service delivery were identified at this stage (Westerberg, 2021).

Table 4.6 Delivery options for IKEA and competitors in Paris. Yes= option available, No= option not available, (-) =no information.

Delivery options		IKEA	But	Conforama	Leroy Merlin	Alinéa	Maisons du Monde
Service Delivery	In store (click and collect)	No	Yes	Yes	Yes	Yes	Yes
	Delivery at home	Yes	Yes	Yes	Yes	Yes	Yes
	Delivery to pick-up point	Yes	No	Yes	Yes	Yes	Yes
Self-service Delivery	Reusable bag	Yes	-	Yes	Yes	Yes	Yes
	Paper bag	Yes	-	-	Yes	Yes	Yes
	Other	Renault car rental	-	-	-	-	-

4.2.2.2 Competitors - Tokyo

Some of the home furniture competitors for IKEA in Tokyo can be seen in table 4.7 below. In Tokyo, IKEA have two city centre stores, as mentioned in 4.2.1.2. IKEA and its competitors' delivery options were identified. The main competitors according to the interviewee are Muji and Nitori, offering home furnishing accessories and furniture (Hofer, 2021). Compared to IKEA they are both established in Japan, Nitori with a market share in mainly Japan as well as Taiwan, USA and China (Nitori, 2021). Muji on the other hand have a global spread like IKEA (Muji, 2021). In this comparison Watashi No Heya and Franc franc was also added to the group of competitors for home furnishings. When it comes to only accessory retailers, there are many competitors from convenient stores to shopping malls (Hofer, 2021).

In general, fewer companies offer a Click & collect service and delivery to the pick-up point, which points out the focus on home delivery services in Japan. Both Click & collect as well as delivery to pick-up point involved the customer participation for the goods to reach its final destination. When investigating the self-service

options for delivery the information was lacking. An interesting finding was that Nitori offers rental trucks (Nitori, 2021).

Table 4.7 Delivery options for IKEA and competitors in Tokyo. Yes= option available, No= option not available, (-) =no information.

Delivery options		IKEA	Muji	Nitori	Watachi No Heya	Franc franc
Service Delivery	In store (click and collect)	Yes	Yes	No	No	No
	Delivery at home	Yes	Yes	Yes	Yes	Yes
	Delivery to pick-up point	Yes	Yes	No	Yes	No
Self-service Delivery	Reusable bag	Yes	Yes	-	-	Yes
	Paper bag	Yes	Yes	-	-	No
	Other	-	-	Free truck rental service	-	-

4.2.2.3 Competitors - New York City

The final targeted market, New York City and the IKEA competitors were investigated in terms of their delivery options. The US. market have a lot of large retailers such as Walmart, Target, Marshalls and TJ Maxx, presented in the table 4.8 (Dominguez, 2021). These competitors are chains with a various product range, somewhat different than a typical IKEA store. Not only do they have home furnishing and furniture but a large assortment of other retail items. Both Walmart and Target have for example grocery items as well. Marshalls and TJ Maxx are sister stores and have similar prices and assortment in fashion, home goods and accessories (TJ maxx Company, 2021). Amazon, that started as an online retailer, has been added to the group of competitors for IKEA, and that is due to its popularity and big establishment in the US (Dominguez, 2021) (Amazon, 2021). When investigating the delivery option both regarding self-service and services, there are a lot of similarities between the companies, and all have a lot of options for the customer.

Table 4.8 Delivery option for IKEA and competitors in in New York City. Yes= option available, No= option not available, (-) = no information.

Delivery options		IKEA	Walmart	Target	Marshalls	TJ Maxx	Amazon
Service Delivery	In store (click and collect)	Yes	Yes	Yes	No	Yes	Yes
	Delivery at home	Yes	Yes	Yes	Yes	Yes	Yes
	Delivery to pick-up point	Yes	Yes	Yes	Yes	Yes	Yes
Self-service Delivery	Reusable bag	Yes	Yes	Yes	Yes	Yes	Yes
	Paper bag	Yes	Yes	Yes	Yes	Yes	Yes
	Other	-	-	-	-	-	-

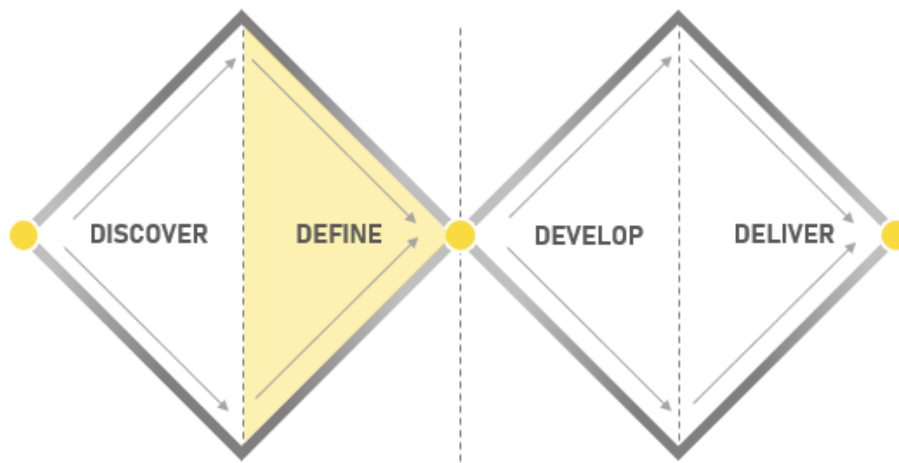
4.2.3 Portable range

Portable range refers to Cash & carry goods that the customer can take home by themselves directly from the store. To develop the optimal solution, it is necessary to know which goods are included in the portable range. This is to create an understanding of what packaging dimensions and weight the solution should be able to carry. What counts within the portable range, however, differs somewhat between the different stores but are overall the same. Lists of the full Cash & carry range was provided by the contacts in Paris and Tokyo. IKEA Queens provided a list of 135 selected items that have been identified, given margins and furniture items, that is wished to increase sales through Cash & carry customers. To identify the dimensions and weight that the solution should be able to carry, IKEA Queens list of selected items was mainly used, with input from the other targeted city centre stores. In table 4.9. the maximum and minimum packaging dimensions and weights, from that list, are presented. It is stated that the critical parameters are primarily the maximum length and maximum weight. Worth mentioning that 78% of the packages in the list have a length equal to or below 0.8 meters and 49% of the packages in the list have a weight below 6 kg.

Table 4.9. Maximum and minimum dimensions and weights of the packages in the Cash & carry range.

IKEA Queens NYC – Portable range		
Dimension/weight	Max	Min
Length [m]	1.72	0.11
Width [m]	0.81	0.05
Height [m]	0.6	0.01
Weight [kg]	25.62	0.119

5 Define A



The Define phase the Double Diamond framework aims to define the specifications for the project to create a clearer picture of the requirements for the solution. From the previous phase, Discover, a definition is made in the mission statement and analysis are conducted. After that a final brief is set together with product requirements.

5.1 Mission statement

The mission statement defines the project's development phase. At this point of the project, it can be described according to the description below in table 5.1.

Table 5.1 Mission statement

Mission statement	
Concept description	- A self-service concept for customers delivering goods home themselves after a purchase from a retail store in an urban setting
Benefit proposition	- Increase instant gratification for customers - Increase possibilities for more people to bring goods home - Provide a sustainable and low-cost option to the customer
Primary Market	- Self-service customer
Secondary Market	- Casual customers - Delivery professional - Influencers
Assumptions	- Suit the IKEA profile and brand - Used by the customer - Sustainable
Stakeholders	- Purchasers and users - Retailer - Manufacturer - Service centre
Constrains	- Only for portable products - Product and not a service

5.2 Analysis of research and data insights

As mentioned in the *Methodology*, in section 3, a human-centred approach is used throughout the project to understand the user needs, the environment and the tasks and thereby fulfil the requirements and create a solution with focus on the user. Therefore, this section mainly covers the data insights, with the research in mind, from the markets regarding the customer behaviour and need, to set out product requirements in section 5.4.

To summarize the insights from the different markets, it is stated that the customer behaviour between the targeted cities is overall the same at first glance. The majority of customers who visit IKEA's city centre stores in Tokyo, Paris and New York City are young to middle-aged women living in single and small households. In contrast to the larger stores located outside the cities, public transport, walking and cycling are popular alternatives to travel to and from the store. The customer profile corresponds well with the behaviours caused by urbanisation, which is expanding in developing countries.

Another thing that sets city centre stores apart from larger stores is the smaller ticket and lower number of purchased products. It is possible that there is a correlation between customers buying few items at a low price and using Cash & carry as a

check out option and it can be explained by customers only buying accessories that are easy to carry home from the store. An argument is that the customer knows before the check-out which delivery option to choose and then adapts the purchase to meet that option. If the customer chooses to carry home the goods themselves and wants to travel from the store by for example public transport, the type and quantity of items are adapted to fit with the chosen mean of transport.

IKEA Japan is at the forefront when it comes to digital marketing, which strengthens the brand in the customer journey. In Tokyo, the IKEA logo is considered fashionable and through social media and influencer exposures Efterträda, a limited merchandise collection became very popular. Based on this, it is of interest to develop a product that conveys IKEA's typical design and is marketed via social media and influencers as something “trendy” and “in time”.

Based on the interviews with the contacts, primarily in Paris and Tokyo, but also New York City, it emerged that many would rather pay than perform the service themselves when getting furniture home. The several options among delivery today as well as the convenience with e-commerce experiences has improved delivery services and the customer use of services has increased. Digitalisation has been an influential factor as well as covid-19. Additionally, customers prefer free deliveries, which is not available at IKEA. On the other hand, customers in Paris think that the effort is too high when renting tools to deliver the goods home themselves compared to home delivery, even though it is cheaper and gives instant gratification. With that insight together with the Tokyoites' disinterest in a self-service solution, it is established that for a self-service solution to be appreciated, it is required that it is low-cost, extremely simple and intuitive with clear instructions.

The large Frakta Carrier bag, mentioned in section 2.3.3, is adapted to carry several things within its volume of 71 litres. For a new solution to be useful, it must meet the criteria and requirements that the Frakta Carrier bag does not. The examination of the current self-service solution clarifies that its biggest weaknesses are long, large packages and many packages in different sizes. The larger and heavier packages are, the less ergonomic the current solutions are. It can only be carried on one shoulder and cannot be crossed over the upper body. What is possible for the customer to take home themselves, when it comes to dimensions and weight, depends on the solution and will therefore be reviewed further. It is then important to refer to what is ergonomic for the user and set an upper limit for which and how many packages the customer can take home.

The limit for what customers is willing to pay for a delivery solution is 10% of the total item(s) price. Based on this, it is assumed that the price for the self-service solution must be at least below 10%, but preferably around the same price as the large Frakta Carrier bag, that is 0.49 EUR. If the carrier bag and the new solution have the same approximate price, the price does not affect the choice between them, but only which of them is best fitted for the task.

Environmental sustainability is a clear trend where costumers have high demands on reusability and recyclability. This also applies to the customers for the selected cities where it is seen as important and trendy. This insight clarifies that the solution must have a well-developed design where all steps from pre-use, use and after-use must be examined to make overall product design more environmentally sustainable. The Ten Golden Rules tool is therefore used as guidance during the design process to promote long life for the solution and use few, simple, recycled, not blended materials, see section 3.2. By displaying the sustainable impacts, it influences the customer to make a more environmentally friendly choice. Transparency thus affects the customer's behaviour and choice and should be considered during the development process and when marketing the solution.

To address the challenges of environmental sustainability and urbanisation, clean air zones and ultra-low emission zones are being introduced. This strengthens the demand for a self-service solution as, in the future, fewer people will own vehicles and more people travel by public transport, cycle or walk. As of today, no optimal self-service delivery solutions have been found, neither in the conducted research nor in the benchmarking. Rental and leasing solutions are disregarded due to the customer resistance. Among the stated IKEA competitors, no relevant solution within this area was found, not even with further development potential. Delivery services will however continue to develop and adapt, but with the customer-centred trend, where customers want it on their terms, a need is created to be able to do it their way by themselves.

5.3 Final brief

Through the *Discovery* phase, it is clarified that there are five difficulties with the solution.

1. Customers think it is too cumbersome to rent tools to get their goods home regardless of the price.
2. Public transport, walking and cycling are popular alternatives to travel to and from the store.
3. Customers would rather pay than performing the service themselves when it comes to getting goods home since there is a disinterest in self-service solutions. For a self-service solution to be appreciated, it is required that it is extremely simple and intuitive with instructions at a low price.
4. Environmental sustainability is a clear trend where consumers have high demands on reusability and recyclability.
5. For the solution to be used by the customer, it must contribute to the customer experience. It is of interest to develop a product that conveys IKEA's typical design and is marketed via social media and influencers.

With this in mind, it was determined to limit the solution to only purchased delivery solutions and focus on customers that use public transport, walks and bikes. The requirement of a sustainable and low-price solution remains.

A new brief to the project was formulated: “Sustainable low-price self-service solution for last mile delivery that is bought and easy to travel with on public transport, when walking and biking.”

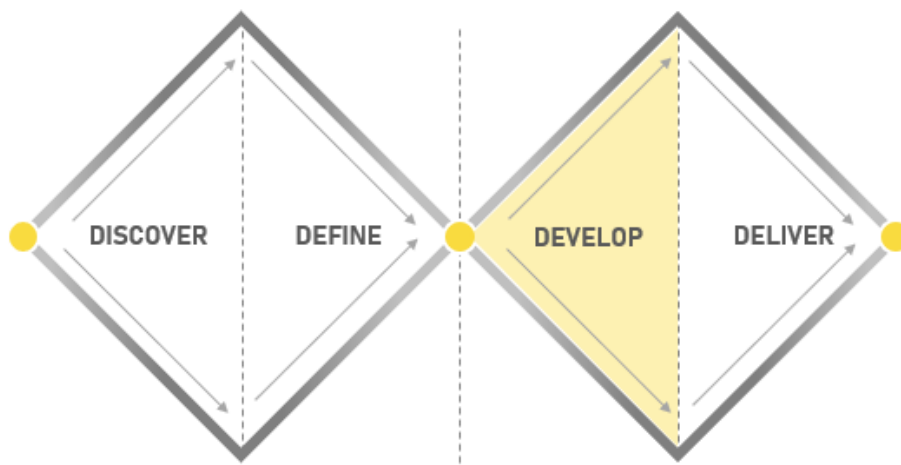
5.4 Product requirements

Based on analysis of the data insights and research, as well as the final brief, the product requirements were decided. In a feature analysis, the needs were ranked according to M = main, N = necessary and D = desirable features. All identified needs are presented in table 5.2.

Table 5.2 Product requirements

	<i>The product...</i>	
<i>Ease of use</i>	Is manageable to use for one person	N
	Is flexible	N
	Is intuitive	N
	Is easy to travel with on public transport, walking and biking	M
	Is adapted for stairs (easy to carry)	N
	Is adding value to the customer experience	D
	Is ergonomic	N
<i>Function</i>	Protects the goods	N
	Independent	M
	Is weather resistant	M
	Is adaptable for different packaging sizes	M
	Can carry several goods	M
	Can carry larger items	M
	Can carry heavier items	N
	Takes up small space when storing	M
	Is lightweight	D
	Is durable	D
<i>Aesthetics</i>	Protects the goods from theft	D
	Is aesthetically pleasing	D
	Is aesthetically related to IKEA's design	D
<i>Environmental sustainability</i>	Is innovative	D
	Is reusable or recyclable	M
	Has few different types of materials	N
<i>Economical</i>	Has small volume of material	N
	Price: EUR 0.5 (+/- 2/0.5)	N
	Has low production cost	M
	Is scalable	N

6 Develop A



In the Develop phase, the focus is on investigating possible concepts for transport of goods within the portable range. From this step forward no solutions for renting or leasing are considered.

6.1 Method

The method for the development of concepts was done in several steps. The first step of the process was to gather inspiration. After that, an idea generation was conducted using the XYZ method. From the idea generation, main concepts were chosen to move forward with. The evaluation of the main concepts was done with the method Six Thinking Hats together with the product requirements presented in section 5.4. This was done to receive a broader perspective of the different concepts and to maintain a human-centric approach. In this section, a final concept category is presented. After that, it was chosen to further *Discover*, *Define* and *Develop* within the area of choice to maintain an iterative process in favor of the outcome. The methods XYZ and Six Thinking Hats are explained in the *Methodology*, section 3.4.3 and 3.4.4.

6.2 Idea generation

Initially, research was carried out on solutions on the market today. This was done to be inspired and get new perspectives as well as to see if products used during transport of goods in general can be applied for this project. Inspiration was taken from a carrying strap for yoga mats, moving aids to carry heavier objects, shoulder straps that are fastened to a guitar case, strap solutions to carry a skateboard on the back and various trolley solutions.

In addition, sketches were made with the intention to get an overview of what areas that could be of interest. The XYZ-method was used to create and exchange ideas during the idea generation. Initial sketches were created and are presented in figure 6.1.

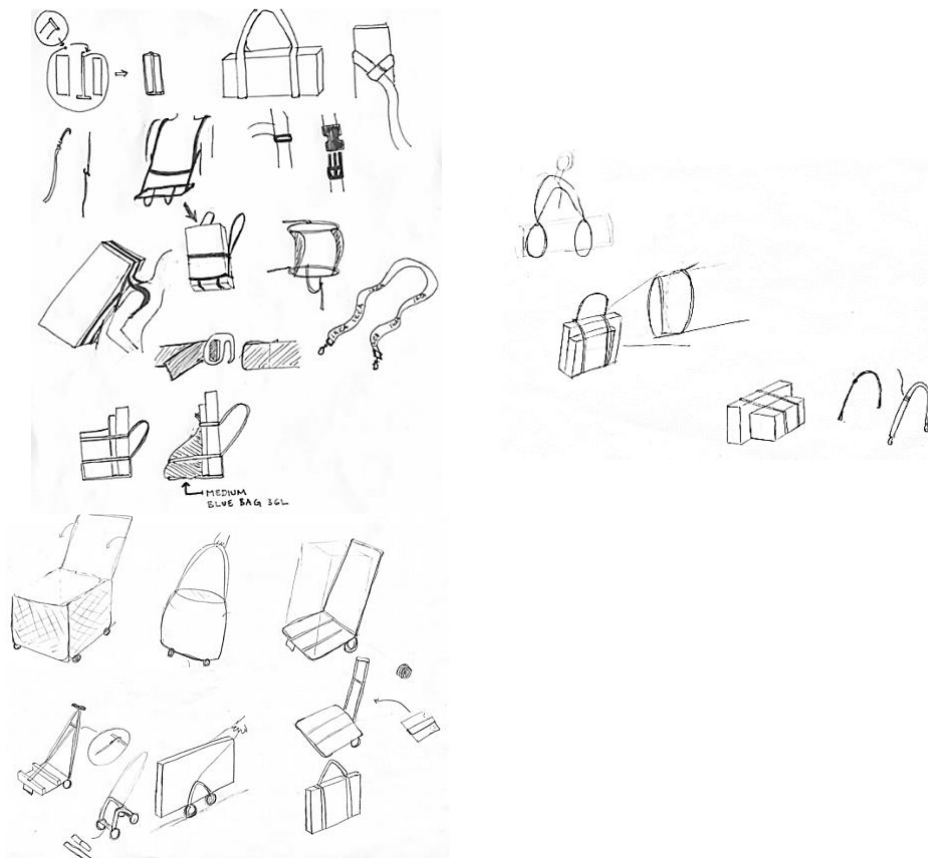


Figure 6.1 Initial sketches of alternative main concepts and fastening solutions.

Moreover, three main concept areas were created at the idea generation. These are presented in section 6.3 along with motivation and evaluation.

6.3 Main concepts and evaluation

After the idea generation, the feasibility of the concepts was evaluated and was used as a basis in the selection of main concept areas for transportation of goods. They were categorized into three different areas of concepts, carry on the shoulder, carry on back and a solution with wheels. The concepts were compared in tables by using pros and cons as well as using the method Six Thinking Hats, explained in the *Methodology*, section 3.4.4. In this step, the main features (M) of the concepts are prioritized during evaluation since they are essential when moving forward. The main features from the product requirements are listed in table 6.1

Table 6.1 Product requirements considered to be main features (M).

	<i>The product is...</i>	
<i>Ease of use</i>	Is easy to travel with on public transport, walking and biking	M
<i>Function</i>	Independent	M
	Is weather resistant	M
	Is adaptable for different packaging sizes	M
	Can carry several goods	M
	Can carry larger items	M
	Can carry heavier items	M
<i>Environmental sustainability</i>	Takes up small space when storing	M
	Is reusable or recyclable	M
<i>Economical</i>	Has low production cost	M

For the three concept areas, the method was applied and can be seen in Appendix B. Pros and cons were evaluated related to the areas and are presented in the following three sections. The features that are specific to the concept areas, carry over one shoulder, carry on the back and a solution with wheels, in terms of how they manage to carry packages were considered in this step. Pros and cons that are the same for all the concept areas are not mentioned unless they are main features (M). Necessary features (N) and desirable features (D). Pros and cons are also mentioned in the evaluation if they are considered distinctive.

6.3.1 Carry over one shoulder

The concept to carry the goods over one shoulder is a cross body strap solution similar to solutions of crossbody bags. It consists of two loops around the packages and a strap to place over the shoulder. Figure 6.2 shows examples of how such a solution could look like. The sketches are made to get an overall picture of the idea. The left sketch has one cohesive strap, and the right is a solution where the

attachment around the package and the shoulder strap can be separated. In table 6.2 pros and cons are presented for the concept area.

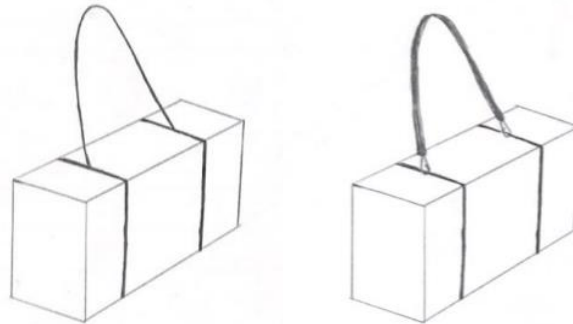


Figure 6.2 Sketches of carry-over-one-shoulder solutions.

Table 6.2 Pros and cons with a solution carried over one shoulder. M=main features, N=necessary features.

Pros	Cons
<ul style="list-style-type: none"> • A small volume of material. (N) • Can be created with only one material. (N) • Can be manufactured at a low-cost. (M) • Intuitive, since it is a carrying solution the customer has seen before. (N) • Adaptable, can be reused for example when carrying yoga mats, skies or surfboards. (N) • Can be used on public transport, and while biking and walking. (M) 	<ul style="list-style-type: none"> • Hard to use with several packages with different dimensions. (M) • Not optimal for long packages takes up much space when carrying along the side of the body. (M) • Non-ergonomic, painful on the shoulder when carrying heavy packages for a longer time. (N)

In the evaluation, several pros and cons were identified. The main benefit of this concept is that it can be manufactured at a low cost and used on public transport as well as while biking and walking. Another advantage is that the solution is intuitive for customers to use since similar features are used in other products, for example the yoga mat. When carrying longer and heavier goods the solution can be problematic by taking up too much space and being unergonomic. Additionally, this solution is similar to the already existing IKEA Carrier bag and it can therefore be discussed whether it will bring value to the customer.

6.3.2 Carry on the back

The second concept is to carry the purchased items on the back with two shoulder straps. This solution could either consist of only straps, as the left sketch shows or a bag more similar to a backpack, see figure 6.3. The concept is evaluated through pros and cons presented in table 6.3.

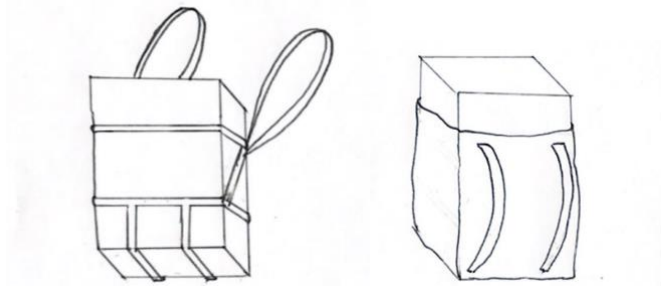


Figure 6.3 Sketches of carry-on-the-back solutions.

Table 6.3 Pros and cons of carrying on the back. M=main features, N=necessary features.

Pros	Cons
<ul style="list-style-type: none"> • Ergonomic, good solution when it comes to carrying several goods that both are big and heavy. Distributes the weight. (N) • Can be used on public transport, and while biking and walking. (M) • Can be optimised and thereby use a small amount of material and few types of materials. (N) • Can be manufactured at a low-cost (M) • Reusable, attach a carrier bag to the strap solution so that it can be used as a backpack as well. (M) 	<ul style="list-style-type: none"> • Needs to be adjusted depending on the user due to people's different body types. (N) • Back and shoulder pain when carrying heavy packages for a longer period. (N)

Overall, the concept is adapted for the city centre store customers by being easy to travel with on public transport, while biking and walking which is one of the main features. The concept also has good conditions to be ergonomic by dividing the load evenly on the upper body. Regarding manufacturing cost, there is a possibility to optimise the use of material and number of different types of materials due to its simplicity. One drawback is that there is a need to make it adjustable to fit each user since people's different body sizes can affect the ergonomic aspect. This is something that needs to be further investigated. In general, solutions that include carrying of some sort can cause pain for the user if the object is heavy and carried for a longer period. Additionally, this can negatively affect the customer's view of the product and even the company. In this case, however, there is a limit for the

distance and weight that will be set based on the solution. As long as the customer is well informed about what is possible and not, this drawback can be overlooked.

6.3.3 Wheels

The third concept area is to use wheels for the solution. For this, there is various numbers of different solutions that were discussed during the idea generation process. The purpose of all the ideas is to pull it behind during use. These ideas are presented below in connection with figure 6.4.

1. A two-wheeled trolley made in some sort of fabric with a strap handle. This solution folds flat when not in use.
2. Four-wheeled solution with adjustable width depending on the load and a strap handle.
3. Two-wheeled sack trolley.
4. A two-wheeled cart that can be pulled by hand or attached to a bike.
5. A set of wheels and a handle that are directly stuck onto the packaging. Inspiration taken from the existing solution Move it cardboard cart (Archer, 2010).

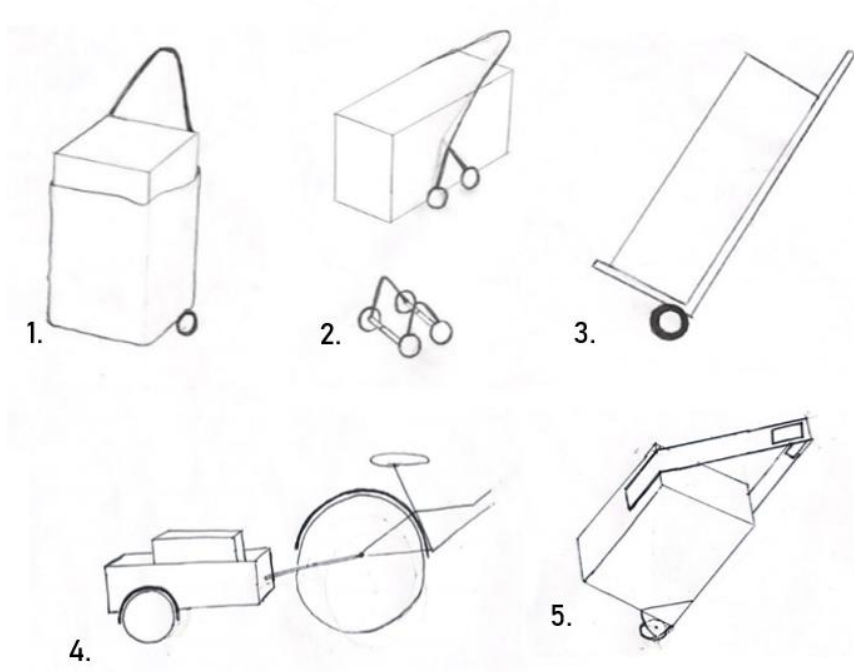


Figure 6.4 Sketches of different solutions including wheels.

Table 6.4 Pros and cons for the wheel solution. M=main features, N=necessary features, D=desirable features.

Pros	Cons
<ul style="list-style-type: none"> • Ergonomic, comfortable for the customer, no heavy lifting is necessary. (N) • There is room for innovative solutions. (D) • The obvious choice when it comes to transportation of heavier items. (M) • A good option when walking long distances. 	<ul style="list-style-type: none"> • Not adaptable, difficult to use when climbing stairs, using public transport or biking (except the bicycle cart). (M, N) • One occupied hand. (M) • Requires more material, in general (N) • More expensive, difficult to manufacture at a low cost. (M) • Direct contact with the ground requires durable wheels which can be expensive and make the product harder to recycle the right way due to different materials. (D, M)

Within the area several different concepts including wheels were considered. The deviating advantage of this category is that it, at first sight, it is considered an obvious choice when moving heavier items. This is due to that it is commonly used when for example travelling and using suitcases with wheels. A solution involving wheels needs to be more durable since it is in direct contact with the ground. Wheels also complicate the usage of the concepts in different setting and have a hard time adapting to the environment. The bicycle cart can preferable be used when biking and all concepts are difficult to use when walking in stairs and some are hard to bring on public transport. It is also not the best choice when it comes to the use of material and will likely be more expensive to manufacture than the other solutions.

6.4 Final choice of concept

Based on the evaluation in section 6.3 and in Appendix B, the carry on the back concept was chosen as the final concept area. This was because it fulfils most of the main features while having other qualities regarding the ergonomic aspect and the possibility to manufacture it with a low cost and few different types of material, which in its case can make the solution more sustainable and keeps the manufacturing cost down. Overall, the other concepts were deselected since they did not fulfil all the main feature requirements.

7 Discover B

In the second Discover phase, research within the chosen category of carrying goods on the back is investigated further. The areas of research are ergonomics, back carrying solutions and buckles.

7.1 Ergonomics

When identifying the needs and stating the product requirements in section 5.4, one necessary requirement is that the solution needs to be ergonomic. The ergonomic aspect for the concept, when carrying goods, limits the dimensions and weights of packages. In other words, depending on the design of the concept, the requirements of how much is possible to carry will differ since it needs to be comfortable for the user.

Students of all ages are a common group carrying backpacks during their academic life. Studies within this area have been conducted to investigate ergonomics, weight and health (Ramadan & Al-Tayyar, 2020). For an ergonomic backpack used daily, the weight of it should not be more than 10-15 % of the body weight and less than 11 kg. This can be applied when studying backpack solutions (University Health Services, u.d.). The weight possible for a person to carry will depend on how well trained the person is, the distance and the time of carrying the weight (Hemphälä, 2021). When filling the backpack with more than one compartment, the heaviest items should be put closest to the back to minimize the torque and distribute the weight. Another way to distribute the weight effectively is to include adjustable straps to keep the load closer to the body and to fit a larger diversity of people (University Health Services, u.d.) (Indiana University, 2021).

It is also recommended to carry a backpack below the shoulders and above the hips, and therefore use the smallest size possible for the functional needs. The dimension of the back varies a lot dependent on a person and general differences are among gender, population and if warm clothes are added. The shoulder straps should be placed in the way that the straps press on soft parts on the shoulders, close to the head, which also prevents the straps from sliding down. The lower end attachments of the shoulder straps should be placed as wide as the hips. (Hemphälä, 2021)

For more comfort, adding padding on the straps can avoid upper back and shoulder pain (University Health Services, u.d.) (Indiana University, 2021). To improve balance and reduce pressure on the shoulders, hip and chest belts can be attached (University Health Services, u.d.). Backpacks today can be seen as equipment during activities in nature and when mountaineering. Then, the ergonomic functions and requirements are in another category, taking heavier weights and longer time of use into consideration for example. The comfort aspect is also more important to reduce any risk of pain and overwork of the entire body (Zadry, et al., 2017).

7.2 Back carrying solutions

For inspiration when developing the concept further, already existing products with the same function were discovered. New and innovative solutions were explored to broaden the horizons and gain new perspectives. Carrying objects on the back is not new, but this section examines how it can be applied when customers must carry packages in different sizes from store to home. Solutions for carrying babies, skateboards and bicycles on the back were investigated to get a broader picture of what the solution could include.

Two already existing solutions of interest are the backpacks from I am run box and Qwstion. I am run box is a company developing backpacks made for running (Iamrunbox, 2021). They have developed the Space bag which is a bag that can be added to backpacks by using molle straps, see figure 7.1. This solution is interesting since one idea is to integrate the already existing Frakta Carrier bag together with the new solution and thus be able to carry both large and small items on the back and completely hands-free.

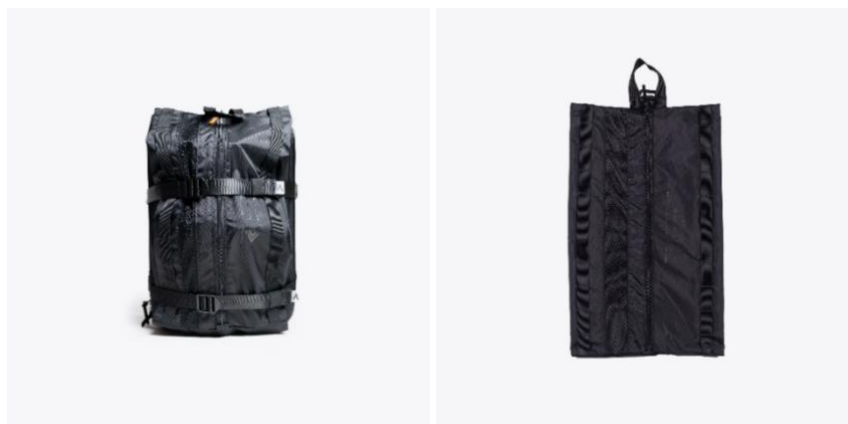


Figure 7.1 on the left, I am run box Space bag attached to the backpack. On the right, the Space bag on its own (Iamrunbox, 2021).

Qwstion is a Swiss backpack brand working with combining design, functionality and environmental sustainability. Figure 7.2 shows how to transform the tote bag into a backpack where the shoulder straps are transformed into an over- one-shoulder bag. (Qwstion, 2021).



Figure 7.2 On the left is how it is carried as a backpack, on the right is how it is carried as a tote bag. (Qwstion, 2021).

7.3 Buckles

When carrying on the back, different concepts has various solutions to attach and fasten the carried load. Different buckles were investigated and the ones of interest are shown in figure 7.3. The five presented buckles were considered in the concept development. The buckles can be made in different sizes and materials, where the most common material groups are plastic or metal.

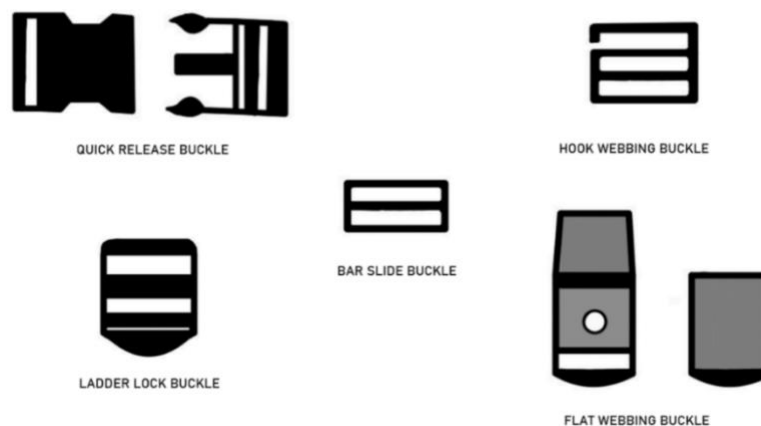


Figure 7.3 The considered buckle types.

8 Define B

In the final define phase, the information gathered from the first and second discover phase (Discover A and B) is used to set the final product requirements. The requirements are used in the second development phase (Develop B) to create the final solution.

8.1 Product requirements

The product requirements are presented in table 8.1. The requirements typed in bold are new and added from *Discover B*, section 7. Based on the ergonomic aspect the total required dimensions and weight of the carried items are set. The most critical aspect regarding the packages is the length and the weight. In section 4.2.3 it is mentioned that 78% of the packages within the portable range have a length equal to or below 0.8 meters and 49% of the packages have a weight below 6 kg. In section 7.1, the ergonomic aspect is investigated where it is mentioned that what the user is able to carry depends on several factors. Examples of such factors are distance and physical health. This together with the information about packaging weights from the portable range, 15 kg is decided to be the maximum load that should be carried using the solution. The definition of length, width and height in relation to the user's back is presented in figure 8.1. These have been determined according to the definition of the packaging dimensions and how they are carried on the back.

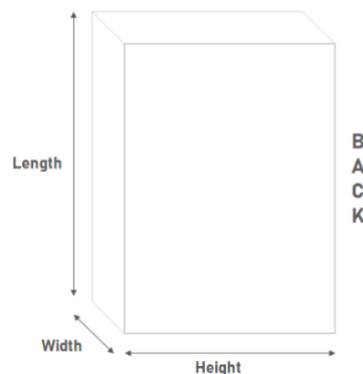


Figure 8.1 Definition of length, width and height in relation to the user's back.

Table 8.1 Summary of all identified product requirements. The requirements in bold are related to the second discover phase where the ergonomic aspect is mentioned. M=main feature, N=necessary feature and D=desirable feature.

	<i>The product ...</i>	
<i>Ease of use</i>	Is manageable to use for one person	N
	Is flexible	N
	Is intuitive	N
	Is easy to travel with on public transport, walking and biking	M
	Is adapted for stairs (easy to carry)	N
	Is adding value to the customer experience	D
	Is ergonomic	N
<i>Function</i>	Protects the goods	N
	Independent	M
	Is weather resistant	M
	Is adaptable for different packaging sizes	M
	Can carry the total height of 45cm	M
	Can carry the total length of 100cm	M
	Can carry the total width of 60 cm	M
	Can carry 15 kg	N
	Takes up small space when storing	M
	Is lightweight	D
	Is durable	D
	Protects the goods from theft	D
	<i>Aesthetics</i>	Is aesthetically pleasing
Is aesthetically related to IKEA's design		D
Is innovative		D
<i>Environmental sustainability</i>	Is reusable or recyclable	M
	Has few different types of materials	N
	Has small volume of material	N
<i>Economical</i>	Price: EUR 0.5 (+/- 2/0.5)	N
	Has low production cost	M
	Is scalable	N

9 Develop B

In the Develop phase of the project, the starting point is the more specified product requirements from the previous section, Define B. This section includes brainstorming, concept development and description and evaluation of two chosen concepts and the final selection of concept.

9.1 Brainstorming

Some of the ideas from the idea generation, presented in section 6.2, was used for further brainstorming. The initial stage was to imagine different functions and adapt them into concepts. Several ideas are illustrated as sketches in figure 9.1 below.

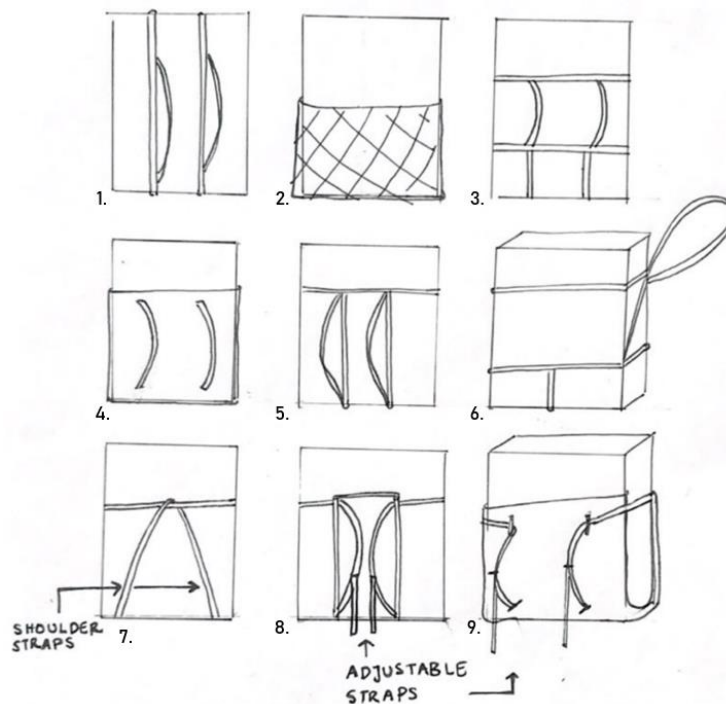


Figure 9.1 Sketches of back carrying solutions.

9.2 Concept development and evaluation

Based on the brainstorming process, it was primarily decided to continue with a strap solution. This was because of the requirements, specifically regarding the sizes, adaptability for different packaging sizes and still be able to fulfil remaining requirements, for example using a small volume of material.

A selection of feasible concepts was chosen to continue with. To receive a practical experience of how different strap solutions would function, simple tests were conducted. The test consisted of tying twine around a box, representing several packages together. Four strap concepts were developed and tested. Sketches of the concepts are presented in figure 9.2-9.6. In Appendix C pictures from the test of *Concept 1-4* can be found.

Concept 1, see figure 9.2, was both stable and comfortable and required three attachment points, one around the package and two for the vertical straps. At these attachment points, it is also required that the length of the straps can be adjusted to fit different packaging sizes.

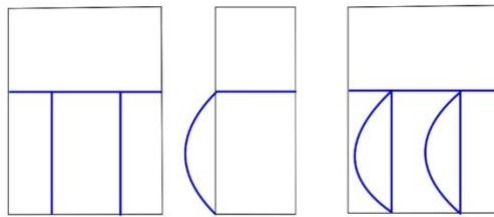


Figure 9.2 Concept 1 showed from the front, side and back.

Concept 2, see figure 9.3, was tested to see if there was a possibility to combine the shoulder straps and the vertical straps. The idea was for the user to be able to adjust the shoulder straps together with the vertical straps to make it more ergonomic compared to non-adjustable shoulder straps as in *Concept 1*. However, this made the concept less stable and harder to put on the back as the straps were more willing to move sideways. *Concept 2* was excluded, and it was decided that the shoulder straps must be separate from the other straps for the best user experience.

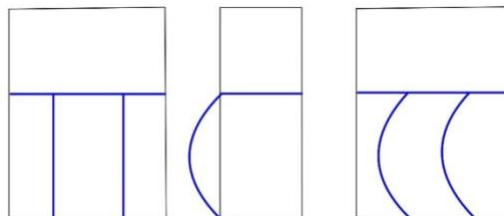


Figure 9.3 Concept 2 showed from the front, side and back.

Concept 3, see figure 9.4, was an original concept from the first brainstorming process. When testing this concept with the twine, it became clear that it did not reach the desired quality regarding functionality. The placement of the shoulder straps depended on the width of the package. With a wider package, the shoulder straps are pulled further out on the shoulder while a smaller width package created an imbalance where the package was not clamped hard enough to be considered stable enough for this solution. *Concept 3* was therefore also excluded.

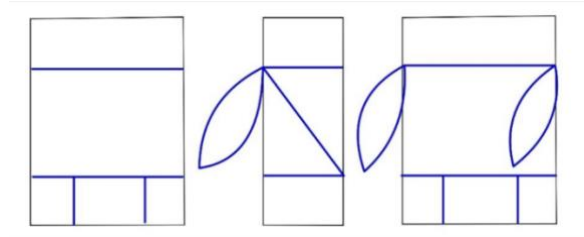


Figure 9.4 Concept 3 showed from the front, side and back.

Concept 4, see figure 9.5, is similar to concept 1 in the means that two straps going under the package and a separate strap going over the shoulders. What sets this solution apart is that there are two horizontal straps where the idea is to stabilize longer packages. However, the result after testing with the twine showed that this solution did not add enough stability versus the use of material and simplicity. In this concept four attachment points are needed, one for each horizontal and vertical strap. The decision was not to proceed with this concept due to the factors mentioned.

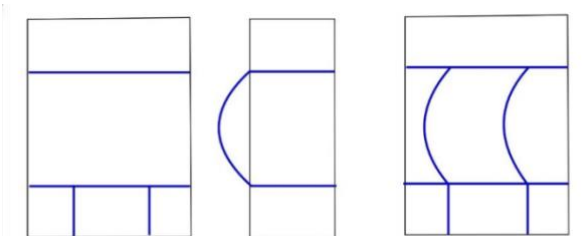


Figure 9.5 Concept 4 showed from the front, side and back.

Based on what it mentioned previously, *Concept 1* gave the best fit and it was decided to move forward with this concept. It had the best performance combined with the simplicity of the solution. After the tests were performed, it was questioned whether a strap solution was sufficiently intuitive and multifaceted. It was therefore decided to include a strap solution combined with a piece of fabric that enfolds the packages as well. This, to create a broader basis and investigate and compare different solutions and thereby provide the best-fitted one for the problem to be solved.

From the second brainstorming, figure 9.1, sketch number 9 was developed to *Concept 5*, see figure 9.6. The problem with this solution is to make it adaptable

enough for the different sizes of packages. With larger and more packages, the outer fabric needs to cover and stabilize while not being too large for fewer and smaller packages. The width of the packages also differs, and it is therefore decided that this solution must be open on the sides to be adapted to more sizes.

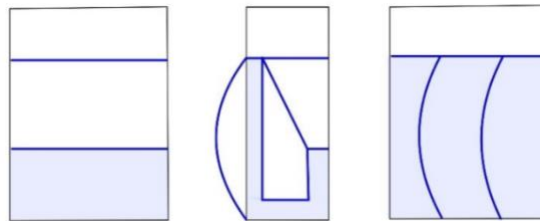


Figure 9.6 Concept 5 showed from the front, side and back.

The strap attachment for *Concept 5* is showed in figure 9.7 At each side, straps are attached in the front part of the fabric. The straps are put through a loop at the back of the fabric, on each side, and then connected at the front. The result of the connected straps is showed on the right side of the figure. The problem solved by this feature to maintain both the back and front side stabilised. Other solutions of this problem were investigated without success, showed in figure 9.8 and 9.9.

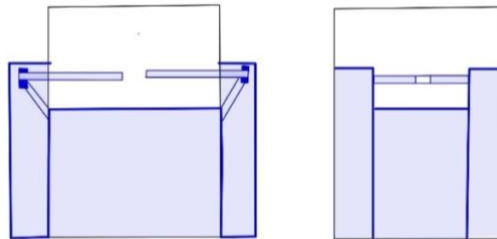


Figure 9.7 Concept 5 showing the straps more detail. On the left it is open and on the right the fabric is folded over the items and straps are fastened and tightened.

The feature in figure 9.8 is to have an additional vertical strap that are to be attached at the front of the fabric. This solution limits the size of packages upwards and was therefore disregarded.

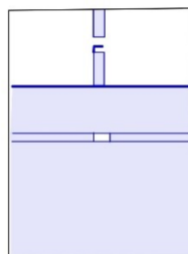


Figure 9.8 Feature to hold up the front side.

The feature in figure 9.9 below, straps were attached at the back of the fabric and are pulled through loops at each side, and then connected. This solution was not proved to be successful in solving the problem since the backside of the fabric is pulled down to the same level as the front side of the fabric. This feature was therefore disregarded.

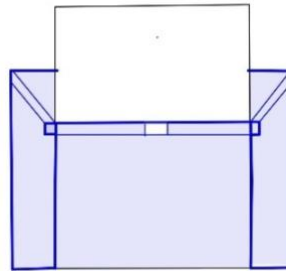


Figure 9.9 Feature to hold up the front side. The figure shows the solution when the sides are unfolded to be able to demonstrate the fastening solution.

In the development process, it is mentioned that the IKEA straps, used on the IKEA Carrier bag could be used for the concepts as well. By using the same straps, the solution will become more recognizable and desirable for the customer and market the IKEA brand. It is also favourable in terms of implementation cost since the same suppliers may be used.

Based on the evaluation and tests, it is decided that *Concept 1* and *Concept 5* are developed further in the next step.

9.3 Development and evaluation of selected concepts

After trying out different concepts, two main concepts were decided to move forward with namely *Concept 1* and *5*. In this section, the two main concepts are presented, described and evaluated according to the product requirements from section 8.1. To be able to understand the functions of the concepts further, simple prototypes were made using straps, IKEA bags and duct tape. The solution needs to be able to carry several packages of different sizes therefore two packages were used during the prototyping. The packaging dimensions are tested only. Tests on how much the solution can carry are referred to further development when transitioning from concept to product.

9.3.1 Concept 1

The first prototype that was created using straps can be seen in the pictures in figure 9.10-9.12 below. The concept consists of three connected longer straps, where two of them goes under the packages (vertical) and one around the packages. Shoulder straps are attached to the two vertical straps, which creates the backpack function. For this prototype, the shoulder straps will be considered non-adjustable to keep the concept as simple as possible with improvement potential. As mentioned in the first description of this concept, three attachment points are required. The first attachment will be around the load and will also decide the placement of the shoulder straps on the package closest to the body. This fastening needs to be adjustable for different sizes of packages. There are two attachments points in the front where the vertical straps meet the horizontal. In figure 9.10 they are symbolised with tape and the function of the attachment is both to assemble the parts but also to configure the length of the straps depending on the sizes of the packages. They should be adjusted to the same length to achieve a balanced load.

During the testing of carrying the packages, it was also included to investigate if the solution can carry a shopping bag. In figure 9.11 it is shown how a Frakta bag can be included in the carrying solution. It can be placed on the outside of the packages and carried by the straps. This was an aspect to consider due to that a lot of accessories are part of the cash and carry range as well, even though the larger and heavier articles within the portable range are the focus for this thesis. Another aspect that is important is how the concept should be used by the customer. Figure 9.12 shows how the concept looks like when opened. The packages are placed on top and straps are fastened and adjusted to fit the packages. The small quantity of different straps makes the concept more intuitive compared to other strap solutions in the development process.

Concept 1 was evaluated by weighting the different product requirement against each other, see Appendix C. It included the weighted importance and satisfactory score from 1-5, where 1 is not successful and 5 is the best possible. The resulting score of the solution is 4,13 of a maximum 5.



Figure 9.10 *Concept 1.*



Figure 9.11 *Concept 1* with an attached shopping bag.

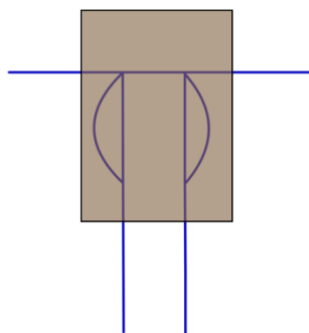


Figure 9.12 Demonstrates when the straps are un buckled and a packaging is placed on top.

9.3.2 Concept 5

This concept, including a piece of fabric fasted by straps, was generated from the brainstorming session but was at first glance eliminated. An improved version of the first idea was then created for further testing and evaluation. The concept can be seen in pictures in figure 9.13 and 9.14 and was inspired by the Frakta Carrier bag. The idea of this concept was to have a piece of fabric with attached shoulder straps and then the piece of fabric continues as a bottom and capsule the load in the front. The shoulder straps will just like in *Concept 1* be considered non-adjustable. The amount of fabric at the front will depend on the sizes of all packages carried together. The front is kept up by a strap at each side going through loops on each side of the back fabric and then back to the front again and attached to each other. In the picture in the lower left in figure 9.13, a tape symbolizes the attachment point. The straps for capsuling the goods are adjustable. This concept enables second use and can carry smaller goods as well.

Concept 5 was evaluated by weighting the different product requirements against each other, see Appendix D. It included the weighted importance and satisfactory score from 1-5, where 1 is not successful and 5 is the best possible. The resulting score of this solution is 4,27 in a total of 5.



Figure 9.13 *Concept 5*.



Figure 9.14 *Concept 5* carried on the back.

9.4 Selection

The selection between the two concepts was done considering the evaluation regarding how easy it is to use, its function, aesthetics, environmental sustainability and the economic aspect. The score of each concept was presented as 4,13 for *Concept 1* and 4,27 for *Concept 5*. This result clarifies that *Concept 5* have a few significant benefits that raise its total score. *Concept 5*'s main benefit is that it is a multifunction solution that is more likely to fit into several purposes and be reused by the customers. Using *Concept 5*, which have similarities to the design of the Frakta Carrier bag, will create a better connection to the IKEA brand and market the brand. When moving forward with this concept the design will be further developed regarding functionality and reusability. Furthermore, it will be investigated how to improve the solution to withstand theft of the purchased items when travelling home.

9.4.1 Buckle selection

When deciding which buckle to use, it is stated that the selected buckle must be user-friendly and durable. The buckle needs to be easily attached and detached and able to adjust the length of the strap. This narrows down the selection into two options, namely the quick release buckle and the hook webbing buckle see section 7.3. The hook webbing buckle contains less amount of material compared to the quick release buckle while the quick release buckle is not as easily detached. Quick release buckles also more common and is therefore expected to be more intuitive for the user. The solution only requires one buckle which is crucial for the solution to work. It is therefore important that it works as it should and that there is no room for error. Due to this, it is decided to move forward with the quick release buckle.

10 Deliver

In the Deliver section, the final concept is determined, the final prototype is presented as well as the development process leading up to the solution. The chapter starts by introducing the process of the definitive stage. In addition, function and characteristics, the economic aspect and further development of the final concept is presented.

10.1 The process

The development of the final prototype was done as an iterative process involving improvements along the way. The sketches and simple prototype of concept 5 were used as the starting point of this process. Detailed sketches with the proportions were made and they showed the placement of straps, and the functions. The prototype was produced by a tarpaulin canvas, several straps, Velcro, sewing thread and two buckles. To be time-efficient and stay open for new ideas, the positions of straps was first tested by being temporarily attached with needles or tape and then sewn on using a sewing machine, when the optimal performance was established. The aim, as mentioned after the selection of concept, was to improve the chosen solution. Different versions of the prototype were made before ending up with the final. All functions and characteristics of the final concept will be described in detail below.

10.2 Function and Characteristics

The final prototype was developed and equipped with additional functions and characteristics during this last step. The main discussion point in terms of improvements was whether to have closed sides on the backpack or to keep the original design with open sides. It was chosen to keep the flexibility given by straps instead of implementing sides and being forced to have a defined bottom size. The downside with having a predefined bottom is the less-adaptive size function as well as difficulties such as excess material when using the concept for smaller items. It was ascertained that the bottom and the sides are dependent on each other in these types of solutions.

The style of the final concept was inspired by the IKEA Frakta series, mentioned when introducing the carrying solutions available at IKEA today. This was partly because it will be beneficial to introduce a concept solution that has similarities to an already well-known product, the Frakta Carrier bag. This makes it easier for the customer to understand the usage area of the product and for it to be connected to IKEA, which is good for branding at the after-purchase stage. Therefore, similar material was used when producing the prototype as the material of the Frakta collection, polypropylene as base material and thread in polyester. Actual straps, with the IKEA logo, from a Frakta Carrier bag was used to create the prototype to fit the series. The choice of material was not extensively investigated and was considered as a suggestion for the concept.

As mentioned throughout the report, the concept needs to meet the product requirements in terms of several aspects. Some of those were the sustainability and economic aspects, which were integrated with the concept design. Sustainability from a design perspective can include minimizing different types of material as well as using an as small volume of material as possible and still fulfil its purpose. The strive was a minimalistic and frugal design to live up to the requirements. This aspect goes hand in hand with the economic aspect, as the production cost and scalability will benefit from this goal as well. It is more economically beneficial to use few different materials and to have a simple design will be easier to produce efficiently. Another part of the sustainability aspect is the recyclability but firstly and preferably the reusability. The functions regarding second use were improved for the final concept. The concept was improved to not only be able to carry square packages by adding a strap to stabilize smaller items, an inside pocket for accessories and a Velcro at the tops to be able to close it. The development from the original concept will be presented in the paragraphs and figures below.

In figure 10.1 below, the figure shows the concept opened, and the positions of the buckle straps. An improvement done from the previous concept is one additional strap to fasten the load. Furthermore, the buckle straps are extended from the left side to right and only contains one strap, to be able to adjust the position of the buckles more easily. This applies to both straps. The upper strap, in the figure, is placed in a hem to keep it in place. The lower strap is placed on the outside and held up by loops fasted on the outside.

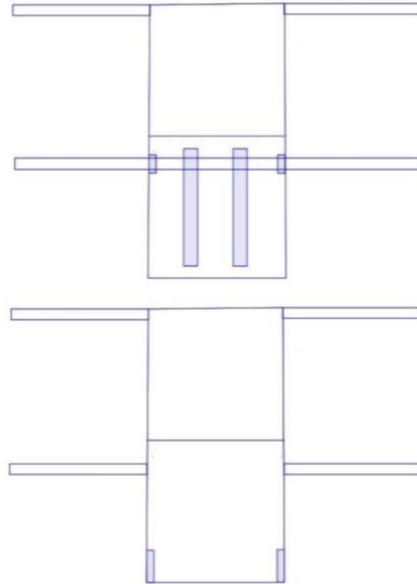


Figure 10.1 The precipitated design concept. The picture above shows the outside and the tightening straps and the lower picture shows the inside.

Figure 10.2 displays the function inside. The added inside pocket is represented in the figure as a blue square. It is placed on the inside at the opposite side from the back side and is made for smaller items. The light blue squares at the bottom and the top represents the Velcro that enables the closing function when being used for smaller items. The closing prevents items from falling out as well as them being taken out by thieves during use. When closing, the canvas can be folded half-half and connecting the top and the bottom. After that, the buckle straps can be tightened. The concept may be used as a backpack when being folded and closed. The pocket and the closing function have improved the original concept by being easy to use in several settings and enable it to be reused more often.

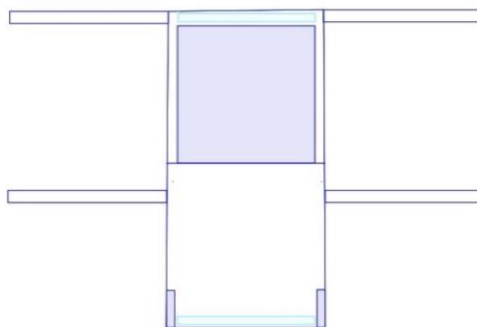


Figure 10.2 Shows the inner-pocket and the Velcro closing function.

Figure 10.3 presents the improved placement of the shoulder straps, which are placed in angle instead of vertical. The distances between the upper attachments compared to the lower attachment is narrower. This improves the usability when putting the carrying solution on the back. The change was inspired by strap attachments at backpacks on the market today. It can be seen in the previously mentioned backpack Qwston for example, see section 7.2. It also has an ergonomic improvement aspect, as it is more comfortable to carry a solution with the new positioning of the shoulder straps.

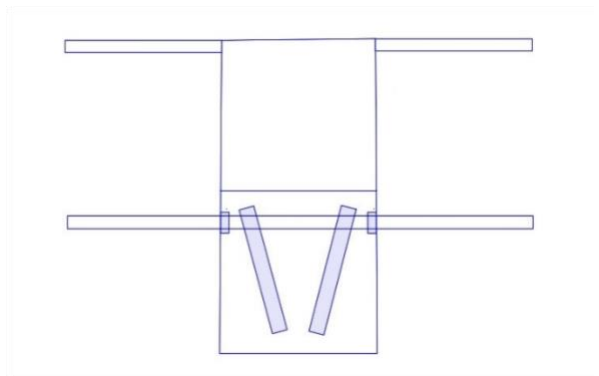


Figure 10.3 The shoulder straps are placed in angle instead of vertical as previously.

Below in figure 10.4, is the overall view of the finalised concept. It shows the inside and outside of the concept. The dimension used in the actual prototype is stated in the figure to get an understanding of the concept in general. These dimensions were decided based on the product requirements and finalised after testing with different packages. The accuracy of the dimension was not prioritised when producing the prototype rather the fulfilment of the desired features. More detailed dimensions are explored but not presented since it is outside the scope.

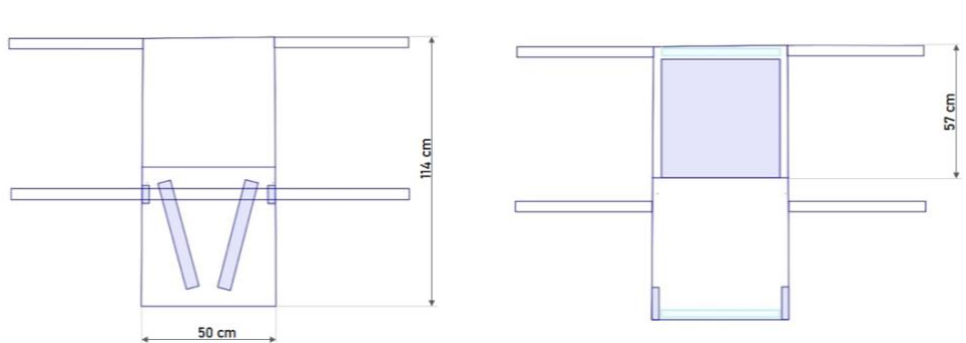


Figure 10.4 The main dimensions of the concept. On the left, the outside is shown with the outer dimensions. On the right, the inside is shown together with the length of how far down the pocket goes.

10.3 The final prototype – Packsäck

To show the final concepts ability to carry several packages with different dimension, three products were selected from the portable range, a shoe-rack, a towel rack chair and a laptop stand. Pictures of these products are presented in figure 10.5. The packaging dimensions for each product are presented in table 10.1. The total weigh of these packages is 15 kg (4+6+5).



Figure 10.5 The selected products from the portable range (IKEA (r), 2021) (IKEA (s), 2021) (IKEA (t), 2021).

Table 10.1 The selected products' packages dimensions (IKEA (r), 2021) (IKEA (s), 2021) (IKEA (t), 2021).

Article name	Type of product	Length [cm]	Width [cm]	Height [cm]
Tjusig	Shoe rack	80	24	4
Rågrund	Towel rack chair	98	45	4
Vittsjö	Laptop stand	58	37	9

The final prototype is named Packsäck and is shown in a picture collage in figure 10.6. The inside pocket can be seen in figure 10.7.



Figure 10.6 The final prototype of the concept.



Figure 10.7 The inside pocket at Packsäck.

10.3.1 User description

The following collage of pictures in figure 10.8-10.10, illustrates how the concept is used. From the concept lying flat until ready to carry.

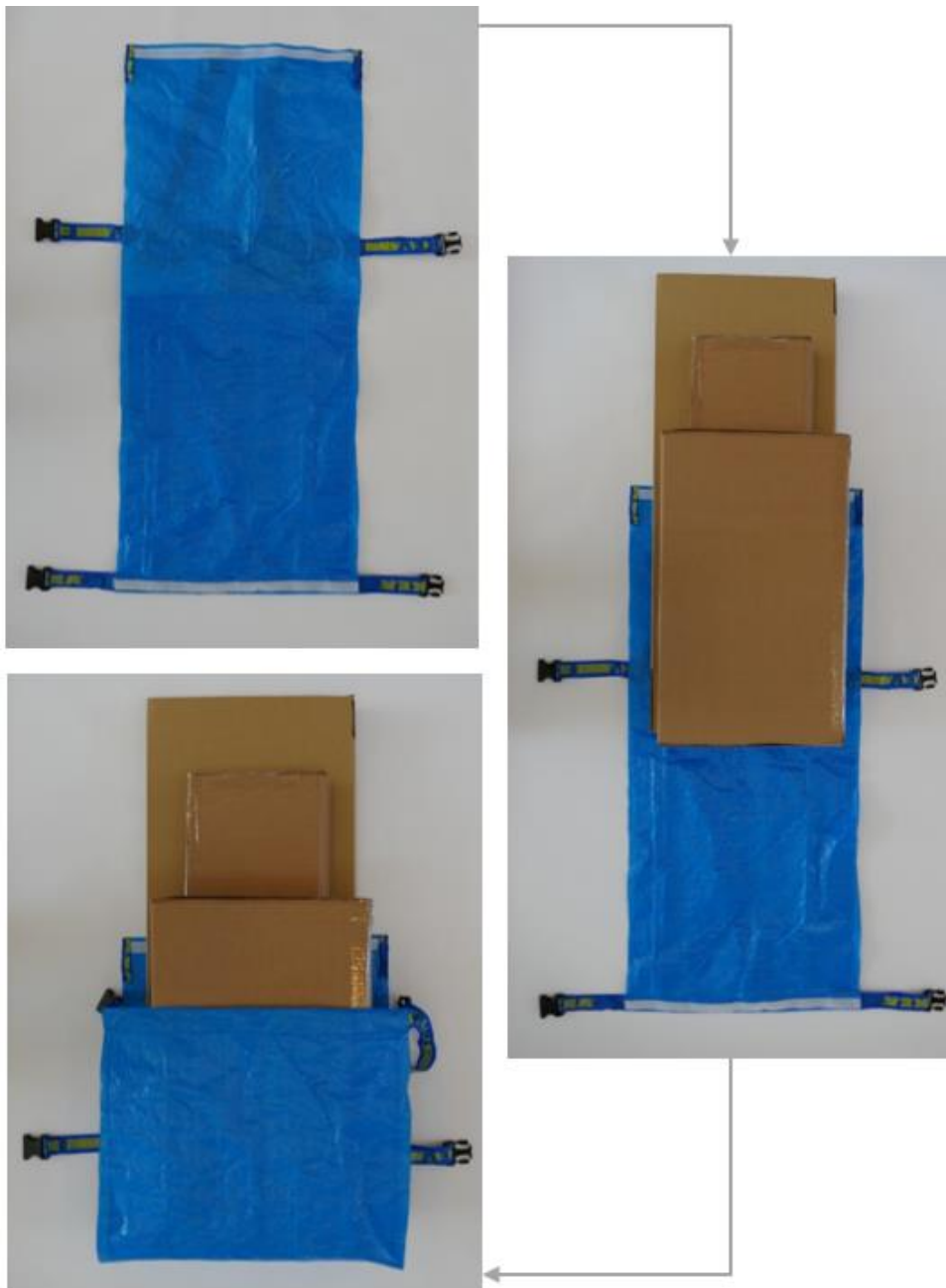


Figure 10.8 Loading packages on the concept and then folding the canvas over the packages.

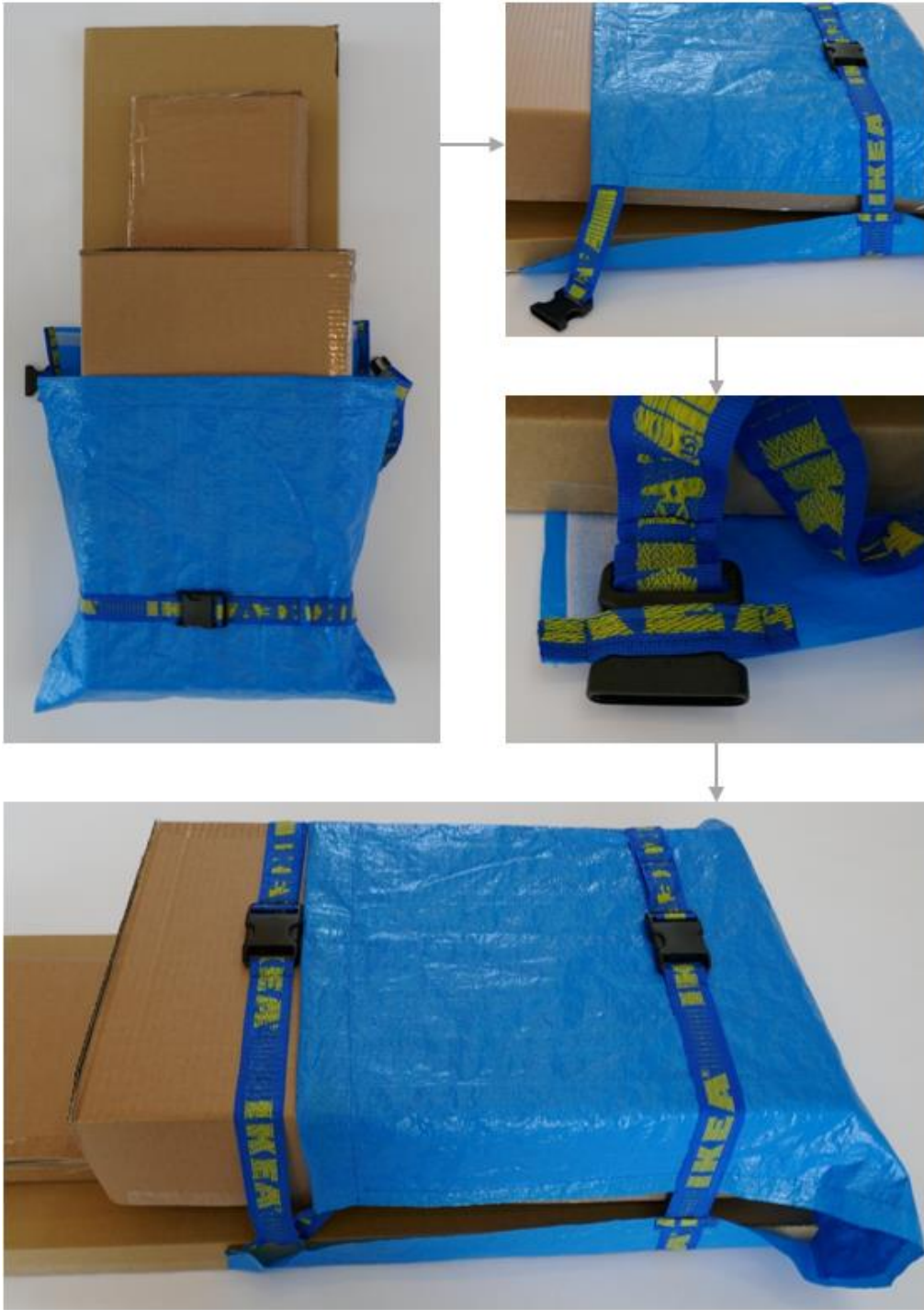


Figure 10.9 Tightening the straps on the concept.



Figure 10.10 The loaded concept with packages, ready to carry.

10.3.2 Prototype in use

In figure 10.11 and 10.12, the final prototype is presented in different environments. It can for example be used when walking as well as biking.



Figure 10.11 The prototype with packages, walking in a city environment.



Figure 10.12 Biking with the prototype, including packages.

10.3.3 Second use

In figure 10.13 below, a collage of pictures illustrates how the concept can be reused. During second use of the concept, it may be used as a backpack. The use is like the first use in terms of the tightening function. When loading smaller items to carry the inside pocket is used, which impedes things from falling out as well as thieves from taking things out during use.



Figure 10.13 The concept used as a backpack during second use.

10.4 Economic aspect

One of the main challenges and requirements was to make the concept low-cost. The definition of low-cost in this project is a product with a selling price of around or less than 5 EUR, and by that be a comparable option to the Frakta Carrier bag for when customers buy larger and heavier goods. Since a great emphasis is placed on making a low-cost concept, the idea is to make this concept a part of the Frakta series. This is managed by using the same aesthetics and materials as the other Frakta products. When creating the product, high importance was placed on reusing the materials and suppliers that IKEA already have and thereby receive a more efficient manufacturing process. Maintaining the same suppliers will minimize the cost for implementation of the new product, give higher profitability and create a strong network between partners in the supply chain. An important supplier aspect is that they fulfil the preferable sustainability requirements, which is an essential negotiation perspective. The product should be innovative, fun and desired, but the design needs to be simple in such a way that it is cost-effective and easy to manufacture. The simplicity of the product makes it easy to operate. By using off-the-shelf components consisting of IKEA straps and bag material made of polypropylene, and plastic buckles cost is minimized.

The prices of the Frakta series differs a bit depending on the market and is used to estimate the selling price of Packsäck. An assumption is that the same amount of canvas material is used in the concept as the bigger Frakta Carrier bag. The price on the Swedish market for this bag is 0.69 EUR. Packsäck has more straps and characteristics than the carrier bag and have similar functionalities as the Frakta Trunk (2.85 EUR) and Plugghäst (3.84 EUR). See section 2.3.3 for description of current IKEA solutions. Frakta Trunk and Plugghäst are considered low-cost products, and Packsäck is considerably stripped in comparison. The price for the Packsäck should therefore be less but more than the carrier bag and is estimated to 2-2.5 EUR.

10.5 Further development of the concept

To develop this concept further durability tests are required to see how much the product can manage. The Frakta Carrier bag manages 25 kg, and the aim is that this solution can manage the same. On the other hand, to bring in the economic aspect of what is suitable to carry with this concept the reasonable aim is set a maximum of 15 kg. Choice of material needs to be further investigated as well by comparing different materials against each other from a cost, quality and sustainability point of view. It would be of interest to see whether there is a possibility to improve the whole Frakta series regarding the choice of material. If IKEA strives to change the

materials in that series to a more sustainable, innovative or cost-effective material it is easily applied to this product as well as it is based on the same principle.

The concept does not include precise dimensions but rather creates an overall picture. When developing the concept further, it is required to go into detail regarding the dimensions and placement of constituent components to further optimise the solution. The length of the back area as well as the dimension of the shoulder straps have a big impact on how the concept fit the user since back sizes differs a lot, not the least globally. It is debatable whether the product should have adjustable shoulder straps or not. The advantage of having it is that the solution becomes more adaptable for the customer and for different user dimensions. The straps can be made adjustable by for example by adding a bar side buckle, using a Velcro or a loose strap that the customer can adapt when attaching it. One disadvantage of adjustable straps is that it requires more components or extra material, which increases both cost, weight and environmental impact. To investigate this further a more in-depth cost and sustainability (LCA) analysis is required where they are weighed against the customer experience. Direct customer insights should be collected through tests and market research for this issue but also to involve the user in the development phase to develop the overall function of the solution further.

The product should also be integrated into the shopping experience seamlessly. The carrying options in the stores differ from each other which makes it harder to implement. For some stores, carts are used during the customer experience and, in the future, it is therefore of interest to adapt or integrate the product to these and thereby make the shopping experience easier. A big packing station is also of interest to make it easy for the customer to pack their bought goods easily.

11 Discussion

In this chapter the project is discussed and evaluated from different aspects relevant to the project.

11.1 Research evaluation

This master thesis project started with a research phase, also called the *Discover* phase. The conducted research was within trends within last mile delivery, self-service, current solutions at Ikea and customer insights from different parts of the world. Looking into the future within the area of last mile as well as overall trends were considered an important part to understand the subject and create a relevant approach for this project. The macro trends investigation showed that urban areas are becoming more common, especially in the developing countries, and with that comes huge challenges. It also changes the behaviour of people when it for example comes to transportation. Fewer people living in urban areas own a car since it is not always the most convenient way of travelling. This put a lot of pressure on public transport but have less negative impact on the environment. Sustainability is on the agenda worldwide and IKEA like many other companies wants to contribute to making the world more sustainable.

To fulfil the customer needs in urban areas, IKEA has opened stores in city centre locations. The customer focus has increased, and the companies need to adapt and be customer-centric. This applies to the business model as well as the entire supply chain processes. The omni-channel business model is a trending way to become more customer-centric and connecting touchpoints. The development of e-commerce and digitalisation, in general, is a challenge many companies are facing today. In many cases, efficient delivery is essential where last mile delivery is the crucial last step. For this project, the combination of a last mile perspective together with a self-service perspective was the area of interest, which is the right focus for IKEA to take but the opposite to what many other companies are doing today.

When investigating the city centre locations, the need for a convenient solution for customers was discovered. The focus as mentioned before were on a solution adapted for furniture from the portable range since it should be a concept that the customer uses themselves after purchase. At the targeted locations Paris, New York and Japan the customer profiles were identified. It became clear that there were

many similarities between the customer needs in the different cities. The preferred check-out option is cash and carry and the average items purchased at city centre stores are significantly less than other larger IKEA stores. The customers generally live in small spaces, and public transport is popular. In Japan, IKEA is a trendy brand. This aspect was chosen to take advantage of to increase the willingness of self-service in the Asian market. The received insights were framed into requirements for a last mile self-service concept. The inducement of a carrying concept at city centre located stores provides the customers with a solution complementing other delivery offers at IKEA and is expanding the options for customers. The concept aims to be available for “the many people”, be sustainable and have a positive effect on the Ikea brand.

11.2 Process evaluation

During the design process, an outside-in perspective was used, meaning that inspiration was mainly taken outside of IKEA after setting the requirements. This perspective was beneficial where the purpose was to get a general view of trends and provide IKEA with a new point of view. On the other hand, insights regarding the development of articles like Plugghäst, in the IKEA range, or other products could have contributed to a concept more fitted in the Frakta range and a product closer to implementation. This working method caused a distance from the IKEA development process and their future work within development. The scope of this master thesis was very broad in the sense that the solution was not predefined in any direction. This made the process itself very iterative and the direction was based on insights along the way.

A critical aspect of the process is that the broad starting point had a consequence on the level of detail of the final concept and the presented solution. The concept requires further work and testing before approaching an implementation. This is due to the short timeframe of 20 weeks. Another aspect of concern is the way the market insights were gathered. The interviewees may have given a personal perspective rather than a completely objective insight based on the entire market area. Also, mentioned when presenting the interviewees from the markets, it is stated that they are from different levels and have different roles within IKEA, and therefore might not be entirely comparable. The next step would be to look at market needs for further customer data within the chosen areas. Since city centre stores are a relatively new concept for IKEA at most of their market's, other competitors than the obvious claimed by IKEA might be interesting to research further and compare with.

11.3 The concept

Overall, the final concept meets the requirements and goals that were decided in the second *Define* phase. The simplicity of the solution contributes to a low production cost where material choice and the number of different materials play a significant role both from a production and an environmental point of view. It means that the solution is scalable and the same suppliers as for the other products in the Frakta range can be used. This creates a low-price solution for customers and by that, more comparable to the already existing Frakta Carrier bag.

The solution is adapted to all different transportation methods one can use to get home from the store, whether it is walking, biking or using public transport. This was one of the main reasons why this concept was chosen over the others. The flexibility that this solution entails where the user has both hands free and is carrying everything on the back contributes to a better customer experience. There is an above limit for how much and how heavy the user can carry, mostly depending on the ergonomic aspects. This could have been avoided if a solution with wheels had been chosen instead but then the flexibility and simplicity is lost, and the cost goes up.

The concept itself is intuitive but can be developed further becoming even more intuitive. Since this is a new concept that has not been applied to any of IKEA's explored competitors for the selected cities, an implementation is required to make the customers familiar with the product. If there are any ambiguities and it is used incorrectly, it can contribute to a negative customer experience. Examples of this are if the goods are not fastened tight enough or if the customer decides to pack more than what is recommended. It is therefore important to add a description of use to make it easier for the customer to understand since it is a new product on the market.

The biggest question during the project is whether it is a solution that will be used by the customers. We live in a time of high pace with focus on development of last mile delivery. The concept is not in line with digitalisation and the service-oriented society and there is a risk that new trends within the last mile in these areas are of greater interest. However, this can be contradicted by advocating the centralisation of the customer. Customers want to feel like they are in control and that they have options and with more options, mass-personalisation can be created. By implementing this solution, a new alternative for last mile delivery is created. People will always prefer different from each other and for IKEA, which is a global company interested in "The many people" and self-service solutions, this solution adds value without excessive risk-taking.

This project is the shell for a finalized product where the current and future trends within the last mile were analysed and used to generate the first draft of a solution.

There are parts of improvements that are mentioned in section 10.5 as well as further research and tests that can be valuable for the final product.

12 Conclusion

This thesis presents research and insights where trends within last mile, customer needs and markets were discovered and defined to develop and deliver a concept adapted for today's and tomorrow's society. The concept is a basis for further development, implementation and tests. The testing should mainly include users as well as functionality- and quality tests. This creates greater value and is in line with a sustainable mindset.

At the beginning of the project, three strategic questions were asked. These questions were used as guidance when developing the solution. To conclude the project, the questions are answered.

1. What are the trends within last mile delivery today and in the near future?

There is a movement towards an increasing customer-centric society where customers' demands on last mile delivery are high. Customers want to be in control and make their own decisions regarding delivery options. Increased demand for instant gratification is also of interest where on-time and same-day delivery is expected. Mass personalisation is a growing trend that refers to offering services to meet individual demands. This can be achieved by new technology where for example, the development of AI and machine learning can fulfil customers' demands regarding personalisation and services. Other growing technologies are unmanned aerial vehicles, drones for delivery and self-driving vehicles. With urbanisation, new behaviours are created where car ownership is decreasing. Some cities have even introduced car-free zones to reduce private car use in city centres. This together with the growing trend regarding sustainability introduces clean air zones and ultra-low emission zones to counteract the emissions as well.

2. Which solutions are available today regarding self-service for last mile transportation?

Today, there are not many options for self-service regarding last mile. One can buy products such as bags, bring a trolley or buy one on-site. It is also possible at some retail stores to rent various means of transport such as a cargo bike or a truck. There is room for a new product that meets customer requirements and complements the existing solutions today.

3. What are the market needs at city centre store locations and what solution is suggested?

There is a need for a solution that enables customers who travel by public transport, bike or walk to take home products within the Cash & carry range. The solution needs to be sustainable, of low price and adaptable. Packsäck is a solution that enables customers without vehicles to take home larger and heavier goods themselves from the stores in city centre environments. Its' design makes it possible to walk, bike and use public transport as the goods are carried on the back leaving the hands free to use. Because of its minimalistic design combined with the choice of material, costs can be kept down and thus be a low-price alternative comparable to the Frakta Carrier bag. Apart from this, it is reusable when for example going to the gym, beach or grocery store because of its flexibility.

References

- Adams, W., 2015. Conducting Semi-Structured Interviews. In: K. E. Newcomer, H. P. Hatry & J. S. Wholey, eds. *Handbook of Practical Program Evaluation*. 4 ed. s.l.:Jossey-Bass, pp. 492-505.
- Ali, A., 2021. *Market Manager, City centre Paris* [Interview] (01 03 2021).
- Amazon, 2021. *Amazon Physical Store*. [Online]
Available at:
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjon_yPwoXxAhVkoosKHaUdCZUQFjAAegQIBRAD&url=https%3A%2F%2Fwww.amazon.com%2Ffind-your-store%2Fb%2F%3Fnode%3D17608448011&usg=AOvVaw30F3418g_IhdoMzCs150zP
[Accessed 01 04 2021].
- Amstel, W. P. v., 2016. *Bringing logistics back into our towns*. [Online]
Available at: <http://www.citylogistics.info/food-for-thoughts/bringing-logistics-back-into-our-towns/>
[Accessed 24 Mars 2021].
- Amstel, W. P. v., 2017. *The future of last mile delivery: 10 most important trends*. [Online]
Available at: <https://www.kennisdclogistiek.nl/nieuws/the-future-of-last-mile-delivery-10-most-important-trends>
[Accessed 24 Mars 2021].
- Andersson, P., 2020. Vad är grejen med Amazon?. *SVT Nyheter*, 7 08.
- Archer, N., 2010. move it carboard cart. *designboom*, 11 08.
- Ball, J., 2019. *Design Council*. [Online]
Available at: <https://www.designcouncil.org.uk/news-opinion/double-diamond-universally-accepted-depiction-design-process>
[Accessed 22 Februari 2021].
- Bono, E. d., 2000. *Six Thinking Hats*. London: Penguin Group.
- Brorough, 2019. *WINS 2019 Delivery Transportation Data*, New York City: s.n.
- Chung Kwik, J. H., 2015. *The efficiency of the car-free zone policy of the groningen city centre*, Groningen: Rijksuniversiteit Groningen.
- Davies, A., Lal, S., Perez, F. & Potdar, S., 2019. Defining 'on-time, in-full' in the consumer sector. *McKinsey Insights*, 13 06.
- Design Council (a), 2021. *What is the framework for innovation? Design Council's evolved Double Diamond*. [Online]

Available at: <https://www.designcouncil.org.uk/news-opinion/what-framework-innovation-design-councils-evolved-double-diamond>
[Accessed 22 Februari 2021].

Design Council (b), 2021. *The Double Diamond: 15 years on*. [Online]
Available at: <https://www.designcouncil.org.uk/news-opinion/double-diamond-15-years>
[Accessed 15 04 2021].

Design Council, 2007. *Eleven lessons: managing design in eleven global brands A study of the design process*. [Online]
Available at:
https://www.designcouncil.org.uk/sites/default/files/asset/document/ElevenLessons_Design_Council%20%28%29.pdf
[Accessed 08 Mars 2021].

Dominguez, C., 2021. *Insights Leader, IKEA USA* [Interview] (10 03 2021).

Europeiska kommissionen, 2021. *Single-use plastics*. [Online]
Available at: https://ec.europa.eu/environment/topics/plastics/single-use-plastics_sv
[Accessed 25 04 2021].

Fishman, T. et al., 2020. Transportation trends 2020. *Deloitte Insights*, 13 04.

González-Gil, A., Palacin, R. & Batty, P., 2013. Sustainable urban rail systems: Strategies and technologies for optimal management of regenerative braking energy. *Energy Conversion and Management*, Volume 75, pp. 374-388.

Guillermet, J., 2021. IKEA Décoration Paris Rivoli : on en connaît la date d'ouverture !. *Le Journal des Femmes*, 29 04.

Gustafsson, E., 2019. Plastskatt, nej tack. *Dagens Industri*, 25 06.

Hemphälä, H., 2021. *Assistant senior lecturer at Ergonomics and Aerosol Technology at Lund University* [Interview] (21 05 2021).

Hofer, S., 2021. *Country Customer Fulfilment Manager, IKEA Japan* [Interview] (08 03 2021).

Iamrunbox, 2021. *Space Bag*. [Online]
Available at: https://iamrunbox.com/products/space-bag?_pos=1&_sid=049907df6&_ss=r
(Approved)
[Accessed 30 05 2021].

Ignat, B. & Chankov, S., 2020. Do e-commerce customers change their preferred last-mile delivery based on its sustainability impact?. *The International Journal of Logistics Management*, 31(3), pp. 521-548.

IKEA (a), 2020. *The 50 day follow-up- IKEA Harajuku*, Tokyo: s.n.

IKEA (a), 2021. *Our heritage*. [Online]
Available at: <https://www.ikea.com/gb/en/this-is-ikea/about-us/our-heritage-pubad29a981>
[Accessed 15 02 2021].

IKEA (b), 2020. *The 50 day follow-up- IKEA Shibuya*, Tokyo: s.n.

- IKEA (b), 2021. *Snapshots. The history of the IKEA brand at a glance.* [Online]
Available at: <https://about.ikea.com/en/about-us/history-of-ikea/milestones-of-ikea>
[Accessed 20 02 2021].
- IKEA (c), 2021. *Vision & Business idea.* [Online]
Available at: <https://www.ikea.com/qa/en/this-is-ikea/about-us/vision-and-business-idea-pub9cd02291>
[Accessed 20 02 2021].
- IKEA (d), 2021. *The Story of IKEA.* [Online]
Available at: <https://ikeamuseum.com/en/exhibitions/the-story-of-ikea/>
[Accessed 25 02 2021].
- IKEA (e), 2021. *One brand, many companies – the IKEA franchise system.* [Online]
Available at: <https://www.inter.ikea.com/en/this-is-inter-ikea-group/the-ikea-franchise-system> (Approved)
[Accessed 24 03 2021].
- IKEA (f), 2021. *IKEA Harajuku.* [Online]
Available at: <https://www.ikea.com/jp/en/stores/harajuku-pube424fb30>
[Accessed 10 03 2021].
- IKEA (g), 2021. *IKEA Shibuya.* [Online]
Available at: <https://www.ikea.com/jp/en/stores/shibuya/>
[Accessed 10 03 2021].
- IKEA (h), 2021. *IKEA Queens.* [Online]
Available at: <https://www.ikea.com/us/en/stores/queens/>
[Accessed 10 03 2021].
- IKEA (i), 2021. *Hej New York! IKEA Queens is officially open in Rego Park.* [Online]
Available at: <https://www.ikea.com/us/en/this-is-ikea/newsroom/hej-new-york-ikea-queens-is-officially-open-in-rego-park-pube750b309>
[Accessed 11 03 2021].
- IKEA (j), 2021. *Leveras.* [Online]
Available at: <https://www.ikea.com/se/sv/customer-service/services/delivery/>
[Accessed 20 03 2021].
- IKEA (k), 2021. *Frakta Paper bag with handles.* [Online]
Available at: <https://www.ikea.com/th/en/p/frakta-paper-bag-with-handles-brown-80483023/>
[Accessed 12 05 2021].
- IKEA (l), 2021. *Frakta Kasse, stor.* [Online]
Available at: <https://www.ikea.com/se/sv/p/frakta-kasse-stor-bla-17228340/> (Approved)
[Accessed 01 04 2021].
- IKEA (m), 2021. *Frakta Kasse, medium.* [Online]
Available at: <https://www.ikea.com/se/sv/p/frakta-kasse-medium-bla-60301707/>
(Approved)
[Accessed 01 04 2021].

- IKEA (n), 2021. *Frakta Trunk för kärra*. [Online]
Available at: <https://www.ikea.com/se/sv/p/frakta-trunk-foer-kaerra-bla-90149148/>
(Approved)
[Accessed 01 04 2021].
- IKEA (o), 2021. *Frakta Kärra med trunk*. [Online]
Available at: <https://www.ikea.com/se/sv/p/frakta-kaerra-med-trunk-bla-s79875197/>
[Accessed 01 04 2021].
- IKEA (p), 2021. *Plughäst*. [Online]
Available at: <https://www.ikea.com/se/sv/p/plugghaest-vaeska-moenstrad-bla-60482034/>
(Approved)
[Accessed 20 04 2021].
- IKEA (q), 2021. *Efterträda Collection*. [Online]
Available at: <https://www.ikea.com/jp/en/new/eftertrada-collection-pub48c7dee0>
[Accessed 20 03 2021].
- IKEA (r), 2021. *Tjustig*. [Online]
Available at: <https://www.ikea.com/gb/en/p/tjusig-shoe-rack-white-30152638/>
[Accessed 30 05 2021].
- IKEA (s), 2021. *Rågrund*. [Online]
Available at: <https://www.ikea.com/gb/en/p/rgrund-towel-rack-chair-bamboo-90253074/>
[Accessed 30 05 2021].
- IKEA (t), 2021. *Vittsjö*. [Online]
Available at: <https://www.ikea.com/se/sv/p/vittsjoe-laptopstaell-vit-glas-90303446/>
[Accessed 30 05 2021].
- IKEA, 2019. *IKEA La Madeleine*, Paris: s.n.
- IKEA, n.d. *FRAKTA Trunk for trolley, blue, 76l*. [Online]
Available at: <https://www.ikea.com/gb/en/p/frakta-trunk-for-trolley-blue-90149148/>
[Accessed 24 Mars 2021].
- Indiana University, 2021. *Back Safety*. [Online]
Available at: <https://protect.iu.edu/environmental-health/occupational-safety-health/workplace-egronomics/back-safety.html>
[Accessed 15 05 2021].
- INGKA (b), 2020. *IKEA installs cargo bikes to drive change*. [Online]
Available at: <https://www.ingka.com/news/ikea-installs-cargo-bikes-to-drive-change/>
[Accessed 15 03 2021].
- INGKA, 2020. *IKEA set to come closer to the many people through different store formats*. [Online]
Available at: <https://www.ingka.com/news/ikea-set-to-come-closer-to-the-many-people-through-different-store-formats/>
[Accessed 15 03 2021].
- Inter IKEA group, 2020. *Inter IKEA Group Financial Summary FY20*. [Online]
Available at: <https://gbl-sc9u2-prd-cdn.azureedge.net/-/media/interikea/igi/financial-reports/inter-ikea-group-financial-summary-fy20->

- 03112020.pdf?rev=3a909f2cdead4ecfbf2c1dd026e954f5&hash=0A92D3F6A6820A818192608A67F28DD3
[Accessed 11 03 2021].
- Khademi-Vidra, A. & Bujdosó, . Z., 2020. Motivations and Attitudes: An Empirical Study on DIY (Do-It-Yourself) Consumers in Hungary. *Mdpi Sustainability*, 12(2), p. 517.
- Kulyuk, O., Kosara, R. & Wassink, I., 2007. Human-Centered Aspects. *Human-Centered Visualization Environments*, Volume 4417, pp. 13-75.
- Lemon, K. N. & Verhoef, P. C., 2016. Understanding Customer Experience Throughout the Customer Journey. *Journal of Marketing*, 80(6), pp. 69-96.
- Lippi, K., 2021. *The 10 Best Moving Straps (Reviewed)*. [Online]
Available at: <https://www.isoldmyhouse.com/best-moving-straps/>
[Accessed 20 04 2021].
- Luttropp, C. & Lagerstedt, J., 2006. EcoDesign and The Ten Golden Rules: generic advice for merging environmental aspects into product development. *Journal of Cleaner Production*, 14(15-16), pp. 1396-1408.
- Mentzer, J. T. et al., 2001. Defining Supply Chain Management. *Journal of Business Logistics*, 22(2).
- Montabon, F., Pagell, M. & Wu, Z., 2015. Making Sustainability Sustainable. *Journal of Supply Chain Management*, 52(2), pp. 11-27.
- Mordor Intelligence, 2021. *Self-service market- growth, trends, Covid-19 impact and forecasts (2021-2026)*. [Online]
Available at: <https://www.mordorintelligence.com/industry-reports/self-service-market#faqs>
[Accessed 02 05 2021].
- Moss, M. L. & O'Neill, H., 2012. *Urban mobility in the 21st Century*. [Online]
Available at: https://wagner.nyu.edu/files/rudincenter/NYU-BMWi-Project_Urban_Mobility_Report_November_2012.pdf
[Accessed 24 Mars 2021].
- Motte, D., 2019. *Product innovation- Product Renewal (PRN)*. Division of Machine Design, Department of Design Science LTH, Lund University, Lund [PowerPoint slides] (20 10 2019).
- Muji, 2021. *Choose your country or region*. [Online]
Available at: <https://www.muji.com/>
[Accessed 25 03 2021].
- Naturvårdsverket, 2021. *Vad är Parisavtalet?*. [Online]
Available at: <https://www.naturvardsverket.se/Miljoarbete-i-samhallet/EU-och-internationellt/Internationellt-miljoarbete/miljokonventioner/Klimatkonventionen/Parisavtalet/Vad-ar-Parisavtalet/>
[Accessed 15 04 2021].
- Nitori, 2021. *Delivery and Assembly Services*. [Online]
Available at: <https://www.nitori.co.jp/en/service/transport/>
[Accessed 25 03 2021].

- Nitori, 2021. *History*. [Online]
Available at: https://www.nitori.co.jp/en/about_us/history.html
[Accessed 25 03 2021].
- NYCEDC, 2018. *New Yorkers and Their Cars*. [Online]
Available at: <https://edc.nyc/article/new-yorkers-and-their-cars>
[Accessed 20 03 2021].
- Nyhlin, M., 2018. Dra maten med rätt dramaten. *Hem & Hyra*, 19 11.
- Olsson, J., Hellström, D. & Pålsson, H., 2019. Framework of Last Mile Logistics Research: A Systematic Review of the Literature. *Sustainability*, 11(24), p. 7131.
- Parguel, B., Benoit-Moreau, F. & Russell, C. A., 2015. Can evoking nature in advertising mislead consumers? The power of 'executional greenwashing'. *International Journal of Advertising*, 34(1), pp. 107-134.
- Qwstion, 2021. *Tote*. [Online]
Available at: <https://www.qwstion.com/en/tote-graphite.html> (Approved)
[Accessed 02 05 2021].
- Railway Technology, 2014. The world's 10 longest railway networks. *Railway Technology*, 19 02.
- Ramadan, M. Z. & Al-Tayyar, S. N., 2020. Development and Experimental Verification of an Ergonomic Backpack. *BioMed Research International*, Volume 2020.
- Regeringskansliet, 2020. *Parisavtalet*. [Online]
Available at: <https://www.regeringen.se/regeringens-politik/parisavtalet/>
[Accessed 15 04 2021].
- Regeringskansliet, 2014. *Strategiska trender i globalt perspektiv 2025: en helt annan värld?*. [Online]
Available at:
<https://www.regeringen.se/contentassets/cb06e1fb555a4c22bc6ec7dbf9449cdd/strategiska-trender-i-globalt-perspektiv---2025-en-helt-annan-varld>
[Accessed 24 Mars 2021].
- Salpeter, J., 2018. Transport for today and tomorrow: the importance of making travel easier. *Intelligent Transport*, 11 04.
- TJ maxx Company, 2021. *Official Site*. [Online]
Available at:
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjQkJnYwYXxAhXTK3cKHZ-2C2gQFjAAegQIBBAD&url=https%3A%2F%2Ftjmaxx.tjx.com%2Fstore%2Findex.jsp&usg=AOvVaw0pYmD8_EOreVCkz8ECY3h1
[Accessed 25 03 2021].
- Toy, J. et al., 2020. *The Logistics Trend Radar 5th Edition*, Toisdorf: DHL Customer Solutions & Innovation.
- Trafikverket, 2020. *Vision Zero Academy*. [Online]
Available at: <https://www.trafikverket.se/en/startpage/operations/Operations-road/vision->

zero-academy/
[Accessed 20 04 2021].

United Nations, 2019. *World Urbanization Prospects 2018: Highlights*, New York: United Nations.

United Nations, 2021. *Take Action for the Sustainable Development Goals*. [Online]
Available at: <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>
[Accessed 16 04 2021].

University Health Services, n.d. *Backpack Ergonomics*. [Online]
Available at: <https://ehs.wisc.edu/wp-content/uploads/sites/1408/2020/09/Backpack-Ergonomics.pdf>
[Accessed 20 05 2021].

Westerberg, M., 2021. *Fulfilment Sourcing Manager, IKEA France* [Interview] (05 03 2021).

Viechnicki, P., Fishman, T. & Eggers, W. D., 2015. Key findings from the "Smart mobility" study. *Deloitte Insights*, 19 05.

World Commission on Environment and Development, 1987. *Our Common Future (Brundtland Report)*, s.l.: United Nations.

Zadry, H. R., Fithri, P., Triyanti, U. & Meilani, D., 2017. An Ergonomic Evaluation of Mountaineering Backpacks. *ARPN Journal of Engineering and Applied Science*, 12(8), pp. 5333-5338.

Zarif, R., Pankratz, D. & Kelman, B., 2019. Small is beautiful. *Deloitte Insights*, 15 04.

Appendix A Interview guide

“...” is replaced by the name of the city of interest.

General:

Can you explain your role within IKEA?

For how long have you been working for IKEA?

Can you explain your relation to city centre stores in general?

Market area:

What do the customers in ... think and expect from the IKEA brand?

Can you describe the customers' view of the city centre store in ...?

What was the expected result of opening the city centre store and how was the actual result?

What are the biggest challenges for a city centre store?

What are the main learnings after opening the city centre store?

What does an IKEA store add to the city centre area?

Which are the competitors in the same area as the city centre store?

Customer:

Why do people visit the city centre store?

What can you tell us about the customer profile for the city centre store?

What does the process look like when interpreting customer needs?

Delivery options:

What are the delivery options for the customers at the city centre store?

What is the willingness to pay for delivery?

Which are the most common ways for customers to bring their goods home themselves?

What are the main issues for customers to bring home their purchases from the city centre store?

How do customers travel to and from the store?

Is the visit often planned or not planned?

What is the attractiveness of a self-service delivery solution in ...?

What are the most important features of a self-service delivery solution?

Product range:

What is the average ticket in the city centre store?

What is the average amount of purchased products per customer in the city centre store for cash and carry?

What is considered a portable product in your market?

Are you able to provide us with a list of these items? Only small furniture

Do you have a sales history for cash and carry that you can share with us? (list of product range)

(Do you have sales history for the series Frakta?)

Other:

How do you think covid-19 will affect the business of the city centre stores in the future?

How does IKEA in ... maintain customer relevance and adapt to “the many people”?

What are the improvements or changes made since the store opened?

Can you provide us with an MDA or follow-up report after the opening?

Do you have anything else that you would like to add or share?

Appendix B Six Thinking Hats

Blue hat- “The big picture” and managing	
Carry over one shoulder	<ul style="list-style-type: none"> • Simple and intuitive solution for the customer, something that has been seen before.
Carry on the back	<ul style="list-style-type: none"> • A practical solution for carrying. • Ergonomic and distributes the weight.
Wheels	<ul style="list-style-type: none"> • Innovative or outdated depending on the process.
White hat – Facts and information	
Carry over one shoulder	<ul style="list-style-type: none"> • Used for carrying sports equipment. • Duffel bags often have shoulder straps.
Carry on the back	<ul style="list-style-type: none"> • Well established principle but not applied as a carry solution customer buys at the cashier. • Backpacks are used by kids and adults.
Wheels	<ul style="list-style-type: none"> • There are existing solutions to this but it is mostly used by elders.
Green - “new ideas”	
Carry over one shoulder	<ul style="list-style-type: none"> • Use the attached shoulder strap as merch on other bags as well and make it reusable. • Add another shoulder strap to make it more ergonomic e.g. one shoulder strap crossbody and one over the shoulder on the same side the packages are carried.
Carry on the back	<ul style="list-style-type: none"> • Reusable - attach the 36 L carrier bag to the strap solution so that it can be used as a backpack as well.
Wheels	<ul style="list-style-type: none"> • Can be combined with an app that for example optimises the way one pack the goods.
Yellow hat - “Positive”	

Carry over one shoulder	<ul style="list-style-type: none"> • Requires small volume of material. • Can be created with only one material. • Intuitive when packing. • Adaptable - Can be reused for example when carrying yoga mats, skies or surfboards.
Carry on the back	<ul style="list-style-type: none"> • Ergonomic - Good solution when it comes to carrying several goods that both are big and heavy. • Adaptable - Can be reused for carrying bags, for example to the gym bag if the carrier bag is attached. • Requires a low volume of material.
Wheels	<ul style="list-style-type: none"> • Ergonomic - Comfortable for the customer, no heavy lifting. • The obvious choice when it comes to transportation of heavier items. • There is room for innovative solutions that are more accepted than the ones on the market. • A good option when walking long distances.
Black hat - "Negative"	
Carry over one shoulder	<ul style="list-style-type: none"> • Hard to use with several packages with different dimensions. • Not optimal for long packages takes up much space when carrying along the side of the body. • Non-ergonomic - Painful on the shoulder when carrying heavy packages for a longer time.
Carry on the back	<ul style="list-style-type: none"> • Needs to be adjusted depending on the user due to people's different body types. • Back and shoulder pain when carrying heavy packages for a longer period.
Wheels	<ul style="list-style-type: none"> • Not adaptable - e.g. difficult when climbing stairs, using public transport or biking. • One occupied hand. • Requires more material, in general. • More expensive, difficult to manufacture at a low-cost. • Direct contact with the ground requires durable wheels which can be expensive and also make the product

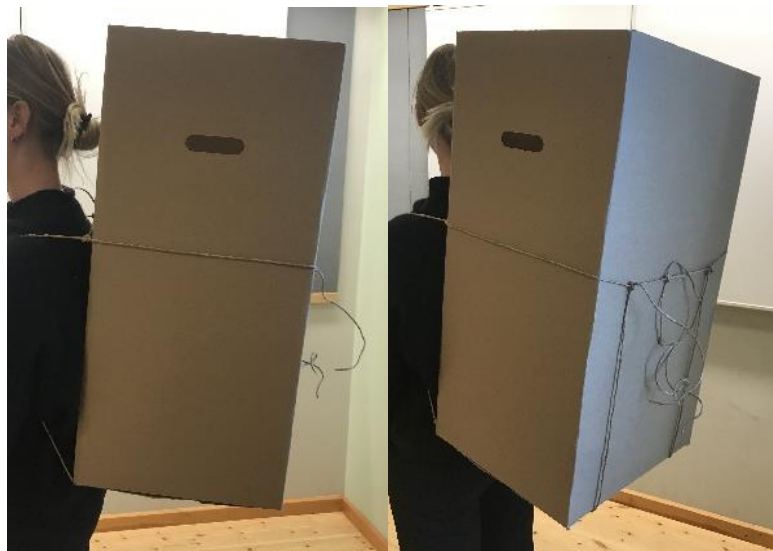
	harder to recycle the right way due to the use of different materials
Red hat- “feelings and emotions”	
Carry over one shoulder	<ul style="list-style-type: none"> • Feels too similar, regarding function and looks, to the carrier bag available in store.
Carry on the back	<ul style="list-style-type: none"> • Ergonomic for heavier packages. • Feels like the solution needs to be a much better option than carrying by hand since it feels like the customers want a low-price and easy-going solution.
Wheels	<ul style="list-style-type: none"> • Feels like it is not adaptable enough for customers visiting the city centre stores. • Feels outdated and a concept that is hard to develop in such a way that it is simple and low-price.
Blue Hat (2) - “The big picture” and managing	
Carry over one shoulder	<ul style="list-style-type: none"> • This solution is a used concept for carrying bags and other things but not ergonomic for longer distances with heavier items and not convenient for long packages.
Carry on the back	<ul style="list-style-type: none"> • This solution is adapted for the city centre store customers, ergonomic and can be manufactured at a low-cost.
Wheels	<ul style="list-style-type: none"> • This solution is a good option when walking longer distances but not the best choice when it comes to public transport or by bike due to small and hectic spaces combined with stairs also not the best choice in terms of use of material and cost.

Appendix C Concept Pictures

Pictures of concept 1



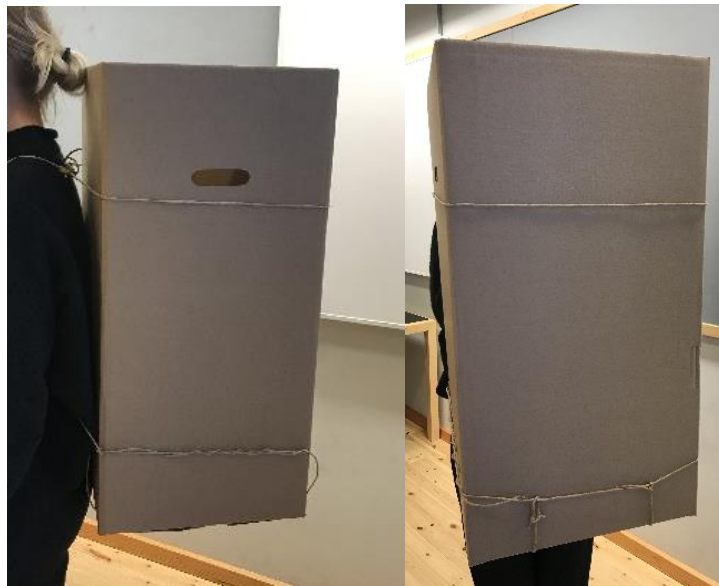
Pictures of concept 2



Picture of concept 3



Pictures of concept 4



Appendix D Concept Evaluation

Table D1. Importance score: M=3, N=2, D=1, Satisfaction: 1-5 (5=not able to make it better, 4=good but space for improvements, 3=average, 2=less good, 1=bad)

Concept 1					
	The product is...	Importance	Normalized score	Satisfaction	Normalised importance x Satisfaction score
Ease of use	Is manageable to use for one person	2	3.23%	4	0.13
	Is flexible	2	3.23%	3	0.10
	Is intuitive	2	3.23%	4	0.13
	Is easy to travel with on public transport, walking and cycling.	3	4.84%	5	0.24
	Is adapted for stairs (easy to carry)	2	3.23%	5	0.16
	Is adding value to the customer experience	1	1.61%	3	0.05
	Is ergonomic	2	3.23%	4	0.13
Function	Protects the goods	2	3.23%	2	0.06
	Is independent	3	4.84%	5	0.24
	Is weather resistant	3	4.84%	5	0.24
	Is adaptable for different packaging sizes	3	4.84%	4	0.19
	Can carry the total height of 45 cm	3	4.84%	4	0.19
	Can carry the total length of 100 cm	3	4.84%	4	0.19

	Can carry the total width of 60 cm	3	4.84%	4	0.19
	Can carry 15 kg	2	3.23%	4	0.13
	Takes up small space when storing	3	4.84%	5	0.24
	Is lightweight	1	1.61%	5	0.08
	Is durable	1	1.61%	4	0.06
	Protects the goods from theft	1	1.61%	3	0.05
Aesthetics	Is aesthetically pleasing	1	1.61%	4	0.06
	Is aesthetically related to IKEA's design	1	1.61%	3	0.05
	Is innovative	1	1.61%	3	0.05
Environmental sustainability	Is reusable	3	4.84%	2	0.10
	Is recyclable	3	4.84%	4	0.19
	Has few different types of material	2	3.23%	4	0.13
	Has small volume of material	2	3.23%	5	0.16
Economical	Price: EUR 0.5 (+/- 2/0.5)	2	3.23%	5	0.16
	Has low production cost	3	4.84%	5	0.24
	Is scalable	2	3.23%	5	0.16
	Total value	62	100%		4.13

Table D2. Importance score: M=3, N=2, D=1, Satisfaction: 1-5 (5=not able to make it better, 4=good but space for improvements, 3=average, 2=less good, 1=bad)

Concept 5					
	The product is...	Importance	Normalized score	Satisfaction	Normalized importance x Satisfaction score
Ease of use	Is manageable to use for one person	2	3.23%	4	0.13
	Is flexible	2	3.23%	4	0.13
	Is intuitive	2	3.23%	4	0.13
	Is easy to travel with on public transport, walking and cycling.	3	4.84%	5	0.24
	Is adapted for stairs (easy to carry)	2	3.23%	5	0.16
	Is adding value to the customer experience	1	1.61%	3	0.05
	Is ergonomic	2	3.23%	4	0.13
Function	Protects the goods	2	3.23%	3	0.10
	Is independent	3	4.84%	5	0.24
	Is weather resistant	3	4.84%	5	0.24
	Is adaptable for different packaging sizes	3	4.84%	4	0.19
	Can carry the total height of 45 cm	3	4.84%	4	0.19
	Can carry the total length of 100 cm	3	4.84%	4	0.19
	Can carry the total width of 60 cm	3	4.84%	4	0.19
	Can carry items of max 11 kg	2	3.23%	4	0.13
	Takes up small space when storing	3	4.84%	4	0.19
	Is lightweight	1	1.61%	5	0.08

	Is durable	1	1.61%	3	0.05
	Protects the goods from theft	1	1.61%	3	0.05
Aesthetics	Is aesthetically pleasing	1	1.61%	3	0.05
	Is aesthetically related to IKEA's design	1	1.61%	5	0.08
	Is innovative	1	1.61%	4	0.06
Environmental sustainability	Is reusable	3	4.84%	5	0.24
	Is recyclable	3	4.84%	4	0.19
	Has few different types of material	2	3.23%	4	0.13
	Has small volume of material	2	3.23%	4	0.13
Economical	Price: EUR 0.5 (+/- 2/0.5)	2	3.23%	5	0.16
	Has low production cost	3	4.84%	5	0.24
	Is scalable	2	3.23%	5	0.16
	Total value	62	100%		4.27