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Reverse Logistics in the Transition Towards Circular Economy

A Case Study of Customer Returns at IKEA

Master's thesis in Supply Chain Management Master's Programme

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SUMMARY

The world is facing an era of resource scarcity and worsened climate externalities. These challenges can partly be linked to industries embracing linear business models, producing beyond the limits of our planet. IKEA has addressed this issue by aiming to transform their current linear business into a circular business by 2030. The development of a closed-loop supply chain can support closing the loop of production and consumption by prolonging product lifecycles. Greater focus can be given to reverse logistics to enable product returns and recovery.

The thesis aimed to analyse how IKEA's transition from a linear to a circular economy affects customer returns and reverse logistics. This was achieved by examining the current reverse flow and exploring initiatives taken within IKEA that serve to facilitate a circular economy. This was done together with an analysis of how a transition towards a circular business model is affected by involved actors in the supply chain (i.e. customers, companies, and society). Interviews were carried out to identify important challenges and opportunities for IKEA in the transition towards a circular business model.

During the study, three initiatives at IKEA were analysed; buy-back and take-back services, offering after sales parts, and usership models, to conclude how IKEA can collect and restore value in second-hand products. The thesis has shown a need for customer convenience in the return process to increase the return rate of end-of-life and end-of-use products. To avoid unnecessary transportation and handling, the thesis has shown the importance of early inspection and separation of products. Also, potential benefits could be seen in performing recovery close to the point of use. To facilitate recovery, the thesis identified product design, resource allocation, and availability of spare parts as critical factors. To accelerate the transition, it is important to understand customers and their attitudes toward second-hand products. Improved customer communication can increase understanding and promote circular behaviour. Based on this study, IKEA has to adapt mind-sets and processes to give larger attention to reverse logistics and the recovery of products to facilitate a circular economy.

Keywords: Reverse Logistics, Circular Economy, Product Recovery, Circular Business Model, Retailing.

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1 Introduction

This master thesis is written on behalf of and in collaboration with IKEA of Sweden. This section covers the background of the research area, as well as a description of the underlying problem that has initiated the thesis. The aim and research questions that the report addresses are then presented.

1.1 Background

The linear ‘take-make-dispose’ model that dominates producer-consumer relationships is reaching its limits. It is a model according to which companies extract materials to manufacture products that are then sold to consumers. When the product no longer brings value to the customer it is discarded. This has led to unsustainable extraction of raw materials and extensive waste generation as products are disposed of after use (Ellen MacArthur Foundation, 2012).

Negative climate impact can to a great extent be attributed to unsustainable consumption of resources and constitutes a problem ever more critical as population and consumption continue to increase (Hanumante, Shastri and Hoadley, 2019). Issues such as resource scarcity and climate externalities are worsened by industries that have embraced linear models (Ellen MacArthur Foundation, 2015). The application of a linear model leads to landfills and emissions that hurt our planet and people. New ways are therefore needed to meet customer needs and gain profits without compromising the life of future generations. Companies are also becoming aware of the financial risks of linear business models as the scarcity of raw material causes prices to rise (Ellen MacArthur Foundation, 2012).

Material Economics (2019) finds that there is a gap between current climate policies and the goals of the Paris Agreement (United Nations, 2015) to create an economy with net zero supply side, including the development of industrial processes and increased use of non-fossil fuels. By instead turning to the demand side, actions can be taken to make better use of what is already produced, thus reducing the need for new production (Material Economics, 2019).

The furniture cooperation IKEA Group, hereinafter referred to as IKEA, is addressing this issue by aiming to, by 2030, transform the currently used linear business model into a circular business model (Ingka Holding B.V., 2020c). The vision of IKEA ‘To create a better everyday life for the many people’ is challenged by growing threats to our planet but the vision also forces IKEA to take measures to transform into a sustainable business that increases the well-being of a growing number of people and the currently poorly treated planet.

The transition towards a circular economy serves to eliminate waste and facilitate reuse of resources and entails changes throughout the business. The complete range of products needs to be designed using principles that enable circulation in different loops such as reuse, refurbishment, remanufacturing, and as a last resort, recycling (Inter IKEA systems B.V., 2019). In such a system, customers play an increasingly important role also after the point of purchase as the products need to go back into the system after use. In addition, the supply chain needs the capabilities and resources to handle the circular loops to prolong the lifecycle of products and materials.

1.2 Linear and circular economy

The concept of a circular economy offers an opportunity to focus on demand side actions as it questions the linear model and hence the currently dominating way of producing and consuming goods. By facilitating circulation of products and materials in different loops, the product lifecycle can be extended, resulting in a reduced need for raw material and decreased waste generation (European Environment Agency, 2017). A transition to a circular economy is increasingly important for a sustainable future and includes changes in internal processes as well as in external behaviour (Hanumante et al., 2019). Kirchherr et al. (2017, p. 229) define the circular economy as “...an economic system that replaces the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes”. This system can be described by different loops, which in turn can be divided into inner and outer loops depending on the distance to the consumer and the value that is built into the products in the different stages (European Environment Agency, 2017). The outer loops focus on recycling and refurbishment/remanufacturing whereas the inner loops consist of maintenance/prolonging and reuse/distribution according to Figure 1 (Ellen MacArthur Foundation, 2015).

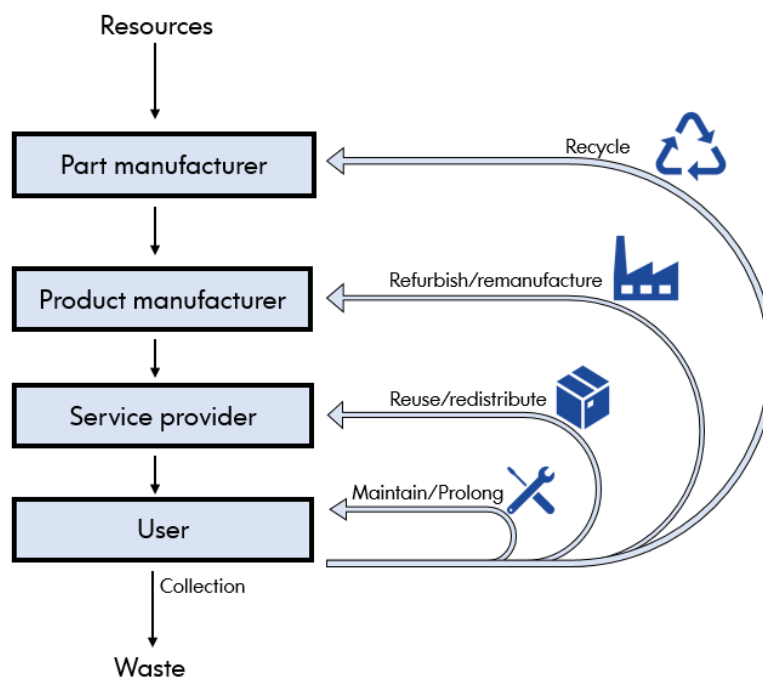


Figure 1. Model adapted from Ellen MacArthur Foundation (2015) illustrating the flows generated by a circular economy

The aim is to keep products circulating in the inner loops for as long as possible, thereby keeping the value of products high while minimising the need for new inputs. Product design determines products potential for circularity whereas the degree to which this potential is utilised is determined by activities taking place throughout the complete lifecycle (European Environment Agency, 2017). Capturing this potential requires a system that can coordinate the collection, refurbishment activities as well as redistribution, depending on the condition of products in the reverse flow (Goltsos et al., 2019).

1.2.1 Shifting to a circular business model

The furniture industry is characterised by the linear business model with the take, make, and dispose perspective. The industry faces the challenge of meeting customers' demands while remaining profitable without compromising the life of future generations (European Environmental Bureau, 2017).

IKEA addresses this challenge by striving to enable the prolongation of product and material life through the four circular loops; reuse, refurbishment, remanufacturing, and recycling. These are described in the following paragraphs as defined by IKEA (IKEA of Sweden, 2019). The reuse loop consists of the customer use of a product and starts directly when a product is acquired. For IKEA the concept includes all phases of regular use and maintenance of a product, such as sustaining its condition and adapting it to changing needs and preferences. This definition means that customer use, second-hand markets, and other ways of passing on products form part of the reuse loop from IKEA's point of view.

The refurbishment loop consists of products in need of processing and thereby include used, damaged, or non-compliant products that are to be refurbished and sold *as new* with only small improvements needed. The repairs or upgrades can be done either by customers, IKEA, or external after-market service providers. The process includes activities such as evaluation, cleaning, repair, upgrades and recertification to release the product back into the market.

The outer loops, remanufacturing and recycling, focus on utilising parts and materials from products in the production of new products, hence these loops only indirectly contribute to product circulation. However, these loops create a potential for cost savings in the supply chain.

A challenge is to keep the product value high for as long as possible by striving to keep products as close to the customer as possible and view recycling as the last resort and thus focus on what Ellen MacArthur Foundation (2015) refers to as the inner loops. For IKEA this translates into the reuse and refurbishment loops visualised in Figure 2.

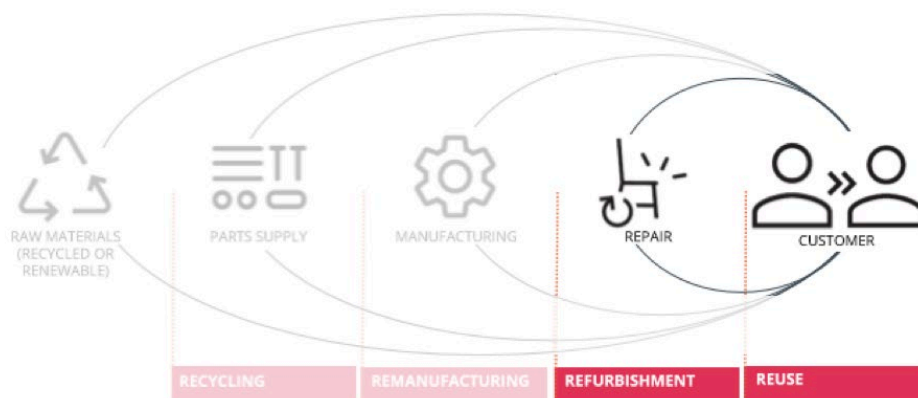


Figure 2. The four circular loops in a circular economy defined by IKEA, adapted to focus on the inner loops close to the customer (Inter IKEA systems B.V., 2019)

A transition to a circular economy requires changes in how and where IKEA interacts with its customers and an ability to influence customers to embrace circular thinking in their behaviour. Customer behaviour is changing and the awareness of sustainable consumption increases (Ellen

MacArthur Foundation, 2015). Despite this, the financial and functional aspects are still the prioritised aspects when making a purchase (European Environmental Bureau, 2017). For IKEA to adapt circular business practices, new service concepts must be offered to customers to find incentives and convenient ways to pass on, repair, and adapt products to extend the product lifecycles (Inter IKEA systems B.V., 2019). Current trends are that people buy second hand to a greater extent, rent products and products are bought as a service or subscription (European Environmental Bureau, 2017). All these changes increase the value of a product since it can be used multiple times. However, it also puts pressure on the design, product flow channels, and after-sale services. A challenge with a more service-oriented offering is that work is often taxed higher than material. Higher taxes on work can result in linear consumption remaining more attractive for customers if buying new products are cheaper than repairing old ones. To drive change, it is important to make sustainable solutions more attractive than alternatives.

Another critical part is that the products must be designed for the circular loops from the very start. IKEA tackles this challenge by incorporating circular design principles in the product design. The principles promote designing for standardisation, adaptability, renewable, or recycled materials, remanufacturing, care, repair, disassembly, reassembly, and recyclability (Inter IKEA systems B.V., 2019). To unleash the value of these efforts, supply chain development is needed to fit into a circular business model. The current development means that new channels and actors are entering the system and with them new challenges and opportunities arise.

1.3 Problem description

Rising concern over the environmental impact of supply chain systems along with increased regulations has given rise to an increased interest in reverse logistics (Wang and Disney, 2016). The transition towards a circular economy impacts business in all aspects and development of the IKEA supply chain is necessary. To facilitate this development there is a need to investigate how IKEA can enable customers to return products to ensure they re-enter the system. The collection, inspection, reprocessing, and redistribution activities pose challenges for a circular economy (Fleischmann, Krikke, Dekker and Flapper, 2000). These additional activities in the reverse flow create new uncertainties compared to traditional forward flows. Products enter reverse loops for various reasons and in different conditions and it is important to understand the character of these reverse flows and what resources are required to enable circular supply chain development and adequate planning (Goltsos et al., 2019).

In a traditional reverse flow, it is mainly unsatisfied customers returning products, but in a circular economy, products are also returned to extend their lifecycle. The changes a circular economy brings to the reverse supply chain in turn create a need for changes in the design of the involved activities. The transitioning into a circular business means that volumes in the reverse flow will increase as products are collected to enable second use. This requires new resources as well as extended capacity in the reverse flow activities. Today, the possibility to handle returns in the IKEA stores is limited which according to customer care specialist (personal communication, February 18, 2020), restricts the recovery processes and thus forces returned products with potential for recovery to be disposed of.

To plan for the customer return flow for previously used products, knowledge on when and if products will be returned is required, as well as information on quantities and conditions (Santibanez Gonzalez, Koh and Leung, 2019). These variables can be described by timing, quantity, and quality (Goltsos et al., 2019) and the uncertainties that they create must be managed to take care of products after use and improve reverse logistics performance. Hence, IKEA has seen a need to investigate how customer returns can be managed in the reverse flow to facilitate a circular economy and identify challenges and opportunities in the involved activities.

IKEA is driving many initiatives to facilitate a transition to a circular economy, for instance buy-back and take-back services, offering after sales parts and usership models. These novel ways to collect and handle previously used products from customers results in the design of new reverse flows and changes in the existing return flow activities to allow products to re-enter the supply chain and facilitate a circular economy where customers and IKEA extend products lifecycles.

1.4 Aim

The thesis aims to analyse how IKEA's transition from a linear to a circular economy affects customer returns and reverse logistics. The thesis explores initiatives taken within IKEA that serve to facilitate a circular economy. The initiatives are analysed with identified challenges and opportunities in the current reverse flow to serve as inspiration for the future design of reverse flows.

2 Empirical background

In the following chapter, the empirical background for the thesis is presented. Firstly, IKEA’s organisation is explained. The information provided is based on IKEA’s official communication, internal documents as well as interviews with employees at IKEA. An understanding of the complex IKEA organisation is needed as a transition to a circular economy affects all aspects of IKEA businesses. The following chapter gives an understanding of the context for this master thesis. Secondly, the chapter includes background information regarding challenges and opportunities in a transition towards a circular business model, provided by two external researchers within the circular economy. This can be seen as a complement to theory by providing an understanding of challenges facing customers, companies, supply chains, and the environment.

2.1 IKEA Group

In 1943, Ingvar Kamprad founded IKEA and started selling general products to meet customer needs at a low cost. Since then IKEA has expanded into a global furnishing business with a presence in over 50 markets (Inter IKEA Systems B.V., 2018). The success of IKEA is largely dependent on the development of an efficient distribution network and supply chain optimisation. Products are produced in large quantities to allow for lower costs and to meet the vision of IKEA “To create a better everyday life for the many people” (Inter IKEA Systems B.V., 2020a). The company started by mainly selling products through mail orders but since then the sales channel has switched to focus on in-store purchases and in later years a growing portion of online sales (Inter IKEA Systems B.V., 2020b).

IKEA is operated by a large number of companies that all run under the same IKEA brand in a franchise structure shown in Figure 3 (Inter IKEA Group, 2019). Inter IKEA Systems B.V., IKEA of Sweden AB, IKEA Supply AG, and IKEA Communications AB form the Inter IKEA Group. IKEA Industry also belongs to the group but is not shown in the figure as it is a supplier to IKEA, working close to IKEA Supply AG and other suppliers. The Inter IKEA Group is ultimately owned by the holding company Inter IKEA Holding B.V.

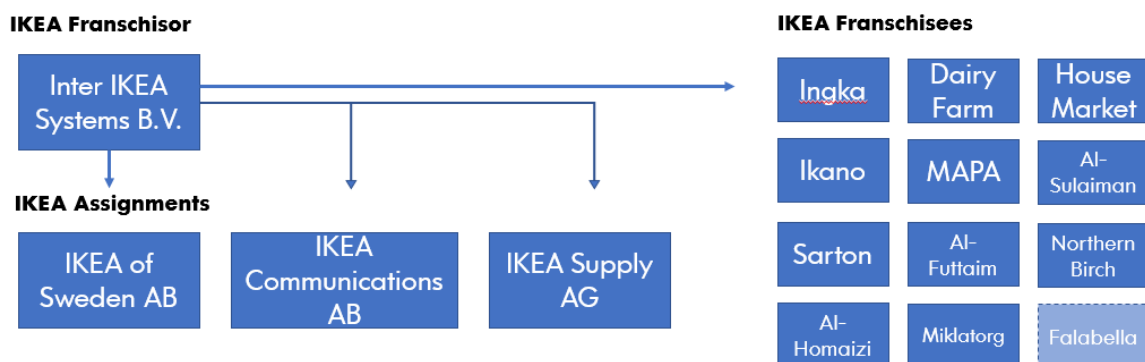


Figure 3. Organisational structure of the IKEA franchise system, adapted from Inter IKEA Group (Inter IKEA Group, 2019)

To the right in Figure 3, the abbreviated names of the franchisees that operate IKEA retail businesses are presented. Ingka is by far the largest franchisee with 374 stores (Ingka Holding

B.V., 2020c), compared to less or equal to ten stores operated by the other franchisees (Inter IKEA Group, 2019). Inter IKEA group and Ingka Group have the same founder but different management and owners. Ingka Group is owned by the Dutch foundation Stichting Ingka Foundation (Ingka Holding B.V, 2020d). When referring to Ingka, the parent holding company Ingka Holding B.V and Ingka Group are considered.

The franchising system was set in place to expand and form a basis for mutual collaboration. While the franchisor, Inter IKEA Systems B.V., takes responsibility for the development and implementation of the IKEA Concept, the franchisee contributes with consumer and market understanding (Inter IKEA Group, 2019).

2.1.1 Inter IKEA Group

The information in the following chapter is based on Inter IKEA Group Financial Summary 2019 (Inter IKEA Group, 2019). The strategic direction of IKEA is carried out by Inter IKEA Group, part of Inter IKEA Holding B.V., by connecting IKEA franchisees with product development and suppliers. Based on annual retail sales, the franchisees pay a franchise fee to Inter IKEA Group and it is from them their products are bought.

In Figure 4, the organisational structure of Inter IKEA group is shown, consisting of the businesses: Franchise, Range & Supply and Industry. These core businesses aim to provide franchisees with the best conditions for implementing and operating the IKEA concept (Inter IKEA group, n.d.). They work close to franchisees and suppliers and strive for continuous improvements and growth.

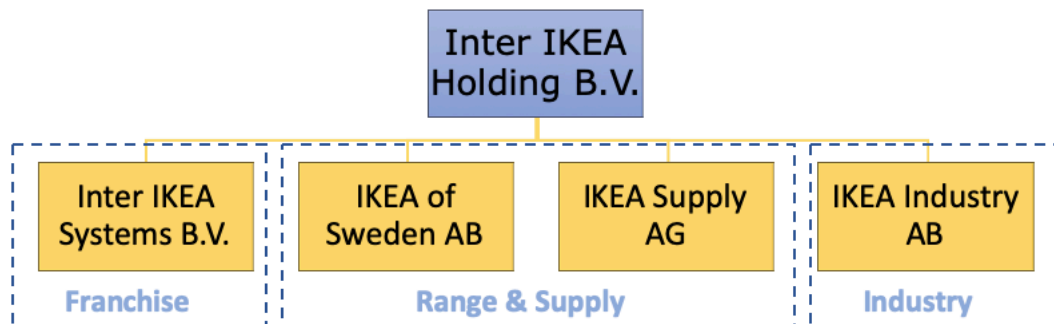


Figure 4. Organisational structure of Inter IKEA Holding B.V., adapted from Inter IKEA Group (Inter IKEA Group, 2019)

The franchise business includes Inter IKEA Systems B.V. and its branches. They license the IKEA system and brands worldwide and work with the IKEA Concept. The franchise system creates flexibility and enables market expansion. The range and supply businesses have the task to develop and supply IKEA products. The business, therefore, spans across the total value chain and includes businesses such as IKEA of Sweden AB and IKEA Supply AG. The industry business is responsible for manufacturing products and focuses on parts in the value chain such as materials, manufacturing, and distribution. The business produces roughly 12% of the total IKEA product range. Product design takes place at IKEA of Sweden AB and to reach the goal of a circular business by 2030, IKEA has committed to having 100% of circular products and source only renewable or recycled materials by the same year.

2.1.2 Ingka Group

A dominant share of the stores is run by the franchisee Ingka Group. The franchisee interacts directly with the customers. They buy products from Inter IKEA and are then responsible for the distribution to the end customers and the return flows. The Ingka Group is made up of three main business areas: IKEA Retail, Ingka Centres, and Ingka Investments. IKEA Retail is the part most people come in contact with, as it comprises 374 IKEA stores operating in 30 markets. The IKEA Retail business represents around 90% of the total IKEA sales (Ingka Holding B.V., 2020a).

Ingka investments ‘...make responsible investments in people and businesses that make a positive difference to people and planet.’ (Ingka Holding B.V., 2020b). The result of investment collaborations is transferred to IKEA Retail to facilitate business development. The investment portfolio includes different themes, one of them being investments into the Circular Economy.

Ingka is part of the transition towards a circular economy and aims to create a business that fulfils customer needs while operating within the 2030s of the planet (Ingka Holding B.V., 2020b). Ingka develops circular services to enable customers to acquire, care for, and pass on products. Pilots have been done to explore usership models, take-back and buy-back services, second-hand platforms, and recovery of faulty products. Ingka also gives increased attention to spare parts and works to make it easier to repair and complement products with the necessary parts (Ingka Holding B.V., 2020c). According to the Ingka Group Annual Summary and Sustainability Report FY19, 65 million products were returned or damaged during 2019 and 47 million were diverted from going to waste. Over 38 million of these products were sold in IKEA’s bargain corners, referred to as As-Is areas, selling mainly unused returned products. The other products could be repaired or repacked and placed back on the shelves. All these figures have increased compared to the previous year.

2.2 The logistic supply chain of IKEA from a flow perspective

The following section is based on a presentation of the IKEA supply chain from a flow perspective given by a process developer at IKEA of Sweden.

IKEA’s distribution network has been successful in lowering total logistics costs while keeping availability high. Goods have been distributed from suppliers to distribution centres (DC) for replenishment but also through direct transport to stores. In addition, customer distribution centres (CDC), located closer to the customers, have been supplied from larger DCs and directly from the production facilities. The stores have traditionally been the meeting place for IKEA and their customers but through more extensive online shopping the use of CDCs and shipping of products have increased. Figure 5 below gives a schematic picture of the IKEA supply chain.

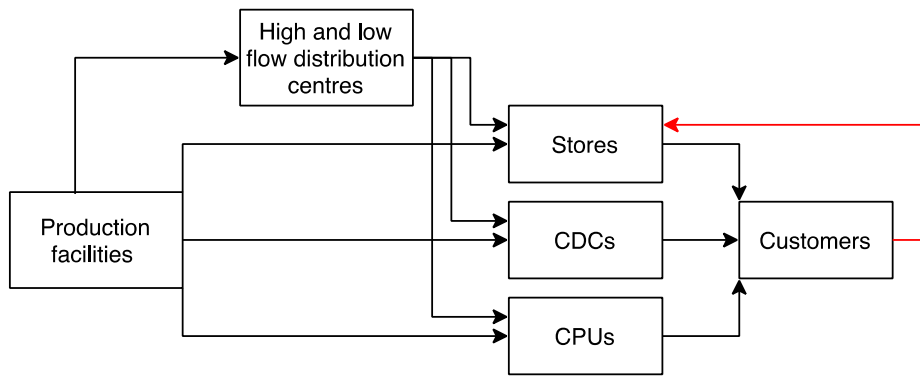


Figure 5. Simplified overview of the IKEA supply chain. The black arrows indicate a forward flow and the red arrow a reverse flow.

The distribution network of IKEA is developing, and a larger focus is given to where and how IKEA meets its customers. IKEA plan to introduce central parcel units (CPUs) to enable smoother shipping of orders, external and internal pick-up points to make it easier for customers to retrieve their goods and, in addition to the high flow DCs, implement low flow DCs closer to the markets.

IKEA, therefore, sees the need to define processes and enable planning for resources on the total market and multiple customer meeting points and not only for the traditional fulfilment units. This requires more flows to be taken into consideration and thus makes the planning process increasingly complex. The customer should be able to choose what, where, and when to buy and pick up their products as well as what services they require. On the other hand, IKEA should be able to choose what, where, and when to produce, store, replenish, pick, and receive returns. Throughout the supply chain there is a need for processes and planning. The ownership of resources is divided between Inter IKEA and the franchisees. The resources belong to Inter IKEA until they reach stores, CPUs, or CDCs where the ownership of the resources is passed on to the retailer. However, the planning process is owned by Inter IKEA and extends from production out to the end customer and further into a return flow.

2.3 Challenges and opportunities in a transition towards a circular business model

This section aims to give the reader a background of challenges and opportunities in a transition towards a circular business model. The transition involves multiple actors that must be considered. Important aspects brought up by external researchers regarding customers and companies, together with challenges for the supply chain and the environment when transitioning towards a circular business model are presented based on conducted interviews.

Customer challenges

The researcher within Design and Human Factors highlights the importance of making it convenient for customers to contribute to the circulation of products. Customers must find greater value in returning end-of-use and end-of-life products, in comparison to disposal. Additional actions, such as cleaning and re-installation, are often necessary when customers want to pass on or acquire previously used products. This may lead customers to dispose of products or decide to buy new ones. By offering services while keeping the ownership of the product during customer use, companies can take responsibility for the additional steps,

referred to as offering products as a service. Offering products as a service could make it more convenient for customers to act sustainably given that companies help them to return products after use.

Customers can be more or less positive toward leasing particular types of products, depending on how they are used. For products that are used temporarily, leasing is more attractive while it is preferred to own products that are used daily. It is therefore crucial to understand which products customers are willing to rent and how customers prefer to gain access to them to develop attractive usership models that hold advantages compared to ownership.

Besides products as a service, communication is key to facilitate the circulation of products. Customers must be aware of the possibility and benefit of recovering used products. By raising awareness, customers can become more willing to repair products instead of throwing them away and buying new ones. It is today often a question of cost, but the environmental benefit is becoming increasingly important for many customers in their choices. The segment of customers that have a positive attitude towards second-hand products is growing and reuse of products has gained status.

Company challenges

If linear consumption and production remain more attractive for customers and firms, circular business models will not gain ground. A transition towards a circular business model requires large investments and changes throughout organisations. Moreover, the value of changing to such a business model can be hard to predict and measure.

Yet, a trend can be seen where circular business models are becoming increasingly common among industries. This requires companies to change their mind-set regarding how they produce and sell products. The aftermarket becomes more important for companies when seeking to achieve prolongation and circulation of products. In a circular economy, the buying and selling of products is part of larger cycles that also include use and reuse. Hence, each purchase creates new business potential on the aftermarket where companies can create value by offering additional services and spare parts. On the aftermarket an increased demand for customised product offerings can be seen. An example brought up by the researcher within Design and Human Factors, is the company Superfront who offers customised fronts to IKEA's kitchen cabinets.

Different design strategies can be used to support companies in their transition toward a circular business model. A strategy brought forward by the researcher within Design and Human Factors, is *designing for extended use*. This strategy includes long-term utility and performance by making maintenance and part replacement easy and convenient and aims to ensure long-term attractiveness among customers. This strategy is gaining popularity among companies since it can often be aligned with the rest of a company's strategies regarding decisions on recycling and product material. Designing products for extended use is a good start, but pressure from society, with harder regulations and policies, is likely to make this strategy a must have in the near future. Companies looking to differentiate themselves from their competitors must thus find other ways. *Design for multiple use-cycles* is another design strategy that can be adapted to facilitate products to be used by different users over time. It focuses on providing clear instructions for how to use products as well as on enabling upgrades, and modification of products through modules.

Being able to successfully convert linear businesses to circular businesses, customers must demand such offerings, and companies must be able to deliver them. Policies and regulations can be introduced to push customers and companies towards sustainable consumption and production. EU directives, such as the Ecodesign Directive 2009/125/EC on Ecodesign requirements for energy-related products [2009] OJL285/10, sets rules to improve the environmental performance of certain products. This directive forces companies to rethink the way they design products and increase the requirements for energy labelling. The researchers describe that stricter requirements, which include a broader range of products and materials, are likely to follow for product design within the near future.

Challenges in the supply chain

When implementing a circular business model, new uncertainties arise in the supply chain, such as the assessment of product lifecycles. The concept of modified product lifecycles can be used to minimise such uncertainties. If companies can modify the lifecycles of products, they can reduce the uncertainty of when products return, and plan for the reverse flow. Many companies already have the technology and data to estimate product lifecycles since they are conducting testing to make sure their warranty times are applicable.

There is a need for increased visibility of products in the supply chain. Many companies would find value in tracking products along the supply chain and at end-user. The used tracking technology should vary depending on product value and characteristics. Digital products such as computers and smartphones can easily adapt technologies such as RFID, whilst products such as furniture are more suited to adapt for example barcodes. It was explained during the interviews that barcodes can be used to access stored data about products in a product passport. Each furniture would for instance have documented information regarding the manufacturing process, materials, and returning/recycling standards. Such a product passport could also increase the value of a product by, for example, allowing the customer to know how many times the product has been reused or what materials the product consists of.

There is large uncertainty in when and where products return, and the return flow varies over time. Product generations run alternately with various lifecycles. This requires a large amount of flexibility which is costly. In many recycling processes this uncertainty has been reduced by not focusing on recycling on a product level, but rather to look at a higher material level. This way it is easier to anticipate volumes and allocate capacity. This, however, requires a quite uniform flow with known materials like recycling of plastic bottles. When recovery processes are more product specific it is harder to plan on such a high level. However, standardisation from a logistical perspective by reducing part variety can make it easier to standardise these activities.

Environmental challenges

Product characteristics play a major role in the environmental benefits that are created. The benefits differ a lot between consumable and durable goods since it is hard to retain value in the consumable and often low value goods. Focusing on durable goods, it is important that they can be transported without being damaged. Further, environmental benefits can be created if bulky goods can be disassembled so that the fill rate increase and more goods can fit into a fewer number of vehicles. This is especially important for commercial transport and less so for private customers that transport low volumes. The goal should be to reduce the number of total

transportations. No additional transport occurs if a customer is driving to a store to purchase new products and at the same time return old products. The problem arises when customers need to do additional transporting to return products.

When evaluating the environmental benefits of circulating products, the efforts and resources needed in all the additional activities must be considered. For example, the transportation to customers, the return as well as necessary recovery processes can be less sustainable than a pure product offering. Every change of user will result in losses in product value. Being able to subscribe to products for short periods can promote short-cycled consumption and thus negatively impact the environment, despite the circulation of products. Considering, different set-ups might be needed depending on whether it is a fashion seasonal product or a long-lived product.

Designing products so that recovery is facilitated often requires more resources and material, which may initially result in increased environmental impact. To make these efforts sustainable the product must be used and recirculated as many times as designed for. It is important to measure the relative impact and effort to make sure that the intended value of product design can be captured.

3 Theoretical Framework

This chapter presents the theoretical framework for this thesis, based on previous research within the areas of reverse logistics, circular economy, and product- and use-oriented business models. The chapter starts with an overview of reverse logistics related to customer returns and circular supply chains and is followed by the main factors influencing reverse logistics activities. Thereafter, product-service systems are presented to gain an understanding of how product and service offerings can be used in a circular economy and how they affect reverse logistics. The theoretical framework ends with the research model for the thesis and formulation of research questions.

3.1 Reverse Logistics

Reverse logistics has been defined by Rogers and Tibben-Lembke (1998; 2002) as the movement of products in the opposite direction of a forward flow to create or recapture the value of products when possible, or otherwise proper disposal. According to Fleischmann et al. (1997) a reverse flow can occur through an organisation's traditional channels, through separate channels or in a combination of the forward and reverse channels, and is therefore not necessarily a mirror of the forward flow. When introducing reverse logistics to recapture the value of finished goods, the products enter a closed-loop network (Fleischmann et al., 2000). Closed-loop networks are more complex than traditional open-loop networks since in addition to forward logistics need to handle reverse logistics (Tibben-Lembke and Rogers, 2002). CE100 (2016) describes reverse logistics as one of the core enablers of the circular economy.

3.1.1 Driving forces behind Reverse Logistics

Many companies introduce reverse logistics in their supply chains to increase profitability. Another reason is that organisations are to an increasing extent being held responsible for their actions throughout the supply chains (Akdoğan and Coşkun, 2012). This responsibility has its origin in legal and social applications and generates multiple driving forces for companies' reverse logistics. De Brito and Dekker (2004) divide the driving forces into three categories; economic, legal, and social. More recent literature adds the environmental aspect as a driving force behind increased focus on reverse logistics and it is therefore brought up in the following sections where each of the forces is discussed separately.

Economic

From an economic perspective, returned products can offer significant advantages to a company. Recovery costs lower than expenses on raw material can reduce high production costs for new products (Akdoğan and Coşkun, 2012). De Brito and Dekker (2004) further explain that companies are getting involved with reverse logistics even with no profit directly projected, but rather as a strategic decision to reach competitiveness and preparing the organisation for future legislation. Fleischmann et al. (2000) describe that reverse logistics helps companies label their brand as sustainable to generate a positive green image. Such a brand image can increase sales for companies since environmental issues are increasingly gaining attention.

Economic incentives to support a circular economy through reverse logistics are also given through legislation. For instance, in Sweden, a lower tax rate on repairs of certain products was introduced in 2017 to increase the economic incentives for customers to choose repair over new products. The tax rate was reduced from 25 percent to 12 percent for repairing products such as bicycles, shoes, and textiles (Skatteverket, 2020). This is meant to create a higher demand for repair services and make it more attractive for companies to offer such services. Another example is the *Circular Economy Action Plan* brought forward by the European Commission as a part of the European Green Deal. The plan is formed to promote sustainable growth (European Commission, 2020). The action plan, among other things, requires EU countries to lower or deduct taxes on repair services and to make sure services are made easily accessible for customers.

Legal

Legislation in this regard refers to legal provisions stating companies' obligations to recover their products and accept them back (De Brito and Dekker, 2004). For instance, certain industries in the European Union have been forced to increase their responsibility in product recovery and are held accountable for a product's whole lifecycle (Akdoğan and Coşkun, 2012; Guide, Harrison and Van Wassenhove, 2003). The Extended Producer responsibility, EPR, aims to improve waste management and collection by shifting the cost and collection from municipalities to producers. EPR is applicable to certain products, such as batteries, in the entire European Union but extended to include a wider product range in some member states. Ongoing projects are looking at the possibility of extending the EPR concept to ensure a more resource efficient Europe (European Commission – DG Environment, 2014). Moreover, the European Green Deal, a set of policies, was set in place to reach the goal of a climate neutral Europe by 2050 and achieving greenhouse gas emission reductions of at least 50 percent compared to the levels of 1990 by 2030. The Green Deal advocates new business models that steer consumption away from disposables and focuses on leasing of products and services (European Commission, 2019). The European Commission also explores return systems and how these can benefit consumers. Included in their action plan is the proposal of a legislative waste reform and initiatives to stimulate a circular economy.

The aforementioned European legislations and policies have a great impact even globally since companies operating internationally need to assess the legislation stated in each country of operation (Akdoğan and Coşkun, 2012). Legislation and policies also determine what responsibility companies have regarding handling defects and warranties, hence, strongly influences return policies and customer rights (Chan, Chan and Jain, 2012).

Social

Corporate social responsibility, CSR, concerns how to incorporate social responsibility into companies' values and therefore pushes them to be increasingly involved in reverse logistics (De Brito and Dekker, 2004). CSR is increasingly important among customers (Chan et al., 2012) and therefore motivates companies to establish an image as socially responsible (Akdoğan and Coşkun, 2012). CSR addresses ethical values, economic well-being, and legal compliance and shapes the attitude, strategy, and relationships for a company (Sarkis, Helms and Hervani, 2010).

Environmental

The negative climate externalities caused by production and consumption are becoming increasingly alarming issues. The extraction and processing of resources are significantly contributing to global climate change (WWF, 2016). There is a need to make better use of what we already have, and scarcity of raw material is a rapidly growing issue along with the worsening climate externalities. World Economic Forum (2019) states that the annual global extraction of materials has grown from 27 billion tonnes to 92 billion tonnes during the years 1970-2017. Present production systems and a population of about 10 billion people in 2060 are estimated to require around 190 billion tonnes of materials every year. However, the main driver is not the growing population but rather our consumption behaviour where we use more resources per capita (World Economic Forum, 2019).

Reverse logistics is a key part of improving our resource utilisation since it allows products and material to circulate and be reused, repaired, remanufactured or recycled instead of generating waste and landfill. Adding reverse logistics to forward logistics allows closing the loop of production and consumption (Ellen MacArthur Foundation and Material Economics, 2019).

Bernon et al. (2018) discuss the importance of *tone from the top*, meaning that the attitude of companies toward a circular economy must come from top management by aligning circular economy values with the strategic directives. These values argue for a higher focus on second-hand products and reduced sales of new products. To achieve this, the values should permeate the entire organisation and be reflected in performance measures (ibid).

3.1.2 Reasons for customer returns

De Brito and Dekker (2004) broadly describe the reason for product returns as no longer functional or functions no longer needed. The reasons for returns vary once the products have reached the customers and can be divided according to the product's lifecycle, shown in Table 1. Firstly, in a business to customer (B2C) context, customers have reimbursement guarantees which allow them to return the product if expectations are not met, regardless of underlying reasons (ibid). Secondly, warranty and service returns allow customers to return products with functional or quality errors even after the reimbursement guarantee. Returned products are either repaired, replaced with a product promised to meet the standard or the customer receives the money back (ibid). Warranty is often limited in time, but customers can still utilise suppliers' repair services in exchange for a fee after expired warranty. Finally, de Brito and Dekker (2004) explain end-of-use (EOU) and end-of-life (EOL) returns. EOU returns often refers to leasing cases where the customer can return the product in a specific stage of the product lifecycle. EOU can also refer to returns ending up on the second-hand market (ibid). EOL returns are instead the products that have reached the end of the lifecycle. Krikke et al. (2004) describe how legislation can increase the return rate and reduce negative externalities such as environmental contamination.

Table 1. The customer return reasons related to the product's lifecycle (De Brito and Dekker, 2004; Krikke et al., 2004)

Reasons for Customer Returns	
B2C commercial returns	Reimbursement guarantees
Warranty and service returns	Functional and quality errors
EOU returns	Products reach a specific stage of lifecycle
EOL returns	Products reach end of lifecycle

3.1.3 Reverse Logistics Activities

This section aims to show how value can be recovered from products returned by customers through different activities. As previously discussed, a closed-loop network is more complex than an open-loop network, and the recovery is only one of the additional activities involved in reverse logistics. Fleischmann et al. (2000) define the activities in a reverse logistic process as collection, inspection, separation, reprocessing, disposal, and redistribution. Since this thesis focuses on prolonging the life of products and circulation, the disposal activity will not be further discussed.

Collection

Covers all activities involving collecting and physically moving the products to a point where further handling is performed. The collection often involves purchasing, transportation, and storing. This activity could be imposed by legislation, such as take-back obligations and responsibility for packaging materials.

Inspection

In this activity, products are inspected and the quality of returned product measured. Inspection can include disassembly, shredding, and testing of products (Fleischmann et al., 2000). Inspection can be done at different points in the reverse flow, in centralised models the evaluation is done later than in decentralised models.

Separation

The separation activity refers to how products are sorted depending on different characteristics determined by the former *inspection* activity. On a high level the separation is done as re-usable products or disposal. Separation serves to make the most profitable and suitable decision for disposition (Blackburn, Guide Jr, Souza and Van Wassenhove, 2004). The separation process results in splitting flows and includes sorting and storage (Fleischmann et al., 2000).

Reprocessing

Refers to the actual recovery of the product and can take different structure depending on the inspection and separation. The recovery process can be divided according to the processes: reuse, repackaging, repair, refurbishing, remanufacturing, and recycling (Sahyouni, Savaskan and Daskin, 2007; Thierry, Salomon, Van Nunen and Van Wassenhove, 1995). The recovery

processes reuse, repackaging, repair, and refurbishing will be explained in more detail in section 3.1.4.

Redistribution

Includes the handling of re-usable products back to a potential market. This activity often contains sales, leasing, transportation, storing, and marketing (CE100, 2016).

3.1.4 Recovery processes

This section describes the different recovery processes identified above; reuse, repackaging, repair, and refurbishing. Aligned with IKEA's desire to keep product value high for as long as possible and do reprocessing as close to the customers as possible, remanufacturing and recycling are not considered in this section.

Reuse

The purpose of reuse is to pass on used products to second-hand markets with none or minor improvements (Sahyouni et al., 2007). A major challenge for the reuse activity is the process of collecting and passing on. Hopkinson, Zils, Hawkins and Roper (2018) identified large differences in customers' willingness to return products across markets when studying a case of cartridges. This made it difficult to scale up and implement uniform reuse strategies in Europe. The authors highlight the importance of incentive structures for returns and an infrastructure that makes it easy for customers to pass on products rather than turning to the option of direct disposal.

The customer perception of second-hand products is also a barrier to the market. Customers that favour previously used products over new products are still seen as a niche group and environmental considerations are often not highly prioritised when making a purchase (Hopkinson et al., 2018). Marketing has for a long time led customers to view new products as superior to used ones and their role can play an important part in a transition to a circular economy by re-educating customers to incorporate sustainability concerns in their choices (Hopkinson et al., 2018).

Repackaging

The repackaging process is done to return items to stock. Through evaluation, the items that can be restored by only exchanging the package are identified (Stock and Mulki, 2009). Repacking can take place immediately after product return if the product itself is in perfect condition, if packaging supplies are available at the processing facility. Due to legislation and other restrictions not all product returns can be sold as new after repackaging. These concerns products where quality and safety cannot be ensured (ibid).

Repair

Thierry et al. (1995) define repair as an activity involving fixing or replacing smaller parts to make a product functional. The ease of repair is to a large extent determined by product design since the product must be designed in such a way that components and worn out parts can be replaced. Ellen MacArthur Foundation (2016) highlights the barrier of getting customers to choose repair over disposal. This requires creating incentives that make it a favourable option. The service should be easily accessible, time efficient and offered at an attractive price.

Refurbishing

Refurbishing aims to bring used products up to a pre-specified quality by disassembling specific parts into modules (Thierry et al., 1995). The modules are inspected and repaired or replaced and the refurbishing upgrade is, therefore, more extensive and resource intensive than reuse, repackaging, and repair processes. In Table 2 the main characteristics of the presented recovery operations are summarised.

Table 2. Comparison between the recovery processes

	<u>Recovery description</u>	<u>Recovery purpose</u>	<u>Market after recovery</u>
Reuse	Pass on product with none or minor improvements	Ensuring product functionality	Second-hand market
Repackaging	Repackaging product in perfect condition with damaged package	Returning product to stock	Sold as new product / Second-hand market
Repair	Fixing or replacing smaller parts	Making the product functional	Second-hand market
Refurbishing	Disassembly, inspect and repair/replace modules	Bring product up to a pre-specified quality level	Second-hand market

3.1.5 Characteristics of a logistics system

The characteristics of reverse logistics and forward logistics have different uncertainties that influence managerial, financial, and strategical decisions (Tibben-Lembke and Rogers, 2002). These uncertainties are further affected when introducing circular economy values. Bernon et al. (2018) argue that there is an absence in understanding how the values of the circular economy should be operationalised into reverse logistics and aligned with strategic directives.

This section takes the previously described activities and recovery processes as a starting point when discussing characteristics of a logistics system, identified by Tibben-Lembke and Rogers (2002). The aim is to identify uncertainties arising when managing reverse logistics in a circular economy.

Forecast

Planning for a reverse flow is more complex than for a forward flow because of the uncertainties involved in the process (Guide et al., 2003). In forward logistics a forecast is used to predict needed products, and is one of the main activities to plan for seasonal fluctuation and other changes in the market to provide visibility (Tibben-Lembke and Rogers, 2002). In reverse logistic flow, the visibility is much lower which generates a reactive flow. Companies try to respond to customers' actions rather than initiate reverse flow activities in planning and decision making (Tibben-Lembke and Rogers, 2002).

Forecasting a reverse flow is, therefore, more difficult, however, a large-scale reverse flow tends to follow the same trends as a forward flow but with some time lag. Tibben-Lembke and Rogers (2002) explain that a large forward flow of products for holiday sales is most certainly followed by a post-holiday return flow. The same trend is found when a sale promotion of

specific products is done to increase the sales, resulting in an increased return flow of the same product.

Even if reverse flows can follow forward flows on a larger scale, the difficulty is to understand the different return rates for the different products. Customers' decisions to return a product is based on multiple factors such as how user-friendly the product is to operate, how clear the instructions are, and how likely it is for the customer to experience buyer's remorse (Tibben-Lembke and Rogers, 2002).

When forecasting reverse logistics in a circular economy, additional attributes need to be considered. A circular economy has a greater focus on products at the end of their lifecycle, and due to a high variety the uncertainties in the timing of product returns increase (Matsumoto, Umeda, Tsuchiya and Tang, 2016). EOU and EOL returns depend on customer usage and wear, which increase the complexity of forecasting.

Transportation

The number of origins and final-destination points is one of the major differences between forward logistics and reverse logistics (Fleischmann et al., 1997). Forward transportation is characterised by few origins and many final destinations. Reverse transportation is characterised by many origins and few destinations during collection, while redistribution is characterised by few origins and many final destinations (Fleischmann et al., 2000). From a logistics perspective, Dekker et al. (2004) therefore argue for a *many-to-many* distribution network when integrating collection with the redistribution, as shown in Figure 6.

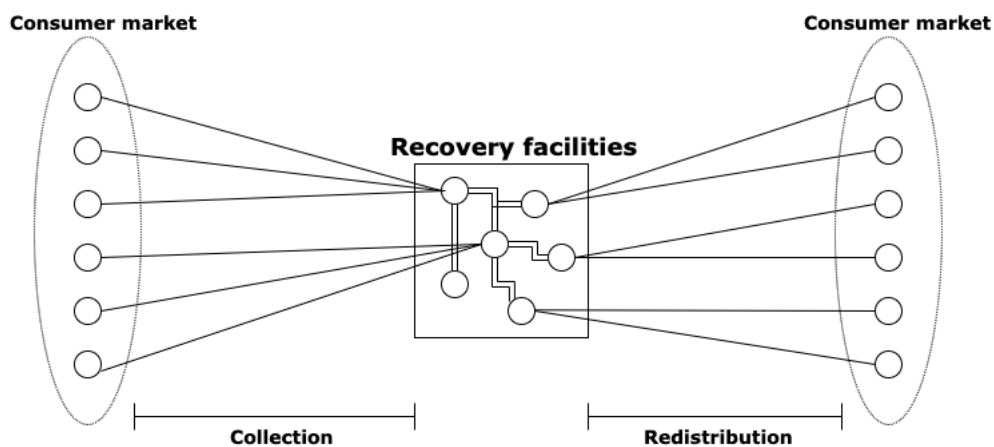


Figure 6. Product recovery network, adapted from Fleischmann et al. (2000)

Increased e-commerce within retail has led to a more decentralised distribution system that has the potential to extend the geographical acquisition area when collecting goods. For example, home delivery results in that customers interact with retailers in their homes to a greater extent (European Environment Agency, 2017). However, the difference between forward and reverse logistics makes it complex to combine the two distribution networks. Tibben-Lembke and Rogers (2002) describe the difficulty of combining the transportation since forward transportation is often set up as milk runs and any returned goods loaded on the truck during the milk run must often be unloaded at each subsequent stop to allow new goods to be unloaded.

Introducing a circular economy means that the transportation in return flows will be characterised by larger volumes and higher variety due to EOU and EOL products. The majority of traditional return flows happen shortly after the point of purchase whereas returns in a circular economy happen throughout the product lifecycle. The importance of reducing energy consumption per unit is further highlighted in a circular economy (Bernon et al., 2018), resulting in higher pressure regarding a shift towards renewable energy and higher filling ratios during transportation.

Product quality

The quality of returned products is important for how they should be managed in a reverse flow. Tibben-Lembke and Rogers (2002) point out that product quality can be considered rather uniform within forward logistics whereas the product quality in reverse logistics is often quite uncertain and inherit a high degree of variation. Determining the product quality at an early stage is important for efficient handling of returns, as products in different conditions require different actions in the reverse logistics activities. Returned products can either possess a functional or material value depending on the condition. This can be captured by going through recovery processes that support circularity (Das and Chowdhury, 2012).

Consideration to reverse logistics and recovery processes must be taken already in the design phase to facilitate the recovery and circulation of products. If products are designed to be easily recovered it can save both time and money (Das and Chowdhury, 2012). By applying modular design principles, the recovery process can be made easier which in turn reduces cost as lead times decrease. Das and Chowdhury (2012) explain how products can be designed at different quality levels depending on the intended use and reuse. A product that is designed to be mounted and dismounted several times must hold a higher quality compared to products that are disposed of after a single use. The circular design makes restoration and regeneration possible at the end of product lifecycles (Ellen MacArthur Foundation, 2015). Also, high quality products are more durable and can stay with customers for a longer time which can slow down consumption and reduce waste.

Packaging quality

New products in a forward flow are delivered in packaging to protect the goods during transit and allows the products to be palletised neatly to reduce storage space and risk for damage (Tibben-Lembke and Rogers, 2002). In comparison, most returned products do not have complete packaging, some products are not properly re-packaged, and some packages are damaged. When shipping returned products, goods cannot be properly palletised because of small volumes and a large variety in size. Many of the pallets are therefore unorganised with different sized packages and more susceptible to damage during transport (Tibben-Lembke and Rogers, 2002).

When returning a product and the end of its lifecycle, the product likely lacks packaging completely due to the time from the point of purchase. Shipping unpackaged goods increase the risk of damaging the products which are a major challenge when aiming for maximising the circulation of used material (Meherishi, Narayana and Ranjani, 2019). Using recyclable or reusable packaging is further important in a circular economy to reduce waste (Meherishi et al., 2019).

Destination, routes, and channels

In a return flow, the channels are often exception driven and reactive rather than proactive due to the large uncertainties that lie in when and in what condition products will be returned (Fleischmann et al., 2000). Reverse logistics is generally not a product of precise planning but rather a response to customers' actions and therefore involves a lot of uncertainty regarding routes and destinations (Rogers, Lambert, Croxton and Garcia-Dastugue, 2002). Inspection and separation activities are needed to determine routes and destinations and are important to reduce uncertainty and facilitate better planning of the flows through different channels (Tibben-Lembke and Rogers, 2002).

A return flow can be centralised to varying degrees. In a centralised return flow, the handling of returns is done in one or a few places, such as a distribution centre, which facilitates consolidation. If a retailer is supplying a large number of stores, efficiency has been shown when picking up returns with the same vehicles that distribute goods from the distribution centre. De Koster, De Brito and Van de Vendel (2002) argue that this saves both time and space since the same resources can be used for both the forward and reverse logistics. However, the authors conclude that a retailer who handles a large number of returns gain efficiency by handling returns in a separate area. The separation is also dependent on the market if new and returned products are sold on the same market, integration is preferred and vice versa (De Koster et al., 2002).

Bernon, Cullen and Gorst (2016) and Nuss, Sahamie and Stindt (2015) instead advocate the importance of multiple return points, a decentralised approach, to reduce transport time and to enable smooth returns for customers. Nuss et al. (2015) further present the two types of collection models, bring-in, and pick-up systems. The bring-in system can include services such as drop-off sites, take-back in-store, and parcel returns. A pick-up system refers to when a retailer picks up goods at the customer, either by third-party transport providers or in its regime.

Hübner, Holzapfel and Kuhn (2016) highlight the importance of letting customers return products independent of the ordering channel. Goods ordered online should be accepted by stores and vice versa. This means that return services should be offered on multiple channels. Offering return options across channels provide a better customer experience but it is also an opportunity to cross-sell and up-sell according to Zhang et al. (2010).

Pricing

The reason for a return is often reflected in the price. A product that is returned because it did not meet expectations can most often be repackaged and sold as new at the same price. In a circular economy, products are to a larger extent returned in EOU or EOL. The closer a product is the end of its lifecycle, the less attractive the product becomes. Greater variety in product conditions leads to a larger variety in the pricing of products. If products go through recovery processes before redistribution, these must also be reflected in the price (Ellen MacArthur Foundation, 2015). The above factors increase the uncertainty of matching the price with the willingness to pay among customers (Tibben-Lembke and Rogers, 2002).

Cost

The cost structure in reverse logistics differs compared to forward logistics. A cost structure in forward logistics is well defined with accounting systems to manage the products through the chain (Tibben-Lembke and Rogers, 2002). Reverse logistics has less visibility since each product is often handled individually which generates a different nature of the cost structure.

Tibben-Lembke and Rogers (2002) describe several activities where return logistics differ from forward logistics in relation to cost. When collecting returned products, the shipment size is generally smaller, meaning that the transportation cost per item tends to be higher. In addition, many products require redistribution to be sold (Fleischmann et al., 2000), and therefore transportation often is a major cost in reverse logistics. Small shipment volumes further generate more material handling which increases the handling cost per item, as returned products need extra labour for quality inspection and separation. Cost related to inspection and separation is often larger when circular economy values are embedded in reverse logistics due to higher uncertainty regarding product quality (Bernon et al., 2018).

Regarding inventory, holding cost is generally seen as a percentage of a product's value. Since returned products have a lower value, inventory holding cost can generally be considered lower. The holding cost is further dependent on the product's obsolescence and shrinkage of theft which affect the value of the product (Tibben-Lembke and Rogers, 2002). With EOU and EOL returns, the obsolescence tends to be higher because of the time difference between the point of purchase and point of return. Consequently, the time difference often reduces the product value and the risk of theft. Tibben-Lembke and Rogers (2002) argue that the cost for recovery processes can be lower than manufacturing new products, depending on the context. This said recovery processes for obsolete products tend to be more expensive due to outdated assortment, resulting in a huge number of products entering the waste stream (Guide Jr and Van Wassenhove, 2009).

Inventory management

In a forward flow context, the uncertainties for inventory management are mainly dependent on product demand, while the selling price is considered known (Silver, Pyke and Peterson, 1998). In a reverse flow context, product arrivals are characterised by more randomness, and selling price is determined at a later stage which results in difficulty when applying traditional inventory models (Tibben-Lembke and Rogers, 2002). Considering that the volumes are generally low in reverse flows compared to forward flows, inventory management has not received a lot of attention in research and practise (ibid). In a fully circular economy, all products should be reintegrated in the supply chain after use, leading to a significant increase in volume.

In general, inventory levels are highly dependent on the return process as an efficient return process enables products to faster become re-sellable (Hübner et al., 2016). Hübner et al. (2016) describe the different advantages and challenges that follow for inventory management depending on the chosen reprocessing location. Reprocessing in the store has the advantages of fast reintegration into store inventory and lower transportation costs. However, space is often scarce and reprocessing costs high. Having a separate recovery centre allows for specialised and often cheaper reprocessing but results in more time-consuming reintegration into inventory and additional transport costs. The trade-off between freight rates and inventory holding should be considered. Centralised inventory lowers the inventory costs but often results in increased

need for transport while decentralised inventories have higher holding costs but allow for shorter distance transports (Hübner et al., 2016).

In a closed-loop supply chain, inventory management also includes the storage of spare parts to facilitate recovery processes. Storage of a large variety of parts during a long period incurs high inventory costs. Savolainen and Collan (2020) lift the opportunities of additive manufacturing, commonly referred to as 3d-printing, to reduce service lead-times and risk of inventory obsolescence. Additive manufacturing allows for spare parts to be printed on demand and a greater variety can, therefore, be offered. However, the use is unexplored in the retail business and the trade-off between stocking parts and printing on demand must carefully be considered (Savolainen and Collan, 2020).

Product lifecycle

The product lifecycle is different in reverse logistics compared to forward logistics. The main purpose of reverse logistics is to recapture the value of used products. The remaining value in a product depends on whether the product still has a demand on the market (Tibben-Lembke and Rogers, 2002). If a product is phased out because that product class is replaced by an improved and superior product, a returned product will have low value on the second-hand market. On the other hand, if a product is replaced by a similar product, the value can remain high since the returned product might still be attractive as a substitute for the new product.

In a circular economy, the prolongation of product lifecycles is central. Products can, for instance, be upgraded by replacing outdated components to improve the quality and extend the product lifecycle (Sahyouni et al., 2007).

Marketing

A major problem with marketing communication linked to returning products is that retailers cannot promote specific products outside the store because of the uncertainty of supply. This limits communication with potential buyers (Tibben-Lembke and Rogers, 2002). A consistent supply of products generates reliability among customers that specific products are offered in-store (Goltsos et al., 2019). Irregular returns in a reverse flow further risk to damage a company's reliability since the availability of products are uncertain (Consumer Reports, 1998; Gurnani and Shi, 2006). Retailers have therefore introduced outlets only selling overstocked and returned products to separate forward products in regular stores from returned products.

The marketing of returned goods is further uncertain for retailers because of the risk of product cannibalisation. Tibben-Lembke and Rogers (2002) describe a belief among retailers that customers purchase a certain number of products and selling second-hand products would, therefore, be at the expense of selling new products and result in lower margins.

Iannuzzi (2017) argues that green marketing is becoming imperative to attract customers in many markets. Customers are to a greater extent demanding sustainable products and companies can see competitive advantages and added value in offering these products. A successful marketing strategy is built on credibility, acknowledging customer demands, and appropriate communication of the green attributes of products according to Iannuzzi (2017). A non-transparent and faulty green marketing can however severely hurt brand image and reliability and lead to greenwashing. Greenwashing can be defined as misleading customers

about environmental practices or the environmental benefits of a company's products or services (ibid).

Track and trace visibility

To enable companies to manage reverse logistical activities efficiently, information systems are needed. The selection of appropriate information systems can reduce cost and increase visibility and the possibility of capturing value in the return process (Mahindroo, Samalia and Verma, 2018).

The quantity and speed of available data have increased during recent years due to internet technologies and has opened up for improved visibility in the supply chain (Kumar et al., 2016). Available technology makes it possible to track products using for example RFID tags. The cost of this technology has for a long time been a barrier for implementation on low value and mass-produced products, but during the last years the prices have dropped significantly making it a more viable alternative. For example, the fast fashion industry has started to adopt RFID technology and has proven its cost efficient in forward logistics as it can provide useful data and significantly reduce handling time for inventory (Cilloni, Leporati, Rizzi and Romagnoli, 2019). Kumar et al. (2016) discuss the opportunities that lie in the internet of things to increase visibility in reverse flows. Sensors embedded in products can provide companies with quality and usage data, information that facilitate better planning processes, and a greater understanding of customers' behaviour. Improved visibility can reduce the uncertainty in the timing of product returns by increasing predictability (ibid).

The need for track and trace capabilities increases in a circular economy since there is a need to keep track of products and materials to ensure circular processes. Werning and Spinler (2020) lift the lack of supply chain visibility as the major barrier for a circular economy and highlights the importance of clear metrics to achieve and sustain circular business models. Hopkinson et al. (2018) advocate investments in information management systems and technology to enable real-time visibility and predictive maintenance and argue that it is critical for circular business models.

3.2 Factors influencing the design of reverse logistics activities

New and changed needs arise for the activities in reverse logistics in a transition towards a circular economy. This section aims to describe design alternatives for the activities; collection, inspection, separation, reprocessing and redistribution, and identify influencing factors. The inspection and separation activities often take place simultaneously and are therefore presented jointly.

3.2.1 Collection

The collection activity is characterised by multiple origins and few destinations and occurs between the consumer market and recovery facilities, showed in Figure 7 (Fleischmann et al., 2000).

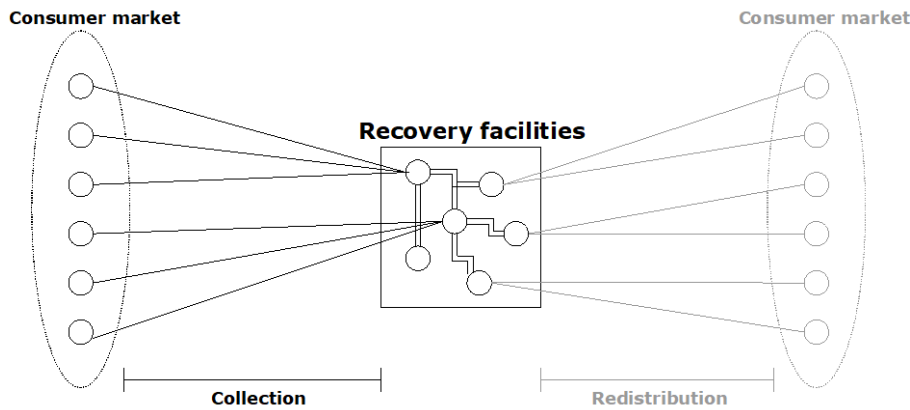


Figure 7. Product recovery network with a focus on the collection activity, adapted from Fleischmann et al. (2000)

The process of collecting goods can be described in three steps: incentivising returns, designing the collection channel, and pre-sorting of goods (Goltsos et al., 2019). There is not much value in designing products for reuse or recovery if they never return to the supply chain (Ellen MacArthur Foundation, 2020). Incentivising the customers to return products as one of the main challenges for retrieving goods. According to Ellen MacArthur Foundation (2020), customers are more willing to return products if they perceive it to have value. To incentivise customers the key motivators; reward and convenience are commonly used. For reverse logistics this translates into a convenient product return process or a system where customers get rewarded for returning products.

The uncertainty in when and if products will be returned combined with the uncertainty in how many that will return constitutes the main challenges for designing the collection activity (Goltsos et al., 2019). The timing and quantity of product returns must be estimated to design and operate efficient collection processes. The collection of products is highly dependent on product value according to Ellen MacArthur Foundation (2020). If a product is characterised by low value, it is increasingly important that it is easy for the customers to return the products. The recovery of these products must be supported by local infrastructure such as home collection recycling. If products inherit medium value, take-back schemes can be used. This can be exemplified using the beverage bottle recycling model used in many countries in Europe where customers return bottles to easily accessible collection points and receive a deposit in return. For high value products, customers are in general willing to sell or swap products and often use platforms or third party actors to do so (Ellen MacArthur Foundation, 2020).

Depending on the business context, single or multiple channels can be used for collection. If the consumer market is characterised by multiple origins, it is important to expand the geographical acquisition area for the collection activity (Fleischmann et al., 2000). This can be facilitated by offering collection through multiple channels. Different actors, such as the manufacturer, retailer, or a third party can be responsible for the activity. According to Savaskan, Bhattacharya and Van Wassenhove (2004), a collection channel operated by retailers is preferred in most cases since the retailers are located closer to customers. Choi, Li and Xu (2013) supports this argument and highlight the environmental benefits of the collection done by retailers as distances become shorter. The collection channel can also be operated by a network of actors to increase customer reach and consolidate volumes (Choi et al., 2013).

Vlachos, Georgiadis and Iakovou (2007) bring up stricter legislation as a reason for increased attention on the collection activity. Obligations, such as take-back obligations, are to a greater extent introduced in markets to increase producer responsibility and environmental consciousness. The extended producer responsibility legislation, present in the European Union, cause a greater need for collection of the concerned products. For low value products covered by the legislation, CE100 (2016) suggests the implementation of centralised collection schemes to achieve cost-effective collection from large geographical areas.

Reverse channels face challenges to adapt their capabilities and capacity to handle the take-back of products. The number of collected products is dependent on the rate of the collection which in turn is determined by the collection capacity and the willingness amongst customers to return products. To establish long term profitability in the reverse logistics, companies must ensure that the right volumes, in the right quality and at the right cost are collected (TU Delft, 2017).

3.2.2 Inspection and separation

Traditionally supply chains have been designed to minimise processing costs of returns and not to recover value. Ellen MacArthur Foundation (2016) advocates the evaluation of products at an early stage to limit the reverse logistics flow to only include products and materials that can be recovered. With a thorough inspection early on, the products can be separated and handled more efficiently using operations tailored to flow characteristics.

Blackburn et al. (2004) debate whether it is desirable to inspect products early or late in the return process based on the time sensitiveness of the value of products. Their findings are presented in the following paragraphs. The authors divide products into the two categories of functional and innovative. Functional products are less time sensitive and the marginal value of time is lower compared to innovative products. Innovative products are instead characterised by short lifecycles and high time sensitivity. The characteristics influence the supply chain design and for functional products an efficient supply chain can be favourable even though speed is sacrificed in favour of cost efficiencies. For innovative products, speed is valued higher than cost and a responsive chain can, therefore, be beneficial even if it is achieved at a higher cost.

The key difference between efficient and responsive models lies in where the inspection activity occurs in the supply chain. To reach cost efficiency, the inspection activity can be centralised while the activity can be decentralised to gain responsiveness and quick processing of returns. In Figure 8 delayed and early product differentiation is visualised based on the findings of Blackburn et al. (2004).

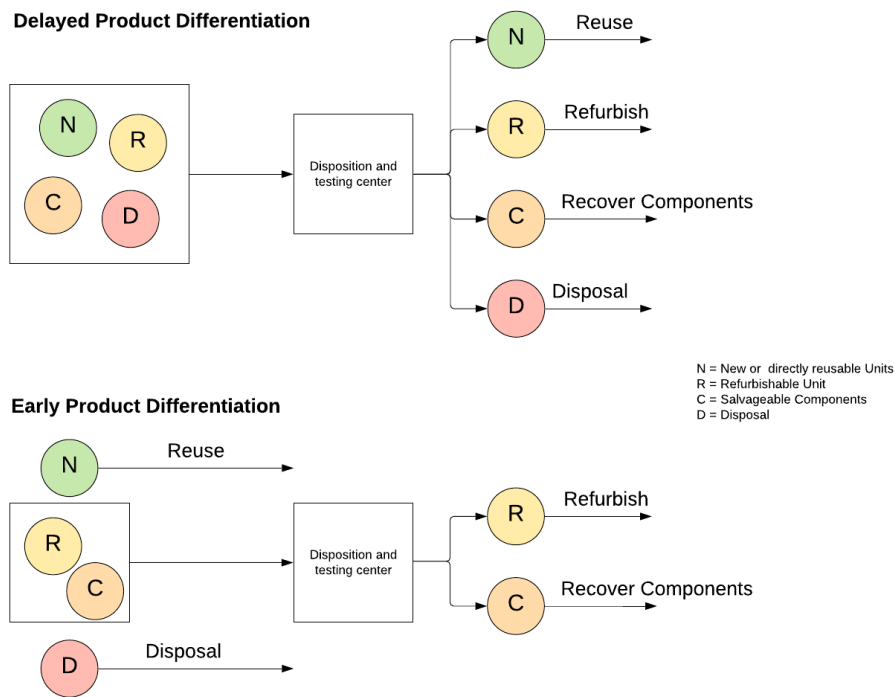


Figure 8. Delayed and early product differentiation in the reverse flow, adapted from Blackburn, Guide and Souza (2004)

The efficient model achieves economies of scale in both the reprocessing and transport of products. The lowered costs however come at the expense of delays. The model stems from the postponement strategy within forward logistics which delays the differentiation of products. In forward logistics the strategy has been successfully used to deal with the cost of variety and multiple inventories. The efficient model also carries benefits for third parties and retailers as all products can be sent to a central location without sorting. Applying postponement in reverse logistics is less advantageous as the product variety and condition is given already when the return is received. The condition might not be directly observable but can be determined through inspection and testing.

In the responsive model, testing and inspection are decentralised to facilitate early process differentiation. The model seeks to achieve preponement by evaluating products at multiple locations. Directly reusable and disposable products can be diverted from the main return flow early on to increase speed in the handling. Directly reusable products have higher value and benefit the most from early differentiation. This approach serves to reduce congestion and queuing for products in need of recovery to keep product value as high as possible.

One challenge to achieving this type of reverse supply chain is the needed capability to quickly and cheaply determine the quality of returned goods. Including technology in products can reduce the cost of inspection by generating data on the condition of products and the need for maintenance in a time efficient manner. Technology can offer the possibility of both responsive and efficient return supply chains as the quality inspection can be done remotely (Blackburn et al., 2004). Informational value is created when inspecting products (TU Delft, 2017). It gives valuable information about customer usage patterns, wear and tear, and customer complaints. This is information that can be used to improve both supply chain activities and product design.

3.2.3 Reprocessing

In a circular economy it is increasingly important to recapture the value of returned products to avoid disposal. To be able to handle larger volumes, companies must have resources to recapture value efficiently (Fleischmann et al., 2000). Thorough inspection and separation are a pre-requisite for the reprocessing activity as the quality of products determines the feasibility of different recovery processes. Reprocessing can be done on material level through recycling, but a higher value can be generated if done on a component or product level (TU Delft, 2017). These are the levels considered in this section.

The reprocessing activity includes decisions on production, handling equipment, and workforce size (Dekker et al., 2004). The processes face a high variety in timing, sequencing, and batching for resources due to a high uncertainty of volume (ibid). In closed-loop networks, multiple forward and reverse flows are crossing each other's paths, and Dekker et al. (2004) describe the value in integrating several of these operations in the same facility to achieve economies of scale by sharing fixed assets and reduce overhead costs.

To gain the most benefit of integrating flows, the flows should utilise similar operations. Fleischmann et al. (2000) discuss the width and depth of recovery networks. The number of locations with similar operations is referred to as the width of the network. The network depth is the number of facilities that returned products pass before they enter the second-hand market. These factors together determine the degree of centralisation (ibid). The possibility of integrating networks is very much dependent on the type of recovery processes involved in the reverse flow (De Koster et al., 2002). The network width is dependent on the geographical spread and is a trade-off regarding transportation distance and equipment setups. The network depth depends on recovery processes and product complexity. Therefore, the involved operations in the different recovery processes for this thesis are presented below to enable a discussion regarding the degree of centralisation and the potential of network integration.

Reuse

The reuse process focuses on passing on products to new customers and often require storing space as the passing on seldomly occurs instantly. The design of the reuse process is closely related to the decision of where to perform inspection and separation. The argument of having the retailer to be responsible for the collection is supported if many of the products are separated into the reuse process since the products stay close to the customer touchpoints and minimise the transportation and time between collection and re-selling point (Choi et al., 2013; Savaskan et al., 2004). Integrating the reuse process to a forward flow would however require space in the forward flows' customer touchpoints.

Repackaging

Repackaging focuses only on package recovery and assume the product to otherwise be in new condition. Stock and Mulki (2009) state that repackaging can occur directly after inspection for products in new condition. The complexity of packaging quality in return flows results in high uncertainty regarding the demand for packing material (Tibben-Lembke and Rogers, 2002). For instance, if most of the returned packages are damaged, the return flow might consider investing in equipment capable of effectively repackaging the products. If the packages on the

other hand are packaged incorrectly, the repackaging process instead need the capacity to repack the existing packages.

Repair

With repair, Thierry et al. (1995) refer to fixing and replacing small parts to improve the product's function. Ellen MacArthur Foundation (2016) lifts two barriers for product repairs; lack of repair information and lack of available spare parts.

Firstly, there is a lack of available information on how to repair products. Repairs can be done directly by customers, manufacturers, or external service providers. Manufacturers are likely to have comprehensive information about the products while customers and external actors seldom do. The more complex a product is, the harder it becomes for these actors to successfully repair the product. Ellen MacArthur Foundation (2016) hence identify the availability of repair information as crucial to avoid disposal of products that can be repaired if the right guidance is provided.

The second barrier for product repairs is the availability of spare parts. The availability of spare parts for the public is often limited and expensive in comparison to the price of new products. Spare parts logistics is difficult since the parts often represent a small value and are needed in a large variety. Stocking and shipping spare parts are costly. To enable repair close to the customer and decrease the cost of spare part management, companies can take advantage of the possibility to disassembly and use spare parts from returned products as spare part supplies. To facilitate smooth repairs, there must also be easy identification of all the parts in a product so that needed spare parts can be uniquely identified and supplied. Ellen MacArthur Foundation (2016) suggests that spare parts should be made available for a period after manufacturing that reflects the potential product lifecycle.

Refurbishing

Refurbishing can be divided into four main operations; disassembly, quality inspection, renovation, and reassembly (Kaya, Bagci and Turkay, 2014; Thierry et al., 1995). Disassembly is the first operation in refurbishing and aims to separate specific parts from the products into modules. Each module is quality inspected to decide whether it can be renovated or disposed of. Unlike the previously described inspection activity, quality inspections within refurbishing are similar to inspections done in a forward flow for new products. This means that manufacturers most likely have existing experience about these inspections. They can, therefore, be integrated into the forward activities to share assets. In refurbishing, most of the modules pass the quality inspection and then enter the renovation operation before the modules are reassembled.

Refurbishing is more complex to integrate close to the customer touchpoints since more resources regarding material, equipment, and labour are required (Thierry et al., 1995). The potential for refurbishment is further determined to a large extent on the product design (Sahyouni et al., 2007). For a complex product in need of expensive equipment and extensive product knowledge, it is a challenge to remain the refurbishing process at the retailer.

3.2.4 Redistribution

Redistribution refers to the diverging product flows from recovery facilities to demand points in the consumer market, see Figure 9.

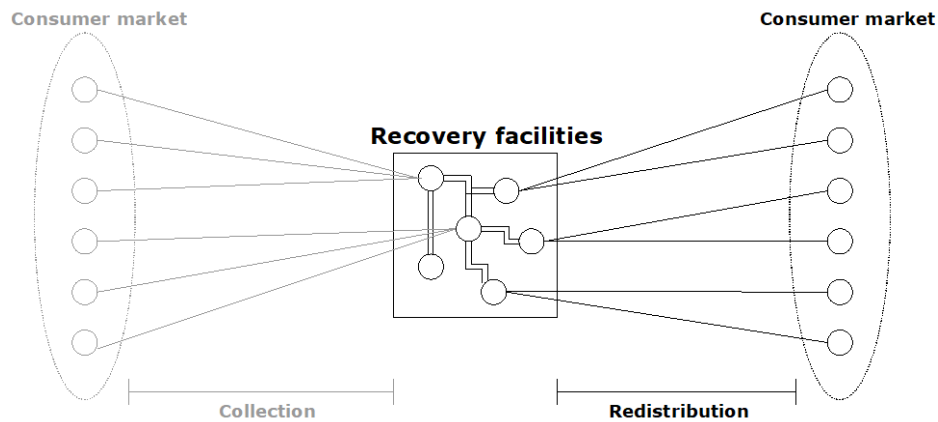


Figure 9. Product recovery network with a focus on the redistribution activity, adapted from Fleischmann et al. (2000)

Redistribution is characterised by few origins and many destinations, as traditional distribution networks in forward flows (Fleischmann et al., 2000). Fewer recovery facilities result in fewer redistribution routes. Consequently, multiple recovery facilities may entail several redistribution routes (Fleischmann et al., 2000). Further the geographical distribution and volume are important factors when deciding redistribution routes. The number of recovery facilities are related to the infrastructure of collection, separation, and reprocessing and depends on the width and depth of the network.

To seize the value of product recovery, companies must be sure that there is a demand for second-hand and recovered products on the consumer market (CE100, 2016). Therefore, the redistribution activity also involves remarketing of the recovered products. Customers perceive the value of second-hand products differently which affects their willingness to pay. CE100 (2016) describes how remarketing and recovery data can be used to improve the remarketing process and predict variations. With proper remarketing planning, recovered products can quickly be returned to the market, and customer behaviour can be influenced (CE100, 2016). In addition, offering second-hand products provides the possibility to reach more price sensitive customer segments since products can be offered at lower prices.

3.3 Product-service systems

A company can sell products or services, the main difference is that product businesses are focused around physical and tangible items whereas service businesses create value through intangible things such as skills, expertise, and time. da Costa Fernandes, Pigosso, McAlone and Rozenfeld (2020) describe how circularity of businesses can be improved through the implementation of product-service systems. A product-service system aims to provide solutions consisting of a mixture of products and services to fulfil customers' needs and generate additional value compared to a pure product offering. Mastrogiacomo, Barravecchia, and Franceschini (2018) define "...the gradual shift from product-centered value proposition

to complex product-service systems offerings...” as servitization. This definition considers the level of servitization a scale where a company can be more or less product or service oriented.

Offering additional services or products as a service does not automatically contribute to a circular economy but can if the value proposition is grounded upon circular principles and strategies. da Costa Fernandes et al. (2020) highlight the need of balancing economic and environmental incentives by directing attention to resource efficiency and longevity. This requires thinking in lifecycles, involving stakeholders, and understanding the value of access rather than ownership.

The two types of product-service business models; product and use oriented (TU Delft, 2017), are presented in the section below with a focus on how they impact reverse logistics

3.3.1 Product-oriented

According to Cinquini, Di Minin and Varaldo (2013) services that focus on products can be divided into transaction-based and relationship-based services. Transaction-based services are described as basic services provided to users such as transport, installation, and spare parts. Relationship-based services instead focus on maintenance of products, offering services such as preventive maintenance, monitoring, spare parts management, and service contracts.

European Environment Agency (2017) presents a study where a large majority of the respondents’ states that they would rather repair their products than purchase new ones but that they in many cases replace or dispose of products due to the high cost of repairs and lack of services provided. The same study also showed that customers within the EU member states are more willing to buy second-hand furniture than buying second-hand electronic equipment or textiles. Overall, European Environment Agency (2017) argues for a gap between customers’ attitudes towards the recovery of products and their actual behaviour that can be explained by the perception of circular solutions to be more expensive, less convenient, and offer lower quality products.

Kaddoura, Kambanou, Tillman and Sakao (2019) have done a multiple case study to evaluate the value in prolonging the lifecycle of products that do not consume materials or energy during usage through the addition of services. The findings showed that the environmental impact of products is reduced by extending the lifecycle of products since the largest environmental impact occurs in the material production phase.

Bakker, den Hollander, Van Hinte and Zijlstra (2014) highlight that in addition to manufacturers, users can be involved in the repair, maintenance, and upgrades. There is a difference in designing products to be easily repaired in an industry setting compared to in the home of customers. Product designers must, therefore, consider whether users will take part in the recovery activities or not.

Central to prolonging product lifecycle through services is the availability of spare parts to support repair and remanufacturing (European Environment Agency, 2017). Spare parts and modules can be made available for customers to order through a transaction-based service that allows customers to repair and recover products by themselves without involving reverse logistics. If products need to be returned to retailers, manufacturers, or external service providers to be recovered, it requires the involvement of reverse logistics. Products must then

be collected, inspected, recovered, and redistributed to customers and spare parts and modules must instead be made available at these facilities (European Environment Agency, 2017).

3.3.2 Use-oriented

Offering products as a service provides the possibility to make products live longer by increasing the reuse and sharing of materials and products. The products can be utilised to a higher degree in comparison to private ownership, as products stay at users only when the function is needed. Hence fewer products and resources can fulfil the same function to customers. To reduce product downtime, it is important minimize the time between use periods (Szwejcowski, Goffin and Anagnostopoulos, 2015). Higher utilisation can on the other hand result in faster deterioration and shorter lifespan of products (European Environment Agency, 2017).

Selling services rather than products gives manufacturers more control over the produced products (TU Delft, 2017). Keeping the ownership of the products makes it easier to track product location and use. This creates added value since the companies can collect data on products and usage which can be used to improve product design and reverse logistics activities (Sundin, Östlin, Rönnbäck, Lindahl and Sandström, 2008). In addition, customers benefit since they only pay for use and typically receive better service, as it is in the manufacturers' interest to provide a product that lasts (Philips Lighting Holding B.V, 2017).

If the product ownership stays with the producer, a service-based business model can significantly improve product circularity. It creates incentives for the producer to design for durability, longevity, and easy recovery since it can minimise the total cost of ownership during the product lifecycle. However, a product-service system does not guarantee a circular business, the labour cost for product recovery can be too expensive and result in a higher lifecycle cost (Ellen MacArthur Foundation, 2017).

Going from selling products to instead focus on providing the product as a service can have some implications. When a product is sold, the customer pays for the product all at once. In a service agreement the customer instead can pay for a certain amount of time or use which means that the selling company must pre-finance product chain (TU Delft, 2017). This is particularly difficult for small companies or when selling products that require large initial investments. Another challenge is the infrastructure and processes that need to be built and adapted to organise for maintenance, repair, and collection of products. Selling products as a service requires changes to the complete supply chain (TU Delft, 2017).

Facilitating a transition from a pure product to a service offering also forces companies to forego the traditional 'sell more, sell faster' culture that prevails, and see profitability and revenue streams beyond the core product. To achieve this, companies cannot see reuse and repurposing of products as cannibalisation on new product sales, instead, the value must be seen as another sales type (TU Delft, 2017).

Ellen MacArthur Foundation (2017) lifts the unfamiliarity with the use oriented business models as a barrier for customer adoption when it comes to leasing office furniture. Customers view it as a more expensive alternative and fear inconvenience through a lack of ownership. In many cases, the opposite is true as maintenance prolongs furniture life and thus decreases the total cost of ownership over time (Ellen MacArthur Foundation, 2017). The product-service

system is common in the business-to-business context but quite immature in the business-to-consumer context where the costs related to products are lower and fashion is prioritised over functionality in many cases according to Ellen MacArthur Foundation (2017).

3.4 Problem discussion

This section aims to discuss the main problem addressed in this thesis in light of the presented theory. The prevailing linear economy is characterised by continuous resource extraction and waste production in an unsustainable way. To limit extraction and reduce landfill, the circular economy offers a solution to form a system that focuses on recovering and reusing products and materials in a regenerative way. The transition from a linear economy towards a circular economy requires multiple changes, from the way we design and produce goods to how we handle goods in their end-of-use and end-of-life. In a circular economy, the products of today can be seen as the resources of tomorrow.

To facilitate the circulation of products, reverse logistics form a key enabler. Returns start at the customer who returns goods for different reasons (section 3.1.2). IKEA is used to handle commercial, warranty, and service returns in their reverse logistics. To achieve the goal of becoming a circular business by 2030, it is increasingly important to address attention to products returning in the later stage of their lifecycle, EOU and EOL return.

With IKEA striving to keep product value high for as long as possible, the theory explains a focus on returning products that can be restored by going through the recovery processes presented in section 3.1.4. Adding EOU and EOL returns to the current reverse flow results in increased volumes which the activities need the capacity to handle. IKEA's product range is broad, and the products have different properties. All products are not suitable for recovery today. However, a lot of development is happening within IKEA regarding product design. Considering the complexity and variability, the thesis focuses on how to manage the flow of these returning products and the increasing volumes. Hence, implications brought on by specific product types are not considered.

IKEA is investigating ways to prolong the life of products by offering take-back and buy-back services, after sales parts and exploring selling furniture as a service. These initiatives support a circular economy but also bring about the need for changes in how to manage reverse logistics. To design supporting reverse logistics activities (section 3.1.3 and 3.2), it is important to understand the characteristics in a logistics system (section 3.1.5). Additional uncertainties arise in these characteristics when introducing a closed-loop supply chain, affecting the reverse logistics activities. The initiatives taken by IKEA involve offering services to a greater extent. The theory regarding product-service systems (section 3.3) therefore aims to provide a basis for an analysis of how this further affects the reverse logistics activities and related uncertainties.

The theory states that the development of reverse logistics is driven by economic, legal, social, and environmental driving forces (section 3.1.1). These are important to understand to analyse the current and future development of IKEA's reverse logistics. Product returns involve more actors than IKEA and challenges and opportunities related to these must be considered. This motivates why the analysis in this thesis is two-fold. The first analysis, in chapter 6, aims to give a broader understanding of actors affecting IKEA and its reverse flows, to enable the analysis in chapter 7 of the specific initiatives.

3.5 Research questions

This thesis aims to gain an understanding of how IKEA’s transition from a linear to a circular economy affects customer returns and reverse logistics. This is achieved by analysing the current state of the return flow and by identifying challenges and opportunities in a transition towards a circular economy. Initiatives driven by IKEA to support the transition are studied to analyse how possible future reverse flows can be designed. The studied initiatives are limited to the offering of product take-back and buy-back services, after sales parts, and usership models.

This leads to the formulation of the following research questions:

- Research question 1. What challenges can be identified in the current design of the reverse flow?
- Research question 2. What challenges and opportunities can be identified for IKEA in relation to the different actors in the move towards a circular business model?
- Research question 3. Based on the identified challenges and opportunities, how can possible future reverse flows for the studied initiatives be designed to support a circular business model?

3.6 Research model

Figure 10 shows how the theory and empirics are used to answer the research questions and fulfil the aim of the thesis.

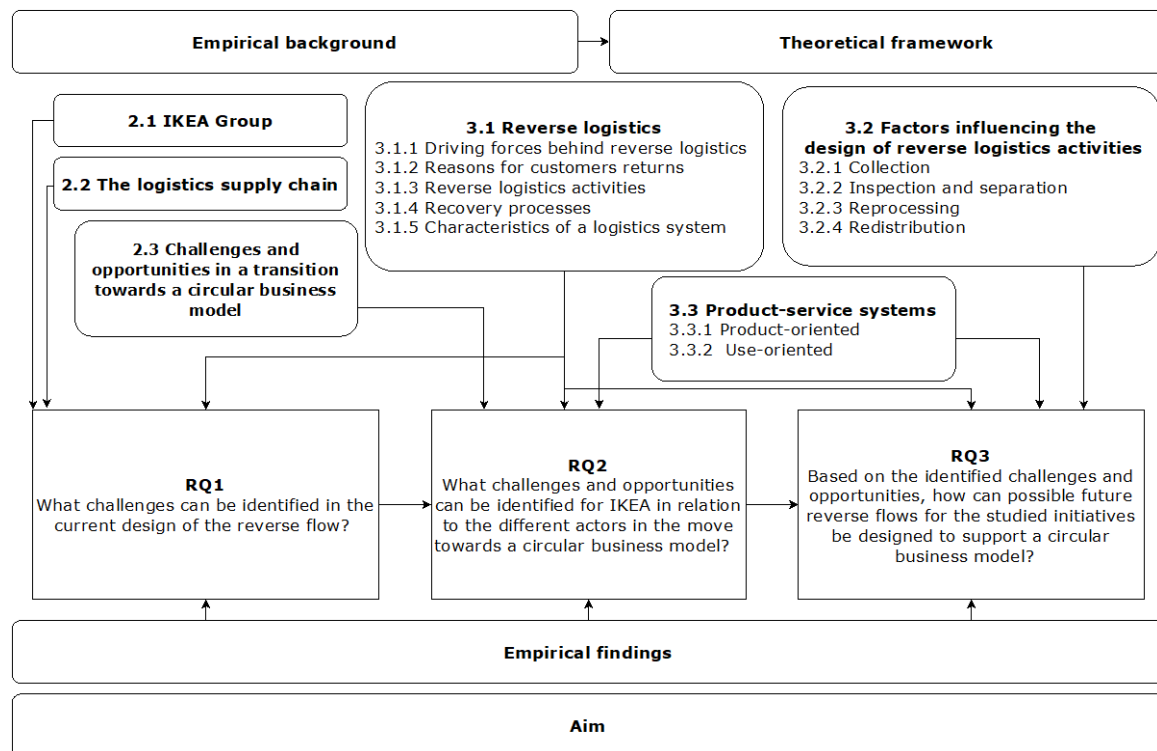


Figure 10. Illustration of the research model

4 Method

This chapter describes the approach used to answer the research questions and fulfil the aim of this thesis. Firstly, the research strategy is motivated, and the research process presented to explain the structure of the thesis. This is followed by a description of methods used to conduct data. Lastly, data analysis and the trustworthiness of the findings are discussed.

4.1 Research Strategy

There are two ways of classifying a method within business research – quantitative and qualitative research (Thornhill, Saunders and Lewis, 2009). To answer the research questions, this study has conducted a qualitative research strategy. A method where obtained data is normally textual, graphical, or pictorial (Yin, 1999). In qualitative research, the focus is to create a strong understanding of the many what and why and is, therefore, allowing for an in-depth understanding. To ensure a good understanding of a qualitative research, Crowe et al. (2011) describe the importance of applying multiple sources of evidence, such as interviews, study visits and observations to create triangulation.

4.2 Research Process

The research process presented in Figure 11 is based on an iterative approach to enable reflection and further improvements of previous ideas throughout the research to achieve a more comprehensive result, inspired by Thornhill et al. (2009). The research process includes; the initiative to research, identification of the problem, research design, review of literature, data collection, data analysis, and finally the presentation of the findings.

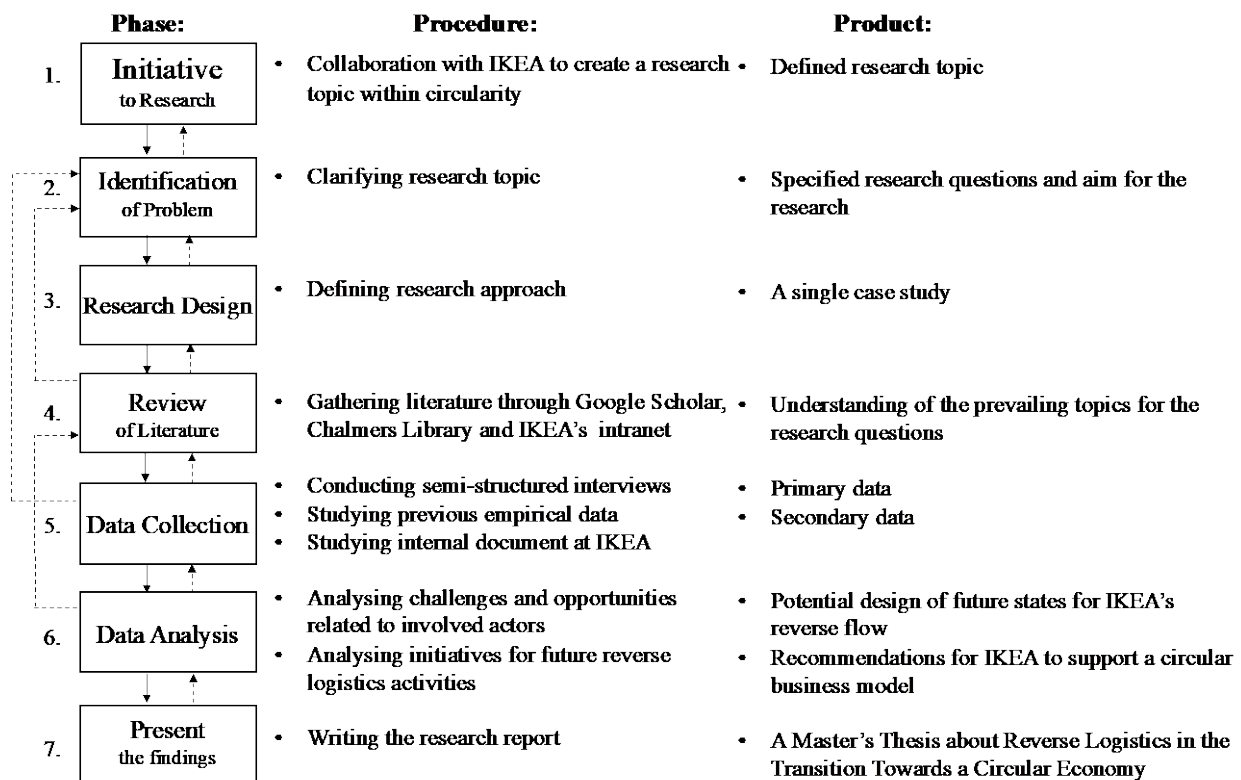


Figure 11. An illustration of the research process, inspired by Thornhill et al. (2009)

The initiative to the thesis was taken by two master's students at Chalmers in collaboration with IKEA to identify a relevant research topic within the field of a circular economy. As the project started, the topic was refined to clarify the research topic into the current research questions. A review of the literature was conducted to understand the topics relevant to the research questions. Literature was primarily collected through Google Scholar and Chalmers Library catalogue together with documents from IKEA's intranet. The gathered literature was analysed based on relevance for the research, robustness and credibility. *Research design, data collection, and data analysis* have been the major phases in the thesis and are discussed separately below. The final phase *present the findings* refers to compiling this thesis and will not be discussed henceforth.

4.3 Research Design: Case Study

A case study can be described as an intensive and detailed analysis of one or several cases (Bell, Bryman and Harley, 2018). A single case study is often related to one organisation or facility (Yin, 1999). For this thesis, a single case study on how circularity affects IKEA's reverse flow activities and what challenges and opportunities it entails for the design of potential future reverse flows has been performed. The case study took the current reverse flow as a starting point to identify challenges and opportunities in the transition towards a circular economy. Initiatives taken by IKEA were studied and analysed with consideration to the identified challenges and opportunities and resulted in the design of possible future reverse flows.

To provide insight into how the reverse flow is designed today and to identify how IKEA is affected by a circular economy, the Ingka franchisees operating in Sweden, IKEA Svenska Försäljning AB, and in the United Kingdom, IKEA LTD, have been included in the case study. These franchisees have been selected due to their participation in many of the pilot projects that are conducted to support the transition towards a circular IKEA by 2030. In addition, IKEA Svenska försäljning AB has a geographical advantage which has made physical meetings possible and IKEA LTD operates in a convenient time zone. Based on gathered information regarding initiatives taken by Ingka, three ongoing initiatives were chosen to be analysed more in-depth on how they can contribute to increased product reuse and prolongation of product lifecycles.

Being responsible for the processes and the IKEA Concept, IKEA of Sweden is an important part of the transition towards a circular economy and has therefore been included in the case study. They are responsible for making sure that all franchisees follow the same concept, but the processes are then carried out by different actors depending on which activities are studied. Hence, this case study has focused on the creation of a holistic picture of how activities in reverse logistics are affected by a circular economy rather than specific actors.

4.4 Data Collection

When collecting information, there are two types of data; primary and secondary data (Thornhill et al., 2009). Thornhill et al. (2009) define primary data as new data collected by the researchers for the specific study. Secondary data is obtained from other sources and was originally collected for a different purpose. Data collection for this study consists partly of

primary data gathered from interviews and partly of secondary data from published literature and quantitative reports at IKEA.

4.4.1 Primary Data

For this thesis, primary data has been conducted through interviews, both internal within IKEA and external with researchers within the research topic.

The collected data from internal interviews are presented as empirical findings in chapter five to substantiate the analysis. The external interviews are presented in section 2.3 in the empirical background. The information in these chapters is based solely on data from the collection, unless stated otherwise. Some opinions discussed in chapter five have been highlighted from individual departments and are then formulated so the reader understands that the statements are related to a specific department rather than IKEA as an organisation.

Interviews

In a pilot study, unstructured interviews were carried out at Inter IKEA's *Plan Balance Sales and Supply (PBSS)* and *Circular* divisions to contribute with knowledge about the organisation and the challenges IKEA is facing within the research topic. During unstructured interviews, data is collected by discussion rather than with prepared questions to clarify and expand the dialogue (Creswell, 2009). Unstructured interviews are a flexible approach since the interviewer does not control the interview with pre-determined questions. This was preferable at an early stage in the study to gain an understanding of the topic by allowing the interviewees to speak freely.

With a better understanding from the pilot study, the interviews had a semi-structured approach to get better insight into relevant data for the actual research questions. Semi-structured interviews are built on a set of standard questions to the interviewees but allow new ideas to be brought up during the discussions depending on what the participants present in the interviews (Creswell, 2009). Semi-structured interviews were preferred in this stage since the interviewers could steer the participants into a specific topic, but later allowing a flexible discussion to better understand the context in-depth.

The interviewees included in this study were mostly from Inter IKEA and Ingka Group and are hereafter referred to as internal interviews. External actors within the research area were also interviewed, hereafter referred to as external interviews, to discuss general challenges and opportunities when moving towards a circular business model. To gather relevant information, it is important to get in contact with the right participants. Regarding the internal interviews, a shortlist of people was provided by the process development manager at PBSS. Those people belonged to various departments involved in forecasting. Further, a majority of the interviewees from the shortlist recommended other suitable participants at other departments to interview to bring the discussion forward. Such a sampling procedure is called snowball sampling and can help researchers with a limited network to reach out to preferred participants (Emerson, 2015). Figure 12 shows how the snowball sampling process was carried out. A complete list of questions asked in the internal interviews is shown in Appendix A.

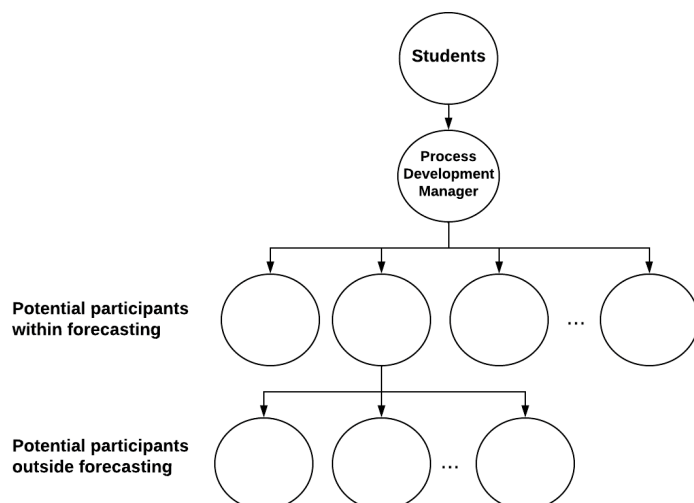


Figure 12. A visualisation of the snowball sampling process

Conducting the external interviews, the initial contact occurred via email after receiving their email addresses from Chalmers’s website. The external interviews focused on challenges and opportunities in a transition towards a circular business model. These interviews also considered other actors involved in the transition to provide other perspectives to the analysis. The researchers research within the fields of Design and Human Factors and Environmental Systems Analysis. Gathered data from external actors have created a background understanding of the challenges and opportunities IKEA faces in the transition. The data has further contributed to important perspectives when analysing potential future reverse flows for IKEA. A complete list of the questions asked in the external interviews is shown in Appendix B.

Physical face-to-face interviews are preferred over, for instance, telephone and e-mail interviews, when interviewees are the main information source of data (Opdenakker, 2006). Hence, most of the interviews were meant to be held in-person when collecting the information to improve the quality of collected data. Because of the prevailing situation with Covid-19 during the data collection, physical interviews were not appropriate in all cases. When physical interviews were not feasible, Video call was used as an interview tool. All interviews were held for 60 minutes, allowing the participants to communicate in-depth information. To ensure correct interpretation of the interviews and verify the data, interviewees received a written summary of the interview. This gave the participants a chance to correct potential misunderstandings and add important information to avoid misinterpreted data in the analysis. In Table 3 and Table 4, the interviewees are presented together with a brief description of their roles.

Table 3. A list of interviewed specialists at IKEA

Interviews with internal specialists at IKEA

Interviewee	Role at IKEA	Organisation	Type of meeting	Date
General information				
Ola Magnusson	Business Architect	IKEA of Sweden AB	Video call	2019-12-19
Mirza Rasidovic	Range Engineering Leader	IKEA of Sweden AB	In-person	2020-01-27
Questions regarding circularity				
Simon Skoog	Project Leader at Circular IKEA	IKEA of Sweden AB	In-person	2020-01-28
Per Stoltz	Sustainability developer	Ingka Services AB	Video call	2020-02-28
Questions regarding current reverse logistics				
Mikael Gunnarsson	Process Development Manager	IKEA of Sweden AB	In-person	2020-01-28
Malin Skarstam	Process Development Manager	IKEA of Sweden AB	In-person	2020-01-28
Peter Hans Johansson	Process Leader at Sales and Supply	IKEA of Sweden AB	Video call	2020-02-03
Ulf Gabrielsson	Process Developer	IKEA of Sweden AB	In-person Video call	2020-02-17 2020-03-16
Christofer Svensson	Category Manager	IKEA of Sweden AB	In-person	2020-02-17
Anna Nilsson	Reverse Flow Specialist	IKEA Svenska Försäljnings AB (Ingka)	Video call	2020-02-18
Karl Tibbelin	Customer Care Specialist	IKEA Svenska Försäljnings AB (Ingka)	Video call	2020-02-18
Roelanda Hulzebosch	Reverse Flow Specialist	IKEA BV (Ingka)	Video call	2020-02-18
Allan Dickner	Range Engineering Leader	IKEA of Sweden AB	In-person	2020-02-19
Christina Sundin	Exchange and Returns Manager	IKEA Svenska Försäljnings AB (Ingka)	Video call	2020-03-05
Joar Malmsten	Shopkeeper	IKEA Svenska Försäljnings AB (Ingka)	Video call	2020-03-05

Questions regarding future reverse logistics				
Sally Desborough	Reverse Flow Specialist	IKEA LTD (Ingka)	Video call	2020-03-02
Greg Lucas	Sustainability Business Partner	IKEA LTD (Ingka)	Video call	2020-03-17
Nathalie Berkein	Service Experience Specialist	IKEA LTD (Ingka)	Video call	2020-03-17
Johanna Jönsson	After Sales Parts Specialist	IKEA of Sweden AB	Video call	2020-03-18
John Welsh	Fulfillment Project Implementation Manager	IKEA LTD (Ingka)	Video call	2020-03-02
			Video call	2020-03-17
Melissa Ciardullo	Project Leader at Circular IKEA	IKEA of Sweden AB	Video call	2020-03-27

Table 4. A list of external actors interviewed during the data collection

Interviews with external actors

Interviewee	Role	Department	Organisation	Type of meeting	Date
Questions regarding circularity					
Anneli Selvefors	Researcher, Design & Human Factors	Industrial and Materials Science	Chalmers	Video call	2020-03-19
Questions regarding reverse logistics					
Maria Ljunggren Söderman	Researcher, Environmental Systems Analysis	Technology Management and Economics	Chalmers	Video call	2020-04-06

Interviews of complex informative character were recorded upon permission. Recordings enable better analysis afterward since it allows the interviewers to re-listen to the information (Thornhill et al., 2009). This means the interviewers can focus on the interview and prepare follow-up questions during the session. Having the interviews recorded, the interviewers can quote the participants directly and have access to accurate formulations which reduces bias in the thesis (ibid). The recorded interviews were used when compiling empirical data. It is important to be aware of the disadvantages of recording interviews. The permission for recording is crucial and was managed with the invitation to prepare the interviewees. When recording interviews, there is a risk that the participants express themselves more cautiously and omit potentially important information (Thornhill et al., 2009). It is therefore important to inform the participants about the purpose of the recording to make the interviewee comfortable with the recordings and the use to provide more accurate answers (Healey and Rawlinson, 1994).

Lack of data due to Covid-19

The primary data collection was planned to be conducted using a majority of physical face-to-face meetings to ensure the quality of the interviews and improve the relationship between the participants and the interviewers. Furthermore, additional primary data was planned to be gathered through study visits at three of IKEA's stores; Älmhult, Bäckebo Gothenburg, and Kungens Kurva Stockholm. The aim of the study visits was to observe how the stores handle customer returns today regarding collection, inspection, separation, reprocessing, and redistribution to complement and compare gathered data from interviews.

But during the period of data collection, the spread and infection of the virus Covid-19 developed to an extent where Swedish authorities recommended the population to avoid traveling if possible. With respect to Covid-19, we decided to cancel our visits to IKEA of Sweden in Älmhult, together with our study visits at the three stores. This resulted in several interviews being conducted by video call and data from direct observations at IKEA's recovery department is missing in this thesis. Furthermore, some interviews were conducted before the extensive spread of Covid-19, therefore, some data from the interviews may have changed related to short-term predictions.

4.4.2 Secondary Data

Secondary data for this master thesis has been gathered as a complement to the primary data conducted. The secondary data has been used when the set of data would be too resource demanding to gather by oneself. This data has partly been collected through internal data reports at IKEA, and partly from a previously published master thesis written for IKEA, with gathered data regarding customer returns.

4.5 Data Analysis

For this thesis, qualitative data and some complementary quantitative data were obtained, and analysed to answer the research questions. The methods for analysing the data differed depending on the type.

The qualitative data was gathered through internal and external interviews. Qualitative data needs to be compared and analysed with theory to create a deeper understanding (Thornhill et al., 2009). The collected data from the internal interviews were analysed with the theoretical framework to compare theory with actions within IKEA. With notes and recordings from the interviews, the authors could draw initial conclusions from the interviews that were further discussed with the supervisor at IKEA and Chalmers. By analysing each interview, new interview questions and topics were assessed to improve future interviews and to bring the research forward. Collected data from the external interviews was instead presented as empirical background to form a knowledge base for the authors to stand upon when analysing IKEA's transition towards a circular economy. Information from the internal interviews were then compared to the information gathered from external researchers and theory to form recommendations to IKEA in their transition towards a circular business model.

The quantitative data was obtained by receiving secondary data from interviewees after the interviews as well as from internal data reports at IKEA. Quantitative data often needs to be processed or analysed using different techniques to become clear (Thornhill et al., 2009). The

data was visualised in charts to see trends and patterns. The collected data mainly consisted of data on customer returns to stores.

4.5.1 The trustworthiness of findings in a qualitative research

In qualitative research it is essential to evaluate the quality of findings to ensure a trustworthy report. Lincoln and Guba (2013) mention numerous ways to assess the quality of qualitative studies and highlight the importance of trustworthiness, presented in this section.

Lincoln and Guba (2013) state that the quality of an inquiry can be referred to as trustworthiness. According to the authors this can be addressed by examining if the findings and interpretations are a result of a systematic process as well as if these outcomes can be trusted. Trustworthiness can be achieved by addressing the four different criteria: credibility, transferability, dependability, and confirmability, presented in the following section (Lincoln and Guba, 2013).

Credibility refers to the ability to establish confidence in the outcomes and analyses of a research study. Lincoln and Guba (2013) suggest that this can be done by using techniques such as long-term commitment, persistent observations, triangulation, and member checks. This has been accomplished by having a close and continuous discussion with the supervisor and interviewees at IKEA and by using multiple sources when gathering information. After the conducted interviews, a summary has been sent to the interviewee to verify the data.

Transferability determines to what extent the findings can be applied in other contexts or subjects. Lincoln and Guba (2013) argue that the degree of transferability should be determined by those seeking to apply the findings and interpretations in his or her context. Enabling this requires a thorough description of the context in which the research took place. This has been done by providing background of the furniture industry, the IKEA organisation as well as of the involved interviewees. The thesis motivates why certain actors were approached and their roles in connection to the researched area.

Dependability discusses whether the findings and interpretations are a product of a steady and reliable process (Lincoln and Guba, 2013). A method to address dependability is to let a chosen person evaluate the inquiry process and the given outcome to ensure consistency. The process of writing this thesis has been continuously reviewed and commented on by supervisors at both IKEA and Chalmers to make sure the process has been consistent.

Confirmability deals with objectivity and how the outcome is a result of a reliable process of inquiry and also the data gathering (Lincoln and Guba, 2013). Confirmability can be achieved by, for example, conducting audits or by triangulation. The qualitative nature of this study requires objectivity when reviewing empirical data and the findings from the analysis. Increased objectivity has been achieved by using multiple sources and by having critical discussions with the supervisors during the process to reduce biases.

5 Empirical findings and identified challenges and opportunities

In the following chapter, the empirical findings from the case study are presented based on interviews at IKEA. Firstly, the current return process is presented to create a better understanding of the starting position for the transition towards a circular economy. The aim is to identify current challenges in the reverse logistics activities to answer research question 1.

Secondly, broader challenges for IKEA in the transition towards a circular business model are identified, focusing on creating convenience, establishing infrastructure, and the role of society. The section aims to contribute to the analysis of how different actors give rise to challenges and opportunities in IKEA's reverse logistics, to answer research question 2.

Finally, the three studied initiatives taken at IKEA to move towards a circular business are described and challenges and opportunities related to the reverse flows are identified. These empirical findings form the basis for the analysis in chapter 7 in which research question 3 is answered.

5.1 Customer returns at IKEA

The current state of IKEA's reverse logistics is mapped using findings from the interviews, secondary data collected from internal IKEA reports, and an earlier mapping done by Andersson and Wictor (2018). Firstly, the reasons for IKEA's current customer returns and how the company categorises them are presented. Secondly, the material flow of customer returns at IKEA is described to better understand how product returns are handled today. Finally, IKEA's material flow is divided into reverse logistics activities and challenges in the current reverse flow are identified.

5.1.1 Handling customer returns

At IKEA, returns are divided into internal and external returns. Internal returns occur before products have reached the customer. External returns take place after the customer has acquired a product and is referred to as customer returns in this thesis. Customers return goods for different reasons and to track why customer returns occur, a global reason code setup has been developed by IKEA. The system consists of six reason codes and each code is followed by sub-reasons presented in Table 5.

Table 5. Description of the reason codes and sub-reasons for returns at IKEA, adapted from Andersson & Wictor (2018)

Reason code	Change of mind	Service process	Product Quality	Sales process	Customer assistance
Explanation	Products not wanted by customers	Problems during the service process	Products with production errors	Problems during the sales process	Other customer related issues
Sub-reason	Style or size does not fit	Packaging and/or product damaged	Parts missing or wrong	Incorrect or misleading information	Order of articles/parts
	Bought more than needed	Late delivery or service	Product has defects	Ordered wrong product	Refund VAT
	Found better product elsewhere	Delivery differs from offer	Product does not function as expected	Payment issues or over sales	Forgotten IKEA items
	Found better price elsewhere	Not satisfied with service	Unsafe or recalled product	Handling damage	Customer incident
				Picking error	

Customer returns are further divided based on an inspection of the condition when the products have been returned to stores. Sellable products are given the code TT320 and can be put back on shelves or in storage to be sold as new products. The code TT325 is given to unsellable products, indicating that a product or package is faulty and in need of recovery. Today, returns correspond to approximately four percent of annual sales in Sweden. In their master thesis, Andersson and Wictor (2018) concluded that sales and returns follow each other quite closely. Hence, a decrease in sales means that the returns also decrease with some time lag. The return volumes are low in comparison to sales but a trend of a slightly increased amount of returns can be seen during recent years, both in terms of quantity and value. From September 2017 to March 2020 the products given the code TT320 represent 77 percent, whilst products coded as TT325 stand for 23 percent as shown in Figure 13.

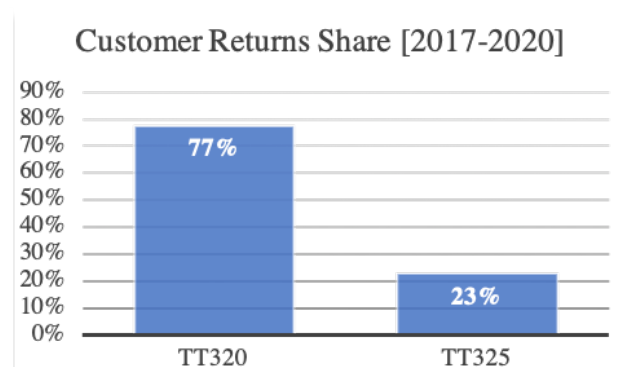


Figure 13. Customer returns share of TT320 and TT325 products. Data retrieved from the year 2017 w.36 to the year 2020 w.13 for the Swedish and British markets

The reason codes most commonly given to the TT320 and TT325 returns are presented in Figure 14. Customer change of mind is the most common reason for returning products, and most of these products are re-sellable when returned. All the other reason codes generate, in comparison, a low amount of returns. The large deviation seen in the graph can be explained by looking at the sub-reasons for returns where it is shown that the large return volume is due to the recall of a product (sales process).

Returns per week divided according to return reasons

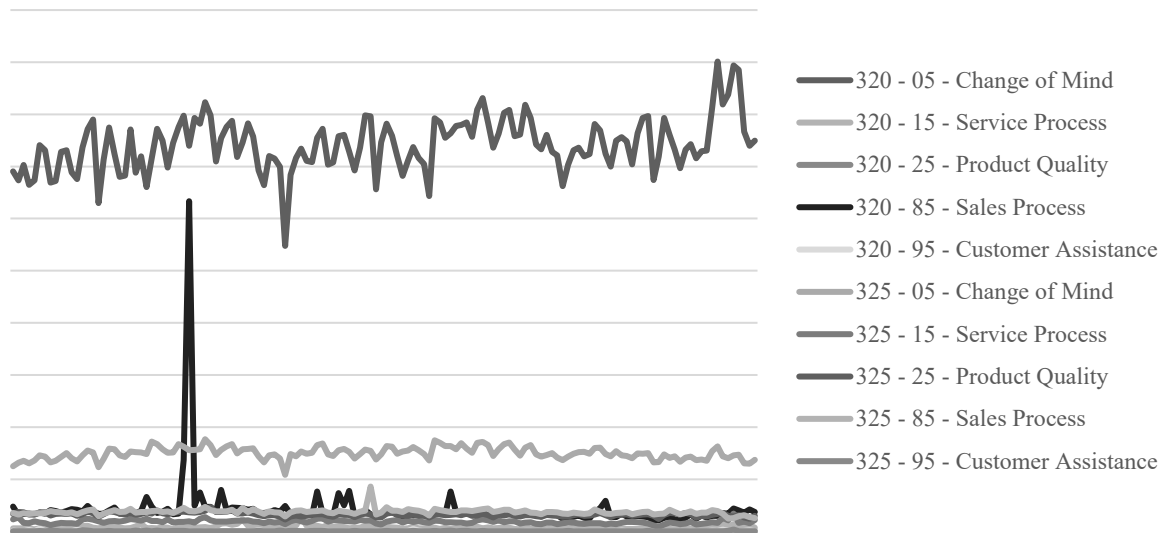


Figure 14. The number of returns per week divided according to IKEA’s return reasons. Data retrieved from the year 2017 w.36 to the year 2020 w.16 for the Swedish and British markets. The y-axis is linear and starts at zero

5.1.2 Current reverse flow

The management of returns takes place at local IKEA stores. Every IKEA store has an As-Is area, where returned products are sold at a discounted price. Either as-is or with slight recovery being made (repackaging, recondition, repairing, and replacing spare parts). In Figure 15, IKEA’s current return flow is visualised.

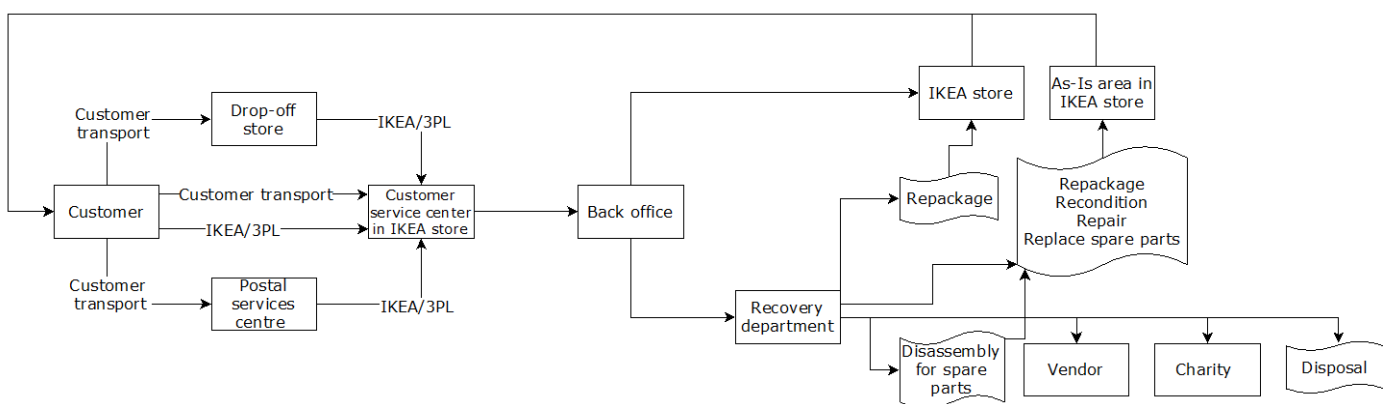


Figure 15. A mapping of the material flow for product returns at IKEA, adapted from Andersson & Wictor (2018)

All returns coming back to IKEA are handled by the Customer Service Center (CSC) at the stores where the return process is initiated by registration in the IKEA information system. The registration includes return code, condition, and if necessary, additional comments to create an understanding of why the return occurred. This information is important for IKEA to act proactively to reduce the number of returns that could be prevented, such as returns happening because of quality or service issues and change of mind, hereinafter referred to as traditional returns.

After registration, the returned goods are sent to back office where a decision on the future processes is taken based on the condition of goods. Sellable goods that can be sold as new are returned to shelves or storage while all other goods are transported to the recovery department. Some products can be sold directly as-is at the As-Is area while others need to go through recovery processes. Data is missing on what percentage of the unsellable goods that are recovered, but IKEA argues that approximately 70 percent of the products can be sold as-is after recovery.

All IKEA stores have a recovery department proportional to the size of the store. At the recovery department, decisions are taken on whether to recover a product or not. Factors such as complexity, time, resources, and space are taken into consideration. In the recovery department, products can also be disassembled to be used as spare parts. The primary activities for the recovery department are repackaging and complementing products with spare parts. The repackaged, repaired and reconditioned products are then either sold as-is or as-new depending on how extensive the recovery process is and the condition of the product. Most recovered products are sold as-is due to regulations and the difficulty of assuring quality and safety. However, there are significant financial benefits for a product that can be sold as new and only needs repackaging, since it requires both less time and the margin price is higher. Both the As-Is and recovery areas have grown in many Swedish stores during recent years as the volumes have increased. An increasing amount of online sales can be seen as a contributing factor together with the overall increase in sales.

Increasing volumes can also be explained by IKEA's global return policy, with very generous terms, that makes the return process relatively easy and keep customer satisfaction high. All products can be returned within a year and they can be returned assembled and even without packaging. The customers are also free to choose the most convenient return option for them. The most commonly used option is customers bringing the products back to the store by themselves. They can also choose to leave products at a drop off store or to a postal service that then arranges the transport to the IKEA stores through internal IKEA transport or by using external third-party logistics. Another option is to order a transport service directly from their home, in which IKEA or third-party logistics are responsible for the transport from the customers' homes to IKEA stores. Independent on the chosen option, the returns end up in the customer service center in the IKEA store. Returning products to an IKEA store is free of charge while collection at home is a service that customers pay for. The different IKEA markets can decide upon their return policy, based on the global return policy, but adjusted to conditions in their specific market. For example, Sweden has excluded custom fitted worktops in their return policy since a lot of kitchens are sold on their market.

5.1.3 Challenges in IKEA's current reverse logistics activities

The following chapter summarises the current challenges in IKEA's reverse logistics activities brought forward after interviewing internal specialists at IKEA. To get a better overview, the current reverse flow has been divided into different reverse logistics activities, illustrated in Figure 16.

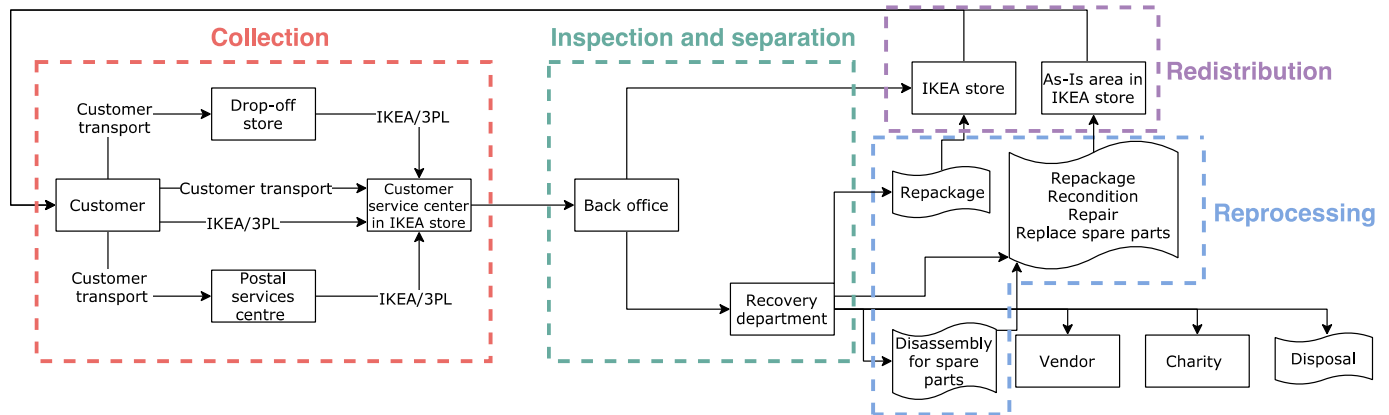


Figure 16. The material flow for product returns divided into different reverse logistics activities

Challenges for collection

Traditionally, IKEA has forced customers to visit the stores physically. As a consequence of the focus around the stores, the vast majority of the collection of used products currently takes place in the IKEA stores. However, changed customer behaviour has made IKEA adapt and today increased attention is given to customers' needs and demand, and IKEA is developing services to meet these. One important question for IKEA is whether the current reverse flow can be used to facilitate the circulation of products. Either it can be adapted to meet emerging circular needs, or a separate flow is needed. A lot of additional transportation is needed if customers drive to stores with the sole purpose of returning products, compared to third-party logistics that can consolidate returning goods. In addition, the stores are not built to take care of a large volume of returning products efficiently way and the processes needed for product recovery are not present in all stores. There is therefore a need to explore where and how products should be collected.

Reverse flow specialists describe that information about collected products must be integrated into other planning. The stores need to know what volumes they are expected to handle, especially when increased e-commerce causes stores to take care of returns that do not originate from their stores.

Challenges for inspection and separation

An identified challenge at IKEA is that returns often result in wrong products in the wrong place because of large uncertainties and lack of standards in the handling. All returns are inspected in the store, independent of the condition. The sustainability manager at IKEA argues that "It is important to know what level of recovery that is needed, and that it is done early in the chain".

During the inspection activity, the quality and safety of products must be assessed. Compliance can be seen as a barrier to the circulation of products. IKEA must be able to secure quality and

safety when products are returning from customers' homes. This puts pressure on the inspection process as there lies great uncertainty in what wear and tear the product has been exposed to. There is furthermore the risk of getting vermin into the IKEA stores, which could potentially harm other products as well.

Challenges for reprocessing

The resources and handling space within product recovery are limited which sometimes forces products to be discarded or donated. The lack of sufficient resources is seen as the main reason for not being able to recover full-fledged products according to the recovery department, both in Sweden and the United Kingdom. Too few people work with recovery in relation to the incoming volumes and the time needed to restore products. An Exchange and Returns manager in Sweden describes how the planning process for exchange and returns is characterised by profitability criteria and strives for a high degree of efficiency. The productivity of saving products is generally low since time is expensive. This creates a demand for better measures of the value of the recovery process, as the recovery is primarily seen as a cost. As the price for handling and getting rid of garbage and waste increases, it is increasingly important to minimise waste and make more of the resources on hand.

Another challenge for the recovery process is the customers' expectations in relation to the time and competence needed to recover products. At IKEA, customers returning a defective product expect to immediately get a new product or a refund. In reality, it takes time and resources to repair and recover defective products.

The recovery process is to a large extent dependent on product design. Generally, the products are not designed to facilitate recovery. For example, multiple packaging and use of different packaging materials make it time-consuming and complex to repack products in-store. IKEA also lacks a uniform system to handle spare parts and components. These parts are handled completely separated from the rest of the IKEA range, with own storage, processes and planning. The products within the IKEA range are given unique identifiers at a high level and not for every single part. This makes it hard to order and identify missing parts. To order spare parts there is a system that keeps track of employees' search history to better understand the demand and need for spare parts. The system supports in creating a picture of common quality issues and makes it possible to better forecast the right parts to stock. An alternative to ordering parts is for the recovery department to build up a spare part inventory by disassembly of returned products.

Another challenge can be seen in that the range of spare parts today is focused on assembly parts. The availability of furniture parts is limited, which can hinder recovery. Further, these parts are not always given unique identifiers which make them hard to identify and order.

Challenges for redistribution

The customers' attitudes towards second-hand products is a challenge for the redistribution of returned products. The perception that used products are of lower quality means that customers are usually willing to pay less. This in turn affects the profitability of these products for IKEA. Nonetheless, increased awareness amongst customers regarding the environmental impact of their consumption patterns create an increased interest in the reuse of products which can be seen in the volumes purchased in the As-Is area in the stores. A challenge for IKEA is to

communicate this value and get more customers to choose previously used products available in the As-Is area rather than new ones.

5.2 Challenges for IKEA's transition towards a circular business model

In this section, empirical findings based on internal interviews at IKEA are presented, with a focus on customer convenience, an infrastructure supporting a circular economy, and society's role in the transition towards a circular business model. IKEA put a lot of resources into the areas; choice of material in future products and product design supporting circulation, to facilitate a circular business model. But, to become a truly circular business by 2030, IKEA's responsibility extends beyond material and design. IKEA has identified three important areas that need attention in a transition towards circularity.

Firstly, IKEA's circular business model must ensure convenience and be financially advantageous both for IKEA and for its customers. IKEA's current return flow is very much dependent on customers' initiatives. To access customer returns, it is the customer's responsibility to return the product to the store. Such a solution includes limitations since many customers find it more convenient to dispose of the product elsewhere. Because of today's limitations, current customer returns related to EOU and EOL are limited to small volumes. This has also led to that while the customer behaviour in the forward flow is thoroughly mapped, the opposite is true for customer returns which makes them hard to predict. This creates large uncertainties in the return flow which complicate forecasting and resource allocation. The lack of knowledge is also a hinder for building return processes adapted to customer behaviour.

Secondly, the retailer Ingka highlights the importance of establishing an infrastructure to support a circular business model. When operating according to a business model focusing on product circulation, more resources within the reverse logistics activities are required. Furthermore, changed business focus generates new requirements for IKEA which includes the need for additional knowledge. The sustainability manager at IKEA states that "the infrastructure must be cost effective and easily accessible for the customer". According to representatives from Ingka, an infrastructure supporting circularity should involve external actors to tap into expertise that does not exist in-house. Creating a network of actors establishing a circular infrastructure speeds up the process and increases the opportunity of being market leaders within the circular furniture business. Furthermore, circular business models create possibilities for new product sales channels, such as leasing and second-hand offerings.

New sales channels are likely to affect the sales in the traditional channels. To make accurate forecasts and plans, it is important that the redistributed products are included in the systems and accounted for. Sales and supply planning within IKEA sees a need to measure how the sales of second-hand products and subscriptions affect the traditional sales so that processes, and planning can consider potential cannibalisation. A more complex reverse flow, with more return types, will generate increasingly complex planning processes if volumes increase. Furthermore, performance measures must also be adapted to a circular business model so that a decline in sales in the traditional channels is not necessarily seen as something negative.

The last main area brought up by the retailer is the role of society. Legislations and policies have their origin from society, where attitudes towards change is important. A transition

towards a circular economy benefits from pressure and support from society, pushing customers and companies towards circular behaviour. IKEA can for instance benefit from actions taken on a broader level, such as the package prepared by the European Commission to facilitate the transition towards a circular economy (European Commission, 2015). The package includes actions on both general and material specific levels. These actions have been or are currently being implemented in the EU to support companies to adapt and develop their circular capabilities. The European Commission describes that the underlying idea is that some obstacles are generic while others are industry or material specific.

IKEA highlights that a truly circular economy can only be achieved through joint efforts in the society. For the collection to take place, customers must be incentivised and supporting infrastructure must be put in place to make it convenient to return products. IKEA can facilitate and promote a circular economy but, in the end, customers, IKEA, suppliers, and other actors must work together to circulate products and minimise waste.

5.3 Ongoing initiatives at IKEA and how they affect the return flows

IKEA's future solutions may take different directions. The company highlights the uncertainty regarding future services provided and points out the importance of their ongoing pilot projects. By testing new solutions, IKEA gains knowledge about different markets and finds best practises that can support a circular business model when implemented on a larger scale. This is an iterative process with inputs from different markets and directly from customers to create a long-term solution supporting product circulation.

Below, IKEA's approach to improving the handling of customer returns is discussed, followed by three ongoing initiatives; buy-back and take-back services, offering after sales parts, and usership models. These are presented and elaborated to understand how they can affect the design of potential future return flows at IKEA. The initiatives have been chosen based on the interviews with representatives from IKEA together with their potential to contribute to reuse, prolongation of product life, and customer convenience.

5.3.1 IKEA's approach to improving the handling of customer returns

IKEA strives to reduce the number of traditional returns while increasing the number of returns related to product recovery. Returns that occur due to change of mind or quality issues could be prevented to a higher extent and save significant cost. Today, IKEA is acting reactively on these returns and advocates more proactive operations to hinder traditional returns. On the other hand, IKEA sees great value in returns that facilitate the circulation of materials and products so that product value can be restored. How this can be done is still uncertain but through pilot projects, IKEA is testing new ways to initiate the circulation of products.

The initiatives IKEA runs are designed to support the move towards a circular business. These initiatives are, among other things, analysing how IKEA can handle customer returns in the future. IKEA advocates collaboration to achieve a fast and successful transition towards a circular economy, which involves building a network and joining forces with others. One example of this is IKEA in the United States and its collaboration with Optoro, a company focusing on reverse logistics and a provider of returns optimisation technology. IKEA even opens for solutions where the company is completely excluded from the reverse logistics activities. Collection, reprocessing, and redistribution can instead be performed by business

partners operating on second-hand markets. This can for instance be seen in the collaboration between IKEA and Blocket on the Swedish market, where Blocket’s platform is used for products to change ownership. Contrary, IKEA also discusses the possibility of retaining the ownership of products by offering furniture as a service. This would mean that IKEA is responsible for collecting and restoring the value of products when the service contract expires.

Another important discussion at IKEA regards future recovery processes. A scattered return flow with many origins makes collection complex for IKEA. IKEA, therefore, seeks to separate the recovery processes depending on the characteristics and level of recovery needed. The sustainability manager at IKEA describes that “The structure needs to be adapted depending on to which extent the returned products need to be restored. Small things can be done relatively locally while bigger things may need a slightly more centralised structure. Products should not be sent too far for the business case to be viable”.

With a growing focus on product returns, IKEA sees a need to explore the potential of tracking products through their lifecycles, to explore how to better plan for collection and recovery activities. IKEA has been trying to understand a product passport type concept to increase the visibility of product information. Some areas being explored are how to make data available on a central database, that can be accessible for both internal and external actors, with comprehensive information about the products.

A growing share of customers show interest in prolonging the life of their products and knowing the environmental impact of purchases which is also in with the company’s values. IKEA is trying to understand how to communicate product information and its impact in a simple way. Product information such as choice of material, product capabilities and instructions, transport destinations, and performed recovery etc.

5.3.2 Buy-back and take-back services

Buy-back and take-back initiatives were introduced by IKEA to preserve the value of EOU and EOL products that were previously disposed of. Furniture buy-backs and resells provide an affordable option for the many people and are also a move in the direction of becoming a circular business.

In 2010, IKEA started to collect EOL products in customers’ homes by offering a take-back service. The service also includes products outside the IKEA range. The take-back service is visualised in Figure 17.

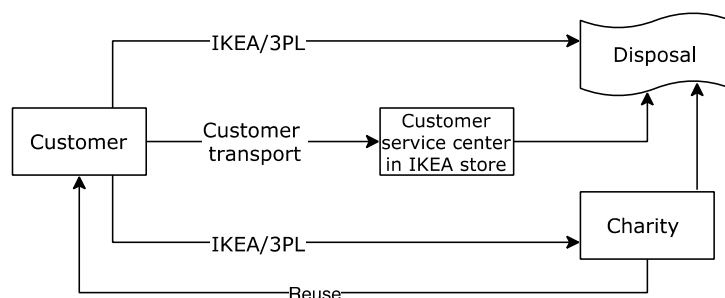


Figure 17. Product flow for IKEA's take-back service

This service focuses on taking back products such as mattresses and sofas from customers' homes for a small fee. IKEA's take-back service is often related to home delivery, where transport service providers offer customers to bring back their old products when delivering new IKEA products. In Japan, IKEA even offers a take-back service free of charge for specific products when delivering new products through home delivery. The take-back service is based on a network of actors that enable the pick-up of products. The majority of returned products are disposed of. In the United Kingdom, products returning through the take-back service can be given to charities that IKEA support by sharing best practises in how to increase the reuse percentage.

The buy-back service focuses only on specific IKEA products that have reached EOU rather than EOL. Customers using the service can bring their used products to the customer service center in their closest IKEA store, where the products undergo a safety inspection to determine whether the product is sellable, illustrated in Figure 18.

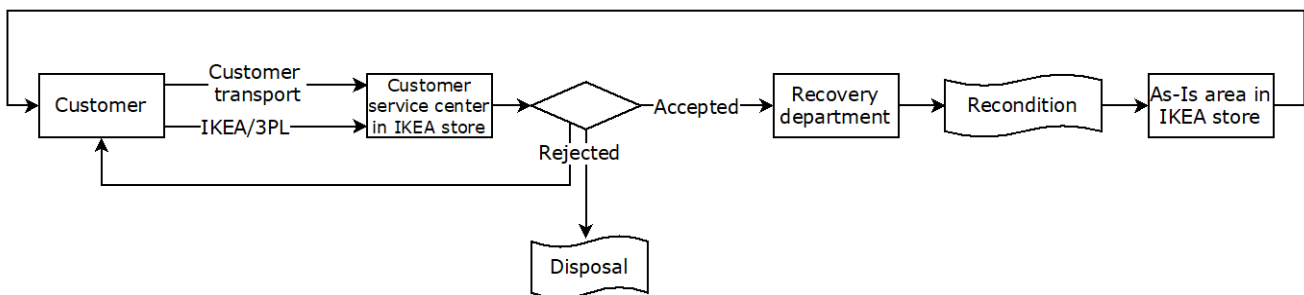


Figure 18. Product flow for IKEA's buy-back service

The recovery team works with a checklist to ensure the quality of returned products, including; no sharp edges, no risk of vermin, and ensuring correct assembled parts. Accepted products are cleaned and resold at the As-Is area, but no further reprocessing is performed. Customers returning accepted products are given vouchers that can be utilised in the store. Accepted products are sold for the same price as the value given on the voucher. IKEA has taken on a responsibility to accept IKEA products that are returned independent of reason or condition, despite the fact the extended producer responsibility as of today does not apply to furniture. For products rejected in the inspection, IKEA, therefore, offers to dispose of the products. In some cases, IKEA can give vouchers to rejected products due to misunderstandings between them and the customer and then sees the payment as goodwill.

Challenges and opportunities in the reverse flow

Most of the products that are collected through the take-back service are today recycled, and it is a challenge for IKEA to keep the products at a higher value since these products typically have reached EOL and primarily represent material value. The products returned through the buy-back service constitute value as-is and can be resold directly in the store. Because of regulations, IKEA is restricted in how to re-sell buy-backs, and the products are exclusively sold at the As-Is area.

Small scale buy-back services have been implemented in a couple of IKEA stores during the last year, including Edinburgh in Scotland - receiving approximately ten buy-backs per month, and Kungens Kurva - receiving around 20-40 items every month from this service. IKEA sees a close correlation with the advertisement of the service and the number of received products.

For instance, by sending out e-mails during one weekend to IKEA Family members, the store in Kungens Kurva received 40 items in one day. More stores are planning to roll out the service during 2020 on a larger scale which will increase the attention among customers. IKEA in Edinburgh predicts 170 buy-backs per month by June 2020 due to increased customer awareness. There are some regulations regarding which products are accepted by IKEA and it diverges for different markets. For instance, in Sweden the stores accept products such as tables, TV benches, bookshelves, and chairs.

Today, the majority of buy-backs occur in-store. Customers need to travel to a store and fill out paper forms to enable a buy-back inspection. To make it more convenient for customers, Australia offers the buy-back service in all IKEA stores and the initial customer interaction occurs online instead of in-store. By filling in an online form, customers receive an estimated quote that they then bring with the product to the store for a physical inspection where the final value is determined. The online service gives customers a price estimation and prevents customers from bringing in products that cannot be recovered or handled by the stores. A similar buy-back service is in place in Japan, where the customer's first step is to fill out a form online. IKEA in Japan also offers to collect products in the customer's home and deduct the picking fee from the buy-back voucher. This pick-up service is so far limited to the close geographical area around the stores. When scaling up the buy-back service in several markets, the plan from IKEA is to apply the online forms to inform the customers about what types of products IKEA accepts and how much refund the customer can expect on the voucher at an early stage.

So far, the feedback from customers is positive, even if the buy-back service is only implemented on a small scale. Further, feedback given from the store in Edinburgh regarding buy-backs has shown that the resources are sufficient to manage the volumes at this stage, but the received volume is still low and the store sees a risk of lacking capacity if the volume increases. IKEA, therefore, asks the store to track the real time spent on every handled product and the space needed to see what adaptations are necessary when scaling up.

The As-Is area is gaining attention both from customers and IKEA. It has the potential of playing an important role for the stores in the redistribution of second-hand products. IKEA has presented a suggestion to change the name and characteristics of the As-Is area to a Circular Hub in specific markets to increase customers' understanding of circularity and communicate the value of prolonging the life of products. In the United Kingdom, IKEA has had a dedicated space called the learning lab since the beginning of 2019 with the purpose to develop the As-Is area into a more interactive place with a focus on circularity. IKEA has run workshops in the learning lab where customers have been able to participate in the prolongation of product life.

Different pilot projects are being conducted on different markets and best practise is shared to define standard operating procedures. Since the markets have different characteristics, the standard operating procedures are meant to lay a foundation, which the stores then can develop their solutions upon, optimised for their specific markets and customers. However, the location of a Circular Hub will most likely stay within the traditional IKEA stores, at least in the short term. Separated Circular Hubs can be a solution in the future, but it requires larger investments and is yet not decided. IKEA has previously tried to separate the As-Is area from the store, by opening a separate bargain store in Älmhult in 2012, only selling second-hand products. The

bargain store shut down after six years of operations and was instead integrated into the IKEA store in Älmhult. The move was motivated by increased efficiency as synergies could be exploited through utilising the personnel and space at the traditional store. The overall area for offering second-hand products was however more than halved in the move.

5.3.3 After Sales Parts

By offering after sales parts, IKEA helps people to maintain, care for, update, and repair their belongings to prolong product lives. By helping people prolonging their products' lives, IKEA enables the many people to live more sustainable which is an essential part of IKEA's development to become a circular business by 2030. People strive to consume less, and by developing a convenient service that helps end-users maintain, repair, and update their products, customers can prolong product lives within the limits of our planet.

IKEA established *After Sales* in the 1970s to fulfil customers' needs of spare parts. Today, IKEA offers spare parts in 52 markets and has a part range consisting of; *assembly parts* – spare parts defined by part numbers such as screws and hinges, *furniture parts* – spare parts with only internal part numbers such as drawer fronts and table tops, *kitchen articles* – spare parts within the range of IKEA Kitchen, and *other parts* – including lightning and more complex products.

IKEA's Easy Buying and Selling team, hereinafter referred to as EBAS, is driving different developments within IKEA of Sweden to make sure that the after sales offering is established in close connection to the development of the IKEA offer. This is done to facilitate a proactive approach to decide the offering and enable customers to prolong product life.

Individual stores can order specific spare parts to meet market demand. IKEA aims to store spare parts for outdated products to prolong product lives. Assembly parts are the most convenient part range to store since they are often small, standardised and easy to track through their part numbers. Therefore, assembly parts are made available three years after 'end date sale' of a product. Kitchen articles are available for two years after the 'global end date sale', furniture parts are available for one year and other parts usually for two years.

The range of assembly parts is made available for customers in different ways in different markets. In some markets the parts are offered free of charge whilst others charge the customers a small fee. Customer satisfaction is considered more important in this process than the profitability. IKEA aims to give its customers the right assembly parts instantly when visiting a store and therefore store a range of the most commonly used spare parts. The range is determined based on historical data and varies between stores and markets. By keeping parts in storage, IKEA can avoid breaking packages in-store which saves both money and time. It also makes it possible to satisfy customers faster and increase sustainability since products can be restored to a greater extent. In addition to the storage held in stores, customers can order parts through customer service and in certain markets through the website.

IKEA's offering of after sales parts can be separated into two different product flows; firstly, when products are returned to stores and IKEA regains ownership of the product, and secondly, when customers keep the product and obtain spare parts to prolong the life of a product in their home.

When IKEA takes over the ownership of a product, the product is returned to the store because of commercial, warranty, EOU, or EOL reasons. As seen in Figure 19, the product flow for after sales parts only consider products accepted at the inspection in the store that require spare parts to be sellable on the second-hand market, regardless of type of return.

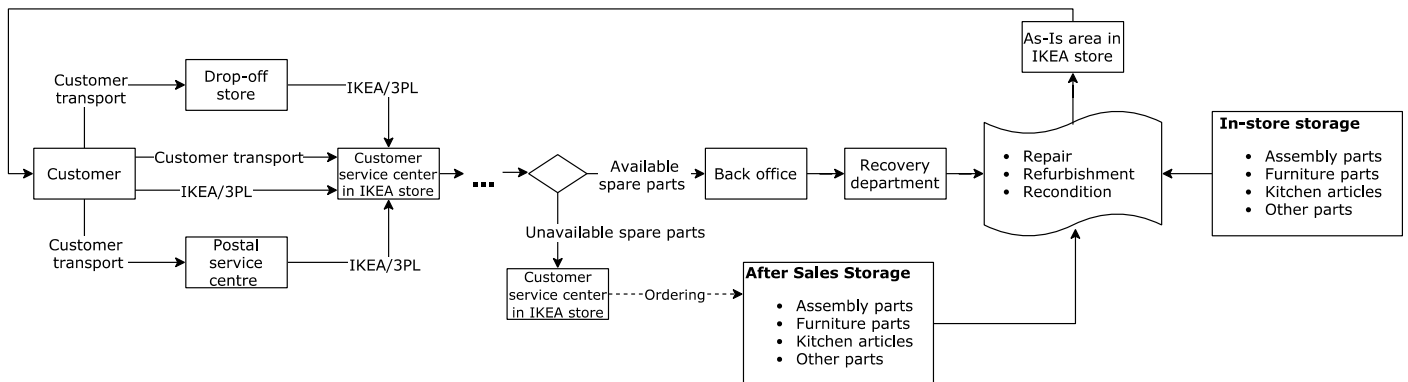


Figure 19. Product flow for IKEA's offering of after sales parts when products are delivered to store

IKEA aims to recover returned products with available spare parts in store. Spare parts unavailable in stores are often ordered from IKEA's after sales storage to recapture the value of a larger volume of returned products. All products that are recovered are sold in the As-Is area in-store.

When customers want to prolong the lifecycle of a product by purchasing new spare parts, the product flow looks different. In this flow, the products remain in customers' homes, and the customer visits an IKEA store to pick up needed spare part or contact IKEA to place an order. Today, IKEA stores have no requirements on how to handle spare parts, resulting in that the meeting with customers differs depending on market and store. For instance, assembly parts are available directly for customers on the Swedish market by a self-picking area in the store, whilst some markets require customers to order assembly parts at the checkout or the customer service center. Assembly parts are the part range at IKEA that has the highest demand among customers and can easily be ordered directly by their part numbers. If a spare part is available in the store, the customer can pick it or purchase it and bring home to recover the product instantly, described in Figure 20. If the required spare part is unavailable in the store, the customer service center can order the spare part from an after sales storage for home delivery to the customer.

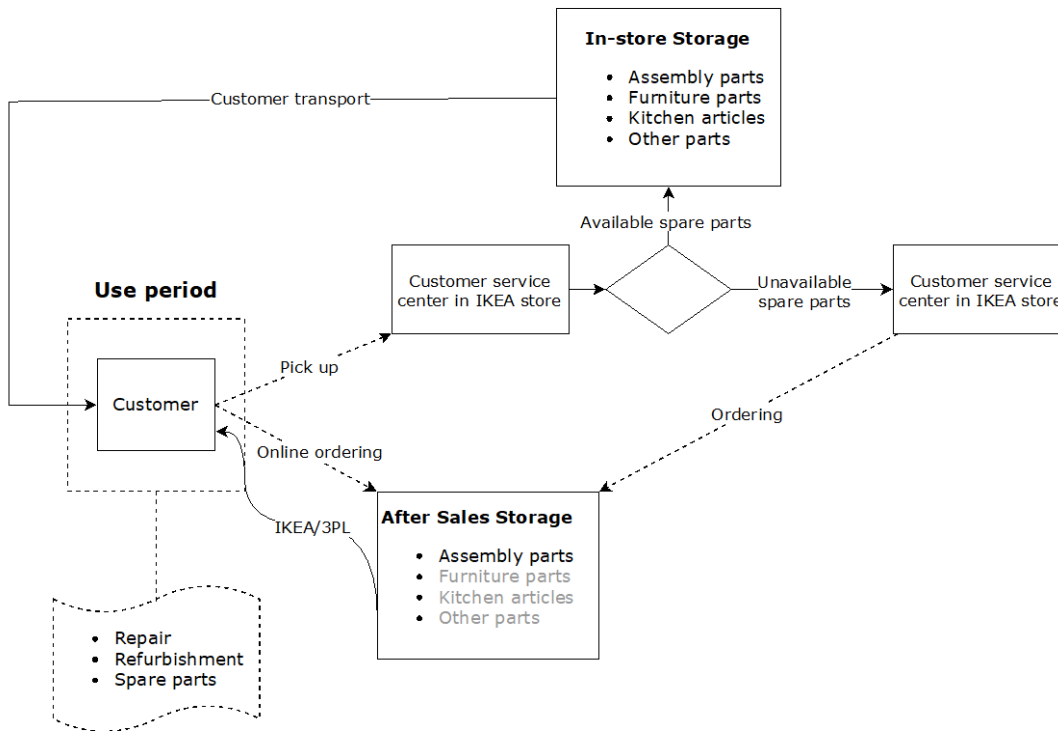


Figure 20. Product flow for IKEA's offering of after sales parts when products remain at the customer

In some markets, including Sweden and Germany, the customer can order assembly parts online for home delivery. The assembly parts are directly shipped from one of IKEA's after sales storages, with no involvement of the stores. One challenge for IKEA regarding online sales for spare parts is the difficulty for customers to identify required spare parts without a part number. This issue has limited the current online ordering system to only include assembly parts.

Challenges and opportunities in the reverse flow

IKEA's after sales has developed in an ad-hoc approach, without clear direction across the organisation. This has allowed different markets to develop scattered offerings, resulting in little alignment related to the aftermarket. IKEA aims to create a global after sales coverage, yet with market specific variations by focusing on cross-functional solutions across the value chain to build long-term relations and brand trust. IKEA further aims to align after sales with the development of its other offerings to make sure the business potential in the aftermarket is seen throughout the organisation.

IKEA's currently dispersed and decentralised digital systems have been identified as an issue for their positioning in the aftermarket. Currently, IKEA's spare parts are operated through multiple systems, depending on the market, contributing to scattered offerings in the different markets. EBAS has therefore sent a business request to be able to handle all parts in the same IT system, to take further steps towards creating a better offer to the markets and customers.

IKEA's challenge to connect customers with the right furniture parts is difficult due to the lack of identifiable part numbers. To secure that the customer will receive the correct part, IKEA would need to develop a solution for customers to order furniture parts themselves. Ingka is

also developing the possibility to order assembly parts online to a greater extent, similar to the current offering of assembly parts in Sweden and Germany.

5.3.4 Usership Models

At IKEA, offering products as a service is still in the development phase. Ingka is looking into usership models where IKEA offers products to customers who pay for use and later return products to IKEA. This offer intends to make it easier for customers to acquire, care for, and sustainably pass on IKEA products to contribute to a circular economy. The subscription initiative is a result of consumer research and increased need of product circulation. During 2020, furniture subscription will be tested in a low scale on 30 markets. The initiative will focus on niche segments to evaluate customers' responses, including; students in the Netherlands, public and private business sectors in Sweden, expats in Switzerland, and private customers in Poland (Ingka Holding B.V., 2019). The aim of the initiative is to develop a subscription-based usership model where IKEA maintains ownership of products and can secure recirculation as many times as possible and with as high value as possible.

As IKEA's usership model is in a developing phase, the product flow for usership products is uncertain. The product flow, shown in Figure 21, is therefore simplified and has its focus on what activities should be performed in the initiative and has less focus on where and how they should be performed.

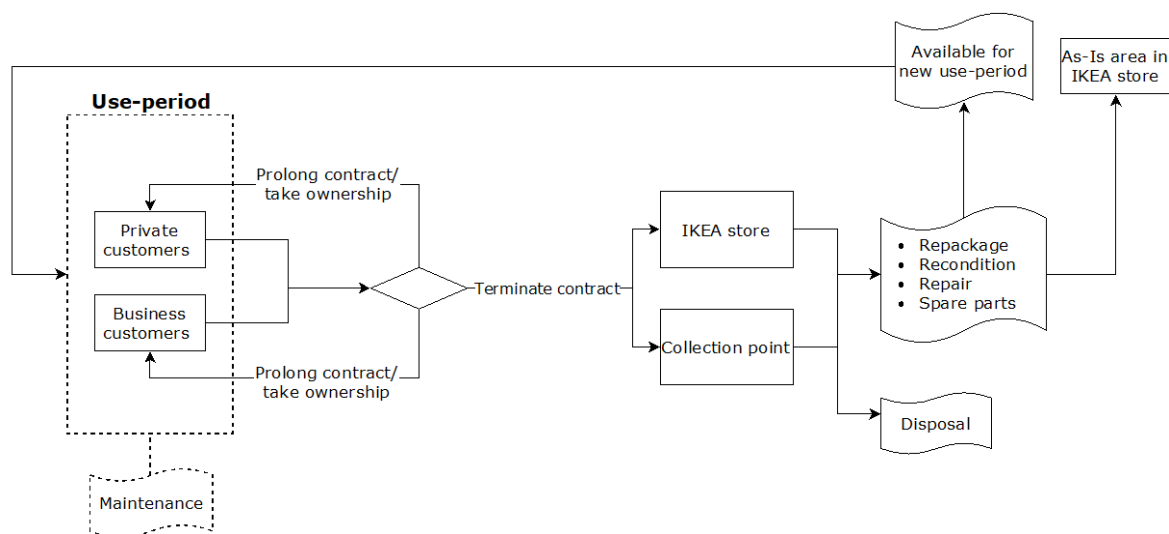


Figure 21. Simplified product flow of IKEA's usership model

The usership model aims to offer specific IKEA products as subscription to business customers as well as private customers over some time. During the use-period, products may need some sort of maintenance, which is to be included in the usership contract to a certain extent. When the end of a contract is reached, customers will be given the choice to renew the contract, take ownership, or return the product to IKEA. Prolonged contracts and customer taking over ownership result in no product transportation as products remain at the customers. However, products returned to IKEA would need to be collected at the customers and further inspected and separated depending on the condition and destination. A returned product aims to be redistributed either through a new usership period or sold as a second-hand product. To redistribute returned products, some sort of reprocessing is often required before the products

can re-enter the market. For products that cannot be recovered, spare parts are instead disassembled and reused to recapture more value and minimise the disposal.

Challenges and opportunities in the reverse flow

A challenge for the usership model is the lack of maturity among customers toward a model that provides access rather than ownership of furniture. According to IKEA in Edinburgh, most customers still want to own their products. However, new business models with a different view of ownership have emerged in other industries, such as car and bike-sharing, and are making customers more familiar and willing to pay for access rather than ownership. Also, customer behaviour is changing, and people are increasingly aware of their actions' impact on the planet and strive to be less wasteful. An opportunity can be to target segments showing a greater demand and are more willing to adapt alternative ways of consuming furniture.

Since the responsibility for the products stays with IKEA during the use-period, there is a need to assure quality and functionality during this time and offer maintenance if needed. To avoid unnecessary transport of products, IKEA aims to provide these services at the point of use. When the use-period has expired, IKEA has identified the challenge of collecting the products. Collecting assembled products at multiple points is costly and further there is uncertainty in where these products should be directed. The stores are not designed to handle these products. An alternative could be to direct products to separate collection points where storage and reprocessing activities can take place.

The storage of products becomes a growing issue when offering furniture as a service if there is a mismatch between supply and demand, meaning that there might be a gap between use-periods. Product downtime further results in a loss of potential profit. An identified challenge for IKEA is therefore to minimise downtime and efficiently inspect, reprocess, and redistribute products. IKEA must assess the condition of a product to determine if it should be made available for a new use-period, sold as-is, or routed to disposal. If a usership product is purposed to be offered again, recovery is needed to restore value and guarantee quality and safety. A challenge is therefore to determine what recovery should be done and to balance the cost with the value of making a product available for subscription.

Finally, IKEA highlights the challenge and opportunity in tracking and tracing products through the supply chain during a use-period. Since usership models focus on re-collecting products for multiple use, improved visibility of the products can support in tracking and evaluating the condition of products so that necessary recovery and maintenance can be given and product life prolonged while unnecessary movements can be reduced.

6 Analysis of challenges and opportunities related to involved actors

IKEA's transition towards a circular economy is largely dependent on other actors. The design of supporting reverse logistics is affected by the interaction between customers, companies, and the society. The different actors give rise to various challenges and opportunities for IKEA. In the following chapter, the empirical findings relating to these actors (section 5.2) are analysed with the empirical background (section 2.3) and the theoretical framework (chapter 3) to answer research question 2.

6.1 Challenges and opportunities for IKEA in relation to customers

This section analyses challenges and opportunities in reverse logistics for IKEA in relation to customers. The section highlights the importance of creating incentives and convenience for customers in a reverse flow and how communication with customers can increase knowledge and influence behaviour.

6.1.1 Incentives and convenience

It is important to create incentives and convenience for customers to increase returns of used products. To establish a long-term solution for customer returns, customers must find greater value in returning EOU and EOL products compared to product disposal. This challenge is seen in IKEA's current return flow, where customers most often are responsible for initiating product returns by bringing the product back to an IKEA store. This reduces the convenience for many customers and limits the volume of product returns to IKEA.

To increase the convenience for customers, extended company responsibility in return activities is identified as an opportunity. This can for instance be seen at IKEA, through take-back service, where IKEA offers full responsibility for collection and removal of EOL products. Furthermore, building a network with other actors is an opportunity identified for companies to reach out to more customers. IKEA can benefit from joining forces with others since its return flow is scattered due to the geographical spread of its customers. A larger presence can create increased convenience for customers. Besides, building a network provides the opportunity to tap into expertise and knowledge to accelerate the transition.

Customers' willingness to return products is related to their perceived value of a product (Ellen MacArthur Foundation, 2020). If a product is characterised by low value, the incentives and convenience in customers' return process must be higher. When sufficient convenience is difficult to achieve, an opportunity for companies is instead to increase incentives. To increase customers' perceived value of returning EOU and EOL products, IKEA can make use of reward systems. This can be seen in the buy-back service, where customers receive financial compensation when returning products. It is essential to understand customers' willingness to return and to adapt the return processes according to perceived value to meet customers' need for incentives.

6.1.2 Knowledge and communication

Traditional returns occur due to unfulfilled customer expectations (De Brito and Dekker, 2004) and stand for the majority of customer returns at IKEA today. The return process can, therefore, be associated with negative customer experience. EOU and EOL returns do not necessarily have to be linked with negativity. Such returns could be associated with satisfied customer use

and positive customer service. But since most of today's customer returns are preventable, there is a risk that customers have a negative association with product returns, regardless of the character. People's attitudes towards product returns can, therefore, be a barrier to increasing return volumes. By increasing people's awareness of returns' positive attributes, the overall attitude towards returns can change and the amount of EOU and EOL returns to IKEA can increase.

Moreover, the low volume of positive returns can partly be explained by inadequate communication between companies and customers and is further identified as a challenge. A dialogue between the parties is essential in a circular business model to increase the awareness about the positive attributes of EOU and EOL returns. Improving information sharing is a great opportunity for IKEA to help customers understand the value of used products and change their attitude towards returns.

Another challenge related to customer communication is that customers often find it hard to know how to facilitate best practice in relation to sustainability. In that case, clear guidelines regarding sustainable behaviour is identified as an opportunity for companies. For instance, extended producer responsibility (European Commission – DG Environment, 2014) can help reduce the uncertainty among customers on where to turn with specific products. The legislation covers certain products for which companies are given extended responsibility throughout the lifecycle and an obligation to accept returns after use. This means that customers always can turn to the producing company if uncertainty arises, which reduces their uncertainty of acting sustainable whilst it encourages product returns for the company. Similarly, IKEA can reduce the uncertainty among its customers by improving communication with customers, informing that EOU and EOL products from IKEA always can be returned to IKEA for recovery or recycling.

6.2 Challenges and opportunities in relation to companies

This section analyses challenges and opportunities in reverse logistics for IKEA in relation to companies. The analysis emphasises the product offering, shifting mind-set, supporting infrastructure and network as well as product visibility.

6.2.1 Product offering

An identified challenge is products that are not designed for recovery (Das and Chowdhury, 2012). IKEA has addressed this challenge by using principles that enable reuse, refurbishing, remanufacturing, and recycling when designing new products. However, it takes time to replace the existing range, and the products that reached EOU and EOL today are not always designed according to these principles. It is therefore important to understand that it takes time before the value of design efforts can be captured. In the long-term, products designed to be easily recoverable can save both time and money. Therefore, an opportunity can be the use of modular design principles to reduce lead times and consequently also costs.

The intended use and reuse should affect the design and desired quality levels. Products designed to be assembled and disassembled several times must hold a higher quality compared to products disposed after a single use. An opportunity is therefore to use the design strategies; design for extended use and design for multiple use-cycles brought up in section 2.3. These strategies have much in common with the circular design principles developed by IKEA

regarding designing for adaptability, care, repair, disassembly, and reassembly which all serve to keep the functional value of products high. Information gathered when inspecting returned products could be better utilised in product design to reduce the complexity of recovery (TU Delft, 2017). An opportunity for IKEA is hence to utilise information about customer usage patterns, wear and tear, and customer complaints to improve product design and recovery processes. Products can, for instance, be designed so that parts that are more inclined to break are made easily replaceable.

Product design determines the products' potential to be circulated whereas the degree to which this potential is utilised is determined by activities taking place throughout the complete lifecycle (European Environment Agency, 2017). A challenge for circular business models is to get back previously used products. The control IKEA has is lost when products are sold to a customer. The uncertainty of whether products will return can be reduced by keeping ownership of products (TU Delft, 2017). Keeping the ownership of products increases incentives to design for durability, longevity, and recovery since the total cost of ownership can be minimised when knowing that products return.

Taking responsibility for returned products presents financial opportunities to reduce material cost and cost of new production while reducing the extraction of new material (De Brito and Dekker, 2004). This could benefit IKEA since the value of design efforts can be captured to a greater extent and it prevents customers from disposing products that still have functional or material value. Designing products facilitated for recovery often initially requires more resources and material. These efforts can result in an increased environmental impact, which further enhances the importance of recirculating products as many times as designed for.

6.2.2 A shifting mind-set

A transition towards a circular business model requires companies to shift their mind-set regarding how products are produced and sold. A challenge is therefore to change the traditional 'sell more, sell faster' culture prevailing in many companies (TU Delft, 2017). During the interviews at IKEA, the urgency to change traditional business practices were consistent. There seems to be a consensus that the current linear production and consumption model is unsustainable in the long-term. The attitude towards change is positive but there is a great deal of uncertainty about how to go about it.

At IKEA, the business model has been built upon producing large quantities to reduce costs and lower prices so that products can be made available for the many people. The environmental driving forces behind reverse logistics make it clear that greater focus must be given to product and material circulation rather than new production and resource extraction (World Economic Forum, 2019). A more service-oriented offering allows companies to see profitability and business opportunities beyond the core product (TU Delft, 2017). This opportunity can be seized by IKEA by extending the service offering to include more recovery-related elements. By doing so, IKEA can further establish a socially responsible image among customers. Integrating corporate social responsibility in the company offering is increasingly important among customers (Chan et al., 2012), and can further help IKEA to reach more customers when sustainability becomes central in business models.

To shift mind-set, the circular economy values should be aligned with strategic directives (Bernon et al., 2018). Within IKEA this can be seen through the stated goal of becoming a

circular business by 2030. The goal permeates the entire company and needed actions are visible in business strategies moving forward. However, during the interviews with employees involved in product recovery it was brought forward that the current KPIs do not measure the value of product recovery. Therefore, there is a risk that new product sales are prioritised over recovery and second-hand sales. KPIs that measure the value of recovery can increase the attention given to reverse logistics and recovery and create incentives to allocate more resources to the activities.

6.2.3 Supporting infrastructure and network

An infrastructure adapted to linear production and consumption poses a challenge for the transition towards a circular economy (TU Delft, 2017). The linear model is well-established and difficult for individual actors to influence. Creating a network of actors to establish a circular infrastructure is an opportunity to accelerate the process. IKEA has expressed a need to establish an infrastructure that supports a circular business model, where the value of returned products can be restored.

A challenge for IKEA is its broad range of products, resulting in high variety. In addition, IKEA's broad global presence makes it important to find solutions for all markets and adapted to different customer needs. Building an infrastructure that supports the circulation of products requires more resources within reverse logistics and additional knowledge about product returns. A challenge is that the volumes of products returned with the purpose of redistribution today are low, which makes it expensive to invest in supporting infrastructure and processes necessary to scale up. Building a network and collaborating with others make it possible to gain economies of scale in for example transportation and recovery processes even if IKEA's return volumes initially remain low.

Uncertainty lies in what role IKEA should take and to what degree of responsibility can be taken by external actors in different activities. Developing new product sales channels, such as usership models and second-hand offerings, requires new capabilities and processes but can at the same time be used to establish an infrastructure adapted to a circular business model.

The absence of understanding the value of operationalising circular values into reverse logistics is a common issue among companies (Bernon et al., 2016), resulting in that reverse flow gets less attention compared to forward flows. The design of reverse logistics activities and necessary infrastructure can be improved by generating data on product locations and use (Masi, 2019). This can be done by keeping the ownership of products in-house and using track and trace technologies. At IKEA, customers take over the ownership when making a purchase, and thus data regarding product use and the condition is limited after the point of purchase. In addition, IKEA describes that the customer behaviour in their reverse flows is poorly mapped compared to forward flows due to the historically small volumes and large variation. This creates uncertainties and difficulties for planning and is also a hinder for adapting return processes to customer behaviour and needs. Taking advantage of available data and mapping customer behaviour in the reverse flow can, therefore, be useful for understanding how to design return flows that facilitate a circular economy.

6.2.4 Product visibility

Managing the uncertainties in timing and quality can improve reverse logistics performance and enable companies to take care of products after use (Goltsos et al., 2019). These uncertainties can be seen in the reverse flow of IKEA and they increase in a transition towards a circular business model. The large uncertainty of when and if products will return, can partly be explained by the high variability in product lifecycles (Matsumoto et al., 2016). This uncertainty is visible within IKEA who offers a wide range of products with different lifecycles. It is further intensified since customers use products differently.

To improve predictability, the concept of modified lifecycles is introduced in section 2.3. Modified lifecycles can reduce the uncertainty of timing since companies can actively plan for specific durability and lifetime of parts. Companies can also focus on enabling the estimation of product lifecycles so that predictions can be made on when products will return. A good understanding makes it possible to know when recovery is needed and enable a more proactive way of working.

Many companies have the technology and data to do such estimations since they conduct testing to determine reasonable warranty times. IKEA conducts extensive testing of products to ensure quality, safety, and warranty times and this testing could be used to make estimations and improve predictability. Transferring and making this data available in the return processes could create value and reduce uncertainties since the timing of returning EOL products could to a greater extent be predicted. For example, if products are given expected lifetimes during the design phase, the time between purchase and EOL return can be predicted given that the product is returned. This information can further be used to reduce uncertainty in quality. For example, estimations can be made on what parts are more inclined to break. Such information can benefit the inspection and quality assurance.

The use of appropriate information systems can reduce cost, enable real-time visibility, and predictive maintenance (Hopkinson et al., 2018; Matsumoto et al., 2016) and is critical for circular business models. The cost of track and trace technologies has dropped significantly which has increased the attractiveness of using RFID or sensors in products (Cilloni et al., 2019). Embedding sensors in products can further provide companies with usage data and create a better understanding of product lifecycles. However, the tracking technology used should vary depending on product value and characteristics.

IKEA has started to explore a product passport type concept to increase the visibility of product information. In a circular economy it is important that a product passport can be active during multiple use-cycles so that the information stored can be accessed when the product return and enter recovery processes. Since furniture is often used for a long time it is important that the tracking and tracing of products make use of a standardised technology that is connected to a central database to avoid losing important information over time. Improving product visibility can reduce the uncertainties in both timing and quality for IKEA.

6.3 Challenges and opportunities in relation to society

This section analyses challenges and opportunities in reverse logistics for IKEA in relation to society. The analysis focuses on how stricter regulations affect the furniture industry and IKEA as an actor.

6.3.1 Stricter regulations on material choice and production

Companies with linear business models have in many respects shaped the society and its people, meaning that a transition towards a circular business model is correlated with high costs and uncertainties. It is therefore difficult for individual companies to develop circular business models alone. Furthermore, circular business models will not pick up speed if linear consumption and production remain more attractive for customers and companies. To facilitate the circular economy and change actors' behaviour, society pushes actors toward sustainable actions by stricter regulations on material choice and production. Stricter regulations are identified as a challenge for IKEA since it forces them to comply.

Regulations becoming stricter and more extensive over time (European Commission – DG Environment, 2014), results in that companies face the challenge to continuously adapt. To keep up with such development, actors embracing circularity can jointly develop best practises by sharing knowledge. Shared knowledge can provide guidelines and opportunities to learn from others. By joining forces with others, IKEA can continuously develop a circular business model prior to regulations to be better prepared for change. Further, the provision of support in the transition towards a circular economy, such as the actions taken by the European Commission (European Commission, 2015), makes it easier for IKEA to accelerate change.

An example when actors joined together to develop best practise, is the deposit system of plastic bottles, described in section 2.3. This is a well-functioning system where users, companies, and municipalities all work together to recycle plastic bottles and capture the value of used goods. The uniform and standardised bottles, together with financial incentives, make it possible to achieve large return volumes that can be handled in the same way. The standardisation has enabled a common infrastructure.

At IKEA, and the furniture industry, products are instead characterised by high variation and heterogeneous materials making it difficult to standardise recovery processes and establish an infrastructure that supports the broad product range. Modular and standardised design can be used to reduce the variety and contribute to a more standardised recovery process. However, finding a holistic solution in the society for the recovery of furniture is difficult which results in that companies are forced to develop their solutions to suit their strategies and product range. Developing best practise jointly with other companies embracing circularity, can help IKEA develop a well-functioning system where different actors work together sustainably to recover and recycle furniture.

For companies to better prepare for future regulations, an identified opportunity is to follow the development of regulations in other industries to prepare for potential future regulations in the furniture business. For instance, the Ecodesign Directive 2009/125/EC pushes companies toward sustainable solutions by setting requirements on energy efficiency and environmental performance of products. Similarly, EPR increases the responsibility of collection for certain products by shifting the cost from municipalities to producers (European Commission – DG Environment, 2014). These factors are driving companies in specific industries to act more sustainable. Furthermore, ongoing projects are looking at the possibility of extending the EPR concept into new industries (European Commission – DG Environment, 2014), meaning that similar directives could be developed for other lines of business, such as the furniture industry. By following the development of regulations in other industries, such as EPR and ecodesign,

IKEA can be prepared and easier adapt if similar directives are introduced in the furniture industry.

7 Analysis of initiatives and recommendations for future reverse logistics activities

This chapter analyses and discusses how possible future reverse flows can be designed to support a circular business model based on the studied initiatives; (1) buy-back and take-back services, (2) offering after sales parts, and (3) usership models. The reverse logistics activities (section 3.1.3) form the structure of the analysis that is based on the empirical findings (section 5.3) and the theoretical framework (chapter 3) together with the empirical background (section 2.3) to answer research question 3. The analysis finally leads to potential future states for IKEA's reverse flow.

7.1 Reverse logistics activities for a buy-back and take-back service

The buy-back and take-back services offered by IKEA require supporting reverse logistics activities. The analysis aims to clarify what is important when designing the activities in a future return flow that promotes the circulation of EOU and EOL products through take-back and buy-back services.

Figure 22 and Figure 23 show how the current reverse flows for the buy-back and take-back services are divided according to the reverse logistics activities. This section has these figures as starting point when analysing the activities.

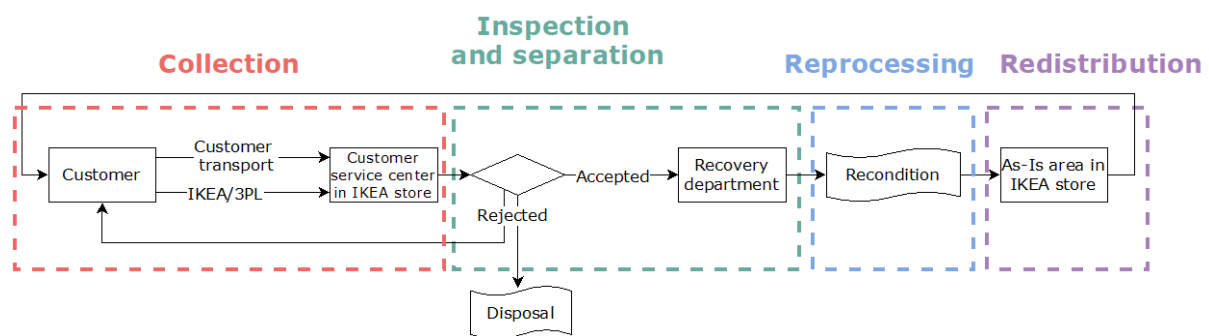


Figure 22. Illustration of how the buy-back service is divided according to the reverse logistics activities

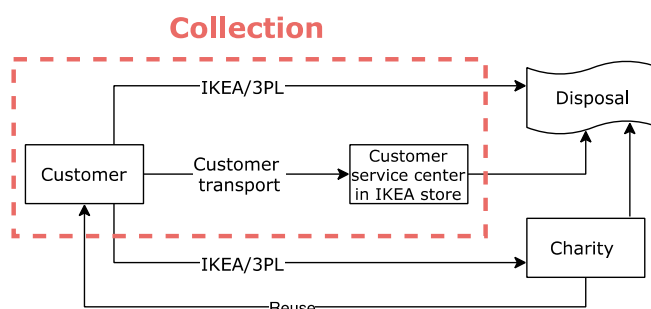


Figure 23. Illustration of how the take-back service is divided according to the reverse logistics activities

7.1.1 Collection

In the following section, the collection of products is analysed based on the three-step process for collecting goods; incentivising returns, designing the collection channel, and pre-sorting of goods (Goltsos et al., 2019). The aim is to analyse the challenges for collection identified in

sections 5.1.3 and 5.3.2 with the theoretical framework. The challenges are linked to the uncertainties in the characteristics; transportation, forecast, destination, routes, and channels, inventory management, cost, packaging quality and track and trace visibility (section 3.1.5) to analyse how these challenges can be managed through the design of the activity.

Incentivising returns

A major challenge for the collection of previously used products is incentivising returns (Ellen MacArthur Foundation, 2020; Goltsos et al., 2019). This challenge is present at IKEA, who has seen the need to create incentives for customers to return EOU and EOL products. Rewards and convenience can make customers perceive returning products to have value (Ellen MacArthur Foundation, 2020). IKEA has addressed this challenge with the buy-back service where customers receive financial compensation in the form of a voucher. Despite this, the volumes of returned products to the stores are low.

The collection of products is highly dependent on product value and different approaches can be used for collecting products with low, medium, and high value (Ellen MacArthur Foundation, 2020). The product range of IKEA is dispersed and characterised by relatively low prices. Products that are perceived to have low value are more sensitive for inconvenience among customers and greater incentives are needed. To collect a wider range of products that inherit different values, the incentives can be adapted to different product types and values. In addition, to creating financial incentives, IKEA aims to communicate environmental and social benefits so that customers realise the total value of returning products and contributing to reuse and a circular economy.

Designing the collection channel

The collection activity takes place between the consumer market and recovery facilities and the number of collection points and destinations are determined by the degree of centralisation in the return flow (Fleischmann, 2000). The degree of centralisation creates different uncertainties for destinations, routes, and channels. At IKEA, returns are collected to the closest store. This can be seen as a decentralised approach with multiple return points (Bernon et al., 2016; Nuss et al., 2015). The advantages that follow are reduced transport time and a large geographical acquisition area that makes it convenient for customers to return products.

Inventory management is influenced by the decentralisation of the collection activity due to the trade-off between freight rates and inventory holding costs. Decentralised inventories increase inventory holding costs while shortening transport distances (Hübner et al., 2016). On the other hand, a more centralised return handling would facilitate consolidation and improve resource utilisation (De Koster et al., 2002).

The two collection models, bring-in and pick-up systems (Nuss et al., 2015) can be designed more or less centralised. The bring-in system offered by IKEA through the buy-back service is today limited to the stores, but the service could be extended to include the collection of products in other channels such as drop-off sites or parcel returns. Similarly, the pick-up system offered by IKEA through the take-back service can be more centralised by having drop-off sites where customers can leave their products for pick-up by IKEA or third-party logistics providers instead of collection occurring in the home of customers. This would increase the degree of consolidation.

Extending these services would also mean transferring from a single to a multiple channel offering. Offering return options across channels provide an opportunity to increase sales through cross-selling and up-selling as well as improves the customer experience (Zhang et al., 2010). A customer that return a product using the buy-back service and receives a refund is likely to do other purchases in the store. If a return is instead initiated online, additional purchases are likely to be made on the IKEA website. Offering return options across channels can be seen in the traditional return flow at IKEA, where returns can be sent using postal services or left at drop-off stores in addition to the alternatives of customer transport and pick-up. Extending the return channel in the buy-back service to include similar options could be an alternative for IKEA since the channels already are established for the traditional returns.

The collection channel can be operated by different actors, such as the retailer, manufacturer, or a third party. A collection channel operated by retailers is often preferred if returned products are sold on the same market. The retailers are located closer to customers, making it more convenient and shortening the transport distances (Savaskan et al., 2004). This is the case at IKEA, who operates the collection channel and keeps products and reprocessing close to the customer touchpoints. However, the customers are responsible for initiating the returns and third-party logistics are used for transportation.

The many-to-few relationship in the collection activity gives rise to uncertainties for transportation and makes route planning complex. Combining forward and reverse transportation can be a challenge if it is set up as milk runs and collection and delivery are to happen simultaneously (Tibben-Lembke and Rogers, 2002). IKEA offers pick-up service combined with delivery at some markets today. The difficulty of route planning has however limited the service to serve the geographical area close to the stores. The planning is made simpler since all products that are collected through the take-back service are brought to disposal and therefore the number of destinations is low. However, the number of destinations increases if products are to be reprocessed in the store, which further complicates route planning.

The volume received from the buy-back and take-back services is today low at IKEA and the reverse logistic network is not adapted to handle large volumes. Handling and transportation of small volumes result in higher costs per item (Fleischmann et al., 2000). The cost structure is often less visible compared to the forward flow since products are handled individually. Due to the currently small volumes, transparency in the cost structure has not been prioritised at IKEA. However, this becomes a greater challenge when introducing a circular business model, and the volumes of returned products increase. The need for transportation is likely to rise and to reduce the cost and environmental impact it is important to achieve higher filling ratios and consolidation. Consolidation in both handling and transportation allows for greater economies of scale in the collection activity.

The packaging quality is another challenge for collection, since returning EOU and EOL products often lack packaging completely. This increases the risk of damage during transportation. Since the buy-back service requires customers to deliver their products to the stores themselves, IKEA is not responsible for the collection in today's offering. However, damage during customer transportation risks to lower the value and makes it harder for IKEA to restore value.

Removal of products by IKEA is however included in the take-back service. Most of these products are intended to be disposed of, making the risk of damage less important. If products are collected with the intention of a higher recovery rate, this problem would require greater attention from IKEA and third-party logistic firms. The packaging is also important to increase the filling ratio, discussed in the previous section, since it makes the products easier to palletise. Designing products for disassembly can be a way to reduce the risk of damage and increase the filling ratio during collection.

A challenge when designing the collection activity is the uncertainty in when and if products will be returned combined with the uncertainty in how many products that will return. It is therefore important to forecast returns by estimating the timing and volume to reduce the uncertainty and gain efficiency in the collection. When forecasting returns, it seems that the return flow follows the forward flow but with some time lag (Tibben-Lembke and Rogers, 2002). This can be seen by looking at the relationship between sales and returns at IKEA.

However, the difficulty of forecasting increases when introducing EOU and EOL returns since the time between purchase and return increases, and customer usage has a greater impact. Increasing the track and trace visibility can reduce uncertainty in timing and quantity. According to the analysis in section 6.2.4, this can result in a better understanding of product lifecycles and customer behaviour. By analysing and transferring information gathered in the testing of products to reverse logistics actors, predictions can be made on when and why products will be returned in the EOU and EOL phases. In addition, a thorough mapping of customer behaviour in the return process can help to understand why and when customers initiate returns.

Pre-sorting of goods

The last step of the collection process refers to the sorting of products based on their quality and serves to determine suitable next steps in the reverse logistic flow. Since this pre-sorting can be done independently of the collection activity, it is analysed further in section 7.1.2 below.

7.1.2 Inspection and separation

In the following section, the challenges for the inspection and separation activities identified in sections 5.1.3 and 5.3.2 are analysed with the theoretical framework. The challenges are further linked to the uncertainties in the characteristics; destination, routes, and channels, product quality, cost, track and trace visibility and product lifecycle (section 3.1.5) to analyse how these challenges can be managed through the design of the activities. The analysis focus on the degree of centralisation in relation to the need for efficiency and responsiveness in the return flow.

Functional and innovative products

Products can be divided into functional and innovative depending on the time-sensitiveness of the value (Das and Chowdhury, 2012). IKEA's range consists of both functional and innovative products since some products are standard in the assortment and thereby less time-sensitive and others are seasonal and characterised by short lifecycles and high time-sensitivity. Functional products are argued to be better suited for a cost-efficient supply chain whereas

innovative products require a responsive supply chain to gain speed. To keep the value of the whole range of returning goods as high as possible, there is therefore a need for both efficiency and responsiveness in the reverse flow. This is analysed in the section below.

Efficiency and responsiveness

The inspection and separation activities can be centralised to different degrees. The activities can be analysed in relation to efficient and responsive supply chains, where centralisation increases cost efficiency and decentralisation increases responsiveness (Blackburn et al., 2004). The inspection activity determines the difference between the two to a large extent. Today, the activities take place in-store at IKEA on most of the markets when products return through the buy-back service. The products received through the take-back service is not inspected since they are directed to disposal or charities independent of quality. The analysis will, therefore, focus on the products returned through the buy-back service.

Inspecting products in-store is a rather centralised structure since products are collected to allow inspection in fewer places and using the same resources. Thus, economies of scale can be achieved in both processing and in the transport of products. Having the inspection made in-store results in that all product returns, independent of quality, are directed toward the stores and the separation is delayed. The condition of EOU and EOL returns at IKEA are unknown but predetermined before the inspection takes place and there is therefore little value in delaying product differentiation in contrast to product differentiation in a forward flow (Blackburn et al., 2004). Inspecting products at an earlier stage makes it possible to direct them toward the appropriate channels directly. This can be facilitated by decentralised inspection in the home of customers. However, this requires inspection at multiple points which can be a challenge.

IKEA has tackled this challenge by introducing an online form on certain markets, which allows IKEA personnel to inspect products centrally, but remotely, while the products can remain in the home of customers. Another alternative can be to use mobile applications to share information about the conditions of products remotely. When the conditions are determined, the products can then be separated directly to the right channels.

Early product differentiation through decentralised separation together with a centralised inspection, would make it possible for IKEA to gain both cost efficiency and responsiveness by separating products that are directly re-sellable, in need of recovery, or should be disposed of early on. It would further reduce the uncertainty of destination, routes, and channels and thereby facilitate better planning so that additional transportation and handling can be avoided. Since directly reusable products can be diverted from the main return flow early on these products never have to enter a reprocessing activity. This reduces handling time and needed space for these activities as well as frees up time for the products in need of reprocessing. Reducing the lead-time means that greater value in time-sensitive products can be captured (Blackburn et al., 2004). With early inspections and product differentiation, IKEA reduces the risk of customers bringing in products that cannot be recovered or handled in the store. IKEA has expressed that the level of recovery needed must be determined early in the chain so that the right amount of resources can be allocated.

Uncertainty of timing and quality

The difficulty of forecasting returns creates a challenge for the inspection activity since large uncertainty lies in the timing and quality of products. The uncertainty of timing can be reduced by early and remote inspection and separation. This provides information regarding quantity and quality early on which facilitates better planning and resource allocation in the subsequent activities. The product quality is central for inspection and for how returned products should be managed in the reverse flow. Returns can be separated depending on the functional and material value (Das and Chowdhury, 2012). This can be seen at IKEA where the functional value is captured through the buy-back service and the material value is captured through the take-back service.

Due to higher uncertainty in product quality of EOU and EOL returns, the handling cost per item increases (Fleischmann et al., 2000). Higher handling costs indicate that a certain degree of centralisation is needed to reach cost efficiency, supporting the earlier discussion. Another approach to reach cost efficiency in the inspection of products is the use of technology (Cilloni et al., 2019). The track and trace visibility of products can to a large extent determine the efficiency of the inspection activity. IKEA must secure the quality and safety of returned products and large uncertainty lies in what wear products have been exposed to. By generating data, better knowledge of product condition and needed maintenance can be given (Kumar et al., 2016). Blackburn et al. (2004) lifted the possibility that quality inspection could be done by embedding sensors or other technology into product. However, this type of data generation is more applicable to high value products due to the cost. For products constituting a lower value, digital solutions can instead be used to assess the condition of products. For instance, the online form used by IKEA allows recovery personnel, with knowledge about available resources and recovery potential, to evaluate the condition from distance by looking at pictures and information provided by customers.

In addition, understanding the characteristics of the product lifecycle can improve the inspection activity. Information can be shared about parts that are more inclined to break, how the product has been used, and best practises for recovery of reoccurring problems. The informational value generated by inspection can be used to improve succeeding supply chain activities as well as product design (TU Delft, 2017). The online forms also constitute informational value for customers since they directly can receive an estimation of the potential refund and know if the product is accepted. This is in line with the vision of IKEA to give customers instant support and provide convenient return options. Customers tend to over- or undervalue the potential for recovery of their products due to lacking information and product knowledge. It is therefore better if the inspection can be done by experts.

7.1.3 Reprocessing

In the following section, the challenges for the reprocessing activity identified in sections 5.1.3 and 5.3.2 are analysed with the theoretical framework based on the depth and width of the recovery network. Firstly, challenges for reprocessing related to larger return volumes are discussed and linked to the uncertainties in the characteristics; forecast, product quality, and product lifecycle (section 3.1.5). Secondly, the recovery processes are analysed based on their recovery purpose. The recovery processes are linked to the uncertainties in the characteristics; inventory management, packaging quality, product quality, and pricing (section 3.1.5) to analyse the degree of centralisation the processes should be performed. Finally, the challenge of integrating IKEA's forward and reverse network is analysed and linked to the uncertainties

in the characteristics; costs, destination, routes, and channels, and inventory management. The section aims to analyse how these challenges can be managed through the design of the activity.

It is stated in the empirical findings that too few people at IKEA work with recovery in relation to incoming volumes. Products returned through the take-back service are not prioritised by IKEA since they typically have been considered to have reached EOL and possess a low value. The majority is therefore recycled instead of recovered at a higher value. The resources allocated for reprocessing are limited and IKEA's focus is instead on products where value can be restored as quickly as possible. This is the purpose of the buy-back service, where products are returned and with little or no reconditioning can be resold as second-hand products. To reduce the handling time, only certain products are accepted in the buy-back service. The reason for only performing recovery in the form of reconditioning can again partly be explained by limited resources compared to incoming volumes. These findings show that there needs to be a balance between available resources and incoming volumes to handle a larger volume of returning products and to restore greater value. To do so, an alternative for IKEA is to improve the efficiency in the reprocessing by allocating more resources to handle returned products. IKEA's resource allocation relates to the company's mind-set and performance measurements. For a better understanding concerning IKEA's mind-set and KPIs, the reader is referred to section 6.2.2.

Challenges with larger return volumes in relation to recovery

To improve the design of IKEA's reprocessing activity, it is important to understand the network's depth, described by Dekker et al. (2004) as the extent of the recovery and product complexity, and how increased volumes affect the performance in different processes. Thus, challenges related to increasing return volumes at IKEA are presented to reduce the uncertainties.

The returned volumes of products through the buy-back and take-back services are small which has made a reactive approach possible. However, as IKEA strives to increase the rate of recovery, the volumes are likely to increase. The difficulties to forecast can then result in a larger problem for efficient reprocessing. Returns received through the buy-back service are today correlated with advertisement. This could be a possibility for IKEA to better control when and if products return since a steadier flow makes planning easier and reduce the uncertainty of timing. However, the product quality of returned products would still be uncertain, which strengthens the importance of product visibility, discussed in section 6.2.4.

The product quality of returns affects how they should be managed in a reverse flow (section 7.1.2). Today, IKEA's buy-back service only reprocesses products in need of reconditioning. Returns in need of further recovery and all returns received from the take-back service are recycled or disposed of, meaning IKEA handles many returns as if they only possess material value even though many of the returns possess a functional value. To recapture more value from returned products, IKEA can include more extensive recovery processes in the buy-back and take-back services.

A challenge for IKEA when introducing more extensive recovery processes, such as repair and refurbishing, is that such processes require more resources than reuse and recondition. Because of the limited resources allocated for recovery today, these activities are currently excluded

from the buy-back service. These processes are instead performed individually and reactively on products at IKEA subject to available time and resources.

There is also a greater uncertainty regarding necessary recovery tasks and needed time for these processes, making the planning more complex. To reduce such uncertainty, products should be designed to be easily recoverable (Das and Chowdhury, 2012). By designing products for a return flow, the time and resources needed for recovery can be reduced and IKEA could efficiently perform more extensive recovery in stores and reduce unnecessary disposal. Product design is furthermore essential to prolong product lifecycles. This can be made by developing module-based products to improve the standardisation, described in the empirical background. By improving the prerequisites for recovery of products, the recovery purpose can easier be achieved and more products can be restored.

Attributes of the recovery processes in relation to the degree of centralisation

Regarding transportation, decentralised reprocessing is often preferred since it shortens transport distances (Savaskan et al., 2004). However, the recovery processes have different attributes (Fleischmann et al., 2000) that also have to be considered when determining the degree of centralisation for IKEA's reprocessing. Thus, reuse, repackaging, repair, and refurbishing are discussed individually below.

The purpose of the reuse process is to pass on products to new customers with none or minor improvements, resulting in that storing space is the main resource needed (Sahyouni et al., 2007). A buy-back and take-back flow with many reuse products is therefore suitable for a decentralised network to stay closer to the customers. If the products stay close to the customers, the customer convenience increases, transportation minimises and time between collection and re-selling points is reduced. Reuse is today performed in-store at IKEA and is a more centralised structure since products could be passed on directly between customers. However, utilising the stores helps IKEA to reduce the uncertainty regarding product quality for customers since IKEA inspect the products before re-selling them. To minimise the risk of a large inventory of un-sellable products, efficient inventory management is important. The challenge for IKEA is therefore to create a fast return process to quickly reintegrate products.

The repackaging aims to repackage products and sell them as new if possible. Thus, the main operation relates to the actual repackaging and should be performed as early as possible (Stock and Mulki, 2009), as long as material and equipment are available. This means, with standardised packaging and the right conditions, repackaging should be performed decentralised. However, many IKEA products have complex packages, resulting in difficulties regarding repackaging of products decentralised in the home of customers. Instead, centralisation of repackaging could increase economies of scale, but would result in more transportation and longer time to reintegrate the repackaged products. To handle the trade-off, the repackaging process can be performed in-store. IKEA has multiple stores that give large geographical coverage and the repackaged products can be directly reintegrated. At the same time, consolidation of volumes in the stores allows IKEA to handle repackaging more efficiently. However, repackaging after transporting the products to the stores increases the risk of damage during transport. Having an inconsistency of packaging quality on returned products further increases the uncertainty of product quality at reprocessing. Collected products through buy-back and take-back services often completely miss packaging since the products are

assembled and purchased a long time ago. Thus, it is important to keep the reprocessing decentralised, when possible, to minimise the transportation and the risk of damaged goods. Furthermore, having products designed to be disassembled and reassembled, is another move to reduce the damage on returned products without packaging. Products designed for disassembly and reassembly, or multiple use-cycles, are related to higher quality but also relate to more material and higher production cost, as described in the empirical background. Hence, these products must be utilised as many times as designed for to reap the advantages.

With repair, the products aim to be fixed by replacing smaller parts to improve the functionality (Thierry et al., 1995). There are two main barriers to repair to be performed decentralised (Ellen MacArthur Foundation, 2016). Firstly, the lack of repair information makes it harder to repair complex products decentralised. This can partly explain why IKEA only performs recondition on buy-backs and exclude all recovery process on take-backs, as the products are considered too complex in relation to the need for resources and time. Secondly, spare parts are often expensive and limited in comparison to buying new products. This often creates uncertainty of matching the price with the willingness to pay among potential customers. This can to an extent be reduced by reusing old spare parts and is seen in IKEA's current reverse flow. The challenge for IKEA is to gather a larger volume of spare parts from returned products to repair more products that today are disposed of. This can be made by module-based products, described in the empirical background. For a better understanding of how IKEA handles spare parts, the reader is referred to section 7.2.

Refurbishing is highly linked to disassembly, quality inspection, and reassembly (Thierry et al., 1995). Moreover, refurbishing is a more complex process and requires more material, equipment, and labour, making it more difficult to perform decentralised. To a large extent product design determines the degree of centralised refurbishment (Sahyouni et al., 2007), and relates to product quality and the importance of including product recovery already in the design phase. This is also shown in the empirical background, where design solutions such as design for extended use and design for multiple use-cycles facilitate recovery, reduce complexity, and prolong product lives. This discussion strengthens the idea of utilising module-based design on IKEA's products to reduce the complexity and support a more decentralised refurbishment process in IKEA stores.

Integration of IKEA's forward and reverse networks

It is important to understand whether IKEA can integrate the recovery processes with existing stores to share assets, knowledge, and equipment, referred to as the network's width. As reprocessing faces challenges regarding high variety in timing, sequencing, and volume, fixed assets can be shared in a forward and reverse flow (Dekker et al., 2004). An integrated structure can reduce overhead costs and facilitate economies of scale by shared destinations, routes, and channels. To integrate forward and reverse flows, it is essential to have similar operations in the flows to share knowledge and equipment. This is already done by IKEA as they are integrating current recovery processes in their stores, rather than having separated assets. Furthermore, IKEA also integrates their redistribution with the stores by selling their second-hand products in their stores in the As-Is area. IKEA did an attempt to open a separate bargain store in Älmhult to separate the As-Is area from the store, but later reintegrated the bargain store into the IKEA store to utilise shared knowledge and other resources. By standardising the recovery processes and reducing the complexity, the same knowledge in existing assets can be

shared to a greater extent. One of IKEA's main challenges for integrating and expanding the reprocessing in stores is therefore the resources and available space dedicated to recovery. The integration or disintegration of the reprocessing activity is therefore largely dependent on volumes and the store capacity.

In the decision whether to integrate and to what degree the network should be centralised, inventory management faces a trade-off between freight rates and inventory holding costs. Because of high uncertainty regarding recovery processes, decentralised structures require higher inventory and holding costs to provide the service level needed in every facility, compared to one or fewer inventories in a centralised structure. Consequently, the recovery speed reduces in a centralised structure while transportation cost increases.

A company with global coverage needs multiple facilities to efficiently reach out to its customers even if the network has an integrated structure. Having several assets also makes it possible for IKEA to specialise to a greater extent. Facilities can then be adapted to specific recovery processes. From a long-term perspective, a growing number of returns could motivate recovery in separate facilities to achieve greater economies of scale. This would support a separate recovery department for IKEA, performing more extensive repair and refurbishing processes not feasible in stores.

7.1.4 Redistribution

In the following section, the challenges for the redistribution activity identified in sections 5.1.3 and 5.3.2 are analysed with the theoretical framework. Firstly, challenges related to customer perception of second-hand products are linked to uncertainties in the characteristics; marketing, product lifecycle, and pricing. Secondly, challenges regarding the reintegration of products into a forward flow are linked to uncertainties in the characteristics; transportation, destination, routes, and channels, and inventory management (section 3.1.5). The analysis aims to give a better understanding of how to design the redistribution activity for second-hand products.

Perception of second-hand products

It was concluded from the interviews with IKEA that customers' attitudes towards second-hand products is a challenge for redistribution. The products that pass inspection and re-enter IKEA through the buy-back service are sold in the As-Is area only. They are perceived to be of lesser quality amongst most customers which affects their willingness to pay. The variety of product quality also affects the pricing of products. When products are returned to IKEA through the buy-back service, the price is determined after inspection. To make a profit on recovered products, the cost of recovery should be reflected in the price and this cost is often hard to measure which in turn makes the profits uncertain.

Knowing the demand for second-hand and recovered products on the consumer market is important to capture the value of product recovery (CE100, 2016). Understanding the demand is important for IKEA since there needs to be a balance between the cost of recovery and the willingness to pay among customers to be financially viable. The customer demand can be influenced through marketing. However, retailers have difficulties in advertising returned products outside their stores, resulting in restrictions when it comes to communication with potential buyers. For IKEA, this means that it is more complex to attract customers with advertisement since ads for returned products cannot be product specific.

IKEA instead focuses on clear communication of the sustainability work, promoting customers to take part in a circular economy, and encouraging reuse. This can be seen in the development of the As-Is area into a Circular Hub, to communicate the values of a circular economy. Green marketing is a way to add value and attract customers to companies with credible sustainability strategies (Iannuzzi, 2017). By getting customers to understand the importance of sustainable consumption and production, higher margins can be justified. However, poorly performed green marketing can create a risk for green washing that can hurt brand image and reliability among customers (Iannuzzi, 2017). To reduce the risk, it is important to make sure communication and strategies are credible.

The volumes purchased in the As-Is area have increased, and IKEA is seeing the environmental awareness among customers regarding their consumption patterns rise. Through marketing, IKEA can get more of the customers to choose second-hand products available in the As-Is area rather than new ones.

The value of a returned product is dependent on whether it is still demanded on the market and closely related to the product lifecycle. Phased out products that are replaced with improved ones have low value while the value of similar substitutes can remain quite high (Tibben-Lembke and Rogers, 2002). For IKEA to enable product circulation, there must be customer demand. Designing for multiple use-cycles is presented in section 2.3 as a strategy to achieve this. Modules can be replaced to prolong and upgrade a product and keep the product value and demand high. When deciding on product design for multiple use-cycles, it is important to understand whether customers are keen to prolong the life of such a product type. This should be taken into consideration since designing for multiple use-cycles is related to higher production cost, and there is no value in designing for multiple use if the demand fades. In the IKEA range, different products can be more or less suited to be designed for multiple-use cycles.

Offering second-hand products provides an opportunity to reach more price-sensitive customer segments (CE100, 2016). The IKEA concept is built around the idea of making the range affordable for the many people, this has been a challenge to accomplish on some geographical markets where purchasing power is weak. Offering second-hand products on these markets can, therefore, be an opportunity for IKEA to reach customers in an attractive price range. Products that are perceived to be of lower quality can still be good enough if it is reflected in the price. This can be a way for IKEA to sell products that would not have been demanded in other markets, but still holds functional value. Making the range affordable for the many people can also include extending the number of products that are directed towards charities instead of turned directly to disposal.

Reintegration of products into a forward flow

It is desirable to redistribute products as fast as possible since value tends to decline over time (Tibben-Lembke and Rogers, 2002). This supports IKEA's strategy to only accept products through the buy-back service that can almost directly be redistributed in the As-Is area. However, focusing on fast reintegration limits the number of products that are accepted through the service, which can lead to the disposal of products that still constitute value. An efficient return process reduces the uncertainties for inventory management since products are made resellable faster and the risk of declining product value and obsolescence decreases.

When reviewing the destinations, routes, and channels for redistribution, the products that end up in the As-Is area are dependent on customer returns and the range is not pre-planned. Irregular returns pose a risk of damage to a company's reliability since the availability of products is uncertain (Gurnani and Shi, 2006). Therefore, separation of the traditional sales channels from the redistribution of returned products can be beneficial. At IKEA, a separation is made within the store, and second-hand products never mix with new products, but they are sold on the same market. Retailers who handle a large number of returns can benefit from separate handling (De Koster et al., 2002). However, if new and returned products are sold on the same market, integration is preferred, which can support the chosen IKEA structure. The integration enables customers to find both new and second-hand products in the same place, and one single marketplace can thereby attract a broader range of customers.

A risk of cannibalisation can then be seen if second-hand products are bought instead of new ones (Tibben-Lembke and Rogers, 2002). In a circular business model this is positive, but as discussed in 6.2.2 it requires changing mind-sets and measurements so that the value of selling second-hand products can be focused on and valued in a similar way as new sales.

Redistribution is further dependent on the number of recovery facilities and demand points in the second-use market (Fleischmann et al., 2000). Few recovery facilities result in fewer redistribution routes and vice versa. Today, recovery occurs in-store and second-hand products are then made available in the As-Is area in the same store. Hence, redistribution requires customers to visit the stores. With regards to transportation, this results in that customers themselves transport products to the point of use and the degree of transport consolidation in the redistribution routes for second-hand products is therefore low.

7.1.5 Future state recommendation

Based on the analysis of the reverse logistics activities in Figure 22 and Figure 23, this section forms a recommendation for the future state reverse flow combining the offering of buy-back and take-back services. The future state is visualised in Figure 24.

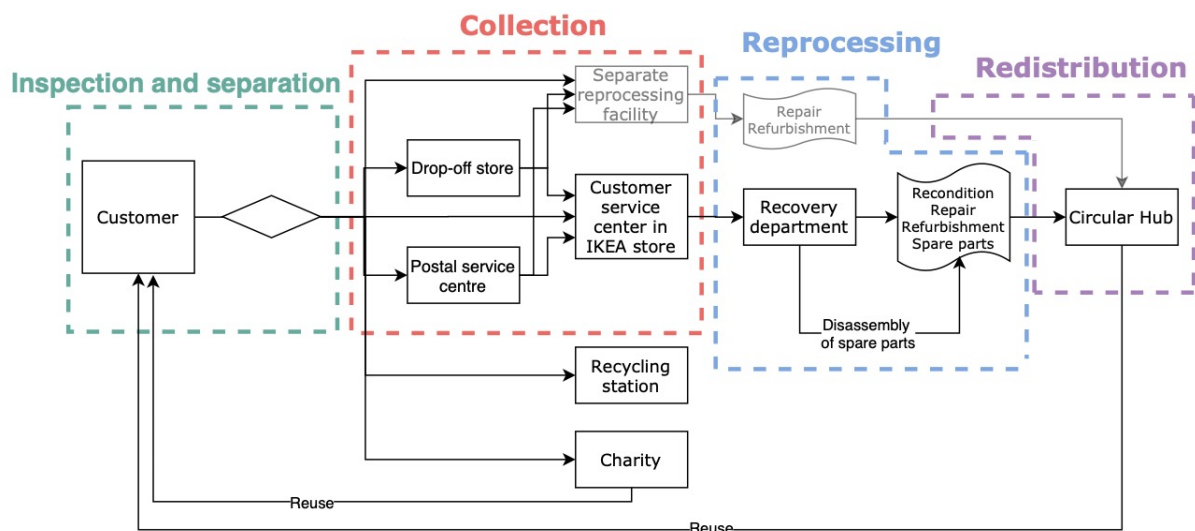


Figure 24. Reverse logistics activities in a possible future state reverse flow for offering buy-back and take-back services at IKEA

The figure shows that the first activity has been changed to inspection and separation instead of the former initiating collection activity. The analysis concluded that the inspection and separation activities should take place decentralised, at point of use, so that products can be routed to suitable channels as early as possible. Meanwhile, the actual inspection should be performed remotely and centralised by experts to gain cost efficiency and accuracy. This can be enabled using technologies such as online forms, product passports, mobile applications, or sensors that can provide enough information for inspection to take place. The type of technology used should be adapted to product type and value.

This would mean that the potential of product recovery is determined before any transportation occurs and EOL products can directly be routed to recycling while the functional and material value of EOU products can determine suitable subsequent processes. Having both functional and innovative products in the range require IKEA to reach both efficiency and responsiveness in the return process. Early product differentiation reduces the risk of having to reject products returned through the buy-back service in-store as well as the risk of the disposing of products through the take-back service that still holds functional value. This would mean that rather than having the customer choose a certain buy-back or take-back service, the product quality determines the product flow after inspection.

The decision to separate products in different channels affect the collection activity. The single channel used today by IKEA's buy-back service is seen as a barrier for product returns as customers are forced to visit the stores. The analysis brought forward the benefits of extending the collection activity to a multichannel offering to increase customer convenience. The additional channels, drop-off store, and postal services, seen in IKEA's traditional returns can potentially be used for EOU and EOL returns as well. Since products are inspected and separated before collection, the products can directly be collected through channels adapted to their destinations. This can shorten the lead-times and makes products faster re-sellable. It also results in that no additional work or transportation is needed to handle products that must be re-routed.

Having inspection and separation prior to collection further reduces the uncertainty of timing and quantity in the collection activity since information about returns can be given at an earlier stage. In the analysis it was revealed that incentives given to customers can be adapted to product type and value to receive a broader range of returns. To stay close to customers and sell the returned product on the same market, advantages can be seen in having a retail operated collection. However, retailers can benefit from collaborating with others in the collection activity to increase consolidation in transport and handling. To further increase filling ratios and reduce the risk of damage during transport, IKEA can benefit from designing products for disassembly.

The early inspection means that information regarding product quality, quantity, and timing can be transferred to the reprocessing activity at an earlier stage, and hence, better planning and resource allocation are facilitated. By knowing what recovery processes are needed, the recovery department can easier balance the available resources and the incoming volumes. To reduce the need for resources and create conditions for efficient recovery processes, products should be designed to facilitate recovery. This can for instance be done through simple packaging, exchangeable parts, and modular design.

IKEA can include more recovery processes than reconditioning to recover more value and be able to accept more products in the buy-back and take-back services. The reuse and repackaging processes are shown to be suitable to perform decentralised, preferably in-store, if the products can be sold in the same facility. However, the repair and refurbishment processes are more resource demanding and thus more suitable to be performed centralised. Due to the low volumes of EOU and EOL at IKEA, the benefits of separate reprocessing facilities for repair and refurbishment are few. However, if volumes grow significantly this can be a future possibility to increase economies of scale and handle the limited capacity in stores. This possible flow is shown in grey in Figure 24, to indicate that it requires large volumes to bring benefit. The integration or disintegration of the reprocessing activity in the stores can thus be argued to be both process and volume dependent.

As recovered products are sold on the same market as new products, integration of these products in-store is preferred. However, to avoid damaging the reliability of IKEA, these products should be kept separate from new product sales. This strengthens the current design of the As-Is area regarding the degree of integration. However, IKEA is exploring if the As-Is area can be turned into a Circular Hub where greater attention is given to the value of second-hand products. This can be a way to improve communication and customers' perception of second-hand products.

Customer demand can also be influenced by product design. By designing products for multiple use-cycles, products can be upgraded and recovered to keep the product value and demand high. Furthermore, the analysis pointed to the need to map customer demand for second-hand products. Such mapping can also help IKEA to identify price-sensitive segments and markets attracted to the more affordable prices for second-hand products.

7.2 Reverse logistics activities for offering after sales parts

The offering of after sales parts at IKEA requires supporting reverse logistics activities. The analysis aims to clarify what is important when designing activities in a future return flow that promotes prolongation of product lifecycle through an offering of after sales parts. As described in the empirical findings, IKEA's initiative of offering after sales parts can be divided into two different product flows; when products return to the store and IKEA retakes ownership and when products remain in the home of customers and customers prolong the product life. The activities for the two product flows have different set-ups and are therefore analysed separately in each section below.

Figure 25 and Figure 26 show how the current reverse flows are divided according to the reverse logistics activities when offering after sales parts. This section has these figures as starting point when analysing the activities.

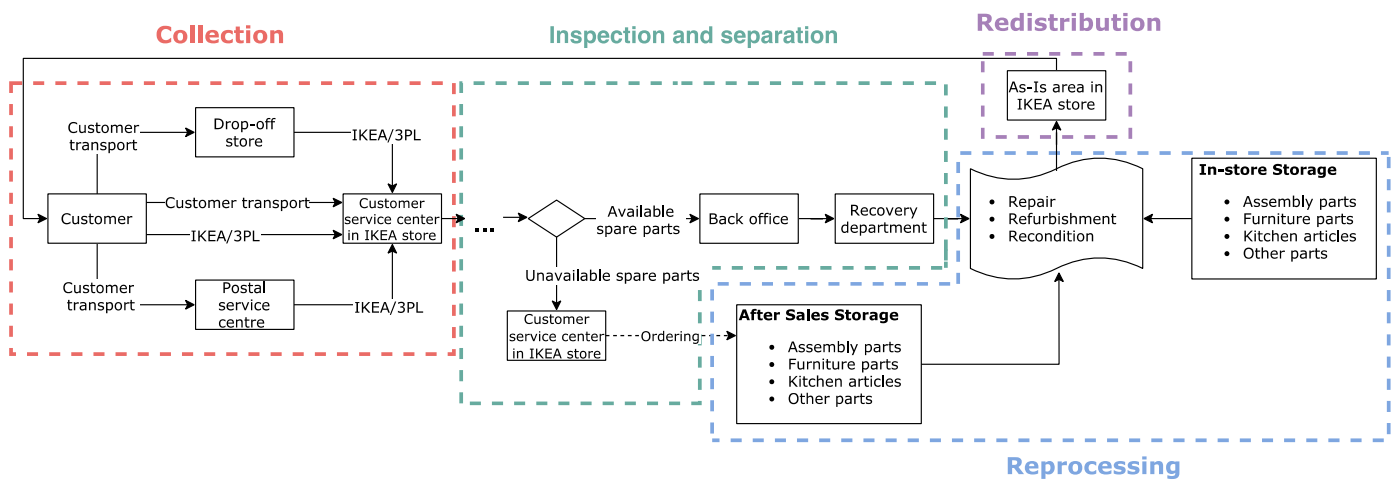


Figure 25. Illustration of how the after sales offering is divided according to the reverse logistics activities when products return to store

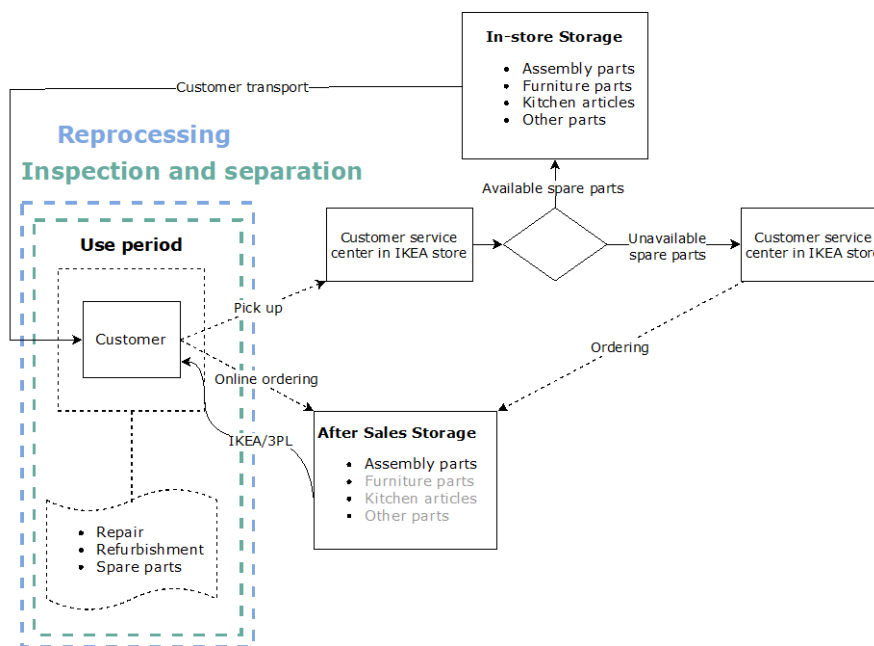


Figure 26. Illustration of how the after sales offering is divided according to the reverse logistics activities when products remain in customers' homes

7.2.1 Collection

In the following section, the collection activity is analysed based on the three-step process for collecting goods (Goltsoos et al., 2019). This section only discusses the design of collection channels and incentivising returns, as pre-sorting of goods is related to IKEA's inspection and separation activities, motivated in section 7.1.1. The challenges for collection, identified in sections 5.1.3 and 5.3.3 are analysed with the theoretical framework. Firstly, this section discusses the collection activity when products return to the store. The challenges are linked to

the uncertainties in the characteristics; transportation, forecast, track and trace visibility, destination, routes, and channels, and cost (section 3.1.5). Secondly, challenges for collection when products remain at the customers are linked to uncertainties in transportation (section 3.1.5). The section aims to analyse how these challenges can be managed through the design of the activity.

Products returned to store

The offering of after sales parts supports the recovery of all types of returns, including commercial and warranty returns that require spare parts to become re-sellable. Concerning the collection of EOU and EOL products, the activity is similar to the buy-back and take-back collection. The reader is therefore referred to section 7.1.1 to better understand the analysis of collecting EOU and EOL products and how to create incentives for customers to return products with a lower value. The following subsections will instead have a higher focus on the collection of commercial and warranty returns, referred to as traditional returns, in relation to after sales parts. By analysing IKEA's traditional returns, this discussion aims to contribute with knowledge regarding how returns with a higher value are handled. This information can further be combined with the analysis in section 6.2.1 to better understand how the collection activities at IKEA should be designed to handle product returns with different values and how to incentivise customers.

The transportation in the collection activity is characterised with a many-to-few distribution network because of a scattered customer market. This creates similar challenges to the activity as discussed in section 7.1.1 and relates to IKEA's uncertainty regarding when and if products will return and in what volume. However, traditional returns most often occur shortly after the point of purchase and tend to follow the same trend as forward flows with some time lag on a larger scale (Tibben-Lembke and Rogers, 2002). This can be seen at IKEA by looking at the returns in relation to sales and can help when forecasting traditional returns by reducing the uncertainty of timing, volume, and destination to a certain extent. But to truly reduce these uncertainties, it is important to understand the return rate for different products, which relates to how customers perceive the product and which factors influence the decision to return them (Tibben-Lembke and Rogers, 2002). Today at IKEA, most returns happen shortly after purchase mainly due to change of mind. The decision can be dependent on user-friendliness, clarity in instructions, and likeliness to experience buyer's remorse (Tibben-Lembke, 2002).

Increased track and trace visibility can improve the understanding of customers' product perception and is discussed in section 6.2.4. With improved product visibility, IKEA can obtain useful data to better understand customer behaviour. Having a better understanding of customers, IKEA can improve the predictability regarding product returns on a more detailed level than following the trend of a forward flow. Hence, improved product visibility can help IKEA to reduce the uncertainty regarding time, volume, and destination.

Customers are more likely to return products if they perceive it to have value as discussed in section 6.1.1. By analysing customer behaviour through improved product visibility, IKEA can improve the customer experience and make the return offerings more convenient based on usage data. IKEA is today offering return options across channels for its traditional returns including pick-up and bring-in services. Traditional returns occur most often when customers are unsatisfied with their IKEA products. Therefore, IKEA focuses on satisfying the customers

by making the return process as convenient as possible, to make sure the customers leave with a positive experience. By offering flexible returns for the customers, IKEA can increase the convenience for customers by letting them choose the most convenient channel to return the product. With customer data and knowledge about their behaviour, IKEA can continuously develop a flexible return process, convenient for the customers.

For returns handled by pick-up services, IKEA faces the challenge of high transportation and handling cost per item because of small volumes compared to a forward flow. By utilising multiple channels for traditional returns, such as postal services, IKEA has created a network of actors instead of performing all activities in-house. When consolidating customer returns, transportation and handling costs are reduced while the potential for higher filling ratio increases for transportations. Moreover, with a network of actors picking up returns, IKEA increases the convenience for customers. This means that IKEA most likely attracts more customers willing to return.

Products remaining in customers' homes

The prolongation of the products' lifecycle can be improved by increasing the availability of spare parts and modules for customers (European Environment Agency, 2017). This is shown in IKEA's product flow when customers aim to prolong the lifecycle of a product in their homes. When products remain in customers' homes, the collection activity is omitted. The only collection that can be seen in such product flow, is when customers drive to the store to collect spare parts. Customer collection may increase the total number of transportations if the transport occurs solely to pick-up the spare parts. It is therefore important to encourage customers to drive to the store when they have other purposes of visiting the store, or the nearby area, to consolidate the transportation.

If customers are satisfied with their products and are willing to prolong the lifecycles, IKEA can eliminate the uncertainties related to collection completely. To support this, products should be designed for extended use and multiple use-cycles, described in the empirical background. By making it easy and attractive for customers to replace parts and upgrade the products, the products remain valuable for the customers for a longer period and reduce the need for collection and the uncertainty regarding transportation.

7.2.2 Inspection and separation

In the following section, the challenges for the inspection and separation activities identified in sections 5.1.3 and 5.3.3 are analysed with the theoretical framework. The challenges of lacking identifiable part numbers for spare parts and customers' lack of knowledge of products are linked to the uncertainties in the characteristics; track and trace visibility, product quality, and product lifecycle (section 3.1.5). Further, the degree of centralisation is analysed in relation to the uncertainties in the characteristic destination, routes, and channels to gain a better understanding of how to design the activities.

Products returned to store

The offering of after sales parts in the store is only applicable to products where the need for spare parts has been identified during the inspection (section 5.3.3). Therefore, the analysis of

the inspection and separation activities for EOU and EOL products returning to the store is applicable and covered in section 7.1.2.

Products remaining in customers' homes

When products remain at customers, the purpose is to prolong the product lifecycle by identifying parts that need to be replaced or upgraded. An identified challenge for IKEA is that several spare parts are not given unique identifiers, making the identification and ordering of parts more difficult. The lack of identifiable part numbers results in that customers can only identify assembly parts, making the uncertainty high regarding other spare parts, such as furniture parts. This limits the possibilities for inspection in customers' homes.

It can partly be explained by the development of IKEA's After Sales, as it has been developed in an ad-hoc approach. This has led to internal identifiers being created locally for many spare parts, making it complex for IKEA to communicate on spare part-level. If IKEA manage to create a standardised universal part-number system for all its spare parts, it would support its goal of integrating spare parts into its product range so that spare parts can be made available online for the customers. This would reduce the uncertainty for customers of not being able to identify required spare parts in their home and would further support decentralised inspection.

Another challenge is customers' lack of knowledge about the products. When products remain in customers' homes, and they perform inspection themselves it is important that required spare parts can be identified. To improve customers' knowledge regarding products, track and trace visibility is important. By sharing data among the actors, product visibility can be improved significantly. The knowledge among customers can further be improved by design for extended use and multiple use-cycles as described in the empirical background. These design strategies can increase customers' knowledge of IKEA products, by providing clear instructions and easy identification of parts, to reduce the complexity of performing the inspection in customers' homes.

Despite these efforts, customers can still experience uncertainty regarding the inspection process. In section 7.1.2, the possibility of having experts performing inspection remotely is discussed. Helping with inspections can be an alternative for IKEA to improve the customer experience in the after sales offering.

With inspection performed in customers' homes, products can early be separated into products suitable for recovery by customers or not. This reduces the need of transportation, since many recovery processes can be performed in customers' homes. For products remaining at customers, the reverse flow back to stores is eliminated. Spare parts are then instead transported in a forward flow to the customers, resulting in a reduced number of transportations. Consolidation in a forward flow is easier to perform compared to a reverse flow because of fewer uncertainties concerning the number of articles, product size, and point of origin (Tibben-Lembke and Rogers, 2002), and is therefore advantageously. Reducing the need for transportation in a return flow further reduces IKEA's transportation and handling cost.

7.2.3 Reprocessing

In the following section, the challenges for the reprocessing activity identified in sections 5.1.3 and 5.3.3 are analysed with the theoretical framework. The challenges of supplying spare parts

and enabling recovery are discussed and linked to uncertainties in the characteristics; product quality, forecasts, inventory management, product lifecycle, and cost (section 3.1.5). The section aims to analyse how these challenges can be managed through the design of the activity.

Products returned to store

IKEA takes over the ownership of products when returned to the stores. As mentioned in 7.2.1, the reasons for the incoming returns differ which affect the handling. The analysis of the reprocessing activity for EOU and EOL products can be found in section 7.1.3 since these are returned through the buy-back and take-back services. This analysis will, therefore, focus on the supply of after sales parts to the stores to enable reprocessing. The demand for after sales parts are determined by the product quality in returning products.

IKEA has a broad product range which results in a huge number of parts. The availability of spare parts is a potential barrier for product repair as the parts often represent a small value and are needed in a large variety (Ellen MacArthur Foundation, 2016). IKEA has addressed this issue by letting individual stores decide what parts to keep in storage based on historical demand and future forecasts. The range of after sales parts are today stored between one to three years after the end date sale. Ellen MacArthur Foundation (2016) suggests that spare parts should be made available for a period that reflects the product lifecycle in to enable product circulation. Today, the demand for spare parts mainly arises shortly after purchase at IKEA, as a result of faulty products or quality issues, which explains why parts are not held in storage for long after the end date sale. However, if the purpose of the after sales service extends to include prolongation of product life, the spare parts must be made available for a longer time. This creates uncertainties for inventory management, since storing a broad range of after sales parts for a long time increases cost. An opportunity lifted in section 3.1.5, is the opportunity to make use of additive manufacturing to print needed spare parts on demand (Savolainen and Collan, 2020). This would reduce the need of stocking a large variety of parts. Since it is an unexplored technique, it would require IKEA to carefully evaluate the benefits and costs.

Design efforts and accurate forecasts are further important to manage inventory. Designing for standardisation can reduce the variety since the same parts can be used for multiple products. In addition, the design strategy, design for extended use, can make products easier to repair and maintain. To increase the accuracy of forecasts, information regarding product lifecycles and durability can be used to forecast parts that are inclined to break or get worn out.

Today, IKEA's range of spare parts is developed with a focus around assembly parts. During the interviews, it was expressed that a wider range of modules and furniture parts could improve the offering. This could result in the recovery of products that are today forced to be disposed of. IKEA is working to extend its part number system to include furniture parts and make it possible to uniquely identify all parts in the range.

Common spare parts are made available in the stores whereas unavailable spare parts can be ordered upon demand from IKEA's after sales storage. The spare part supply available in stores comes partly from the order range but also from dismantling returned products. If the parts are directly available, the lead time for recovery can significantly be reduced.

Products remaining in customers' homes

The after sales service makes it possible for customers to perform reprocessing of their IKEA products at home. This can be seen as a very decentralised reprocessing following the reasoning of Bernon et al. (2016). It requires that the right parts are made available and can be delivered to a broad customer base, as discussed in the collection activity. With reprocessing at the point of use, transportation can be limited to include only the necessary parts, and the back and forth transportation of bulky products can be avoided. However, it presupposes that the product is to stay with the same customer and is hence not applicable for reuse.

The availability of information is central to how to perform repairs (Ellen MacArthur Foundation, 2016). This importance can also be seen in the offering of after sales parts within IKEA. If repair is to be performed directly by customers, sufficient guidance must be given. Products need to be adapted to enable recovery in the home of customers rather than in an industry setting, if users are to be involved in repair, maintenance, and upgrades (Bakker et al., 2014). Customers should be informed about the possibility of repair and about how they should proceed. Early inspection performed by experts can give customers information about the possibility of repair and form a basis for the customers' decision to recover a product using spare parts. Through the assembly instructions developed by IKEA, customers can identify specific parts and understand how they should be assembled. This makes it possible for customers to identify parts in need of recovery and place orders.

Spare parts are often expensive in comparison to new products (Ellen MacArthur Foundation, 2016). IKEA aims to instantly satisfy customers in need of spare parts and therefore a positive customer experience is prioritised over profitability. In some markets the parts are offered free of charge while others charge a small fee. However, if the demand for spare parts rises as prolongation of products is promoted, the cost for providing these parts becomes more significant for IKEA. The process of stocking and shipping spare parts is costly due to the large variety and unique orders (Ellen MacArthur Foundation, 2016). Costs can be reduced by taking advantage of disassembly of returned products as a spare part supply. This opportunity has been captured by IKEA where the recovery department builds up a spare part inventory in the stores through disassembly of returned products that cannot be directly resold. Further the variety of spare parts can be reduced by more standardised design. On the other hand, providing a more comprehensive after sales offering gives IKEA the possibility to create new revenue streams.

In the theoretical framework, refurbishing is described as extensive and resource demanding and thus difficult to integrate close to customer touchpoints (Thierry et al., 1995). However, modular design can make the process simpler and possible to perform by customers themselves. This requires a wider range of after sales parts and reinforces the reasoning made by Sahyouni et al. (2007) of how the potential for refurbishment is determined already in the design phase. By including furniture parts and modules in the after sales part range, IKEA has the opportunity to make refurbishment less resource demanding, and product life can be easier prolonged at the point of use.

7.2.4 Redistribution

In the following section, challenges and opportunities for the redistribution activity identified in sections 5.1.3 and 5.3.3 are analysed with the theoretical framework. The challenges in the two product flows are analysed separately and linked to uncertainties in the characteristics;

inventory management, pricing, destination, routes, and channels, and product lifecycle (section 3.1.5). The analysis aims to give a better understanding of how to design the redistribution activity.

Products returned to store

As the redistribution of products returning to stores is similar to the redistribution of buy-backs and take-backs, the reader is referred to section 7.1.4 to better understand the analysis of redistribution regarding the uncertainties in transportation and marketing.

An efficient return process generates a fast re-selling process (Hübner et al., 2016). By re-selling products faster, companies' inventory management reduces the risk of storing obsolescence products and losing value. To improve the return process efficiency at IKEA, the availability of spare parts in stores is essential as discussed in the previous section. Having spare parts available when returned products arrive will support in getting the products out on the second-hand market faster. If returned products can enter the second-hand market faster, IKEA can recover a larger volume of returned goods. Instead of disposing them because of the limited space in the recovery department which is a common occurrence today. This further reduces the risk of losing product value in stores as products are not becoming obsolete to the same extent.

Because of restrictions at IKEA, most of the products that are recovered with spare parts are resold in the As-Is area. IKEA is therefore limited when it comes to sales channels of recovered products, even for products with high functional value. Furthermore, customers' attitudes towards second-hand products at IKEA is a challenge since the customers' willingness to pay for a product from the As-Is area is relatively low. Hence, extensive recovery would result in higher costs for IKEA, but low selling prices in the As-Is area. Re-selling products through a Circular Hub could improve customers' attitudes towards second-hand products, as discussed in section 7.1.4. If customers' willingness to pay remain low, it can be argued that new restrictions and regulations are required for IKEA to be able to sell the products as new.

Products remaining in customers' homes

When customers aim to prolong the lifecycle of a product by bringing spare parts to their homes, redistribution is not needed since the products stay with the same user. The focus is instead on the distribution of spare parts out to customers and it can be seen as a forward flow of spare parts (Fleischmann et al., 2000). For spare parts being picked up in the stores, the distribution is similar to section 7.1.4 and is not further discussed in this section.

For spare parts being delivered home to customers in a forward flow, challenges regarding uncertainty in destination, product size, and quantity is reduced. Therefore, consolidation with third-party transport providers is a great opportunity and can help IKEA to widen its geographical acquisition area. As growing e-commerce has led to a more decentralised distribution system (European Environment Agency, 2017), IKEA can offer convenient shipping of spare parts to an even larger acquisition area. In addition, spare parts are generally smaller than products, and distribution does not require as much space.

7.2.5 Future state recommendation

Based on the analysis of the return activities in Figure 25 and Figure 26, this section forms future state recommendations for the two different scenarios. First the future state of products returned to the store is presented, followed by the future state of products remaining in customers' homes.

Products returned to stores

Based on the analysis of the reverse logistics activities, this section forms a recommendation for the future state reverse flow when products are returned to the store. The future state is visualised in Figure 27.

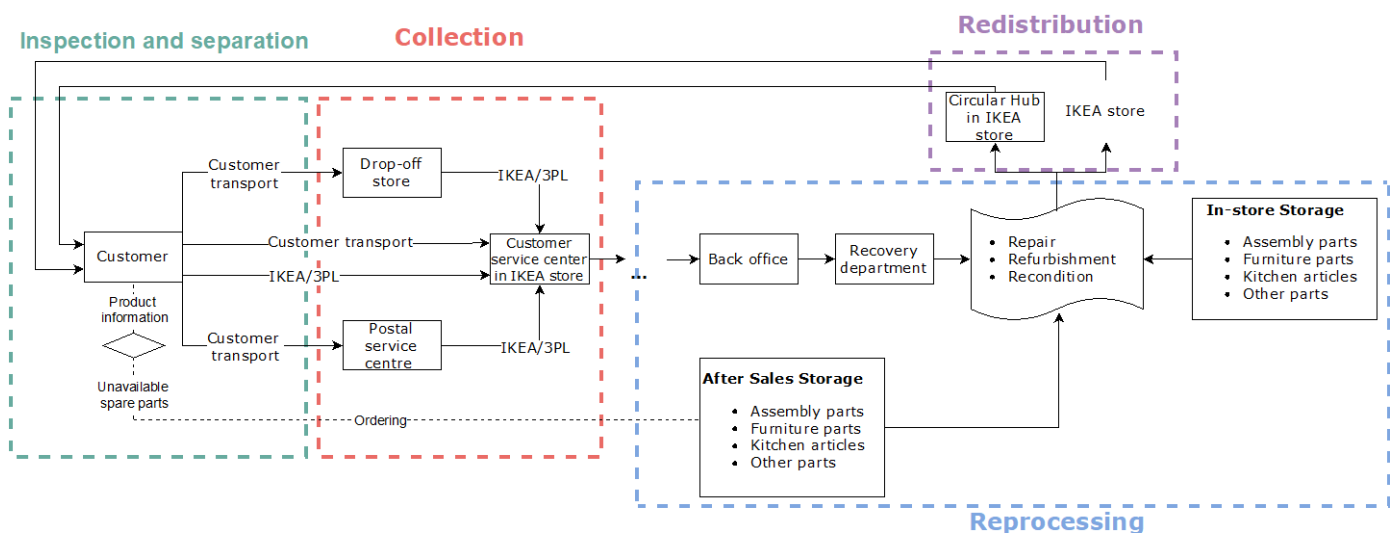


Figure 27. Reverse logistics activities in a possible future state reverse flow when offering after sales parts for products returned to an IKEA store

Following the same reasoning as in section 7.1.5, the figure shows that the first activity has been changed to inspection and separation instead of collection, and the activities are carried out in the same way. However, central to the after sales parts offering is that this change allows spare parts to be ordered before the returning product arrives in store. This creates a possibility to shorten lead-times since the availability of spare parts in the reprocessing activity can increase.

The collection activity for EOU and EOL products is the same as for the combined buy-back and take-back service. For warranty and commercial returns, the flow of products is also the same, but these returns are commonly associated with negativity among customers which makes a positive customer experience increasingly important. This can be done by increased product visibility and the mapping of customer behaviour. These returns are also easier to forecast since the time between purchase and return is significantly shorter.

For EOU and EOL products, the analysis of the reprocessing activity (section 7.2.3) is applicable also in this case, with the difference that the recovery is focused around exchanging spare parts. Ordering spare parts when demand occurs through early inspection makes it possible to reduce the need for stocking a wide range and large volumes in-store. However, extending the after sales parts offering to include a wider range of furniture parts and modules instead increases the need for inventory. By designing for standardisation, the variety of needed

spare parts can be reduced and consequently also the inventory. Exploring additive manufacturing can be an alternative to handle variety and inventory. Another opportunity for IKEA is to predict wear to a greater extent using technology and information sharing. IKEA can take advantage of information generated in the testing of products by transferring it to reverse logistics activities. This makes it easier to forecast demand and increase the availability of spare parts.

To recover products using spare parts, the products must be designed so that parts are easily exchangeable, and the parts must be identifiable and available. To manage the spare parts, there is a need for universally unique identifiers as well as the integration of spare parts into the product range. Ongoing projects at IKEA are aiming to achieve this.

Products that are repaired, refurbished, or reconditioned using spare parts, are then redistributed on the market. Based on the analysis in section 7.1.4, the products can be sold in a Circular Hub at IKEA. Products with high functional value can instead be recovered to be sold as new if quality and safety can be assured. The availability of spare parts is central to the redistribution activity since fast reintegration reduces the decline in product value.

Products remaining in customers' homes

A recommendation for the future state of the reverse logistics activities when products remain in customers' homes is presented in Figure 28 below. No collection or redistribution activity occurs since the products stay at the customer. Hence, this conclusion will focus on the activities; inspection, separation, and reprocessing.

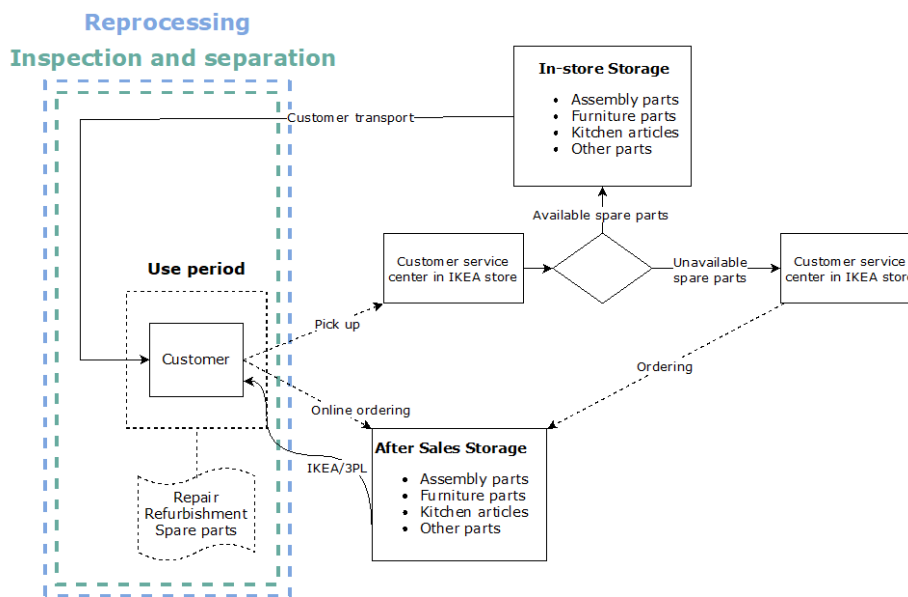


Figure 28. Reverse logistics activities in a possible future state reverse when offering after sales parts for products remaining in customers' homes

The analysis shows that inspection and separation should be performed by customers, decentralised in their homes to increase convenience, and to separate product flows early. If needed, expert assistance with inspection should be made available. Having those activities performed in customers' homes, the customers can receive information instantly whether

reprocessing is feasible in their homes. Enabling separation directly in homes reduces the number of products in need of transportation to be recovered. To facilitate customer inspection, customers must have access to clear instructions and easy part identification to inspect the product properly. This can be supported by clearly marked parts and instructions available online. For customers to identify required spare parts, IKEA needs to develop a universally unique identifier system. This system further needs to include a wider range of spare parts, for customers to identify all types of spare parts, such as furniture parts. When required spare parts are identified, customers should have the possibility to order them directly through IKEA's online store or the closest store to bring the parts home.

Regarding reprocessing, the analysis concluded that the activity also should be performed by customers in their homes, to the extent possible, to reduce the number of products that require transportation to be recovered. For customers to perform recovery themselves, IKEA must provide information about how to recover the products. This can be done using online instructions or mobile applications.

Furthermore, the analysis showed that product design is important to facilitate customer recovery. Designing products for extended use and multiple use-cycles can support customers to repair, maintain, and upgrade products directly in their homes. Making a wider range of spare parts available for a longer time results in higher inventory costs. IKEA can reduce these costs by reusing old spare parts from returned products and design products for standardisation to reduce the variation in the part range. In proven feasible, additive manufacturing can be used to print parts on demand.

When reprocessing is performed by the customers, the analysis describes the limitation in processes feasible to perform by customers. By designing products modular-based, IKEA can enable more extensive recovery in customers' homes and further reduce the transportation of products in need of recovery performed by experts.

By omitting collection and redistribution of products, the reverse flow of products is eliminated. Required spare parts are instead consolidated with forward flows, reducing the total number of transportations.

7.3 Reverse logistics activities for a usership model

Offering furniture through a usership model at IKEA requires supporting reverse logistics activities. Below, the most reoccurring challenges related to these specific activities and brought up during the interviews are analysed with the theoretical framework. The analysis aims to clarify what is important when designing activities in a future return flow that promotes the circulation of products by offering furniture as a service.

Figure 29 shows how the simplified reverse flow for usership models is divided according to the reverse logistics activities. The analysis has this figure as a starting point.

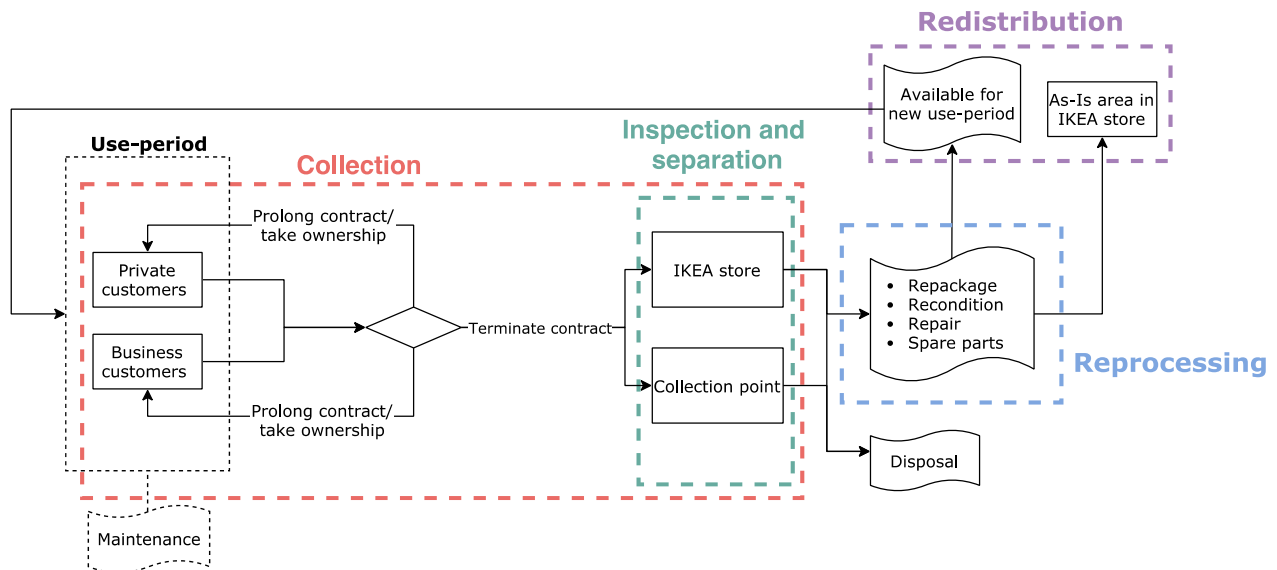


Figure 29. Illustration of how the usership model is divided according to the reverse logistics activities

7.3.1 Collection

In the following section, IKEA’s collection activity when offering a usership model is analysed based on the three-step process for collecting goods (Goltsos et al., 2019). As usership models result in product returns when contracts terminate, incentivising returns are not relevant to analyse in this initiative. Further, pre-sorting of goods is related to IKEA’s inspection and separation activities, motivated in section 7.1.1, and are analysed in section 7.3.2. Hence, this section focuses solely on analysing the design of collection channels for IKEA’s usership model.

The challenges and opportunities for collection, identified in sections 5.1.3 and 5.3.4 are analysed with the theoretical framework. The challenges are further linked to the uncertainties in the characteristics; transportation, forecast, destination, routes, and channels, inventory management, cost, and track and trace visibility (section 3.1.5). The section aims to analyse how these challenges can be managed through the design of the activity.

The usership model aims to offer products to customers through a subscription while IKEA keeps ownership. This enables customers to possess products only when the function is required (European Environment Agency, 2017). This results in reduced uncertainty regarding timing and quantity for collection. An identified challenge for IKEA in the offering usership models is the risk of shorter product use-cycles at specific customers, compared to traditional sales. Shorter use-cycles mean more frequent transportation of assembled and bulky products. Being able to rent products for a short time can promote short-cycled consumption and negatively impact the environment despite the circulation.

Usership products offered to private customers risk to result in small volumes in the reverse flow since customers are allowed to terminate contracts at different times which makes consolidation more complex even if timing and quantity are known. Small volumes in a reverse flow result in higher transportation and handling costs (Fleischmann et al., 2000) and is an

increased challenge for IKEA. To reduce the total number of transportations, an identified opportunity for IKEA is to establish decentralised collection points with multiple return channels. Creating decentralised collection points would improve customer convenience since it shortens the transportation distance.

Usership models offer services rather than products (Philips Lighting Holding B.V, 2017), which might result in a lower willingness to return among customers since they only pay for the functionality of a product. IKEA must, therefore, find a convenient system for customers to return products, alternatively develop a well-functioning pick-up system. To find convenient locations for customers returning usership products, one opportunity for IKEA is to map the movement of used furniture that has reached end-of-use in customers' homes. The mapping aims to understand how customers move second-hand furniture, with no involvement of IKEA. Having the movement of second-hand furniture mapped, IKEA can find natural nodes in the society where furniture often passes. This could for instance result in having recycling centres conveniently located for customers. These recycling centres can then be evaluated as possible future nodes in a decentralised collection network to increase convenience for customers. Dependent on customers' demand regarding the collection, the activity will be designed differently, either with convenient bring in systems or well-functioning pick-up systems. It is therefore important to understand customer perception and their behaviour to design the collection activity. These uncertainties can be reduced by improved customer communication (section 6.1.2).

Usership products offered to business customers can result in large volumes of returns since they handle much more products than private customers and tend to return all products at the same time. Regarding inventory management, this increases the need for storage and resources to handle returned goods. IKEA stores are not designed to handle large returns of products, meaning that furniture as a service creates a challenge for IKEA in terms of storage and resources. This urges the need for decentralised collection points for IKEA when introducing usership models to expand the company's storage space. The need for storage can be reduced with improved forecasting and track and trace visibility. Furthermore, an identified opportunity for IKEA is to reduce the time gap between two use-periods with better forecast and track and trace visibility, which would result in a reduced need for storage. Usership models help companies to forecast the reverse flow since they keep the ownership of the products (Philips Lighting Holding B.V, 2017), and can increase the track and trace visibility based on the duration of usership contracts. This means that IKEA better can plan for redistribution of products directly from one customer to another to reduce storing time between usership contracts. This is also important for IKEA since usership products only generate value when they are used by customers, and downtime should, therefore, be minimised. Utilising direct redistribution between customers requires that the product quality allows products to be sent to a new customer with no recovery. This will be discussed more in detail in section 7.3.3.

7.3.2 Inspection and separation

In the following section, the challenges and opportunities for the inspection and separation activities identified in sections 5.1.3 and 5.3.4 are analysed with the theoretical framework. The analysis builds upon the previous analyses of the inspection and separation activities in section 7.1.2 and 7.2.2. These analyses brought up the advantages of decentralised and early inspection, performed remotely by experts. The same reasoning applies when performing an

inspection of products offered as a service. This section, therefore, focuses on challenges and opportunities related specifically to the usership model and how these relate to the characteristics; forecast, track and trace visibility, and product quality (section 3.1.5).

Selling a service gives retailers more control compared to a pure product offering as ownership and responsibility are kept (Philips Lighting Holding B.V, 2017). The uncertainty in timing discussed in the prior initiatives can thus be reduced when products are offered through a usership model. The use-periods are fixed, and it is known when products will return which reduces the uncertainty in timing and increases the ease of forecasting.

Keeping ownership of products makes it easier to track product location and use (Sundin et al., 2008). This can support the inspection activity for IKEA since greater visibility makes it easier to continuously determine product quality and identify necessary recovery processes. This allows for more proactive maintenance which can extend the longevity of products (Selvfors, Rexfelt, Renström and Strömberg, 2019). During a subscription, the inspection of a product is not a single occurrence and an identified challenge for IKEA is therefore how to ensure the functionality of products during the entire use-period. Today, IKEA's offering is centred around the selling of products and the infrastructure to provide services after purchase is undeveloped. However, knowing where products are and in what condition they are in, provides an opportunity for IKEA to plan for maintenance to a greater extent, and develop such infrastructure.

Early inspection means that the product flow can be diverted after an expired use-period and products can be separated depending on future destinations. To maximise the uptime of products (Porter and Heppelmann, 2015), it is desirable to determine product quality as early as possible. A product can stay with the same customer through the prolongation of the contract or if a decision is made to take ownership of the product. Else, the product can be separated depending on the condition. Products with high functional value can be recovered in an inner loop, while products inheriting material value can be routed to the outer recycling loop (Ellen MacArthur Foundation, 2015).

7.3.3 Reprocessing

In the following section, the challenges and opportunities for the reprocessing activity identified in sections 5.1.3 and 5.3.4 are analysed with the theoretical framework. The degree of centralisation and integration of recovery processes are analysed, and challenges are linked to uncertainties in the characteristics; forecast, inventory management, transportation, and product quality (section 3.1.5).

The benefits of increased ease of forecasting through greater visibility discussed in the previous section (7.3.2) spills over to the reprocessing activity as well. The uncertainties in quantity and quality can thus be reduced. This creates an opportunity to improve the balance between available resources and incoming return volumes so that products can be recovered to a greater extent. However, the uncertainty of where the reprocessing should take place exists. Decentralised reprocessing can shorten transport distances and is often preferred. This is an opportunity that can be exploited by offering products as a service, since reprocessing can be performed continuously, at the point of use, through maintenance during the use-period.

As discussed in the offering after sales parts (section 7.2.3), reprocessing at the point of use can be performed by users themselves if the right conditions are given. However, when offering furniture as a service, the responsibility for product functionality stays with IKEA. A success factor in IKEA's traditional offering is letting customers perform self-assembly of furniture. When offering furniture as a service, a challenge is to determine how the responsibility should be divided between users and IKEA. IKEA can be responsible for performing maintenance or for making sure customers themselves can perform maintenance on products. As discussed in 6.1.1, extended company responsibility in return activities can increase convenience for customers. However, the service offering may differ between segments. Business customers are likely more interested in functionality provided by IKEA during the complete use-period whereas private customers might be willing to perform simple maintenance themselves. The service offering must be adapted to different segments based on customer behaviour and attitude. Offering additional services to the core product is a possibility to add value and generate a new revenue stream (TU Delft, 2017). As IKEA does not provide these services today, an opportunity can be to join forces with others and build a network to perform necessary reprocessing during use-periods.

As discussed in 7.1.3, there are other attributes of the recovery processes that steer the degree of centralisation of reprocessing. There can be difficulties in performing more extensive repair or refurbishment at the point of use. These difficulties can to some extent be reduced by designing for recovery and multiple use-cycles and through making easily exchangeable after sales parts available, as discussed in section 7.1.1 and 7.1.2. Contrarily, reuse and repackaging are more suitable processes to perform decentralised. Direct transportation from one user to another (section 7.3.1) can be facilitated if the product quality can be assured decentralised, so that products can directly be redistributed to new users. Shortening the reprocessing lead-time is important for keeping the product value as high as possible (Blackburn et al., 2004). This provides an opportunity to increase product uptime and decrease inventory holding costs since the need for storage is eliminated. The storage of products is seen as a growing challenge for IKEA when offering furniture as a service wherefore it is important to quickly redistribute products after an expired use-period.

Despite this challenge, not all recovery can take place at the point of use. Having recovery performed more centralised in the store was discussed in 7.1.3. The difference when analysing the usership model lies in that the returned products are not necessarily redistributed in store. Thus, the benefits of integrating the forward and reverse network are fewer. The flows should utilise similar operations to gain the most benefit of integrating flows (Fleischmann et al., 2000).

The recovery operations that can be performed in-store are however similar for products returning after a use-period or EOU. Taking advantage of these shared assets could motivate reprocessing taking place in the store. But as capacity in the store is limited (section 5.1.3), and these products have different destinations, an alternative could be to perform reprocessing activities in separate facilities. Reprocessing in separate recovery facilities can reduce processing costs, increase available space, and enable more specialised processing. However, it implies a need for both additional transport and storage. The trade-off between freight rates and inventory costs must, therefore, be considered together with the total lead-time between collection and redistribution.

As discussed in section 7.1.3, the question of integration is further dependent on volumes. In consideration of the novelty in offering furniture as a service, building capacity in separate facilities can be costly in the short-term. When handling low volumes, utilisation of the resources available in-store can thus be beneficial. However, the return volumes differ depending on whether it is business or private customers. Business customers typically rent large volumes that cannot be handled in-store when returned. Separate reprocessing facilities can thereby be a more long-term alternative. To accelerate development, IKEA can also explore collaboration with other actors to gain economies of scale in the reprocessing activity.

7.3.4 Redistribution

In the following section, challenges and opportunities for the redistribution activity identified in sections 5.1.3 and 5.3.4 are analysed with the theoretical framework. The challenges are linked to uncertainties in the characteristics; inventory management, transportation and destination, routes, and channels (section 3.1.5). The analysis aims to give a better understanding of how to design the redistribution activity.

It was concluded from the interviews that it will be a challenge for IKEA to minimise the downtime of usership products. Product downtime is a challenge for usership products since it increases the need for storage and reduces the income opportunities (Szwejcowski et al., 2015). Hence, an identified opportunity for IKEA is to improve its re-selling processes and redistribute products directly from one customer to another. An efficient return process facilitates a faster re-selling process (Hübner et al., 2016), and therefore reduces the need for storage and risk of losing value. For IKEA to reach an efficient return process, it should develop the redistribution activity to have multiple destinations, routes, and channels. Multiple channels enable products to re-enter the market faster. This is possible with an early inspection and separation (section 7.3.2). By having an early inspection, usership products can be separated early and redistributed directly between customers or directly from a decentralised collection point. Flexible redistribution reduces the transportation of products since every product route is optimised according to its condition and destination. To successfully establish a decentralised redistribution, IKEA should jointly develop a distribution network with third-party transport providers to improve the filling ratio and reduce transportation costs when offering multiple routes and channels. This is essential as transportation is often a major cost related to reverse logistics. As redistribution is a forward flow of products, it can more easily be consolidated with other forward flows that support a network of actors that work together to reduce the cost and environmental impact. Similar to the discussion in section 7.2.4, the increasingly decentralised distribution system with more home delivery (European Environment Agency, 2017), makes it possible to widen the geographical acquisition area by developing the distribution network together with others.

Another challenge identified for IKEA is customer behaviour and negative attitude towards second-hand products. When offering products as service, products tend to switch homes more frequently resulting in more customers receiving used products. To get usership models to gain ground, customers' attitudes related to second-hand furniture must change, discussed in section 6.1.1. As customers pay for functionality rather than ownership in usership models, it can be discussed that customers might be more focused on the actual function of a product and therefore more tolerant of used products.

Furthermore, customers' attitudes towards renting products can be a potential environmental risk. If products become easy to obtain, replace, and discard frequently, the use cycles become shorter, and wear on products increase. The environmental benefit of circulating products then risks being absorbed by an increased need for transportation. This means that before implementing furniture as a service on a larger scale, the service must be analysed upon attractive product types among customers and how they use the products to ensure a sustainable solution and is very much related to customer communication (section 6.1.1). IKEA can learn from other industries that have embraced usership models and should together share knowledge to gain an understanding regarding customer perception and behaviour (section 6.3.1). This could support IKEA when designing the collection activity as decisions are based upon best practise.

Finally, a challenge for IKEA is whether products can be redistributed onto new use-periods after collection from previous periods because of regulations and policies. There is a risk that specific furniture products are not allowed to be redistributed into new use-periods, and therefore only can be resold in IKEA's As-Is area or future Circular Hub. When customers pay only for use, the selling company must pre-finance products (TU Delft, 2017). This leads to large initial investments for IKEA. Therefore, multiple subscription-cycles are required for IKEA for usership models to be profitable.

7.3.5 Future state recommendation

Based on the analysis of the reverse logistics activities in Figure 29, this section forms a recommendation for the future state reverse flow when offering products through a usership model. The future state is visualised in Figure 30.

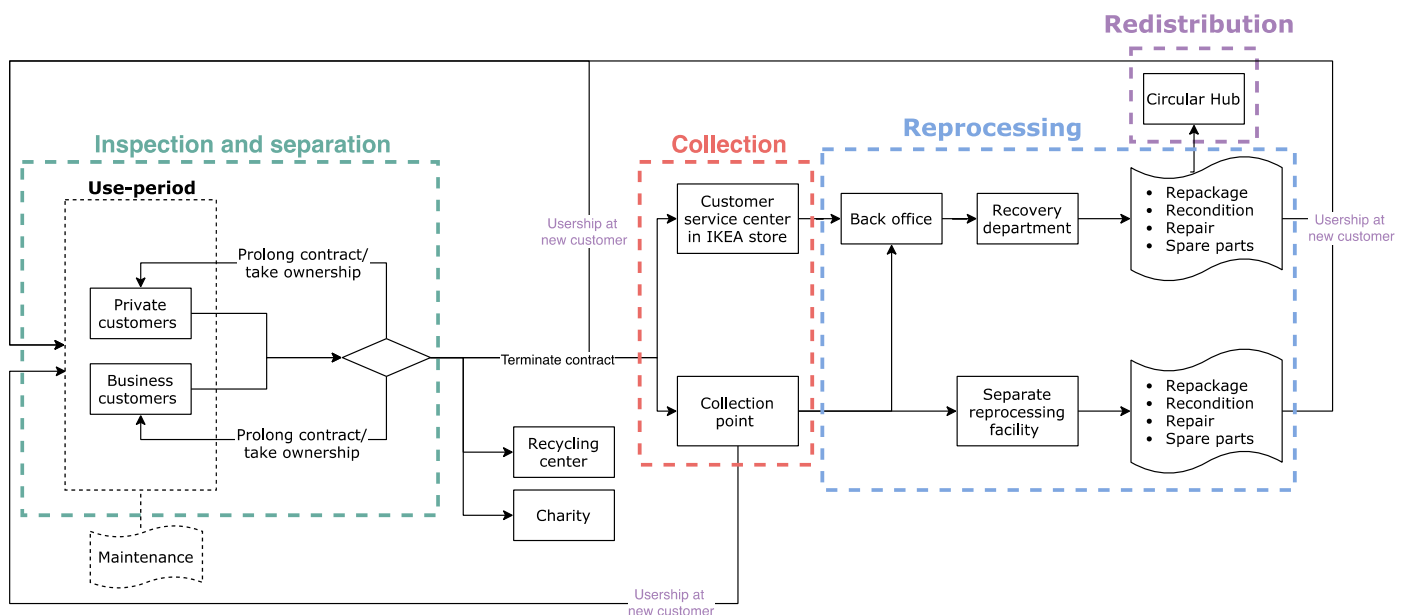


Figure 30. Reverse logistics activities in a possible future state reverse flow when offering usership models at IKEA

Following the same reasoning as in section 7.1.5 and 7.2.5, the analysis shows that inspection and separation should be performed first among the reverse logistics activities to increase

convenience and to separate products early. As usership models reduce the uncertainty in timing and quantity due to fixed use-periods, IKEA can easier plan for the inspection. It is stated that one of the main challenges for IKEA in usership models is to minimise the downtime of products. An early inspection enables decentralised separation which facilitates direct redistribution between customers or directly from decentralised collection points. This reduces the need for storing space for IKEA while it maximises the utilisation of products.

The collection activity in a usership model is also facing a reduced uncertainty in timing and quantity. However, subscription products from private customers tend to generate small volumes that must be collected conveniently in relation to the customers. Therefore, IKEA should create a decentralised collection activity with well-functioning pick-up systems and convenient bring in systems, adapted to customer demand.

Returned volumes from business customers tend to result in large volumes and increase the demand for storage since IKEA's stores are not designed for large return volumes. This urges the need for decentralised collection points since separate facilities enable storing space. With a decentralised collection activity, IKEA is recommended to establish a network of actors to reach more customers and take advantage of their return channels. Further, consolidated transportation can increase the filling ratio and reduce transportation and handling costs. As the track and trace visibility of products increases when products are offered as a service, IKEA can better forecast the collection. This can result in improved product uptime by collecting products and redistribute them on the same route.

It is stated in the analysis that reprocessing should be performed at the point of use when possible, referring to products with the condition of reuse and uncomplicated repairs. This recovery is recommended to be done continuously during the use-period to make redistribution available directly from one customer to another. Whether the recovery should be performed by customers themselves or by experts will most likely depend on customers' perception in the different market segments and will again be decided upon customer communication (section 6.1.2). This is important to understand before designing the maintenance for products at customers within a use-period.

As described in section 7.2.5, the recovery processes that can be performed decentralised, at the customer, are limited. To be able to perform more extensive recovery such as more complicated repairs and refurbishing, the reprocessing activity should be developed in a more centralised structure. As discussed, usership models tend to generate large return volumes from business customers and can therefore be difficult to integrate with IKEA stores. Integration with IKEA stores should instead be focusing on private customers in the same area as the stores to utilise shared assets. But since the usership models most likely will generate large volumes of returns, IKEA will require separate facilities to handle larger volumes. Separate facilities further allow IKEA to perform more extensive recovery compared to when recovery is performed in stores, referring to more extensive refurbishing. If separate facilities are introduced, the same facilities can also be utilised by IKEA's other initiatives when volumes increase to handle larger volumes of returns to reach economies of scale in the facilities.

To minimise products' downtime, IKEA is recommended to develop fast re-selling processes. This can be done by enabling redistribution directly from customers or decentralised collection points. As redistribution is a forward flow of products, it is easier for IKEA to integrate the

flow with other actors and jointly develop a distribution network with third-party transport providers to reach more customers and reduce the need for centralised collection. It is further essential for IKEA to ensure customer demand for second-hand products offered as subscription. If usership products lose their attractiveness on the market after a few subscription-cycles, the products will instead be resold in IKEA's Circular Hub, which is less financially beneficial for IKEA. IKEA needs to understand their customers' attitudes towards usership models and design the offerings so that usership products remain attractive for multiple use-cycles. Finally, IKEA needs to explore regulations and policies for different products to enable multiple subscription-cycles for products entering usership models.

8 Conclusion and future recommendations

This chapter summarises and presents the findings of the research questions in conclusions and future recommendations. The thesis concludes with recommendations for IKEA and further research.

8.1 Answers to the Research Questions

RQ 1: *What challenges can be identified in the current design of the reverse flow?*

The identified challenges in the current design of the reverse flow can be divided into different reverse logistics activities. For the collection activity, the challenges are related to the current concentration around the stores. Most returns take place in the store, causing inconvenience for customers and a lot of transportation. The capacity to handle returns in-store is adapted to low volumes which causes a challenge if IKEA is to take care of more returning products. Moreover, returns are not integrated with planning and the uncertainty of incoming volumes is therefore high.

In the inspection activity, a challenge is that products end up in the wrong place since all products are brought to the stores independent of condition. IKEA must then secure the quality and safety of these products to determine if they are sellable or unsellable. Large uncertainty lies in what wear the products have been exposed to and there is also the risk of getting vermin into the stores.

The challenges for reprocessing are mostly related to the recovery department at IKEA. The main challenge is the limitations of available resources and handling space. Also, the productivity of saving products is generally low, and recovery is primarily seen as a cost. The low productivity can partly be explained by product design that is not adapted to facilitate recovery. Customers' expectations can further hamper recovery since they expect to immediately get a new product or a refund when returning a product. The time needed for recovery is therefore not made visible. Other challenges can be seen in the management of spare parts. IKEA lacks a uniform system to handle these and all parts are not uniquely identifiable. The range of spare parts is focused around assembly parts and the availability of furniture parts is limited causing a barrier for recovery.

Lastly, customers' attitudes towards the As-Is area as well as communicating the value of second-hand products are identified as challenges for the redistribution activity at IKEA.

RQ 2: *What challenges and opportunities can be identified for IKEA in relation to the different actors in the move towards a circular business model?*

By analysing the role of customers, companies, and the society in the move towards a circular business model, challenges and opportunities for IKEA could be identified. The conclusion of these findings is presented in Table 6 below.

Table 6. Concluding summary of the identified challenges and opportunities for IKEA in relation to customers, companies, and the society

	Challenges	Opportunities
Customers	Lacking incentives and convenience	<ul style="list-style-type: none"> •Taking extended responsibility for return activities •Joining forces with others to extend customer reach •Adapting the return process according to product value
	Lacking knowledge	<ul style="list-style-type: none"> •Increasing awareness among customers by communicating circular economy values •Providing guidelines for sustainable behaviour
Companies	Complex recovery	<ul style="list-style-type: none"> •Modular design •Using product information to improve design and recovery processes •Designing for extended use and multiple use-cycles
	Getting back previously used products	<ul style="list-style-type: none"> •Keeping ownership •Creating incentives and convenience
	Changing sell more, sell faster attitude	<ul style="list-style-type: none"> •Offering furniture as a service •Aligning circular economy values with strategic directives •Increasing attention to reverse logistics •Measuring the value of recovery in KPIs
	Adapting infrastructure and processes to circular production and consumption	<ul style="list-style-type: none"> •Creating a network of actors to accelerate the transition •Mapping of customer behaviour to understand how a circular business model should be designed •Developing product sales channels facilitating product circulation
	Handling the uncertainty in timing and quality	<ul style="list-style-type: none"> •Using product testing to make estimations and improve predictability •Increasing product visibility through use of technology (product passports, mobile applications, RFID)
Society	Adapting to stricter regulations	<ul style="list-style-type: none"> •Continuously developing a sustainable business prior to regulations •Developing best practises jointly with other companies embracing circular business models •Following development of regulations in other industries to prepare for stricter regulations in the furniture business

RQ 3: Based on the identified challenges and opportunities, how can possible future reverse flows for the studied initiatives be designed to support a circular business model?

The answer to research question three is three-fold since the studied initiatives have different characteristics. The recommended future state is presented in section 7.1.5, 7.2.5, and 7.3.5 for each initiative. The recommendations that are considered important for all the studied initiatives are presented in the conclusion below.

The analysis showed the importance of having inspection and separation performed as early as possible to reduce transportation and handling. It was concluded that inspection should take place at the point of use, either by IKEA or by customers. If performed by IKEA, it should be done remotely and centralised using, for instance, online forms or mobile applications. If performed by customers, they must be given enough product information and guidance to make correct evaluations. The early inspection was also identified as a key to increase visibility and facilitate better planning in the subsequent reverse logistics activities. By transferring information gathered at the inspection, uncertainties in timing, quantity, and quality can be reduced.

For IKEA to increase customer convenience and return volumes, the need for multiple collection channels was visible in the analysis. The barriers for customers to return products should be kept as low as possible. To extend the channel offering and customer reach, an opportunity for IKEA is to collaborate with other actors. This creates possibilities to consolidate and increase filling ratios during the collection activity. Offering products through a usership model is seen as another way to increase product returns since the ownership stays with IKEA. However, these products must also be collected at the end of the use-period. To increase customer convenience, it is further essential to understand how customers perceive the value of the products in the different initiatives. This is important since customers' willingness to return products is related to their perceived value. IKEA should focus on increasing people's awareness of the positive attributes of returns by improved customer communication. By having improved communication with customers, IKEA can better understand customer perception and behaviour to design the collection activity to meet customer demand.

To support a circular business model, IKEA's products need to be designed so that value can be recovered in the reverse flow. The analysis concluded that products designed for recovery, extended use, and multiple use-cycles increase efficiency and productivity in the reprocessing activity. This can for instance be achieved through simple packaging, modular design, and easy exchangeable spare parts. Moreover, product information generated over time can be used and analysed to continuously improve both product design and recovery processes.

It is shown in the analysis that the location of recovery is important for the different initiatives. It is recommended that recovery should be performed decentralised to the extent possible. This refers to the point of use for products that are to stay with the same customer and for products directly redistributed between customers. For products intended to be sold in the As-Is area it refers to recovery in store. Reuse and uncomplicated repairs can be performed at the point of use with support from experts remotely to reduce transportation and increase convenience for customers. The product transportation back to stores will thus consist of products in need of more extensive repairs and refurbishing and the reprocessing in stores should focus on those processes to a greater extent. If IKEA sees an increased volume of returned products over time,

it is important to evaluate the possibilities of having separate facilities performing more extensive recovery. Separate facilities should be considered since the IKEA stores are not designed to handle large return volumes. The analysis shows that separate facilities can be an opportunity to gain economies of scale in more extensive recovery processes as space is not limited.

The analysis discussed the importance of greater availability of spare parts to enable recovery in customers' homes, integrated into stores or long-term in separate facilities. The availability is essential both for customers and IKEA stores to facilitate a more decentralised recovery. To identify required spare parts, IKEA can expand the part range with unique part numbers for more spare parts than only assembly parts. With well-defined spare parts, customers can easily identify required spare parts and turn to IKEA to receive needed spare parts. It is further recommended that IKEA's spare part range should be included in the product range for customers to make it easy to order required spare parts online or to purchase them in stores.

From what can be identified from the analysis of the redistribution activity in the initiatives, fast reintegration in the forward flow is important to keep product value high. It is concluded that the integration of recovered products in-store is preferred since resources can be shared and customers can find second hand and new products in the same place. However, to ensure reliability, the products should be offered in a separate area as done today. Further, the analysis showed that redistribution does not always take place. Product lifecycles can be prolonged at the point of use by making spare parts available. Redistribution can also happen directly between use-periods, without the involvement of stores, if products are offered through a usership model.

The analysis showed that customers' attitudes towards second-hand products is a challenge for redistribution. This affects customers' willingness to pay, making it difficult for IKEA to redistribute second-hand products. IKEA needs to communicate the value of second-hand products. Focusing on green marketing can help IKEA to change customers' perceptions regarding used products and attract customers to purchase second-hand. The development of the As-Is area into a Circular Hub at IKEA is a good example of how green marketing can be used to communicate the values of a circular economy.

8.2 Recommendations for IKEA

In addition to the specific recommendations for each initiative, more general recommendations for IKEA were identified to effectively move towards a circular business model. These are divided into ten areas and presented below.

Mind-set and KPIs

First and foremost, it is recommended for IKEA to shift its mind-set from only a focus on sales of new products to also see the value in returned products and recovery. IKEA has already taken great initiatives in aligning circular economy values with their strategic directives but is recommended to transfer these values into the operations related to recovery more clearly. This can be done by changing the way IKEA measures the value of recovery in KPIs. KPIs aligned with circular economy values can help IKEA to allocate more resources in stores in relation to recovery. With a higher priority to product recovery, the stores can increase the recovery rate and handle more returns.

Customer communication

Many customers are unaware of the potential in restoring products. It is important to communicate that buying new products is not always the only option. This can be done by creating increased awareness of the potential of recovery and can occur through the Circular Hub to increase awareness, return volumes, and willingness to pay for second-hand products.

Customer incentives

It is important to gain a better understanding of customers, to create incentives that suit different segments. Customers value different things and the return process must therefore be adapted to their needs. This requires a mapping of customer's attitudes towards returning products. Generally, low value products must be met with large incentives and convenience whereas the opposite goes for high value products.

Network of actors

To create customer convenience and facilitate take-back of products, a network of actors is needed. A prerequisite for circulation is that products can be moved. For IKEA to reach a wider geographical acquisition area, joint forces can help to create multiple channel return options which further increase the convenience for customers.

Forecasting returns

To handle returns efficiently they must be forecasted. A circular economy increases this need as return volumes can be anticipated to grow. It would be valuable to introduce reason codes for EOU and EOL returns to separate these from traditional returns. The difficulties of forecasting such return flows are however immense but can be minimised by early inspection and increased product visibility, presented separately below.

Early inspection

Early inspection is implemented at IKEA to some extent in certain markets by using online forms before buy-backs are initiated. This allows for an initial estimation of product value to be done when the product stays at point of use and products can be separated before they reach the stores. Our findings show that this constitutes great potential and can be further developed. For instance, using mobile applications to remotely inspect products and give customer guidance on actions to prolong product life.

Product visibility

Increased product visibility can further increase the ease of forecasting. IKEA is exploring the potential of tracking products through their lifecycles. A product passport has the potential of storing product information as well as add on information throughout the product lifecycle. This is seen particularly important when products are used multiple times. The information should be made available for different actors so that the informational value can be spread across IKEA.

Product design

IKEA is doing extensive work to design products according to circular principles. This must be done in parallel with the development of the initiatives to support circularity. A product

purposed to be sold through a usership model requires durability, whereas, for an after sales offering, spare parts must be made easily exchangeable. This requires a lot of alignment and cross-functional work within IKEA. Large uncertainty still lies in how the products will be offered and used, making it important for product design and offerings to be developed jointly.

Deciding the recovery location

Where products can be recovered is to a large extent dependent upon the product design. Using simple packaging, modular design, and easy exchangeable spare parts, support decentralised recovery. Like early inspection, remote support from experts can further increase the amount of recovery performed in customers' homes. This would mean that reprocessing in-store could focus on more extensive repairs and refurbishing, in addition to today's uncomplicated repairs and recondition. If the reverse flow would face an increased volume of returns, separate facilities should be considered. This would also allow IKEA to specialise their reprocessing, as facilities can be adapted to specific recovery processes. Here, IKEA can collaborate with others to access specific knowledge and capabilities from others.

Promoting the spare part range

Our final recommendation is to promote the range of spare parts to a greater extent, both in stores but also online, for customers to be able to exchange assembly and furniture parts themselves. To enable this, all parts must be given unique identifiers so that identification and ordering are made simple. Work is ongoing at IKEA, EBAS has sent a business request to be able to handle all parts in one IT system, and INGKA is driving the development of increased online sales of spare parts. In long-term, a recommendation to IKEA is to include the spare part range in the product range to increase the attention given on the aftermarket. Moreover, EOU and EOL returns can occur much later than traditional returns, which makes storing spare parts complex. It is therefore important to work with standardisation of spare parts so that they can be used in multiple products. Another future possibility can be to explore additive manufacturing or 3D printing of parts on demand to reduce the need for storage.

8.3 Recommendations for further research

This study has been explorative since IKEAs transition towards a circular economy is still in an early stage. The study has brought forward many interesting areas suitable for further research, some of which are presented below.

To increase the attention given to the recovery of products, changing KPIs was identified as an opportunity. Further research could contribute with studies on suitable indicators that take the value of recovery into account and puts it in relation to costs.

The circulation of products is highly dependent on product type and characteristics. It would be interesting to segment products and research on important factors affecting reverse logistics when allowing different product types to circulate.

The thesis also showed the importance of customers' attitudes towards returning products and purchasing second-hand products. Further research can be done to better understand the demand for different customer segments to design future reverse flows that support the many people.

The transportation of returning products is another area that needs to be explored more deeply when transitioning towards a circular economy. It can be studied with the degree of centralisation in the different reverse logistics activities. Moreover, the challenge of consolidating transportation in forward and reverse logistics can be examined.

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Appendix A – Template of interview questions with internal specialists at IKEA

1. A presentation about ourselves and our thesis
2. Presentation of the interviewee and his/her role at IKEA

Specific questions to gather general information about IKEA

1. What responsibility lies at Inter IKEA?
2. What responsibility lies at the retailers?
3. How do the different organisations collaborate?

Specific questions related to circularity at IKEA

1. What is done in the short and long term to reach the goal of a circular IKEA 2030?
2. What initiatives are taken by retailers that affect the reverse flow?
3. How is responsibility divided between Inter and the retailers in the transition?
4. How do you work to align efforts?
5. How can you ensure that products return to IKEA after use?
6. How can you ensure products can be recovered and circulated?

Specific questions related to the current reverse logistics at IKEA

1. How is the reverse flow designed today?
2. What are the main reasons for customer returns?
3. How large are the returned volumes?
4. How much handling is done on returned products?
5. What are the restrictions when recovering products?
6. What are the main challenges for handling the recovery of products?
7. What actors, activities, and channels are involved?
8. How do you plan for the capacity in the reverse flow?
9. What implications would a high-volume reverse flow have for the existing infrastructure?
10. Who is responsible for reverse logistics?
11. How do you create visibility in the return flow?
12. How much of the returned products can be sold as new or as-is and how much are disposed?
13. How long time does it on average take for a returned product to be sold as new respectively as-is?
14. Why are certain products not recovered?
15. What factors are considered in the decision to recover or dispose of returned products?

Specific questions related to potential future reverse logistics at IKEA

General questions regarding different initiatives at IKEA

1. What potential channels can be used in a future return flow?
2. What potential actors can be involved in a future return flow?

3. What potential activities can be present in future return flows?
4. Which are the main challenges in the transition towards a circular economy according to you?
5. Which are the main opportunities in the transition towards a circular economy according to you?
6. How do initiatives taken at IKEA, affect reverse logistics?
7. Which of these initiatives do you perceive to have the greatest potential, and why?

Buy-back and take-back services

1. Can you describe the logistics behind the buy-back and take-back services?
2. How do you perform the collection of products?
3. How do you perform the inspection of products?
4. What type of reprocessing is performed in the services?
5. How are the products redistributed?
6. How are the products disposed of?
7. How large are the volumes?
8. What feedback has been received from these services?
9. How do you measure the value of incoming products?
10. How do you think these services can facilitate a circular economy?

After Sales parts

1. Can you describe IKEA's after sales offering and how the range is developed?
2. How do you decide which components to have in stock and for how long?
3. How do you measure after sales? Have you seen any increases in the use of after sales parts?
4. Do you work with modules, if so, how?
5. To what extent are spare parts offered directly to customers today?
6. Where are the spare parts offered to customers?
7. Are spare parts made available based on a request, prognosis, or a combination?
8. How do you think a circular economy will affect after sales?

Usership models

1. In what stage is the development of usership models?
2. Where are you piloting offering furniture as a service?
3. What type of products are you including in the pilots?
4. Which segments are you targeting?
5. What actors, activities, and channels do you think would be involved in such initiative?
6. What potential do you see in the offering of usership models?
7. Will the offering differ depending on the market?
8. How do you adapt product design to facilitate multiple-use cycles?
9. How do you think usership models can facilitate a circular economy?
10. What challenges do you see in scaling up usership models?

Appendix B - Template of interview questions with external actors

1. A presentation about ourselves and our thesis.
2. Presentation of the interviewee and his/her role.

Specific questions to gather general information about circularity

1. How can the reuse of products be promoted from a user perspective?
 - a. What is important for creating incentives?
 - b. What do customers demand and what efforts are they willing to make?
 - c. How does it differ depending on product type?
2. How to incorporate the visibility of products in the design process?
3. How can producing companies take an active role and gain profitability in the circulation of products?
4. What would you say are customers' general view of product circulation?
 - a. How does a second-hand product stand in comparison to new products?
 - b. How has that changed over time?
5. What is customers' attitude towards owning products versus gaining access to products?
 - a. How has that changed over time?
6. What is most important for customers, companies, and society respectively in the transition towards a circular economy?
7. How do you measure the value of design efforts when it takes a long time before products return?

Specific questions to gather general information about reverse logistics

1. How to handle the uncertainty in time between purchase and return?
2. How to handle the variation in quality due to usage and tear?
3. What are the advantages and disadvantages of centralised and decentralised inspection?
4. How to standardise inspection despite a broad product range?
5. How to handle the uncertainties of quality and quantity when planning for reprocessing?
6. What are the challenges for marketing second-hand products?

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