



# Inefficient packaging in e-commerce

Exploring the underlying causes and business network interdependencies

Master's thesis in Supply Chain Management

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## Abstract

As the e-commerce steadily is increasing, there's a need to make transports more efficient in regards to environmental and financial aspects. The more goods being transported, and the greater customer demands, the more pressure is put on all actors in the business network; retailers, customers, manufacturers and carriers. By decreasing the excess air in parcels, environmental impacts and financial losses could be decreased. As a result, the fill rates could automatically increase throughout the e-commerce business network. Traditionally, the main focus has been on fill rates in transportation vehicles. Today, the focus also includes the fill rates in parcels.

The aim of this thesis is to identify and analyze the underlying causes that contribute to the inefficient packaging with excessive air in e-commerce. The thesis is based on theory about logistics in e-commerce, packaging logistics, business networks and resources. Further, an analytical framework is developed and used in the analysis. This explorative study is mainly built on interviews with actors related to e-commerce. A virtual case study of one of the actors packaging process was also performed. Further, a survey was conducted in order to examine the perspective of the consumers. By performing the virtual case study, conducting interviews and a survey, a rigorous analysis in regards to parcels and packaging was enabled.

The study resulted in an identification of how the perspective of a parcel differs between actors in the business network. Further, the analysis indicates that there are interdependencies between actors in the business network. Also, several challenges seem to occur due to these interdependencies. The analysis of the findings resulted in the conclusion that the actors in the business network should realize the fact that single resources need to be connected and gradually changed, to solve the problem of complex interdependencies. Further, it is concluded that the actors have to collaborate in order to decrease the excess air in parcels. The first step towards reaching such a goal is to be transparent and share the obstacles that hinder actors from taking certain actions that would enable a decrement of excess air.

**Keywords:** *e-commerce, packaging, business network, resourcing, parcels, excess air*

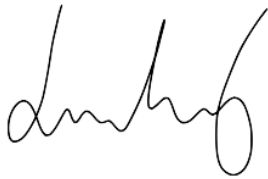


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Louise Enberg



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Anna Skilbred

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# Terminology

<i>SEK</i>	- Swedish krona
<i>AGV</i>	- A mobile robot used to move materials around a manufacturing facility
<i>3PL</i>	- Third-party-logistics, companies that offer outsourced logistics services
<i>Pick-up points</i>	- A place where one collects and picks up parcels close to their home
<i>Parcel lockers</i>	- Storage place for parcels at pick-up points
<i>Fill rate</i>	- A logistics measure of inventory effectiveness
<i>Unilateral</i>	- One-sided
<i>CSR</i>	- Corporate social responsibility
<i>Service points</i>	- Locations where the postal service has agreements where you can pick up your parcels
<i>Automation</i>	- The use of automatic equipment in a manufacturing or other process facility
<i>CO<sub>2</sub></i>	- Carbon dioxide
<i>Lean</i>	- A universal management tool for delivering value and optimizing work processes

# 1. Introduction

The following chapter is intended to provide the reader with the necessary background information regarding the master thesis and also describe its purpose. Further, the chapter also presents the outline of the report.

## 1.1 Background

E-commerce became possible in 1991 when Internet was opened to commercial use (Mourya & Gupta, 2014). The Internet has occupied a huge portion of our lives and many activities have gone online, one of these is shopping. Since the commercialization of Internet, millions of companies have gone online. There are numerous incentives for companies to engage in e-commerce. One of the main benefits is the insignificance of the physical distance (ibid.). With a web-shop, every customer is always just a mouse click away, every hour of the day. Also, some fixed costs, such as high rents for physical stores, disappear when selling online. Benefits for consumers with e-commerce shopping, in addition to the accessibility, are the possibility to price comparison, more choices, faster information, time savings and home deliveries (ibid.).

Statistics indicate that the trend of online shopping is continual. E-commerce is for example increasing annually with 15%. During the first six months of 2019, Nordic consumers spent 112 billion SEK online, where 44.2 billion SEK originated from Swedish citizens (PostNord, 2019). In total, Swedish citizens spent 87 billion SEK online during 2019, see figure 1. Moreover, 44% of the purchases during 2019 were made from a mobile phone, in comparison with 13% during 2016. This transition could, according to PostNord (2019), be one important factor to the high growth rate for e-commerce.

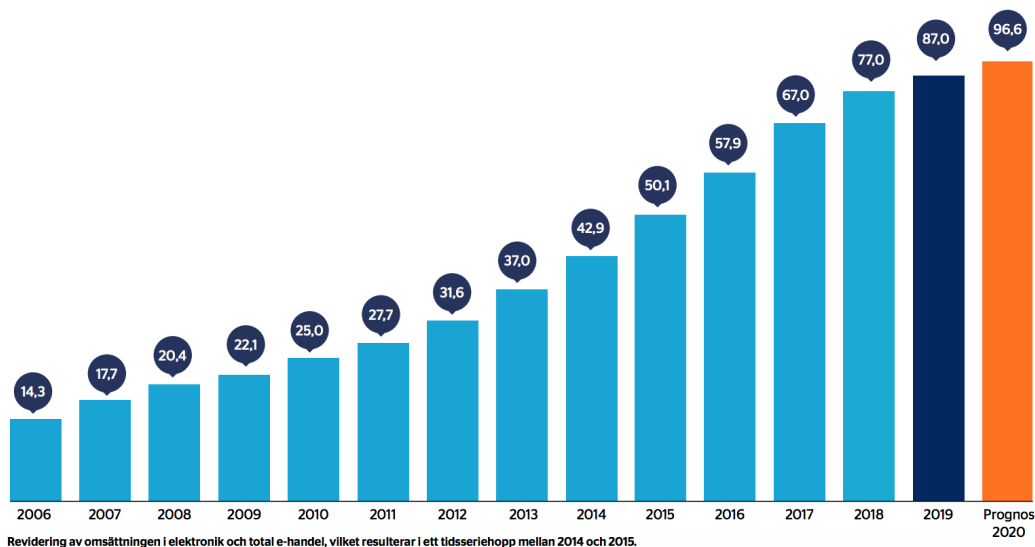


Figure 1. Bar Graph illustrating the e-commerce revenue in billion SEK from year 2006 to 2019. The bar in orange illustrates the forecast for 2020 (PostNord, 2019).

Besides all benefits coming with e-commerce, there are some downsides and challenges as well. These are among others, a lack of personal touch, hidden costs and frequent changes in technology (Mourya & Gupta , 2014). E-commerce goods also require a different supply chain structure, than for the e-commerce goods sold in traditional shops. Delivery points are both numerous and dispersed for the e-commerce and the parcels are of smaller sizes which place higher demands in terms of coordinating the goods in transit. Further, the last-mile deliveries are often made using smaller vehicles (Trafikanalys, 2019).

Parcels originating from e-commerce contain approximately 30% of air (PostNord, 2019), which confirms that there is an increasing need to identify what actions in the supply chain that need to be taken in order to decrease the excessive air in parcels. If parcels could consist of less excessive air, more products could be transported in fewer distributing vehicles (ibid.). The e-commerce would, with regards to the high growth rate, require three times more of resources such as terminals, vehicles and drivers in seven years. Therefore it is crucial to minimize the transportation of air, since expanding the infrastructure in such a large scale is not sustainable (ibid.).

Consumers also question the size of the parcels in relation to the product, and what kind of effect the packaging and wrapping inside could have on the environment. On social media, there's an ongoing debate among consumers, where both stories and pictures of parcels that transport a lot of air are shared. Many products are for example sent in standard-sized boxes and contain plenty of filler materials like bubble wrap or paper to protect them (PostNord, 2019). There's an urgent need for improvement in packaging and resource logistics (ibid.). This issue not only leads to financial inefficiencies, but also to environmental effects that impact the society. Surveys made by PostNord show that customers are both willing to wait longer and pay more for their deliveries, if it would result in less environmental impacts (ibid.).

## 1.2 Purpose

The aim of this thesis is to identify and analyze the underlying causes that contribute to the inefficient packaging with excessive air in e-commerce.

## 1.3 Outline of the report

This report consists of 8 chapters and appendix. The first chapter is supposed to provide the reader with an introduction to the thesis, in form of a background, as well as the purpose of the thesis. Chapter 2 presents the theoretical framework, which serves as a base for the analytical framework, which is presented in the end of the chapter together with the research questions. The third chapter presents and discusses the applied methodology, which includes a discussion of research strategy and design as well as research methods. Chapter 3 also includes sections where the research challenges, data analysis and the quality of the research are discussed. The fourth chapter contains the empirical data, such as data from the survey, interviews and the

virtual case study. Chapter 5 provides an analysis of the empirical data, followed by chapter 6, which includes a discussion. In chapter 7, the conclusion which contains the most important findings of the thesis is presented. Finally, recommendations for further research will be presented in chapter 8.

## 2. Theoretical framework

In the following chapter, the literature and framework that will be of main focus for this thesis are discussed. Further, an analytical framework that is adapted for the purpose of this thesis will be presented, along with the research questions. The theoretical framework starts with a description of logistics in e-commerce, including warehousing, distribution and transportation. Thereafter, research within the area of packaging logistics is presented, followed by a section which explains the role and interdependencies of resources, actors and activities in business networks. As the parcel will be the main focus in the thesis, the resources will be of particular interest.

### 2.1 Logistics in E-commerce

Electronic commerce, *e-commerce*, is transforming the way organizations perform their tasks and interact with consumers (Quaddus & Achjari, 2005). The definition of e-commerce is provided by Kalakota & Whinston (1997) as “*electronic commerce includes any form of business activity conducted via electronic means, which might range from products/services information to selling and/or buying products.*” E-commerce between retailers and consumers is referred to as B2C E-commerce. He et al. (2019) define it as “*B2C E-commerce means a type of retailing where a company sells products to consumers by online channel.*”

In order to succeed with E-commerce, effective and efficient logistics systems are crucial (Ramanathan, 2010). Also, He et al. (2019) argue that the logistics capability is positively related to firms’ performance on the E-commerce market. The word *logistics* is a generic term that refers to all activities that are necessary to bring a finished product to its ultimate consumer, including warehousing, distribution and transportation (He et al., 2019). B2C E-commerce is characterized by a huge number of small order sizes, where customers demand fast and reliable shipments. Therefore, B2C E-commerce supply chain creates a need for another type of logistics than the traditional supply chain. Ramanathan (2010) further stresses that the ability of an organization to attract and retain customers is vital to its success. There are number of factors that affect the customer experience; convenience; availability of products; delivery; return policy and so on. Some of these factors are dependent on the logistics performance of the company (Ramanathan, 2010). He et al. (2019) also agree with the fact that there’s a correlation between logistics performance and customer loyalty, meaning that if a company has a high logistics service performance, it can indirectly have an impact on market share of E-commerce firms via customer satisfaction and customer loyalty.

In the following sections the main activities within logistics in e-commerce will be explained. Firstly, warehousing will be introduced. The section of warehousing is followed by a description of distribution and transportation. A flow chart of the activities can be seen in figure 2.

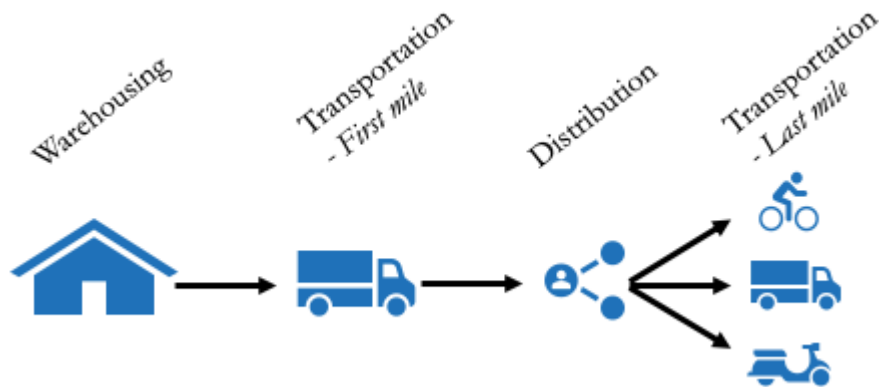


Figure 2. A flow chart illustrating the main activities in the logistics e-commerce; warehousing, distribution and transportation.

### 2.1.1 Warehousing

Warehousing can be described as the intermediate storage of goods between two steps of the supply chain. It includes basic functions such as receiving, storage, order picking and shipping. Boysen et al. (2019) point out the main elements of a warehousing system to be the storage devices (e.g., a rack), material handling systems (e.g., a conveyor belt) and picking tools (e.g., picking workstation).

Warehousing for e-commerce faces some requirements that differ from traditional warehousing; small orders, large assortment, tight delivery schedule and varying workload (Boysen et al., 2019). However, the importance of these requirements seems to vary. Graves (2013) highlights the importance of time reduction for picking and packing processes, due to that the consumers are next in the supply chain, and not stores. Therefore, it's crucial to make the warehouse more efficient in fulfilling e-commerce orders. Similarly, Boysen et al. (2019) argue that it's highly necessary to have warehousing systems especially suited for e-commerce retailers. Boysen et al. (2019) suggest automation of picking and sorting processes in order to increase the efficiency, presenting Automated Guided Vehicle (AGV) picking and shelf-moving robots as potential solutions.

### 2.1.2 Distribution

The distribution center is one of the most important transshipment nodes within the logistics network (Yu et al., 2020). The distribution center is a facility where parcels are transported to and from suppliers. After leaving the receiving area the parcels are processed in a sorting area and picked according to the order information. According to their specific destinations, the parcels are recombined in a consolidation area and thereafter ready to be loaded onto an outbound truck in a shipping area for last mile delivery (Yu et al., 2020).

Yu et al. (2020) argue that distribution center operations in e-commerce are of much more complex character than in traditional distribution. This is mainly due to the characteristics of

e-commerce orders, but also because e-commerce customers tend to have high expectations regarding logistics service performance. Another important aspect is that bulk goods, unlike e-commerce orders, can be delivered weekly to stores. E-commerce orders, on the other hand, requires more frequent and faster deliveries (McPherson, 2015).

Burt and Sparks (2003) stress that the greatest debate in B2C e-commerce revolves around the distribution process. The debate is primarily about whether existing supply chain processes and systems are appropriate for e-commerce, or if new ones will be required. According to Graves (2013), one of the main reasons for outsourcing the distribution to 3PL providers is that they have the appropriate equipment and facilities for e-commerce as well as extensive experience with deliveries towards consumers.

Distribution also has a significant impact of the value proportion, where the distribution of packages is an important part of the customer experience (Graves, 2013). Some important aspects, among others, that have a huge impact on the customer experience are; the speed of delivery, the packaging and presentation of the products, personalized and relevant documentation, as well as post-sale customer service (McPherson, 2015). Issues associated with the deliveries could for example result in customers switching retailers (PostNord, 2017).

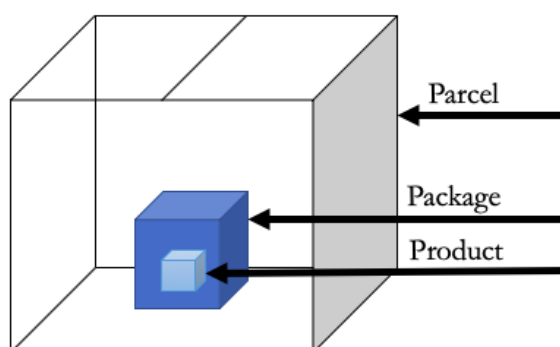
### 2.1.3 Transportation

Order fulfilment is considered as one of the most expensive and critical parts of the supply chain for companies engaged in e-commerce. The most important element of the order fulfillment process, in regards to the customer experience, is the last-mile deliveries (Janjevic 2020). Esper et al. (2003) describe the last-mile deliveries as the transportation to the final customer or point of sale. The roles within transportation in e-commerce, similarly to the distribution activities, also differ from traditional shopping. In particular for the last-mile deliveries. For example, within the fashion e-commerce, the majority of transportation are being operated by 3PL providers, a change from traditional shopping where the customers are the ones responsible for the last mile transportation (Burt & Sparks, 2003). Further, Esper et al. (2003) highlight the importance of customers having trust for e-retailers and carriers for fulfillment. The carriers should, for example, attend to increase the customers' trust regarding timeliness of delivery and condition of the product upon delivery. Ramanathan (2010) also agrees about the importance of goods reaching customers from warehouses without being damaged.

The customers can choose among several modes of delivery. Two commonly used modes in Sweden are home delivery to the mailbox and pick-up points delivery (PostNord, 2017). Using physical stores as pick-up points is sometimes also an option for the customer, in this case, the customer becomes the one responsible for the last-mile of transportation.

## 2.2 Packaging logistics

Throughout this study, the parcel will refer to the surrounding of which a product is packaged in. The parcel could be both a padded envelope, a plastic bag or a cardboard box. The package is what a product is packed in when you see it on the shelf in the store, these packages are often branded and contain more information, see figure 3 and 4. In this thesis, the term packaging will be used when referring to the activity of packing a product, both when packing a product into a package as well as packing a package into a parcel.



*Figure 3. Illustration of what a product, package and a parcel is referring to.*



*Figure 4. From the left, a padded envelope which a package is sent in, which in turn contains the product, to the right.*

Jönsson et al. (2018) present the fact that the packaging is developed separately from the product development in many companies, as the packaging culturally is seen as a part of the production & logistics activities. The packaging activities are often outsourced to other companies and therefore tend to be neglected by the product developer (Jönsson et al., 2018). Jönsson et al. (2018) consequently argue that the packaging should be integrated with the

product development in order to take full command of the entire product life cycle, to optimize costs and to prevent potential issues related to packaging.

It is crucial to have a collaborative supply chain approach in order to achieve cost efficient packaging systems with minimal environmental impact across the whole supply chain (Pålsson et al., 2016). The packaging solutions are often inefficient as a result of lack of collaboration between supply chain actors in packaging development (Pålsson et al., 2016). Pålsson et al. (2016) further explain that packaging interacts with various supply chain actors, and has a significant impact financially and environmentally. These impacts result from packaging, purchasing, packaging development, transportation and end-of-life handling (Pålsson et al., 2016).

Vakulenko et al. (2019) present the fact that customers are sensitive to any event happening in the customer journey, meaning that the entire evaluation of one experience with one firm can be impacted by one minor mistake. For example, customers tend to get a negative experience when receiving parcels much bigger than the package and product inside (Vakuleno et al., 2019). Customers highlight the fact that they often have received parcels as big as shoeboxes, with products inside as small as one mascara. Vakulenko et al. (2019) further explain that customers experience that they often need to travel a longer distance to pick-up points where it's possible to accommodate bigger parcels.

Logistic service providers and retailers are exploring new innovative solutions to meet the increasing volumes of parcels being both returned and delivered, and to meet the increasing customer expectations in order to stay competitive (Vakulenko et al., 2018). They do so by implementing innovative tools such as self-service technologies, like parcel lockers. These enable self-service collection and return of goods ordered online (Vakulenko et al., 2018). Self-service parcel lockers have received positive feedback from different actors in the supply chain, as it enables flexibility for the customers and improves the service experience. However, this innovative solution has limited storage possibilities, which is a disadvantage from a customer perspective (Vakulenko et al., 2018). As Sweden is a country where the use of parcel lockers service is increasing, the disadvantages should be aimed at being decreased (Vakulenko et al., 2018).

Pålsson et al. (2016) emphasize the fact that packaging has negative effects deriving from transportation. These arise due to volume and weight inefficiencies in the packaging. If these inefficiencies can be decreased, the supply chains will more likely be decarbonized and total resource consumption could be minimized (Pålsson et al., 2016). There's an opportunity to reduce environmental impacts along the supply chains with less product waste, energy use in logistics and consumed packaging material (Pålsson et al., 2016). Pålsson et al. (2016) highlight the fact that allocation decisions should consider the impact the packages and parcels have on fill rates in transportation, as it should be as high as possible. Pålsson et al., (2016) mean that different factors hinder the success of such a progress. For example, companies are

semipermanently dependent on packaging machinery, while customers have requirements on packaging that inhibit an integrated approach to increase the efficiencies of packaging (Pålsson et al., 2016).

Packages and parcels should mainly provide protection to one product, but also aim at adding the lowest possible additional weight and volume to a product during transportation (Pålsson et al., 2016). Pålsson et al. (2016) argue that this contributes to higher fill rates that hence will reduce the energy consumption and environmental effects in both logistics and stationary logistic facilities, such as warehouses and ports. The fill rates can be improved by focusing on implementing packaging approaches such as stackable packing, postponing packaging processes and minimizing volume of empty packages and parcels (Pålsson et al., 2016). The European building block concept also enables the possibility to mix different products on Euro pallets, because of unitized parcel sizes (Pålsson et al., 2016). Pålsson et al. (2016) further explain that a barrier to maximize the fill rates is that companies experience difficulties to optimize packaging systems so they are able to fit with all different kinds of transportation modes worldwide. However, companies seem to believe that the fill rates can be maximized by reducing air in packaging for small product series (Pålsson et al., 2016).

## 2.3 Theoretical Framework for Resources

In order to understand and analyze packages and parcels as resources, a framework is needed. The ARA-model (Håkansson et al., 1992) and theories of how resources are embedded in networks, with various interfaces, will therefore be presented in the following section. The ARA-model explains how resources, activities and actors are dependent on each other in business networks and will be used as a framework for analyzing parcels as resources.

The ARA-model relies on three layers: Actors, Activities and Resources. The actor layer refers to links developed between actors through interaction. Actors more specifically refers to companies and individuals, and how they develop and establish relationships (Tr, 2017). The degree of stability of the actor layer depends on how the actors see, know and feel close to each other as well as how they trust, appreciate and influence each other (ibid.). The activity layer relates to the integration and coordination of activities that may develop between actors. The activities, for example production, logistics, administration and deliveries could be more or less integrated. Specific activity links in a business relationship have been pointed out to have substantial economic effects on the actors involved (Håkansson et al., 1992). The resource layer refers to the degree of the adaption, or connection, between the resources in a network. Resources refer to a combination of tangible resources such as; equipment, plants, humans and physical and financial assets and intangible resources such as; knowledge, skills, trust and brand image etc. As one company seldom has all resources needed in order to run a business, it needs to access the resources of other actors being part of the same network (Tr, 2017). In other words, some resources of a company are often tied into the collection of another company's resources through resource ties (ibid.). Resource ties refer to *“resources a company provides or uses are tied directly to those with which the company has direct relationship with*

and also to those that are indirectly connected” (ibid.). Håkansson et al. (1992) explain that the resource ties occur as the actors in a relationship confront and mutually adapt their resources over time. Further, resources are defined and valued based on how they are combined and used in a network (Tr, 2017).

The three layers can be analyzed on a company-, relationship-, and network level. Håkansson et al. (1992) explain that each of these three layers are interconnected and affected by the wider network in terms of *resource constellations*, *activity patterns* as well as a *web of actors*. On a relationship level, *actor bonds* are created between different actors, *resource ties* connect the resources of the actors, and the *activity links* connect the activities of the two actors, see figure 5. While on a company level, there are *resource collections*, *activity structures* and *organizational structures* (ibid.).

	<b>Company</b>	<b>Relationships</b>	<b>Network</b>
<b>Activities</b>	Activity Structure	Activity Links	Activity Pattern
<b>Actors</b>	Organizational Structure	Actor Bonds	Web of Actors
<b>Resources</b>	Resource Collection	Resource Ties	Resource Constellation

Figure 5. Illustration of the ARA-model and the effects of business relationships (Håkansson et al., 1992).

Companies perform different activities in order to finally generate revenues and profit to obtain profitable and sustainable businesses (Tr, 2017). As activities are performed to fulfill some function in one network, the activities will naturally impact others in the same network (ibid.). If one company decides to change or add another supplier in their business network, it will consequently affect the existing suppliers and their business as well (ibid.). In the end, the whole network will change structure as activities, actors and resources change (ibid.). Each company’s situation and business context decide what dimensions in the network that will have to change in order to achieve certain goals of improvement and growth (ibid.).

Logistics systems can be seen as dynamic, logistics resource constellations, which is a result of interactions across and between different types of resources (Jahre et al., 2006). A focal

resource refers to that there could be a single, specific resource, functioning as the centre of the described and analyzed resource constellation. If the focal resource is a product, it could be described for example by price and variation in price, the design and technical features of the product and the extent of standardization or adaptation of the content of the product (Jahre et al., 2006). If one resource is seen as the focal resource in a business network, its value will be dependent on how it is connected to other resources in the network. This is illustrated in figure 6, where actors, named as *A* in the figure, control specific resources, named *R*. The resources are in turn affected by actors and resources further away in the network. In other words, one actor may perceive certain resources in one way, while another actor might perceive its value differently. The resources have different interfaces and are interconnected with other resources in the business network by resource ties, which is illustrated with lines in the figure.

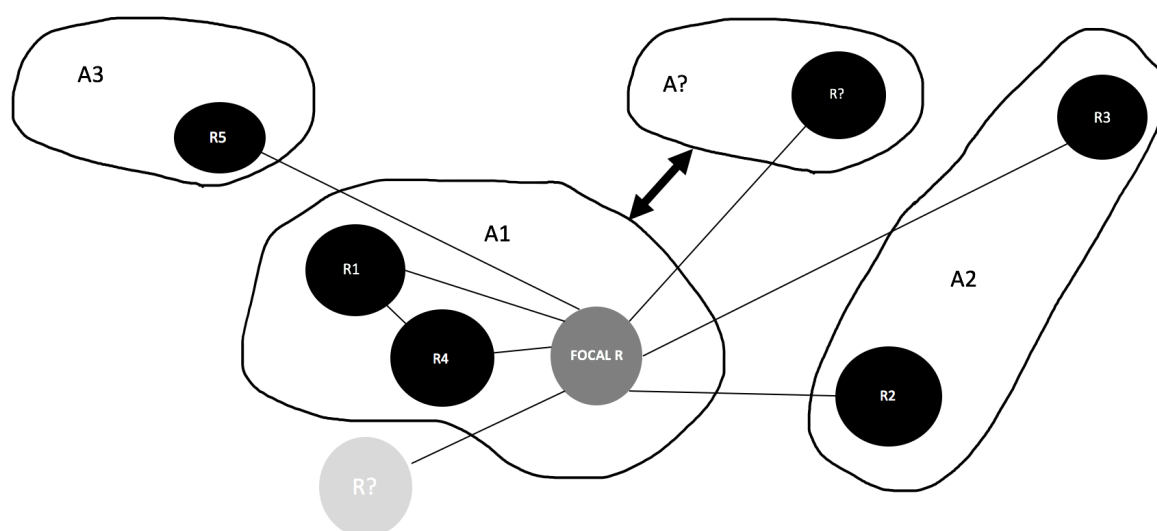


Figure 6. Embeddedness of a focal resource in a business network.

Further, Jahre et al. (2006) discuss the physical and organizational interfaces between resources. Physical interfaces between resources are primarily technically conditioned. Organizational interfaces between resources, on the other hand, are mainly characterized by social and organizational aspects. Jahre et al. (2006) also implicate that there is a difference between how these are formed. The physical interfaces between resources do not evolve automatically, these are formed by involvement of organizational aspects in all sets of resource combination and interfaces. Jahre et al. (2006) argue that the most complex resource interfaces are the mixed ones between a tangible and an intangible resource. These are also difficult to analyze since they involve both technical and social/administrative aspects. The only way of solving the problem with complex interactions is that single resource elements are connected and gradually changed. This process is called *resourcing*. The concept of resourcing is used to indicate that there's never a given value of a resource, since single resources are never used in isolation but combined with other resources. The value of a resource therefore depends on how it is utilized and combined with other resources (ibid.).

Logistic resources, such as warehouses, vehicles and software etc., are often utilized and developed through interactive processes between business partners. Interaction, recombining resources and changes in interfaces are also, sometimes, undertaken between business units that belong to the same organization (Jahre et al., 2006). In some situations, companies choose to rely on unilateral adaptations, for example when a product is designed or adapted to fit the existing infrastructure. In these cases, the adaptations are entailing interactive effects between resources but there is a lack of interaction between actors. The reasons behind these conditions could be that mutual adaptations are considered to be too resource demanding or that there is a problem with convincing the other actors of the benefits with joint investments (ibid.).

Interdependencies between tangible resources and activities in which these are involved are interpreted differently among the actors involved. Four aspects that often are confronted during interaction, and where actors seem to make different interpretations are; the actual feature of the set of interfaces, which interfaces to prioritize, which interface modifications that are required and how the changes should be implemented (Jahre et al., 2006).

Actors can interpret features of resources differently. A resource could have both physical and abstract features. The physical features of a resource, such as size, design and weight could be highly important for one actor whilst abstract features such as time could be more interesting for another. Taking a parcel as an example, the communicative role of packaging could for example be most crucial for a marketing department, where features such as attracting, appealing and branding are relevant (Lindh et al., 2016). For the regulatory affairs managers, on the other hand, informational value is the most important feature (ibid.). Further, Jahre et al. (2006) argue that for the carriers, the facilitate handling function that involves features such as weight, utilization, apportionment and gripability might be the preferred features of a parcel.

Jahre et al. (2006) present three ways to cope with the complexity of resourcing. These sub-processes are designing, influencing and learning. Firstly, products that are related in some way have to be designed to fit together. Further, facilities must be designed in regards to its connections with other facilities and products. Learning and influencing is about the way business units learn and teach in order to develop and improve the supply chain performance. Business relationships are highly important when it comes to influencing. Companies have to influence their counterparts in order to be able to implement a change. For mixed interfaces, economizing is particularly central, since most resourcing efforts are financially driven (ibid.). To realize the potential for economizing, recombining of physical and organizational resources are required, as well as changes in their interfaces. Sometimes the main reason for not fully utilizing the relationship potential could be related to internal organizing in a company. For example, if each business unit within a company is autonomous.

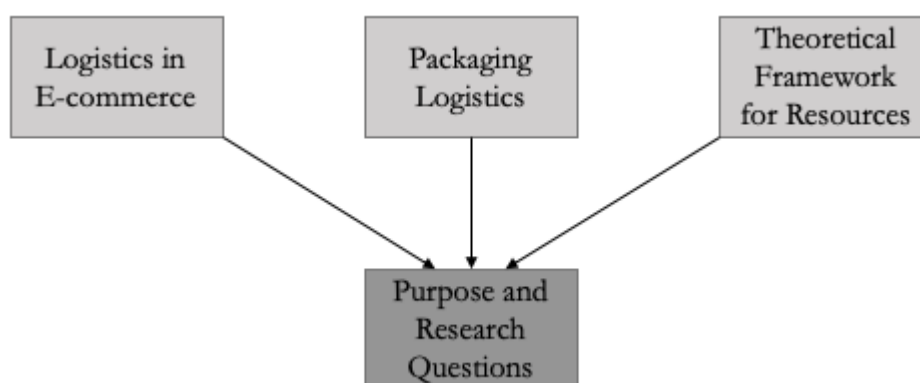
## 2.4 Analytical framework & RQ's

In the following chapter, it is described how the theoretical framework results in an analytical framework that works to support the purpose of the master thesis, which is further specified by the formed research questions.

### 2.4.1 Analytical framework

The first chapter of theory that is presented, Logistics in E-commerce (2.1), aims at mapping out the main activities within E-commerce logistics. The next chapter of theory, Packaging Logistics (2.2), presents how different actors in the supply chain perceive and value packages. Furthermore, it also describes how the design of packages differ among actors. The last chapter of theory, Theoretical Framework for Resources (2.3), provides a thorough description of resources and how these are linked to actors and activities in business networks.

To sum up, all of these theories aim at providing support and inspiration to the purpose of this master thesis; *to identify and analyze the underlying causes that contribute to the inefficient packaging with excessive air in e-commerce*, see figure 7. The analytical framework (2.4) will help to understand how different actors in the e-commerce business network perform logistic activities that are related to parcels and how they are interconnected through resource ties and actor bonds. The analytical framework will further be used when analyzing the different interfaces of a parcel, which is seen as the focal resource. Finally, each actors' interests and actions towards having efficiently designed packages and parcels will be analyzed.



*Figure 7. Schematic diagram of how the theoretical framework supports the purpose and research questions of the master thesis.*

### 2.4.2 Research Questions

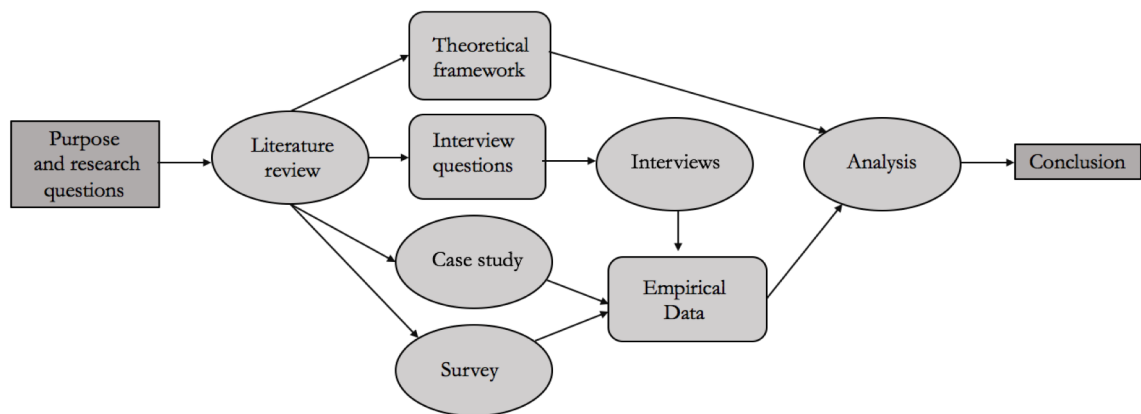
The following research questions are to be scrutinized throughout the master thesis, and finally acknowledged. The questions are related to the identification and analyzing of underlying causes that are contributing to inefficient packaging with excessive air in e-commerce.

*RQ1: What resource interfaces can be identified from the perspective of the parcel as the focal resource and what are the effects of these resource interfaces on inefficient packaging?*

*RQ2: How do the perspectives of features of a parcel vary among actors in the business network and what are the effects of the various perspectives on inefficient packaging?*

### 3. Methodology

This chapter presents the methodology that was used in order to fulfill the purpose of this thesis as well as being able to answer the research questions. Initially, a research strategy is presented that describes which research approaches that was used. This section is followed by a more thorough description of the different methods used in order to collect data and how these were designed. The following section, named research challenges, includes a discussion about obstacles that arose during the process and how these affected the design and methods used for the research. Lastly, the realization of the analysis is described followed by a section regarding research quality in terms of validity and robustness. A schematic diagram of the applied methodology can be seen in figure 8.



*Figure 8. Schematic diagram of the applied methodology.*

#### 3.1 Research Strategy

According to Bryman & Bell (2003) there are two different research strategies a study can employ. The two strategies are qualitative and quantitative research and they differ in the way they aspire to conduct research. The study of qualitative approach is based on words, contextual understanding as well as participants points of view while a quantitative approach deals with numbers and statistics (Bryman & Bell 2003). This thesis used a qualitative approach in order

to develop a thorough understanding of the underlying causes and interdependencies for inefficient packaging in a business network.

Further, Bryman & Bell (2003) distinguish between an inductive and deductive approach. An inductive approach generates new theories based on research findings while the latter, deductive approach, refers to the testing and revision of existing theory. An approach that can be seen as a combination of these two approaches is the abductive approach. Abduction begins with incomplete observations, e.g. a phenomenon that can't be fully explained by existing theory. Abductive reasoning is when iteration is applied, alternating between observations and literature. This thesis was conducted using an abductive approach. The interdependencies and underlying causes of inefficient packaging in the business network can be seen as the phenomenon. Existing theory and frameworks were merged with data collection in order to answer the research questions.

## 3.2 Research Design & Method

The following section describes the methods used for the research and how these methods were designed and conducted. The section starts with a description of the literature review, which is followed by a presentation of how and why the interviews were conducted. Thereafter, the section ends with a description of the survey and the case study.

### 3.2.1 Literature review

In order to create a theoretical framework and research questions, a literature review was conducted. According to Snyder (2019), a literature review plays an important role for all types of research. It can serve as a basis for knowledge development, create guidelines for practice or even help to engender new ideas within a specific field of research.

The sources used in the literature review were both academic articles and textbooks. The articles were mainly related to the following fields of research; e-commerce logistics, supply chain, packaging logistics and resourcing in logistics. In the search for relevant literature, keywords such as *e-commerce logistics*, *packaging*, *product development* and *business networks model* were used. The articles were accessed mainly through the Chalmers library database, ScienceDirect and Google Scholar. Some literature, related to the relevant subject, were also provided by our supervisor Kajsa Hulthén. The aim of the literature review was to increase the knowledge and to find relevant theories that could be used in the creation of the analytical framework.

### 3.2.2 Interviews

Interviews are used to secure information that can't be found in documentations, or data that might be difficult to find through observations or written responses (Phillips & Stawarski, 2008). According to Phillips & Stawarski (2008), the interviews can be of different characters; structured, semi-structured or unstructured. During a structured interview, the interviewers ask

specific questions with little or no room for deviation from the desired response. A semi-structured interview, on the other hand, allows the interviewee to respond more freely which further open up for follow-up questions. Also, a semi-structured interview is based on a few general questions instead of many specific questions (Phillips & Stawarski, 2008). An unstructured interview is a spontaneous conversation, not a specific set of questions in a predetermined order (ibid.).

In this thesis, the interviews were of semi-structured character, with the purpose to let the interviewees share valuable information that is not directly related to the specific questions, but still important information that is relevant for the purpose of the thesis. In order to get a deep understanding and collect information regarding the inefficient packaging in business networks, several interviews were conducted, where the research questions served as a guidance for this development. The interview questions, that served as a starting point for the interviews can be found in appendix A. The interviews were performed in Swedish, thereafter transcribed and finally translated to English.

The interviewees were decided in collaboration with Sofia Leffler Moberg, Sustainability Manager at PostNord. To get a broad understanding of the entire business network, the interviewees included actors from different industries; such as packaging; retailers and carriers. All interviews were recorded in order to ease the analysis of the interviews later on in this thesis. All the interviewed company representatives have in common that they are somehow related to e-commerce. Some of the interviews were conducted during DCongress, which is an annual exhibition organized by the Swedish Digital Trade Federation. The exhibition welcomes companies that somehow are related to e-commerce. At Dcongress, the 5th of March 2020, several company representatives from various industries related to e-commerce were interviewed face-to-face. The remaining interviews were conducted via Skype or Facetime. In total, 14 people from four different industries were interviewed, see table 1.

Table 1. The interviewed company representatives.

Company	Title	Date	Type of business/industry
Best Transport	Home Delivery Manager	2020-03-05	Carriers/Distribution service
Bring	Logistics development manager	2020-03-05	Carriers/Distribution service
Lager 157	E-commerce Manager	2020-03-05	Retail
NetOnNet	Logistics manager	2020-03-05	Retail
Tiger of Sweden	E-commerce Manager	2020-03-05	Retail
Reclaimit	Developer	2020-03-05	SaaS-provider
Nordicfeel & Eleven	Acting CEO	2020-03-05	Retail
DS Smith	Account Manager & Sales Manager	2020-04-08	Packaging
Lyko	Communication & Sustainability Manager	2020-04-14	Retail
PostNord	Head of E-commerce & Logistics Strategy Manager Maintenance Technician Terminal Manager	2020-04-24 2020-05-04 2020-05-07 2020-05-07	Carriers/Distribution service

### 3.2.3 Case study

Case studies can be used to build theory that could help to answer the research questions. All case studies should have a clear structure and design prior to the data being collected as it otherwise can be easy for the researchers to focus on irrelevant areas of the results (Easterby-Smith et al., 2015). The structure and design of the case study should focus on the research questions, procedures for interpretations of the data and the link between data and the research questions (Easterby-Smith et al., 2015). Case studies are based on observations, personal interviews and sampling from a number of individuals from one or several departments, companies and/or industries (Easterby-Smith et al., 2015). In this thesis, a virtual case study with Lyko was conducted, where a packaging process was observed. The virtual case study was carried out with the aim to observe all interfaces that the parcel meets along the packaging

process, and to identify the underlying causes for the used parcel features of Lyko. Finally, the results from the virtual case study were analyzed by using the theoretical framework as well as other collected empirical data.

### 3.2.4 Survey

Phillipps & Stawarski (2008) describe a survey as a specific type of questionnaire, with several applications in measuring program success. Phillipps & Stawarski (2008) further stress that surveys are preferred in situations where attitudes, beliefs and opinions are of interest. The answers are usually based on a scale, ranging from *strongly agree* to *strongly disagree*. In this thesis, a survey was conducted in order to collect information regarding the consumers' personal experiences of parcels and packages in e-commerce. The survey was distributed through social media websites, such as Facebook and LinkedIn, and was directed towards those having experience from ordering products online. The survey has 212 respondents, where both ages and genders are unknown. The survey can be found in appendix B.

## 3.3 Research Challenges

Meanwhile the master thesis was conducted there was an outbreak of a virus, called coronavirus, which had a huge impact on the society, in terms of social distancing, financial difficulties, terminations and bankruptcies. This resulted in some necessary adjustments and changes regarding the initial choice of methods. For example, a physical visit to a distribution terminal was not possible to perform, nor was a physical warehouse visit at the company Lyko. In order to still be able to collect additional empirical data, the decision to conduct more interviews was made. Since physical interviews were not possible due to social distancing, interviews were conducted via Skype and Facetime. The planned physical case study at Lyko was conducted as a virtual case study via Facetime.

## 3.4 Data Analysis

Once the empirical data was collected, an analysis was conducted. In the analysis, the presented theory and theoretical framework served as a support in order to identify important findings and to systematically analyze these further. The transcribed data from the interviews and surveys was selectively chosen, with basis from the purpose of the master thesis. The analytical framework served as the main theoretical framework when the data was analyzed, where the main focus was on how actors value and handle resources differently. As the data was analyzed, it was apparent which interfaces and features that are valued and important for each actor, and how the findings differ between interviewees representing different perspectives. Finally, the empirical data and analysis were discussed in the light of the theory. The discussion is followed by a conclusion, based on the research questions.

### 3.5 Research Quality

Data analyzes can be more or less robust, depending on factors such as different motivations for interviewees to respond to interviews (Easterby-Smith et al., 2015). Interviewees may respond in a way where the aim is to impress or enlist the interviewer. If different data sources, methods and collections of data are used, the robustness is likely to be higher (Easterby-Smith et al., 2015). Also, the transcription of the conducted interviews can result in a misleading conclusion if it is missing out of relevant information. However, the data collection was conducted with the basis of a thorough literature review, which is the foundation of a good study with high robustness (Easterby-Smith et al., 2015). Easterby-Smith et al. (2015) mean that the quality of a study can be enhanced by having others reviewing and interpreting the work-in-progress of a study. This has been done in collaboration with both an industrial and academic supervisor, where the latter is a Professor of Supply Chain Management at Chalmers University of Technology. The supervisors have enabled an higher research quality.

There is a risk that the quality of the empirical data might have been affected by the virus outbreak. For example, the interviews conducted after the outbreak might have been of less interest for the interviewees as they could have had more urgent matters to prioritize. For example, there was an historically high number of Swedish citizens losing their jobs during the Covid-19 outbreak (Dagens Industri, 2020). The most impacted industries were retail, transportation and restaurants (ibid.). As a result, the collected responses might differ from what they might have been before the outbreak.

The quality of the collected data could also be impacted by interviewees giving socially desirable responses to align with contextual demands (Wetzel et al., 2016). For example, one might give responses that makes it sound like the environment is important, while the interviewee actually don't consider the environment to be important. The biased response could originate from the fact that the environment might be of high importance for the society.

## 4. Empirical data

This chapter presents all empirical data that has been collected. Firstly, in the section named the consumer perspective, the received data from the survey will be presented. The following sections include findings from face-to-face and phone interviews with various actors within e-commerce, as well as a virtual case study. There is a distinction between what industry the empirical data originates from in these sections.

### 4.1 The Consumer Perspective

Consumers play an important role in the e-commerce supply chain and have a lot of power to put demands on how the e-commerce supply chain should be designed and operated. Therefore, it is highly important to get an understanding of the consumers' experiences of parcels when

shopping online. In the following section, the results from a survey will be presented, see appendix B for survey specifications.

### Question 1

The first question is regarding the importance of the aesthetic of the parcel. The respondents were asked how important it is that their product is nicely packaged and appealing when opened. 49% of the respondents chose the second option, *slightly important*, which can be interpreted as that it is somehow important but not crucial for their experience, since other aspects are of higher importance. 26% respondents chose the options *not important* and 25% chose the options *important*. See figure 9 for a response summary of question 1.

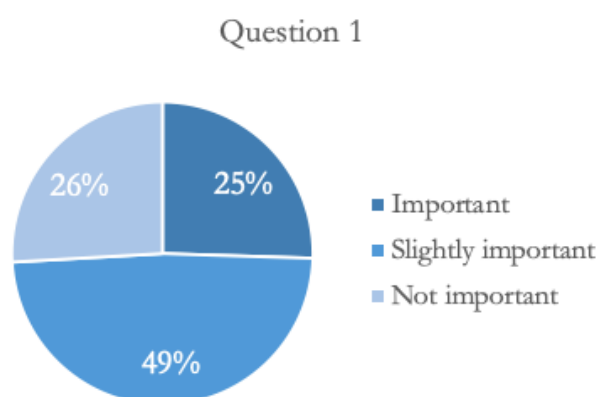


Figure 9. Response summary of question 1.

### Question 2

The second question is about the importance of that the size of the package is reasonable in relation to the ordered product/products. 81% of the respondents considered this as *important*, while 4% chose the option *not important*. 15% considered it as *slightly important*. It can be concluded that this question is the one where the respondents are most unanimous. See figure 10 for a response summary of question 2.

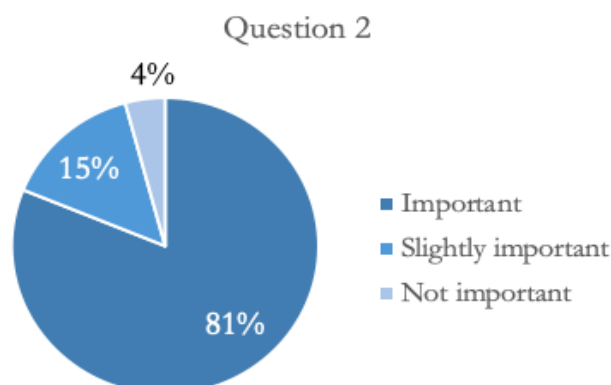


Figure 10. Response summary of question 2.

### Question 3

The third question is regarding how often the respondents consider the parcel to be in reasonable size in relation to the ordered product/products. 63% of the respondents chose the option *sometimes, approximately 50% of the times*. 28%, chose the option *rarely, approximately 20% of the times*. 8% of the respondents expressed that the parcels *always* are in reasonable relation to the ordered product/products. Lastly, 1% chose the option *never*. See figure 11 for a response summary of question 3.

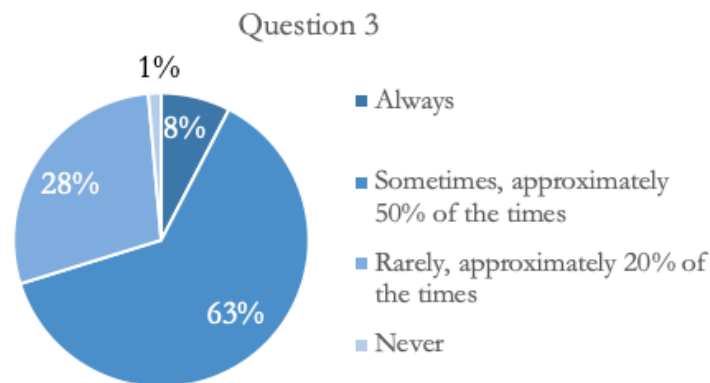


Figure 11. Response summary of question 3.

### Question 4

In the fourth question the respondents were asked if they could consider waiting a few days extra to get multiple orders that were placed during a short time from the same company in the same parcel. 78% responded that they were willing to wait, were 44% would wait with the purpose that it is *better for the environment* and 34% would wait due to *practical reasons* e.g. saving time by picking up fewer parcels. 17%, expressed that they would *not be willing to wait* some extra days to pick up one parcel instead of several. For the remaining 5%, it *doesn't matter*, which must be interpreted as that they are willing to wait. See figure 12 for a response summary of question 4.

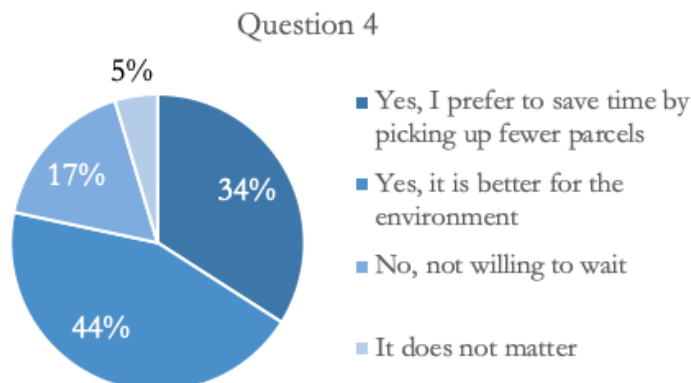


Figure 12. Response summary of question 4.

## Question 5

The last question in the survey is related to the choice of delivery point. The respondents were asked about preferred delivery options. The answers were quite evenly distributed among the four options. 38% of the respondents answered that they preferred the parcel to be delivered directly to the *mailbox/doorstep*. 34% wanted to get their parcel delivered to a *service point*. 15% preferred to use a *parcel locker* as the delivery point (e.g. Instabox). The remaining 13% chose the option *collect at store*. See figure 13 for a response summary of question 5.

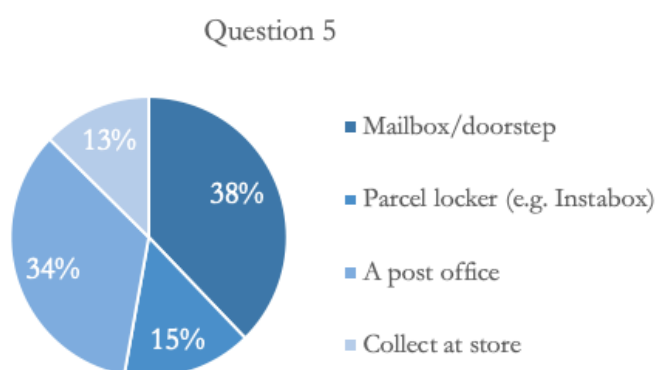


Figure 13. Response summary of question 5.

## 4.2 The Retailer Perspective

In the following section, the empirical data originating from a virtual case study and interviews with various e-retailers is presented. E-retailers are companies that sell goods through the Internet. Some of the e-retailers are at the same time retailers, who sell goods in physical stores as well. The interviewed companies belong to industries such as fashion, consumer electronics and beauty/cosmetics.

### Lager 157

Lager 157 is a fashion retail company that offers clothing at low prices. They have several stores all over Sweden as well as e-commerce. *“The only way to improve the design of the parcels in order to contain less air, is to potentially bring in vacuum packaging”*, the E-commerce Manager says when being asked how their parcels could be improved. The parcels being used today are plastic bags, which are suitable for soft products like clothing. Lager 157 however has some product categories, like scented candles, which are challenging to send in plastic bags. These products require another type of wrapping, in this case bubble wrapping, in order to be delivered intact.

It is said that *“No customer would appreciate having creased apparel delivered which would result in having to iron the clothing right away.”* However, the vacuum packaging could be feasible if being done in the right way; on the right product categories such as clothing instead of on candles. When being asked about the product development of the packaging, Lager 157

operates it at the e-commerce department together with the CSR team of the company, in order to take environmental demands into consideration. Lager 157 also has a close cooperation with packaging suppliers, where it can be rather challenging to empty the plastic bags on air. However, plastic bags are used as Lager 157 considers cardboard parcels to be too bulky and too challenging to optimize from an excess air point of view. Alternating both bags and cardboard parcels would not be efficient from a time perspective. It is more important to pack and send away orders quickly, than having different choices of packaging solutions available in the production units. It would take more time as the cardboard parcels would require more manual work, than bags do, as no automatic packaging machines are in place today. The packaging is handled manually by having one trolley being packed with 12 orders at a time, which later are packed into the final bags that are sent away with carriers to the customers. Once this is done, another empty trolley is packed and the process is repeated.

### **Tiger of Sweden**

Tiger of Sweden is a fashion retail company that is famous for their classical high quality clothes. The company was founded in 1903, selling classical men's wear. In the end of the century they extended their assortment to include women's wear as well as accessories and shoes. Besides having e-commerce, they have physical stores in Stockholm, Gothenburg and Malmö.

The E-commerce Manager starts with sharing his thoughts about the difficulties with optimizing the parcel size in relation to the products. *“Our main challenge is that we are selling clothes in different categories, where some clothes are quite big and some are too sensitive of being packed tightly”*, he says. This would require a wide range of parcel sizes. Recently, they went from 14 to nine different sizes of parcels, but they still believe nine are quite many from an economical point of view. He argues that vacuum packaging could be possible for some product types, for example jeans and some knitted sweaters. For other products, such as suits and silk blouses it would not be suitable. Regarding the consumers' experiences, when receiving clothes that are vacuum packaged, he believes that if you explain why they are packaged in that way, the consumer would accept it. One again he emphasizes that this only would be applicable for a few product groups.

When discussing the design of the parcels, the company representative explains that from a design perspective, it is important for Tiger of Sweden that their parcels go in line with the rest of their branding material. He stresses, on the other hand, that the sustainability question is really important for them as well. Therefore they do not use any plastic in their parcels. They have also started to send some products in climate neutral bags. The only time they use wrapping in their parcels is when sending sensitive products that need to be fixed, such as suits. All the wrapping they use are in paperboard. 80% of the parcels sent are cardboards in portfolio format that are really easy to open and close again, which has resulted in that 95% of all returns arrive in the same parcels that were sent out.

## **NetOnNet**

NetOnNet is a company that sells home electronics to lower prices than in regular stores. They started out with e-commerce as the only sales channel, but since 2001 the e-commerce was completed with warehouse stores. Their business concept relies on self service, which enables them to keep their prices low. For example, they have no sale associates in their warehouse stores.

The E-commerce Manager from NetOnNet shares the same thoughts as Tiger of Sweden about the difficulties with optimizing the parcel size in relation to the product. A huge variety in size and shape between products requires a wide range of parcels, which according to the company representative would be very expensive but also time consuming for the warehouse workers, since it would require a decision of which parcel to use for each product and order. Therefore, they save a lot of time by using fewer parcels. He believes that automation of the packaging process could help reducing a lot of time while still being able to use a variety of parcels. Currently, they use both manual packaging as well as automatic packaging. The packaging machines take the specific product into consideration when packing. The machines cut the parcel to fit the product perfectly, which results in a parcel with close to no excess air. Unfortunately, the packing machines can't handle all sizes, which restricts the packing machine to only handle a maximum dimension of 50x50 cm. He really believes that everyone would benefit from decreasing the size of the parcels. From an economical point of view, it would be cheaper for them to send smaller parcels and the carriers could fit more parcels in every vehicle and terminal. He further stresses that the benefits are obvious from a sustainability perspective, which indicates a win-win situation. Regarding consolidation, he believes that it would be fully pardonable for consumers to wait one extra day, if explaining the reasons for it. If the consumers could wait one more day it could be possible to deliver 20 parcels day two, instead of 10 parcels day one and 10 parcels day two.

## **Nordicfeel & Eleven**

Nordicfeel & Eleven is one of the biggest e-commerce beauty retailer in the Nordic countries. The company offers perfumes and beauty products to both men and women. Nordicfeel and Eleven were, before Eleven acquired Nordicfeel in 2018, two individual companies.

The CEO of Nordicfeel & Eleven was interviewed regarding the role of packaging and future challenges. *“The main challenge with optimizing packaging is that several alternatives of packaging is crucial to fit each product and order. However, the more choices of parcels being needed, the harder it gets to achieve volume discounts on parcels.”* He means that they work hard to analyze both product and volume data in order to find the most suitable and optimal parcel solutions, in order to decrease the excess air in parcels. The most important factor that drives the development are the financial aspects. *“The better we become in optimizing parcels and decreasing excess air, the less shipping costs are required from carriers such as PostNord”*, he says.

Further, Nordicfeel & Eleven receives customer feedback that indicates that it is important for the younger generation to support sustainable retailers. Therefore, it is crucial for Nordicfeel & Eleven and all other retailers to take that into consideration in order to maintain good customer relationships. *“Customers seem to appreciate our packages today, as the customer support receives much positive feedback.”*

He says that it would most likely not be possible to send products in their packages solely as the packages are developed based on their appearance on shelves in physical stores. In other words, the design and construction of the packages are not adapted to be shipped in the e-commerce, and therefore need additional packaging.

Nordicfeel & Eleven mainly has physical stores as some brands demand physical store appearance in order for them to be resellers of the brands. The physical stores do not generate a high annual profit, the profit mainly derives from the e-commerce. Nordicfeel & Eleven will introduce parcel lockers to their physical stores, which will lead to more people visiting the stores.

Nordicfeel & Eleven has a close collaboration with packaging suppliers. A few years back, they had parcels being produced in China which resulted in long delivery times. As a result, they changed supplier to one that is located closer to Sweden which enable smaller quantities being delivered more often. *“As the packaging supplier is located closer to us, the product development to achieve more efficient packaging has been eased. The only downside to the change of suppliers is that the new one is more expensive compared to the former one in China”*, he says.

The time aspect of packaging orders is extremely important. It can take as little time as 12 seconds to pack a parcel today. If the time would increase, then the number of parcels leaving for shipment would consequently decrease. He claims that if one wants to develop the packaging, the most suitable people to influence the development would be the ones doing the packaging. *“The ones doing the job, is always the ones having the best ideas”*, he says. When being asked if automatic packaging would be an option, he means that it would be a huge investment that only would be of use during high volume peaks such as Black Friday and Christmas. *“It is more suitable to have more manpower during high volume peaks, instead of doing heavy investments. Also, automatic packaging limits the alternatives of packaging as packaging machines cannot handle all kinds of existing parcels.”*

He says that they are positive towards collaborating with other retailers when doing bulk purchases of parcels in order to achieve volume discounts. The only challenge would be that retailers often want to characterize their parcels with certain colors and logos. Sometimes this is done prior to that the parcels are being delivered to Nordicfeel & Eleven, and sometimes the coloring etc. is being done post to delivery. He however believes that the characterization will

become less important in the future, as the customers more likely will accept and prefer sustainable parcels. *“We will no longer offer free deliveries for order values less than 199 SEK at Nordicfeel & Eleven in order to be more sustainable”,* the CEO says. *“No customer will criticize this decision as long as it is promoted as a sustainability action.”*

He says that *“It is luxurious and easy to be a beauty e-commerce retailer since the return of beauty products are less than 1%, meaning that there’s nearly no need for return handling.”* Therefore, Nordicfeel & Eleven do not need to send out return forms in all parcels, and can maintain short packaging times. They are also more sustainable as less papers are distributed compared to companies having high rates of returns.

## **Lyko**

Lyko is a market leading hair care and makeup retailer originating from professional hair care, that offers the widest product range on the Nordic market. They have an omni-channel strategy, with both physical stores and e-commerce, even though their main focus is on e-commerce. The Communication & Sustainability Manager at Lyko was interviewed regarding the role of packaging where he shared his thoughts regarding challenges and benefits on this issue. A team-leader at Lyko’s warehouse was also interviewed and illustrated the packaging activities at the warehouse with the use of Facetime.

When discussing the role of packaging from the consumers’ perspective, the Communication & Sustainability Manager argues that the parcel is the least interesting part of e-commerce. For the consumers, the parcel involves extra effort as you need to bring the parcel to a recycling facility. When consumers place an order online, the design of the parcel is nothing they reflect upon. *“I believe that the unboxing experience is irrelevant, the effort with bringing the parcel to a recycling facility still remains”,* he says. The life span of a parcel is limited to around 48 hours, from the point of packaging to the point of delivery, therefore there is no need to make a huge investment in the aesthetic. *“The consumers want the products they ordered, undamaged and on time, but the aesthetic of the parcel is less important”,* he stresses. Further, he says that he hopes that the parcels will disappear in the future and the products can be sent more often in the packages.

As an example, he mentions the plastic bags that passengers receive with pre-ordered products in when entering aircrafts on charter trips. It is possible to deliver the products in plastic bags only due to the gentle handling throughout the entire supply chain, from point of packaging to point of delivery. He argues that the supply chain in e-commerce needs to be better at gentle handling of parcels. Today, the carriers have different ways of handling the parcels. In order to be able to send the products directly in the packages, the carriers have to adapt their flow.

When asking about their packaging process he explains that it works in the way that the warehouse workers decide what parcel size each order should be placed in. Thereafter, they place a creased paper in the bottom of the parcel, followed by the products, and finally another

creased paper on the top, before sealing the parcel. These instructions come from one of their carriers and the process requires a couple of minutes. When producing thousands of orders every day, these minutes become expensive in man hours, therefore it is crucial to shorten the packaging process as much as possible. At the same time, there is a producer responsibility, which implies paying 2 SEK/kg cardboard. Minimizing the use of cardboard therefore already has an incentive. *“I believe that many retailers think that using huge parcels fasten the packaging process and decrease the man hours, but that might be wrong”*, he says.

He stresses that it is important to get a smooth flow throughout the entire e-commerce supply chain. To achieve this, a close and collaborative dialogue with carriers is crucial. *“I visited one of our carriers sorting facility last year and I was really surprised of how far the parcels are dropped down into a load carrier, this force us to design the parcels durable enough”*, he says. He clarifies that he doesn't blame the carriers for this. The sorting and handling system is old and was not designed for parcels but for letters. Therefore, carriers and retailers need to be proactive and collaborative to find solutions that are suitable for the current situation. *“I believe that it is important to make the sorting and handling process more gentle, but still keep the high precision and speed”*, he further argues. The cost driver is every time a human touches the parcel in the supply chain. The more steps in the supply chain that are automated, the cheaper it will be in the long run. He says that he believes that the e-commerce will continue to grow, and therefore the actor that find the best solution for this will be the winner.

When asking about how the shipping labels affect their processes, he says that the shipping labels indicate from where the parcel originates and to whom it should be delivered. After the packaging process, they sort the parcels in load carriers, depending on which distributor the parcel should be sent to. *“Actors that are even bigger than us, need to have a pre-sorting process for the parcels according to postal code, in order to send the parcels to different terminals. This is crucial to avoid sorting several times”*, he emphasizes. He stresses that a system that enables their system to communicate with their carriers' systems would ease the process a lot. In that case, it would be possible to avoid and minimize the sorting at Lyko's warehouse.

*“We really want to send more orders in padded envelopes, directly to the mailbox, but there is a risk that the package, for example the package of an eye pencil, would arrive creased after it has passed through the sorting facility”*, he explains. Further, he mentions that they have received several complaints about this issue from consumers. The biggest risk, however, with sending products in padded envelopes, is for example if a shampoo or acetone bottle would break in a terminal or vehicle, which could affect the resources in the terminal or other parcels. Once again, he emphasizes the need for making the process more gentle for parcels. Being asked about his thoughts of the design of the packages, he believes that since the e-commerce generally tend to generate more money than physical stores at the moment, the producers will need to start rethinking the design of the packages. They need to adapt their packages to fit better with the e-commerce supply chain. Before, it was the physical stores first, and therefore

a package design adapted for the store shelves. *“We might start to see e-commerce editions for some packages in the near future”*, he says.

Further, he talks about the consumer behavior. *“The consumers normally do their shopping online on Sundays, followed by a lower activity during the week, which increases again when the weekend is approaching”*, he explains. He argues that this behavior is nothing they control, besides doing some promotions to even out the curve. He emphasizes the importance of even out the curve, to get a smoother flow during the entire week. A smoother flow is also important from an employment point of view, since the employment demand would be more even and not concentrated to a few days every week. Also, the route optimization would benefit from a smoother flow. He mentions the home deliveries within the food industry as a successful way of dealing with customer orders and creating a smooth flow during the entire week. *“The option of choosing sustainable delivery and get it delivered a specific day, depending on your address, could be successful also for the retail e-commerce”*, he argues.

He emphasizes that in order to be able to collaborate throughout the entire supply chain, every actor needs to be transparent and clear about what they contribute with. If not, it is sub optimization, which is meaningless. *“We have to apply a just-in-time strategy, lean is applicable not only in the automotive supply chain, but also in the e-commerce supply chain”*, he summarizes. He mentions that networking sessions where actors share thoughts and actions towards having more lean processes would benefit the e-commerce supply chain.

A team-leader at Lyko’s warehouse provided a virtual case study with the use of Facetime, where the packaging process was illustrated. The packaging process starts when the products arrive in a box, via the conveyor belt. The warehouse worker then needs to choose the parcel size that are best fitted for the products, based on an own judgement. There are eight different parcel sizes to choose from, see figure 14. After choosing a suitable parcel size, based on the size of the products inside, the warehouse worker wraps the products to protect them from breaking. Creased paper is mainly used for wrapping, bubble wrapping is only used for bigger and sensitive products like scented candles. After wrapping, the wrapped products are placed in the parcel. The products are covered by a creased paper both in the bottom but also at the top. As the Communication & Sustainability Manager explained, this is a packaging instruction from their carriers, with the purpose to get the products into a fixed position inside the parcel. Further, the parcel needs to include a leaflet with information regarding the order. The destination of each parcel is shown on a display, which helps the warehouse worker to choose leaflets in the language of the destination. The shipping label is also printed out by the use of this system and finally attached to the parcel. The shipping label is limited to one size, and for the smaller parcel sizes it therefore has to be folded in order to fit.



*Figure 14. The eight different parcel sizes that the warehouse workers choose between.*

After the packaging process, the parcel is being placed on the conveyor belt and transported to the load carrier area, which takes approximately one or two minutes. The parcel arrives with the conveyor belt that corresponds to the carrier that the parcel will be sent to. The load carrier area consists of different load carriers, one for each carrier. The load carriers are loaded with parcels in different sizes, with the goal to be as optimized as possible, see figure 15. Now, the parcels are ready to be picked up by the carriers. The team-leader explains that they pay a fixed price for sending away one load carrier, loaded with parcels. The fixed price is different for every carrier. Since they pay for each load carrier they send away, it is an incentive for them to optimize the loading of the load carriers. The team-leader further argues that having only one parcel size would make it harder to optimize the loading of parcels. She would rather prefer having more parcel sizes to choose from than today, even though she is aware of that it then might be a problem with having enough space for all parcels on the shelf at the packing station. The team-leader mentions that they got a new parcel size last year, which is the perfect size for shampoo bottles, which is a product type they sell a lot of. That parcel is wide enough to fit shampoo bottles but not too broad in order to fit mailboxes. The team-leader further explains that one of the eight parcels is possible to crop manually, which enables a better optimized parcel in relation to the products.



*Figure 15. Load carriers loaded with parcels in different sizes at Lyko's warehouse.*

### 4.3 The Carrier Perspective

In the following section, data from interviews with three carriers, and a virtual case study with one of them are presented. Carriers transport goods by sea, air or road from one place to another with the help of shippers. They make goods available for customers, for example by providing sorting facilities.

#### **PostNord**

PostNord is the leading actor of carrier and distribution services in the Nordic region and responsible for the universal postal service in Sweden. PostNord is partly owned by the Swedish government (60%), and partly owned by the Danish government (40%). They deliver parcels and letters for companies as well as for private consumers. PostNord has around 30 000 employees, which makes them to one of the largest employers in the Nordic region. Four employees with different roles within PostNord were interviewed; an E-commerce & Logistics Manager; a Strategy Manager; a Terminal Director and a Maintenance Technician.

The E-commerce & Logistics Manager argues that there are no challenges in their terminals for minimizing the excess air in parcels. The actors having challenges are mainly retailers and packaging developers. He stresses that another issue with having too big parcels in relation to the products, except from that they take up unnecessary space at the terminals and in vehicles, is that the products bounce around inside the parcels and therefore tend to break. The Terminal Director further stresses that the excess air in parcels, and between parcels in transportation vehicles, mainly cause problems related to the fact that more vehicles might be needed for transportation. When being asked about the feedback they receive from their customers, the E-commerce & Logistics Manager explains that the customers are satisfied with their handling and sorting process, and how it is set up.

The Maintenance Technician says that the bigger parcels are handled manually in the terminals and therefore require more human touch points. Big parcels are those having dimensions that exceed 110x70x70 cm and that weigh more than 35 kg. The Terminal Manager says that the bigger parcels are handled manually because they don't fit the machinery in the terminals. Further, customers need to pay extra fees if their parcels require manual handling.

Parcels that are too small, and that the machinery can't handle, also require more human touch points. PostNord means that parcels are considered as too small if their dimensions are below 100x100x10 mm. The Terminal Manager mentions that too small parcels hinder good fill rates in transportation vehicles since they can't be stacked directly on each other in the vehicles. Smaller parcels need to be put into load carriers, which further is put into the transportation vehicles. This loading contributes to excess air between the load carriers in the transportation vehicles. When discussing the shape of the parcels, PostNord argues that standardized parcels, with eight corners, are the most suitable ones for their sorting and handling processes. These parcels provide greater opportunities for automation than other shapes of parcels.

Further, he explains the importance of optimizing how the parcels are being stacked in load carriers and transportation vehicles. Even if the parcels are optimized in relation to the size of the products, it would still be unnecessary excess air in vehicles and load carriers, if not stacked in the best possible way. This contributes to the need of more transportation vehicles, which increases the transportation costs. The Maintenance Technician also stresses that the parcels tend to break if they contain too much excess air once they are being stacked in the load carriers. It is easier to stack parcels into load carriers if they are similar, instead of mixed sizes and materials. *"It is preferable to only stack parcels in cardboard paper than of plastic bags as well."* The Strategy Manager says that it becomes easier for the drivers to handle the parcels if they are of smaller sizes. Further, the pick-up points have limited space for storing parcels. Another actor that often has limited space for transporting big parcels is the consumer. The use of bicycles and electric scooters as modes of transportation in the bigger cities makes it hard to carry home big parcels. Further, the Strategy Manager explains that the actors that provide service points receive a *click fee* for each parcel they store. When the storage time is expired, the parcels are returned to the sender.

When asking the the Maintenance Technician about the drop from the machines to the load carriers, he explains that they have tried different ways of making the drop more gentle. However, he states that it is quite hard to achieve that in the current machines, even if it is not impossible. He further explains that the first parcels are the ones being exposed to the highest drop. Figure 16 illustrates the section in the warehouse where the parcels drop 2 meters from machines into load carriers. This process was developed to minimize the manual handling, like stacking of parcels into load carriers. Minimizing the manual handling of stacking resulted in a more efficient process from a time perspective and at the same time an improvement of the work environment. A drawback with this process being automated is that parcels tend to end

up on the side in the load carriers, resulting in air between parcels. A manual handling process would therefore enable less air between parcels in the load carriers.



*Figure 16. The load carriers that parcels are dropped into at PostNord's sorting facility.*

When being asked about the possibility to deliver products directly in the package, without surrounding parcels, the Logistics & E-commerce Manager seems to be positive. He mentions NetOnNet as one successful actor, that sees the financial advantage of not sending the packages in surrounding parcels, if possible. However, he stresses that sending very small packages without surrounding parcels might be unsuitable since they are not suited for the equipment in the sorting terminals. For example, the curves and the speed of the conveyor belt, which is approximately 2,0 m/s, make it hard to handle too small packages, or packages with a very low weight. In those cases, the parcels or letters tend to be thrown off the conveyor belt. He emphasizes the importance of knowing when it is more favorably to send products directly in the packages and when it is not. *“For example, sending an order with one coffee machine directly in the package would be favorably. On the other hand, if the order consists of three coffee machines it might be more efficient to send all of them in one parcel”*, he says. The Terminal Manager also agrees with the fact that it is possible to deliver products directly in their packages, even though it is not common today. However, it might result in that the packages don't arrive intact. He mentions the customer experience as an important factor that could be negatively affected if the unboxing experience is neglected.

When discussing the shipping labels, the Strategy Manager explains that they are scanned in the same speed as the conveyor belt is having, where smaller shipping labels should not create problems that would hinder smooth scanning. The shipping labels are also viewed with the help of cameras, as a supplement to the scanners. The cameras are able to scan the parcels from all angles, which enables a flexibility for where to place the shipping label on the parcel. The Maintenance Technician also shares his view about the shipping labels. He argues, similarly to the Strategy Manager, that the smaller shipping labels would not be a hinder for smooth scanner, since the machines could scan all sizes of bar codes. The only factor that could be a hinder, if making the shipping labels too small, would be that the terminal workers might struggle with reading the text. This text could for example regard information about the destination. When being asked about the possibility to use QR codes instead of shipping labels, he seems to be positive. *“I’m almost 100% sure that the machines could handle QR codes, they are modern enough”*, he says. The Terminal Manager also seems positive towards using QR codes. He explains that they, for example, have production mobile phones with camera function. However, he emphasizes the importance of having reliable operating systems if removing the destination and sender information from shipping labels. Meaning that, if they can’t match the QR code with the sender, it is hard to know where to send it. *“The benefit with having destination and sender information on the shipping label is that if the bar codes somehow are difficult to read off, we know where to send the parcel”*, he explains.

## **Best Transport**

Best Transport provides services in logistics and IT. They offer last-mile transportation in form of home-deliveries, express-deliveries and same-day-deliveries. The deliveries are carried out with the help of around 500 distribution vehicles, bicycles, cars and trucks, in Sweden, Denmark and Norway.

The Home Delivery Manager at Best Transport was interviewed regarding the effects that the sizes of parcels have on their offered services. He says that the size of the bicycle box, which is 1 cubic meter, is restricting the amount of parcels that can be delivered every day. If the parcels could be optimized in terms of minimizing the volume of air, the fill rate could be increased. Further, he mentions that some of their customers have started to focus more on sustainability, for example how much wrapping they really need for a specific product and if they could increase the amount of air in the parcel. He points out, that currently, the customers are just buying the transportation service and are not involved in the decision of if their parcels are delivered by bicycle or truck. He stresses that this is a matter that they really need to start collaborating on, to see what parcels that could be delivered on bicycles and so on.

Finally, when being asked to provide some reflections about delivering the product directly in the package, instead of delivering the package in a parcel, he argues that this would depend upon the type of product. Theft-prone products, for example alcohol, tobacco or mobile phones would benefit of being disguised. *“Products that are not as theft-prone could be delivered directly in the package to the greatest extent possible, as long as it provides the necessary*

*protection for the product*”, he says. He mentions that one difficulty with delivering directly in the package could be that the handling process might differ between carriers. The bigger actors often handle the parcels more automatically, using sorting facilities that put higher demand on the protection of the products, while others, often smaller actors, have a more manual system for handling of the parcels.

## **Bring**

One interview was with a former Bring Employee, experienced in logistics development. Bring is one of the fourth biggest logistics company in the Nordic region. They offer warehousing and transportation service for various businesses, such as e-commerce and the healthcare. In certain cases, they also offer installation of goods such as furniture and home electronics.

When being asked about his thoughts of consolidation, he argues that since the logistics sector nowadays is quite fragmented, it is harder to consolidate as much as one could before. Previously, a few large actors covered the majority of all zip codes but nowadays there are multiple actors in different parts of the supply chain, some covering the first mile transportation, some covering the middle mile transportation and others responsible for the last mile transportation. Especially in last mile transportation, many small actors want to gain market shares, which results in quite many vehicles transporting small volumes of goods. Further, another factor that results in consolidation difficulties are demands from customers, especially young customers, that expect fast deliveries, preferably the next day. *“Customers’ requirements need to be changed, since it is not sustainable to shop and deliver in the way we do today”*, he argues. Patience, understanding and long-term planning will be crucial.

The design of parcels, for example minimizing air in parcels, are not among the highest priorities for companies. Companies are used to be measured in effectiveness per time unit and it is quite easy to continue working in that way. He stresses that the industry need to rethink how to measure effectiveness and at the same time the consumers need to place greater demands on retailers than they have been doing. He emphasizes that one problem regarding optimizing every parcel in relation to the product is that it is difficult for some systems to handle huge fluctuation in volumes and that there are different activities in the supply chain that need to be handled separately.

When asking what he believes is the best solution for increasing the sustainability within deliveries and transportation today he mentions joint loading. A former project was brought up as an example. The project was a collaboration with the real estate concern Vasakronan, and it was implemented due to the problems with an huge amount of goods flowing into the cities but the return flows consisting of empty vehicles. In the project, Vasakronan brought parcels from Bring into the cities while they loaded the vehicles with recycled goods on the way back. By using that strategy, they managed to reduce the number of vehicles with approximately 80%. Finally, he emphasizes that an increasing level of collaboration between different actors is crucial, especially if the industry aims at being more sustainable, but also from an economical

point of view. *“If all actors just continue to drop the price of their services it will come to a point where no one earns money”*, he says.

#### 4.4 The Packaging Industry Perspective

In this section the interviewed company is operating in the packaging industry, which refers to the planning, creating and manufacturing of packages and parcels.

##### **DS Smith**

DS Smith provides packaging solutions to companies across the whole world. An Account Manager and a Sales Manager at DS Smith represented the company during the interview. They mean that it is not feasible to have customized packages to each unique product that a company may offer. Instead, more customized packages should be used to 20 % of the products which constitutes for 80 % of the sold volumes.

The use of packaging machines enables less manual work and solutions that contribute to less excess air in each parcel. Retailers must however be able to make big investments in order to use packaging machines, which mean that they must, before being financially stable, perform their packaging activities manually which results in higher volumes of air in the parcels. DS Smith offers a basic assortment of parcels, which are cheaper than customized parcels. Retailers that are not as financially strong benefit from buying parcels from the basic assortment. These parcels are, on the other hand, not ideal if aiming for optimal parcels sizes in relation to the products. DS Smith also offers automatic packaging solutions. The automatic packaging solution constitutes of a machine that registers how much space a product takes in a package. Thereafter, the machine cuts off the excess material, often cardboard paper, and finally attaches a lid to the newly cut parcel. In this way, not only the excess air is minimized, the product is also more fixed in the parcel and less prone of bouncing around.

*“The interest in packaging solutions that minimize the excess air differs among companies and industries. The interest seems to increase as one company’s customer orders increase.”* Consequently, the companies also want to invest in packaging machines as the customer orders and interest increases. It seems like most e-commerce companies influence each other with smart solutions for eliminating the excess air in parcels.

They further argue that the size of shipping labels does not usually limit the design and size of the parcels in which the shipping labels are attached to. The size of the shipping labels might be a problem once parcels become very small. This might require a standard being introduced of what measures shipping labels should have, as no standard is existing today. Today, it is more crucial to locate the shipping label on the most suitable side of a package in order to enable smooth scanning and to avoid attaching them over adhesive tape.

*“The greatest challenge is to create awareness among customers. Parcels should contain as low volume of air as possible and hence enable products to be more fixed in the parcels. More products should also be sent in padded envelopes, it is surprising why companies do not do this already.”* The mailboxes are provided with openings that enable envelopes as big as books being put in, which companies should take more advantage of. The larger variety of products that a company offers, the more sizes of parcels are required in order to decrease as much excess air as possible. If companies would start using envelopes as a parcel, then less cardboard parcels would be needed for the products.

*“Everyone should raise awareness of the importance of having smarter parcels, also from an environmental perspective. Awareness should also be raised regarding shipping methods, so that envelopes could be used to send products straight to customers’ mailboxes”,* says the company representatives. *“It is false morality to promote a parcel for having recycled fiber, while having the same parcel containing plenty of excess air.”* Actors should come together and find solutions like for example CO<sub>2</sub> tracking. CO<sub>2</sub> tracking could enable actors to see what impact their choice of parcel would have on the environment.

## 5. Analysis

This chapter presents an analysis of the empirical data. The analytical framework, presented in section 2.4, serves as a tool for the analysis where the parcel is seen as the focal resource. The first 4 sections present the perspectives of different actors in the business network; consumers; retailers; carriers; packaging industry. These sections include analyzes regarding a parcel’s interfaces and the challenges related to these. In the last section, the parcel as a focal resource is put into a larger context, including the entire business network. In this section, the parcel’s interfaces and features, as well as the interdependencies in the business network will be presented and analyzed.

### 5.1 The Consumer Perspective

In the following section, the identified interfaces of a parcel, from the consumers’ perspective, are presented and analyzed, see figure 17. Further, an analysis of the identified challenges for consumers, associated with parcels and packaging, is also provided.

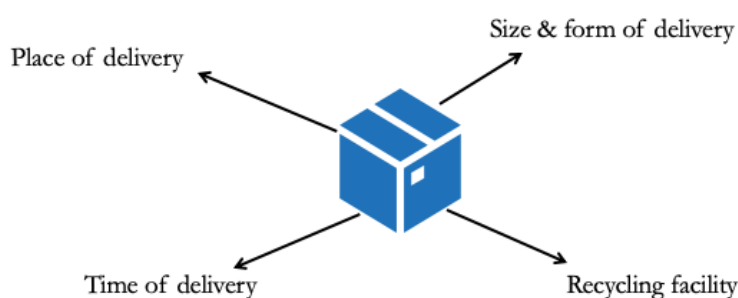
#### 5.1.1 Interfaces

Consumers have several **places of delivery** to choose from when ordering products online. The empirical data indicates that most consumers prefer to get parcels delivered straight to their mailbox or doorstep. Some consumers, not far from being the majority, prefer to pick up parcels at service points. This indication is not surprising since the service point is the most occurring place of delivery today. Parcels can also be delivered to pick-up points, such as parcel lockers and physical stores.

Another interface that a parcel meets when being delivered to consumers is the **size & form of delivery**. Vakuleno et al. (2019) mean that consumers often perceive it as negative when they receive parcels much bigger than the product inside. The survey indicates that a majority of the consumers believe it is important to receive packages in reasonable size in relation to the ordered product. They majority also mean that they receive too big parcels about 50 % of the times they make orders online. McPherson (2015) explains that the customer experience is affected by the packaging and presentation of the product. However, the empirical findings indicate that consumers do not think it is too important to receive parcels that provide a good unboxing experience. This goes in line with the Communication & Sustainability Manager at Lyko who says that the unboxing experience is not important compared to the effort of bringing parcels to recycling facilities.

Consumers have the possibility to choose between different delivery options, with different **times of delivery**. The survey indicates that consumers are willing to wait some extra time for several orders to be delivered at the same time, rather than receiving them one by one, and as fast as possible, at different times. McPherson (2015) however means that the speed of delivery impacts the customer experience. Lindh et al. (2016) explain that the importance of the features of a resource differ among actors; sometimes the size and design is important and sometimes the time could be of even greater importance.

When the consumers have unpacked their ordered products from the parcel, they need to bring the parcel to a **recycling facility**. Therefore, the recycling facility is also seen as an interface that the parcel meets, from the consumers' perspective.



*Figure 17. The interfaces of the parcel from the consumers' perspective.*

### 5.1.2 Challenges

According to McPherson (2015), features such as speed of delivery, presentation and packaging of the parcel, personalized and relevant documentation, as well as post-sale customer service impact the customer experience. From the empirical findings, it is clear that abstract features such as speed of delivery and choice of pick-up points are more important than physical features of the parcel, such as presentation and packaging. However, some challenges regarding the consumers' activities related to the parcel were identified, see table 2.

The effort of bringing parcels to recycling facilities is a necessary activity that the consumers think of as demanding and time consuming. The recycling process is especially frustrating when the parcel is big and not optimized in relation to the product. Also, it is frustrating for the consumers to carry home huge parcels from pick-up points, especially when they order a small product that should not be hard to carry home if the parcel was optimized in relation to the product. This frustration could increase when consumers start to do more of their shopping online, a change in the consumer behavior that is expected to take place. In densely populated cities, often bigger cities such as Stockholm, Gothenburg and Malmö, the modes of transportation are changing from cars to bicycles and electric scooters. This factor makes it even more difficult to carry home huge parcels.

Further, the empirical data indicates that packages that arrive creased, for example a mascara package, seem to upset some consumers despite the fact that the mascara itself is intact. In other words, even though consumers don't seem to value the unboxing experience highly, they have opinions about creased packages.

*Table 2. A summary of the identified challenges for consumers.*

Interface	Challenge
<b>Recycling Facility</b>	Bringing parcels to recycling facilities is boring and frustrating
<b>Size &amp; form of delivery</b>	Carrying home huge parcels is demanding, especially if not using a car as transportation mode
<b>Size &amp; form of delivery</b>	Upsetting when receiving creased packages

## 5.2 The Retailer Perspective

In the following section, the identified interfaces of a parcel, from the retailers' perspective, are presented and analyzed. Further, the section provides an analysis of the identified challenges for retailers, associated with the parcel and packaging.

### 5.2.1 Interfaces

The interviewed retailers argue that there are several interfaces that their parcels meet, see figure 18. The interfaces differ for some retailers, while they share similarities among others. The use of **wrapping** in parcels, to protect the package and product inside, is one of the interfaces that differs between the retailers. For fashion retailers, it is less important to protect

the products from breaking in parcels with wrapping as the products, often clothing, are less vulnerable. The only time fashion retailers use wrapping is when more vulnerable products are sent that needs to be fixed, for example candles and delicate suits. For beauty retailers, it is however more important to protect the products as the absence of sufficient wrapping may result in products breaking in vehicles and terminals.

Most of the parcels being sent by retailers meet the interface of **warehouse workers**. Some retailers use more parcel sizes than others, which depends on both product range and the financial ability. A warehouse worker at Lyko claims that it is easier to pack products into parcels when the parcel sizes are as adapted to the product range as possible. The greater the range of packaging sizes available, the easier it becomes to fill the parcels with products and hence decrease excess air. Pålsson et al. (2016) mean that fill rates can be maximized by reducing the volume of air in parcels, which is what the beauty retailer is doing by using parcel sizes that are as adapted to the product range as possible. NetOnNet however means that the more parcel sizes there are, the more time it takes for warehouse workers to choose the most suitable parcels for the orders. NetOnNet therefore aims at using as few parcel sizes as possible to save time by avoiding warehouse workers from decision making.

There are several ways of performing the packaging activity in warehouses. The empirical findings indicate that retailers are performing the packaging activity differently. Some retailers only perform packaging manually while others partly perform it automatically. Several retailers claim that **packaging machines** would decrease the packaging time in warehouses, while providing a large variety of parcel sizes. Boysen et al. (2019) similarly mean that automation increases the efficiency in warehouses. Retailers also argue that packaging machines can help reducing excess air in parcels as the packaging machines cut off parts of parcels that are not utilized.

Few retailers reason about the relevance of the interface **consumers' unboxing experience** of a parcel. Lyko means that it is not important with the unboxing experience compared to the effort of bringing parcels to recycling facilities. Tiger Of Sweden also means that the unboxing experience is irrelevant by claiming that consumers probably would not dislike the experience of receiving vacuum packed products, as long as the reason why is promoted. McPherson (2015) argues that the factors impacting the customer experience are not only packaging and presentation of the product, but also the speed of delivery, post-sale customer service and relevant information provided. McPherson (2015) is in other words saying that as long as a proper presentation of the product is provided, the packaging will consequently be approved.

Another interface of parcels is the **shipping labels**. Lyko claims that they try to minimize the size of the shipping labels in order to ease the activity of attaching the label. Since most retailers aim at adapting the parcel sizes to the product ranges, and to decrease as high volume of air as possible, parcel variants are becoming smaller. Therefore, Lyko means that the size of the shipping label eventually needs to be decreased in order to fit the parcels as their sizes decrease.

Pålsson et al. (2016) say that packages and parcels mainly should aim at providing protection to products. Lyko chooses parcel sizes based on the size and form of the products to avoid the **packages and products** to bounce around inside. If the package would bounce around in the parcels, then it is also easy for the products inside to break.

The parcels being sent from retailers meet the interface of **load carriers**. Once orders are packed into parcels, they are moved to load carriers before being sent out to carriers' sorting facilities. Lyko illustrates that the parcels are thoroughly placed into load carriers in order to exploit as much space as possible, and hence to decrease potential excess air between the parcels. Pålsson et al. (2016) mean that one should consider the impact that the allocation of parcels has on fill rates in transportation. The better the allocation, the higher the fill rates (ibid.). Lyko claims that the smaller the parcels become, the more parcels can be packed into load carriers. Consequently, the more parcels being sent, the cheaper it becomes. Pålsson et al. (2016) similarly mean that fill rates will increase by using packaging approaches such as minimizing volume of excess air in packages and parcels.

Another interface that retailers have in common regarding their parcels is **returns**. Tiger of Sweden claims that the design of their parcels contribute to smooth returns for the consumers, where 95 % of all returns arrive in the original parcel that was sent out initially. Ramanathan (2010) means that the customer experience is affected by the return experience. In this case, easy returns are enabled with use of the original parcels, which hence lead to positive customer experience. On the other hand, NordicFeel & Eleven presents that only 1% of sent out orders are being returned, meaning that there is barely no need for return handling and no existing return forms in the parcels once they arrive at the customer. In this way, NordicFeel & Eleven saves more time in the warehouse when orders are being packed, as no return forms needs to be added into the parcels.

Some retailers' parcels also meet the interface **stores**. The stores are seen as pick-up points for consumers and the consumers become responsible for the last mile of transportation (PostNord, 2017). NordicFeel & Eleven offers consumers to pick up parcels generated from e-commerce in parcel lockers located in their stores.

**Carriers** is another interface of parcels. Carriers are the ones receiving the parcels from suppliers and delivering them to customers (Yu et al., 2020). NetOnNet implies that the carriers would be able to pick up more parcels to fit in their vehicles and terminals if the parcels were smaller.

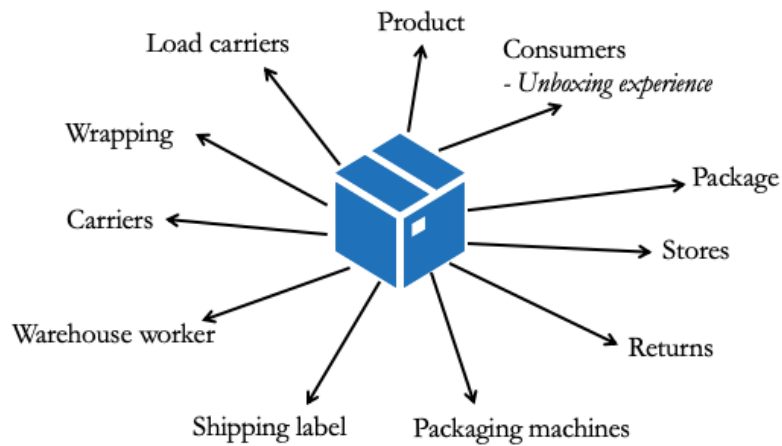


Figure 18. The interfaces of the parcel from the retailers' perspective.

### 5.2.2 Challenges

From the empirical data, it is clearly shown that some challenges are in common for almost every retailer in the business network, see table 3. One factor that appears repeatedly in the empirical data is the product range. Several retailers argue that having a wide product range, with numerous product groups that vary in size, is a huge issue when it comes to optimizing parcels.

Some retailers suggest that automated packaging, using packaging machines that adapt the parcel size in relation to the product, is one way to cope with the wide product range issue. The packaging machines could also decrease the packaging time in warehouses. On the other hand, automated packaging is a huge investment and therefore suitable mainly for financially strong retailers. NordicFeel & Eleven claim that it is expensive to invest in packaging machines, and that it might not always be a smart investment in the long run based on how order peaks are distributed over time. Lyko claims that packaging machines will be cost saving in the long run, as it is cost generating every time a human touches a parcel.

The packaging is a time demanding activity that could be costly if not performed efficiently. From the empirical findings it seems that how well the parcels are optimized in relation to the products could depend on how the company performs the packaging activity. Some retailers mean that the larger variety of parcel sizes, the more time it takes for warehouse workers to choose the most suitable parcels for the orders. These retailers are therefore aiming at using only a few parcel sizes to save time by avoiding warehouse workers from decision making. Lindh et al., (2016) argue that actors can interpret features of resources differently, some value the physical features highly while others value abstract features highly. For these retailers, the abstract features of the parcel, such as time, are most important. Other retailers argue that in the long run a company could save money if investing in more parcel sizes, resulting in better optimized parcels where a higher number of parcels could leave the warehouse every day. For these retailers, the physical features of the parcel, such as size, are the most important, since optimized parcels in relation to the products will result in better fill rate on the load carriers.

Some retailers argue that they experience that the existing supply chain for e-commerce is not ideal for parcel handling. They mean that the carriers do not handle the products carefully enough, which hinders retailers to use less wrapping and enable more products to be sent in padded envelopes directly to mail boxes. Therefore they need to adapt their parcels to provide the products with enough protection to manage the existing distribution infrastructure that has a physical impact on the parcels. If they do not follow the packaging instruction provided by their carriers, the products would not be covered by insurance if damaged.

Adapting products to fit existing resources goes in line with Jahre et al. (2006), and their discussion about unilateral adaptations, where they argue that in some situations, the product is designed or adapted to fit the existing infrastructure. Although the distribution infrastructure is the main obstacle for sending padded envelopes, one challenge is that some consumers tend to be upset if the package arrives creased. The problem with creased package seems to occur due to that the packages are not adapted for e-commerce but for shelves in physical stores. As Jahre et al. (2006) argue, these adaptations often occur due to a lack of interaction between actors. Mutual adaptations are often considered too resource demanding or that it is a problem with convincing other actors of the benefits with joint investments. Also Pålsson et al., (2006) support these findings, meaning that inefficient packaging solutions are often a result of a lack of collaboration between supply chain actors in packaging development. Nordicfeel & Eleven mentions that they changed to a new packaging supplier, closer in distance. This resulted in a closer collaboration, and enabled them to achieve more efficient parcels. The empirical findings also indicate that there is a positive attitude towards collaboration with other retailers when doing bulk purchases of parcels in order to achieve quantity discounts. These discounts could enable retailers to have larger varieties of parcel sizes which hence could result in more efficient packaging.

Another challenge for retailers is the uneven flow of consumer orders throughout the week. The e-commerce consumers tend to place orders mainly on weekends, with a distinct peak on Sundays. A way to deal with the uneven flow is to offer promotions during the weeks, to spread out the orders. However, it is hard to change the consumer behavior completely. The uneven order flow affects the supply chain in the way that a lot of parcels need to be sent at the same time. If the orders could be more evenly spread out during the week, or if the consumers would be willing to wait some extra days, the efficiency of the supply chain could be increased. This would result in a more even labour demand during the week in the warehouses and better utilized space in transportation vehicles.

Table 3. A summary of the identified challenges for retailers.

Interface	Challenge
Product	A wide product range makes it hard to optimize every parcel in relation to the product
Warehouse workers	Packaging is a time demanding
Package	Packages are not designed for e-commerce but for physical stores
Carriers	The carriers' sorting facilities are not ideal for all kinds of e-commerce parcels
Consumers	The customer orders are unevenly spread throughout the week

## 5.3 The Carrier Perspective

In the following section, the identified interfaces of a parcel, from the carriers' perspective, are presented and analyzed, see figure 19. Further, the section provides an analysis of the identified challenges for carriers, associated with the parcel.

### 5.3.1 Interfaces

The **transportation vehicles** decide how many parcels that can be loaded and finally delivered to the intended destinations. Best Transport means that the size of the bicycle boxes, which parcels are to be loaded into, limits the number of parcels that can be delivered in one day.

Carriers deliver parcels to **pick-up points**, which is predetermined by the retailers and the customers that place the orders. If the parcels aren't to be delivered to the doorstep or mailbox, the end-customers get responsible for the last mile of transportation once finally picking up their orders. PostNord further presents the fact that pick-up points have limited space for parcel storage, for example parcel lockers, stores and service points. PostNord also means that the **end-customers**, who are responsible for the last mile of transportation, have limited space in their vehicles to transport parcels of certain sizes.

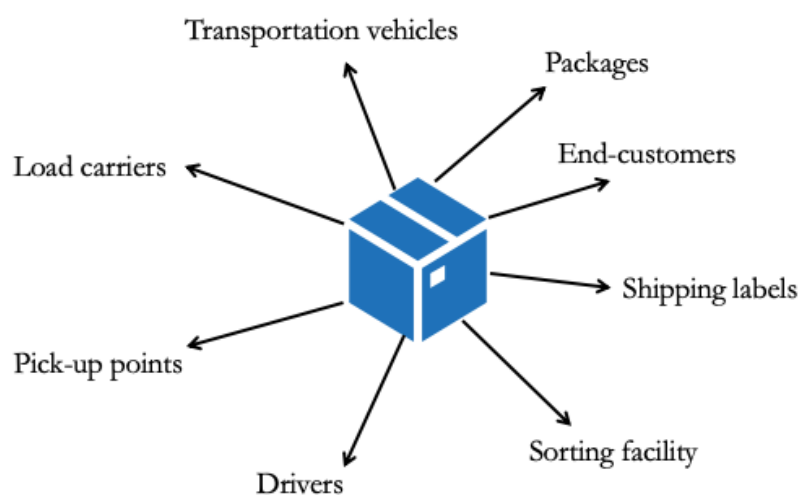
Some retailers, for example NetOnNet, send products directly in their **packages**, without a surrounding parcel. However, other retailers, for example beauty retailers, don't do this as the packages to their products are mainly adapted to store shelves and not the e-commerce.

Parcels are processed in carriers' **sorting facilities** where terminal workers make sure that parcels are passing conveyor belts and machines until it's time for parcels to leave the facility in transportation vehicles. PostNord further explains that the sorting activities become easier for terminal workers once the parcels are smaller.

When the **load carriers** have been loaded at Lyko's warehouse, they are picked up by the carriers and loaded into their transportation vehicles. Thereafter, they are transported to the carriers' terminals for further handling. How thoroughly the load carriers are loaded, in regards to minimizing excess air between parcels, affects the fill rate in carriers' transportation vehicles. Once parcels have been processed in carriers' terminals, they are put into load carriers depending on which destination they are to be sent to. PostNord argues that it is important to stack parcels thoroughly into load carriers in order to minimize air in between parcels. PostNord further explains that it therefore isn't crucial to solely decrease excess air in parcels in order to improve fill rates in transportation vehicles.

The **drivers** of the carriers handle parcels when delivering them to customers and pick-up points. PostNord means that the handling of the drivers becomes easier if the parcels are of smaller sizes.

In the carriers' sorting facilities, the **shipping labels** are scanned and viewed by cameras in predetermined paces. PostNord believes that smaller shipping labels most probably will not affect the ability of smooth scanning in their terminals.



*Figure 19. The interfaces of the parcel from the carriers' perspective.*

### 5.3.2 Challenges

The carriers, similarly to the retailers, seem to be quite optimistic about delivering products directly in the package, without a surrounding parcel. However, the carriers mention some challenges regarding delivering the package without a surrounding parcel. The same challenges might also occur for very small parcels. The challenges could be seen in table 4.

One issue, as Best Transport mentions, is that some products might be theft-prone and therefore needs to be disguised in some way. Another challenge with delivering the package without a surrounding parcel is that the handling and sorting process differ among carriers. Some carriers have a more manual handling and sorting process while bigger carriers have a more automatic handling and sorting process. Best Transport argues that a manual handling and sorting process tend to be more gentle than an automatic one. PostNord, who has a more automatic handling and sorting process, mentions that their equipment, such as conveyor belts, struggle more with the handling and sorting of too small packages, due to the speed and the curves of the conveyor belts. They have a minimum requirement of the size of the parcels, that can not exceed the dimensions of 100x100x10 mm. Therefore, sending packages without surrounding parcels might work better for carriers that have manual handling processes than for carriers that have automatic handling processes. As Jahre et al. (2006) argue, the value of a resource depends on how it is utilized and combined with other resources. This theory could be applied on the package as a single resource. For example, if the handling and sorting process is not adapted to manage packages sent without surrounding parcels, the value of a package would be inappreciable.

The drop from the machines into the load carriers is beneficial from a time and work environment perspective, but results in more excess air in load carriers and a potential risk for parcels being damaged. Therefore, even if the excess air would be decreased in parcels, there is still a challenge for carriers to maximize the fill rates in the load carriers. A variety of parcel types, such as plastic bags and cardboard paper, further complicates the optimization of load carriers.

Some potential challenges that were identified are related to the shipping labels. If making the shipping labels too small, the warehouse workers might struggle to read the text on the shipping labels, which they do manually. It could become troublesome if the shipping labels are minimized to the extent that certain information won't fit. For example, if information regarding the parcel's destination and the sender information is left out, it could be hard to know where the parcel is to be sent, if the barcode is manually unreadable.

Table 4. A summary of the identified challenges for carriers.

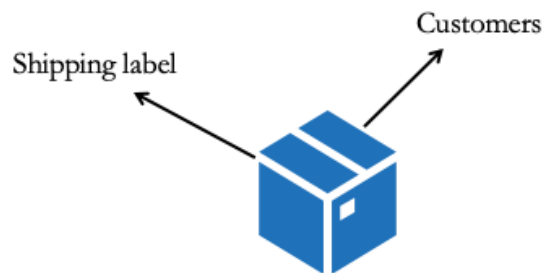
Interface	Challenge
Sorting facility	The speed and curves of the conveyor belt are not ideal for too small or light parcels
Sorting facility	The drop from the machines to load carriers results in excess air in load carriers and potential damages of parcels
Package	Some product are theft-prone
Carriers	The handling and sorting process varies among carriers
Shipping labels	Manual reading by warehouse workers might make it difficult to reduce shipping labels too much
Shipping labels	Removing the destination and sender information from the shipping label would result in difficulties to know where to send the product if the bar code is unreadable

## 5.4 The Packaging Industry Perspective

The packaging industry develops parcels for their customers, based on the customers' needs and demands. Therefore, the packaging industry seems to not have obvious challenges regarding excess air in parcels, even if they are affected by the challenges of retailers and carriers. In this section, the empirical data that was collected when interviewing the packaging company DS Smith is analyzed.

DS Smith offers packaging solutions based on customer requirements, where the **customers** refer to retailers and carriers. Customers are one of the interfaces from the packaging industries perspective, see figure 20. Customers can either have the need of a basic parcel assortment or automatic packaging solutions. DS Smith offers both a basic parcel assortment as well as automatic packaging solutions that enable a reduction of excess air in parcels once products have been put into them. From the empirical findings it is apparent that DS Smith stresses that retailers should choose packaging solutions like padded envelopes more often to reduce excess air. If retailers also choose to use padded envelopes, home deliveries of more orders to mailboxes will be easier to realize.

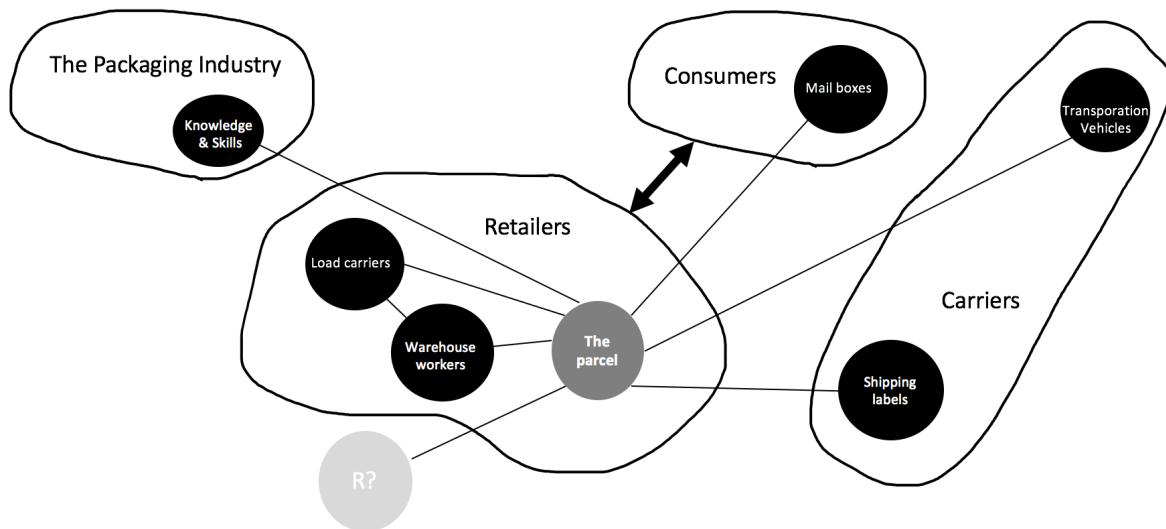
Another interface that a parcel meets in the packaging industry is the **shipping label**. As shipping labels are attached to the parcels being sent within e-commerce, it is important that parcels enable attachment of those. DS Smith means that it is not problematic to attach shipping labels on parcels today, as the sizes of shipping labels do not limit the design of parcels. However, they imply that it might be a challenge if parcels become smaller in the future. It could then be problematic to attach big shipping labels that could hinder smooth scanning downstream in the business network. The challenge is to make shipping labels and parcels fit together, which is in accordance with what Jahre et al. (2006) mean when saying that products that are related in some way have to be designed to fit together. As of today, there is no standard agreements regarding the size of shipping labels. According to DS Smith, it is also important to attach shipping labels on certain sides of parcels to enable smooth scanning. Further, it is important to avoid attaching shipping labels on adhesive tape.



*Figure 20. The interfaces of the parcel from the packaging industries perspective.*

## 5.5 The parcel as a focal resource in a business network

By selecting the parcel to be the focal resource in the business network, one can analyze how different actors have different perspectives of features of a parcel as well as different interfaces. However, these actors are interconnected and interdependent. The consumers, retailers, carriers and packaging industry are all actors in the business network, performing activities and giving access to each other's resources, see figure 21. As Tr (2017) argues, one company seldom has all resources needed in order to run a business, therefore they need to access the resources of other actors being part of the same network.



*Figure 21. The parcel as the focal resource, embedded in the identified business network. Resources are illustrated by circles and resource ties by lines.*

From the empirical data, it is clear that there are resource ties involving all actors in the business network. The resource ties could be identified both between different types of actors, for example retailers and carriers, but also between the same type of actors, such as retailers. The resource ties between different types of actors were both between intangible resources as well as between tangible resources.

Tr (2017) says that there are resource ties between both different departments at the same company and between actors in the business network. Further, there are horizontal development and collaboration between the same kinds of actors, such as retailers, and between different departments at the same company. For example, Lyko mentions that there should be networking sessions for retailers and carriers where they try to work towards applying lean in the e-commerce supply chain in terms of optimizing the fill rates in parcels, load carriers and transportation vehicles. Further, employees at PostNord have slightly different views of how the sorting and handling process at their terminals can be changed in order to enable smoother handling of smaller parcels. Jahre et al. (2006) mean that internal organizing in a company can hinder the development of potential relationships within the company as well as with other actors. For example, the Logistics & E-commerce Manager argues that they do not need to improve their terminals in order to be able to manage more types of parcel sizes, while the Strategy Manager means that some adjustments can be made that possibly can hinder parcels of becoming damaged in the terminal. If the horizontal communication can be improved, then improvements between actors, departments and consequently the e-commerce business network can be achieved. Lyko means that the more transparent actors become in their actions towards having more optimized parcels, the easier it becomes to collaborate and find joint solutions. Retailers argue that the design of parcels probably will not be of interest for the consumers in the future, which is why actors should collaborate and develop parcels that are

more practical than aesthetically appealing. Horizontally between retailers, intangible resource ties such as knowledge exist. Some retailers that are in the forefront when it comes to developing efficient parcels have started to share their findings. Sharing knowledge is about learning and influencing, which according to Jahre et al. (2006) is crucial for business units in order to improve and develop the supply chain performance. As Jahre et al. (2006) further argue, business relationships are highly important when it comes to influencing. The empirical data indicates that the climate between retailers is quite prestigeless, which could enable an even higher level of learning and influencing in the business network.

Vertical collaboration between different kinds of actors is also needed in order to influence and change the business network. Between carriers and retailers, intangible resource ties such as knowledge and skills could be identified. The retailers receive a lot of feedback and guidance from carriers, with the goal to make the parcels more efficient, with less excess air. Similarly, the carriers receive feedback regarding their handling and sorting process, even if it might not be to the same extent. For example, Lyko asked PostNord if it would be possible to drop the products from the machines to the load carrier in a more gentle way. The identified tangible resource ties are sorting facilities, transportation vehicles, shipping labels and load carriers, which all are resources that both retailers and carriers need to access in order to run their business.

The empirical findings indicate that the perspectives of features of a parcel vary among actors in the business network. These findings are in accordance with the findings of Lindh et al. (2016) and Jahre et al. (2006), who argue that the preferred features of a resource could vary between actors in a business network. The preferred features of a parcel depend on the purpose of the parcel for each actor, which is also related to the fact that companies perform different activities in order to finally generate revenue and profit to obtain profitable and sustainable businesses (Tr, 2017).

The consumers want their ordered products intact and delivered on time. The parcel itself is not of great interest. From the moment that the products are being unpacked, the parcels become burdens which have to be taken to recycling facilities. Therefore, the smaller the parcel is, the more manageable it becomes for the consumers. The consumers also prefer smaller parcels, including padded envelopes, since it means that the the ordered products can be delivered straight to the mailbox, which, in turn, means that they save time since they don't need to various pick-up points. The preferred features of a parcel from the retailers' perspective seem to differ among retailers. The reason for this might be either an economical issue or ignorance. Some retailers work a lot with optimizing the parcels in relation to the product, which enable them to increase the fill rate in load carriers. These retailers seem to have a higher level of knowledge regarding efficient packaging as well as a willingness to make the supply chain more efficient. The time aspect of a parcel is also an important aspect. The retailers always try to minimize the packaging process time, since each second is costly in terms of man hours. For some retailers that have a high employee turnover of warehouse workers, it could

be hard to minimize the packaging process time while trying to optimize every parcel in relation to the product. The carriers' perspectives of the feature of a parcel are in many ways similar to the retailers'. They also aim for better optimized parcels in order to increase the fill rate in load carriers, sorting facilities and in transportation vehicles. However, it is also important that the parcels are designed to manage the handling and sorting process in their terminals. For example, standardized parcels with eight corners, are the most suitable ones for their handling and sorting process.

Even if some features of the parcel seem to be more or less important among actors in the business network, they all have in common that financial benefits would arise if the parcels would be better optimized in relation to the size of the products inside. This finding goes in line with Jahre et al. (2006), who argue that for mixed interfaces, economizing is particularly central, since most resourcing efforts are financially driven.

All the identified interfaces of the parcel from all actors' perspectives are illustrated in figure 22. The interfaces belong to the whole business network in which the parcel is seen as the focal resource. The interfaces are of both physical character, such as transportation vehicles, and abstract character, such as time of delivery.

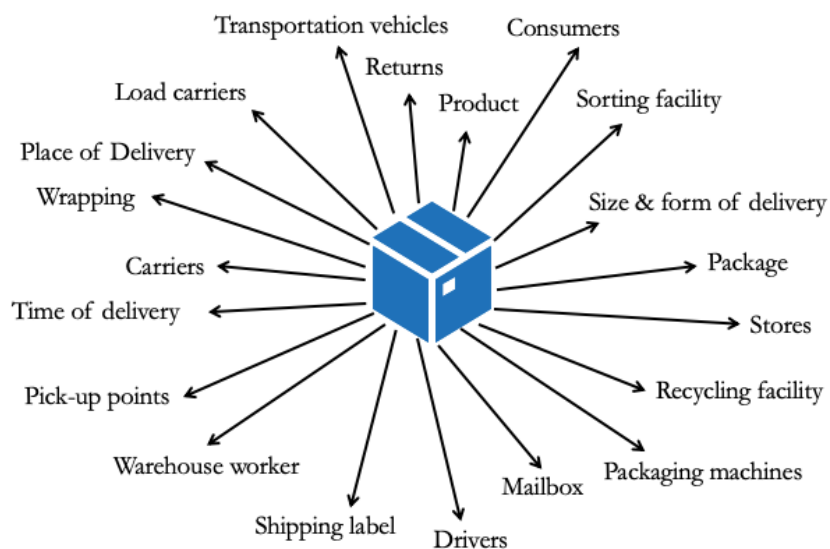


Figure 22. The interfaces of the parcel as a focal resource in a business network.

## 6. Discussion

The analysis shows that there are several challenges that the actors meet in the business network related to eliminating excess air in parcels. As actors have different perspectives related to how they handle parcels, they tackle the challenges differently.

In order for actors to find a common approach towards decreasing excess air in parcels, actors in the business network need to compromise. They should come together and support each other in order to reach that goal. Currently, it seems like actors aren't aware of why other actors handle parcels differently, which hence contribute to the tendency of actors working against each other rather than together. The first step towards reaching such a goal is to be transparent and share the obstacles that hinder actors from taking certain actions that would enable the elimination of excess air. If one actor would share the reasons why they handle parcels in a certain way, it could create understanding among other actors, who then could try to adapt their handling so that it fit others better. By being more transparent, not only understanding could be enabled, but also the possibility of finding improvements that could help decreasing the excess air in parcels. For example, using existing resources in new ways. Actors from various industries could become more transparent by sharing potential ideas and challenges with the help of horizontal and vertical networking sessions for the entire e-commerce business network. In these networking sessions, actors could share ideas of how to tackle certain obstacles related to the excess air in parcels, and hence influence others towards taking the same actions. Actors could also share environmental benefits that may arise from taking certain actions, both individually and together in the business network. These benefits perhaps wouldn't be possible to achieve alone, or wouldn't be as apparent for all actors if these weren't shared. Even though actors tend to compete with each other in order to differentiate themselves from each other, there are areas where they would benefit from cooperating instead. However, it's important to know in what areas to compete and when to cooperate. In order to change a whole business network's attitude and approach towards decreasing the excess air in parcels, the actors must interact and work as a team when needed.

For example, the effort that Lyko puts into having perfect stacking of parcels into their load carriers aren't as perfect at PostNords sorting facilities as they don't have time, nor manual labor, to perform such efforts. These inefficiencies seem to originate from the fact that the business network is measured based on effectiveness per time unit. If the measure of effectiveness could change in the e-commerce business network, then it could be possible to change the attitude that actors have and the actions that are taken. Another measure that could change the behaviour of actors and that could measure the effectiveness could instead be related to fill rates. If everyone would focus on how to achieve better fill rates, not only financial benefits would follow but also environmental ones. Actors would be able to ship more parcels as more would fit in transportation vehicles as a result of less air in and between parcels. Consequently, less transportation vehicles would be needed in order to transport the parcels. The fill rates could also be improved if the actors could take advantage of joint loading, where

actors share routes and transportation vehicles during delivery. There is currently some actors who have taken the initiative of this action in the last mile transportation. If more actors would try to realize this action, then fewer transportation vehicles could be half-filled during transportation.

From the analysis, it is clear that resourcing needs to be considered in the business network. The actors need to rethink how to use various resources. It's apparent that some resources could be used in new ways, in order to increase the efficiency and hence decrease the excess air in parcels. All the actors in the business network need to examine if and how their resources could be used in different ways. To succeed, the actors need to understand the resource ties in the business network and how these affect the usage of single resources. For example, there seem to be ways of using the load carriers more efficiently. The sides of the load carriers could for example be better utilized by using hangers to store plastic parcels. Another example is to readjust the scanners to read QR codes instead of shipping labels. Such action would enable the making of smaller parcels, where more information about the parcels could be stored.

Today, the product development related to parcels, packages and packaging solutions seem to be quite fragmented within the business network, meaning that these activities are not always interrelated. This might result in sub optimization due to that the interfaces and preferred features of a parcel differ among actors in the business network, as the findings in this thesis demonstrate. Therefore, it seems crucial to include the needs of the entire business network to a larger extent than today, in order to develop parcels, packages and packaging solutions that are adequate for all processes throughout the entire supply chain. Every actor needs to take their responsibility on this question.

The findings indicate that there are more potential for improvements of the design of parcels, in regards to size and form. For example, there's a huge potential in developing customized parcel variants that fit the majority of the product assortment, as 20% of the products constitutes for 80% of the volume. Some retailers have already started to reflect upon this. Lyko, for example, realized that it would be beneficial to develop a customized package that fits shampoo bottles, which is one of their most sold product types. At the same time, they assured that the height of the parcel would not exceed the dimension of the opening of a mailbox, which hence enables home deliveries. They also kept the parcel standardized with eight corners, which is the most suitable design for the carriers' sorting and handling processes.

Delivering some products directly in their packages is also a solution that would have a tremendous effect on the elimination of excess air. However, the findings indicate that there are some challenges related to this. On the other hand, these challenges are mainly related to some types of products, such as theft-prone products and very small products. Packages having the same size as standardized parcels would however be possible to deliver without parcels, to a greater extent than today. To ease this transition, a standardized process containing guidelines and measurements for when to deliver products directly in their packages and when to use

parcels, could be established. Another important aspect needed to fasten the transition, is the producing companies' responsibility to develop packages better suited for the e-commerce supply chain. Especially, this is due to the fact that shopping online is increasing while shopping in physical stores is decreasing. For example, they should consider developing more durable corners of the packages and using materials that are robust enough for the e-commerce supply chain.

The packaging industry also plays an important role in the development of better optimized parcels in relation to the size of the products. Their knowledge and skills regarding packaging is crucial to succeed in this area. Potential improvement areas are, for example, development of parcels that are easier to crop and efficient packaging techniques that could be a financial possibility even for less financial stable actors. Also, their knowledge about materials could be utilized in the process of making packages more suitable for the e-commerce supply chain.

Today, many retailers seem to outsource the activities related to development of parcels. However, the issues related to inefficient packing deserve more attention, in order to make the e-commerce sustainable both from a financial and an environmental perspective. The development of parcels should therefore be considered as a core activity to a greater extent by retailers. The retailers should also involve the warehouse workers more often in the development of parcels, since they are the ones spending the majority of the time handling the parcels. They possess important knowledge that are relevant for the product development of parcels. For example, they know which products that are most difficult to package and which parcels that are the most useful ones and so on.

Further, the consumers seem to have a shopping behaviour that is characterized by the expectation of receiving their orders as fast as possible. Therefore, retailers keep competing against each other based on how fast they are able to deliver orders to the consumers. The fact that retailers are competing against each other on this subject may also be a reason for consumers to keep on expecting fast deliveries. In other words, the behavior of the consumers might originate from the way retailers compete. If the expectations of the consumers could change, and the retailers could stop competing based on effectiveness per time unit, then the focus could shift towards increasing the fill rates in transportation vehicles. That is to say, parcels could be stacked with more precision into transportation vehicles which could lead to the possibility of loading more parcels into fewer vehicles. From the findings it already seems like the consumers are willing to wait a few extra days for their orders to be delivered, which is why retailers should try to compete based on other subjects. Instead, they could try and compete based on post-sale customer service and the environmental impact that their deliveries might have.

Further, it seems like retailers not only believe that the consumers expect fast deliveries, but also a certain type of unboxing experience. Retailers however seem to realize that the unboxing experience is of less interest for the consumer today. It still remains that the unboxing

experience contributes to more filling material in the parcels, and hence to a certain level of excess air. If retailers would focus less on the unboxing experience, then excess air could be decreased and focus could shift towards offering more environmentally friendly orders. Retailers could start promoting how the parcels are contributing to a more sustainable world, and consequently making it possible for their customers to feel good about their choice of retailers.

## 7. Conclusion

The purpose of this thesis was to identify and analyze the underlying causes and business network interdependencies of inefficient packaging in e-commerce. Further, the thesis has attempted to answer the following research questions:

*RQ1: What resource interfaces can be identified from the perspective of the parcel as the focal resource and what are the effects of these resource interfaces on inefficient packaging?*

The study concludes that the parcel as a focal resource has a multitude of interfaces to other resources, controlled by different actors. Furthermore, the interfaces are perceived differently from the perspective of various types of actors. Also, within a certain category of actors, e.g. retailers or carriers, there are differences in how the interfaces are perceived. The identified interfaces create several challenges relating to the excess of air in parcels for the actors in the studied business network. The consumers, retailers and carriers all have challenges that are related to different interfaces, see table 5. It can be concluded that retailers and carriers are the ones that bear the majority of the identified challenges. The retailers and carriers also share several interfaces. Consequently, these are the actors that should take a joint lead in approaching the problem with excess air in parcels.

Table 5. A summary of the challenges and the interfaces which these are related to.

Interfaces where challenges are identified	Consumers	Retailers	Carriers
<b>Recycling facility</b>	Bringing parcels to recycling facilities is boring and frustrating		
<b>Size &amp; form of delivery</b>	<ul style="list-style-type: none"> <li>• Carrying home huge parcels is demanding</li> <li>• Upsetting when receiving creased package</li> </ul>		
<b>Product</b>	A wide product range makes it hard to optimize every parcels in relation to the product		
<b>Sorting facility</b>	<ul style="list-style-type: none"> <li>• The speed and curves of the conveyor belt are not ideal for too small or too light parcels</li> <li>• The drop from the machine to load carriers results in excess air and potential damages of parcels</li> </ul>		
<b>Warehouse workers</b>	Packaging is time demanding		
<b>Package</b>	Packages are not designed for e-commerce but for physical stores		Some products are theft-prone
<b>Carriers</b>	The carriers' sorting facilities are not ideal for all types of e-commerce parcels		The handling and sorting process varies among carriers
<b>Consumers</b>	The customer orders are unevenly spread throughout the week		
<b>Shipping labels</b>	<ul style="list-style-type: none"> <li>• Manual reading restrict the possibility to reduce shipping labels too much</li> <li>• Removing the destination and sender information would result in difficulties to know where to send the parcel if the bar code is unreadable</li> </ul>		

*RQ2: How do the perspectives of features of a parcel vary among actors in the business network and what are the effects of the various perspectives on inefficient packaging?*

It can be concluded that the preferred features of a parcel also differ among actors in the business network which results in a complex situation, where each actor has to be aware of other actors' preferred features in order to handle the situation of inefficient packaging in a successful way. Actors have different perspectives of features based on their self interest. Consumers prefer to receive small parcels based on the effort it takes to handle these, both when carrying them home from pick-up points as well as carrying them to recycling facilities. For retailers and carriers, the major perspective regards economical incentives and time aspects. For example, they aim at making smaller parcels in order to increase the fill rates in load carriers to further enable shipping of more parcels. They also aim at decreasing the handling time in warehouses and terminals in order to ship more parcels. However, the importance of standardized parcels seems to be higher for carriers than other actors in the business network. This is due to the fact that their sorting and handling facilities put higher demands on the design of the parcels, as these otherwise restrict the handling in the facilities. Even if some features of the parcel seem to be more or less important among actors in the business network, they all have in common that financial benefits would arise if the parcels would be better optimized in relation to the size of the products inside.

The findings also indicate that there are interdependencies between actors, mainly in regards to various resource ties in the business network. Also, several challenges seem to occur due to these interdependencies. It can be concluded that the actors in the business network should realize the fact that single resources need to be connected and gradually changed, to solve the problem of complex interdependencies. Further, it can be concluded that the actors have to collaborate in order to decrease the excess air in parcels. However, they must decide what areas to compete in and when they should cooperate. The first step towards being more collaborative is to be transparent and share the obstacles that hinder actors from solving their challenges. To sum up, actors must compromise in order to decrease the excess air in parcels.

## 8. Further Research

The findings of this thesis require further investigation, based on a larger variety of actors to validate if the findings are general or specific to the research setting. Further research should also include physical observations of processes throughout the business network in order to identify further interfaces, challenges and interdependencies that could be difficult to identify by using research methods such as interviews, surveys and virtual observations.

## References

- Burt, S. & Sparks, L. (2003) E-commerce and the retail process: a review. *Journal of Retailing and Consumer Services*, vol. 10, pp. 275-286.
- Boysen, Nils & De Koster, René & Weidinger, Felix. (2018). Warehousing in the e-commerce era: A survey. *European Journal of Operational Research*. 10.1016/j.ejor.2018.08.023.
- Bryman, A. & Bell, E. (2003) *Business research methods*. Oxford University Press, Oxford; New York.
- Dagens Industri. (2020). Så slår coronaviruset mot ekonomin. Retrieved 2020-04-29 from <https://www.di.se/nyheter/1130-historiskt-hoga-varsel-se-arbetsformedlingens-presskonferens/>
- Dhandel (2020). D-congress. Retrieved 2020-03-11 from <https://dhandel.se/d-congress/d-congress-2020/>
- Easterby-Smith, M., Jackson, P. & Torpe, R. (2015) *Management & Business Research*, 5th edition. Sage Publications.
- Esper, T.L., Jensen, T.D., Turnipseed, F.L., Burton, S., 2003. The last mile: an examination of effects of online retail delivery strategies on consumers. *J. Bus. Logist.* 24, 177–203.
- Postnord (2019). *E-commerce in the nordics*. Stockholm: Postnord.
- He, P., Zhang, S., & He, C. (2019). Impacts of logistics resource sharing on B2C E-commerce companies and customers. *Electronic Commerce Research and Applications*, 34.
- Håkansson, H. & Johanson, J. (1992) A Model of Industrial Networks, in B, Axelsson & G, Easton, (eds), *Industrial Networks: A New View of Reality*, London, Routledge, 28-34.
- Janjevic, M. & Winkenbach, M. (2020) Characterizing urban last-mile distribution strategies in mature and emerging e-commerce markets, *Transportation Research Part A: Policy and Practice*, vol. 133, pp. 164-196,
- Jönsson, G. Motte, D. & Bjärnemo, R. (2018) Evaluation of a method supporting the integration of packaging development into product development using an assessment framework for methodologies under development. Lund University, Sweden.

Kalakota, R., & Whinston, A. B. (1997). *Electronic commerce—A manager's guide*. Massachusetts: Addison-Wesley Longman

Lindh, H., Williams, H., Olsson, A., & Wikström, F. (2016). Elucidating the Indirect Contributions of Packaging to Sustainable Development: A Terminology of Packaging Functions and Features. *Packaging Technology and Science*, 29(4–5), 225–246.

Lund University. (2020). Förpackningslogistik. Retrieved 2020-02-03 from <https://www.lu.se/lucat/group/v1000238>

M. Jahre, L.E. Gadde H. Håkansson, D. Harrison, G. Persson, and G. Liber. (2006). *Resourcing in Business Logistics: The Art of Systematic Combining*. Liber and Copenhagen Business School Press.

McPherson, D. (2015) Delivering the goods: An e-commerce explosion, the growth of the global consumer, and increasing complexity challenge fulfillment providers to up their games. *Response Magazine*, vol. 23, no. 12, pp. 42-48.

Mourya, S., & Gupta, S. (2014). *E-commerce*. Retrieved from <https://ebookcentral.proquest.com>

Phillips, P. P. & Stawarski, C. A. (2008) *Data collection: Planning for and collecting all types of data*. Hoboken, NJ; Wiley.

PostNord. (2017) *E-barometern Årsrapport 2016*. Stockholm: PostNord.

Postnord. (2019). Förpackningsresan. Retrieved 2020-02-10 from <https://www.postnord.se/vara-losningar/artiklar/e-handel/forpackningsresan>

Pålsson, H. & Hellström, D. (2016) *Packaging logistics in supply chain practice - current state, trade-offs and improvement potential*. Lund University, Sweden.

Quaddus, M. & Achjari, D. (2005) A model for electronic commerce success. *Telecommunications Policy*, vol. 29, no. 2, pp. 127-152.

Trafikanalys (2019). *Leder e-handel till ökade transporter? - delredovisning av ett regeringsuppdrag*. Stockholm: Trafikanalys.

Tr, N. (2017, January 14). *Analysis of Supply Network from ARA Model Perspective*. LinkedIn. Retrieved 2020-02-12 from <https://www.linkedin.com/pulse/analysis-supply-network-from-ara-model-perspective-annie-tran/>

Vakulenko, Y. Shams, P. Hellström, D. & Hjort, K. (2019) Service innovation in e-commerce last mile delivery: mapping the e-commerce journey. Lund University & Karlstad University, Sweden.

Vakulenko, Y. Hellström, D. & Hjort, K. (2018) What's in the parcel locker? Exploring customer value in e-commerce last mile delivery. Lund University, Sweden.

Wetzel, E. Böhnke, J. & Brown, A. (2016) Response Biases. University of Konstanz, Germany.

Yu, Ying & Yu, Chenglin & Xu, Gangyan & Zhong, Ray & Huang, George. (2020). An operation synchronization model for distribution center in E-commerce logistics service. *Advanced Engineering Informatics*. 43. 101014. 10.1016/j.aei.2019.101014.

# Appendix A - Interview questions

## Packaging Industry

1. Hur jobbar ni med kunder för att minimera luft i förpackningar (optimera förpackningarna)?
2. Hur ser variationen ut bland kunderna? (Vissa vill ha mer kundanpassade förpackningar medan andra vill ha ett visst antal förpackningar?)
3. Hur designas paketen utifrån att en etikett ska få plats?
4. Vilka är de största utmaningarna med att minimera luften i paket (från ert perspektiv)?
5. Hur tror ni att man kan hitta lösningar som är win-win för samtliga aktörer i en supply chain?

## Retailers

1. Hur ser ni på att eventuellt samarbeta med olika varumärken som ni köper in av (exempelvis att anpassa konsument förpackningarna för att passa med era etc?)
2. Har populariteten av leveransställe skiftat som ett resultat av storleken på era paket? Dvs, delas fler ordrar ut till brevlåda idag jämfört med innan?
3. Samarbetar ni med andra aktörer inom er bransch med samma typer av frågor och utveckling av paket?
4. Vad är de största hindren för att optimera paket, bortsett från att det ska gå snabbt att paketera ordrar i dem?
5. Varför skickas inte produkter i brev-format i större utsträckning?
6. Fixera produkterna istället för mängder av bubbelplast/wrapping? Varför inte?
7. Hur kan mindre fraktetiketter bidra till mer effektiva förpackningslösningar?

## Carriers

1. Vad ser ni som de största utmaningarna i era terminaler, som gör att det är svårt att minska paketen (andelen luft)? (linornas design, paket faller ner i en stor bunge osv.)
2. Vad vinner ni på att kunderna får lägre fraktkostnader då de sänder mindre paket?
3. Hur skulle mer fyllnads-optimerade paket förbättra/underlätta jobbet för chaufförer samt terminalarbetare?

4. Ser ni något/några “problem/hinder” i hur kundernas paketerar/skickar paket/i deras supply chain som kan ha en negativ påverkan på att minska luften i paket/pakethantering?
5. Vilken typ av feedback (både positiv & konstruktiv) får ni höra från era kunder (Lyko, Ellos etc) gällande denna frågan? Är det oftast samma typ av feedback, samt skiljer den sig från industri till industri?
6. Hur ofta sker det att paket från retailers går sönder eller inte klarar av att gå igenom era terminaler? Vad tror ni är orsaken till det?
7. Varför hanterar era maskiner inte mindre paket lika bra? Vilka faktorer spelar in här?
8. Varför hanterar era maskiner inte stora paket lika bra? Vilka faktorer spelar in här?
9. Finns det några alternativa lösningar till paketens fallhöjd ni har i era terminaler?
10. Skulle det gå att göra frakt-etiketterna väldigt väldigt små alternativt att använda typ QR-koder istället, och fortfarande använda den skannings-tekniken ni har idag? Om inte, vad behöver ändras/utvecklas i så fall?
11. I vilken del av terminalen hade det underlättat mest om paketen vore bättre förpackade, innehållandes mindre luft?
12. Betalar ni postombuden för lagerhållning av era paket?

# Appendix B – Survey

## Undersökning av konsumenters upplevelse av paket inom e-handeln

Uppgifter som lämnas i denna enkät kommer att vara tillgängliga för Anna Skilbred och Louise Enberg, som genomför examensarbetet "Exploring the underlying causes and supply chain network interdependencies that contribute to inefficient packaging in e-commerce" på Chalmers Tekniska Högskola. Enkäten är i enlighet med EU:s dataskyddsförordning (2018), GDPR. Syftet med enkäten är att förstå konsumentens upplevelse av paket inom e-handeln. Uppgifterna sparas inte efter arbetets avslut, Juni 2020.

Stort tack för ditt deltagande!

1. 1. Paketet med dess innehåll är snyggt paketerat och tilltalande när jag öppnar det.

*Markera endast en oval.*

- Viktigt  
 Lite viktigt  
 Oviktigt

2. 2. Paketet är i rimlig storlek i förhållande till min beställda vara.

*Markera endast en oval.*

- Viktigt  
 Lite viktigt  
 Oviktigt

3. 3. Hur ofta anser du att paketet inte är i rimlig storlek i förhållande till beställd vara?

*Markera endast en oval.*

- Alltid  
 Ibland, ca 50% av gångerna  
 Sällan, ca 20% av gångerna  
 Aldrig

4. 4. Jag kan tänka mig att vänta några dagar extra för att få flera beställningar som jag gjort under en kortare tid från samma företag levererat i samma paket.

*Markera endast en oval.*

- Ja, jag föredrar att spara tid och hämta ut färre paket  
 Ja, jag värnar gärna om miljön och väntar ett par dagar extra  
 Nej, jag vill ha mina varor så fort som möjligt i förhållande till när ordern är lagd  
 Spelar ingen roll

5. 5. Jag föredrar att få mitt paket utlämnat till

*Markera endast en oval.*

- Brevlåda/dörren  
 Utlämningsboxar (exempelvis Instabox)  
 Postombud  
 Hämta i butik

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