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# E-commerce packaging as an embedded resource in three network settings

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## ABSTRACT

Packaging in e-commerce distribution receives attention from many perspectives, often in relation to sustainability and efficiency. This attention may concern the use of packaging material or the mismatch between parcel size and the products to be shipped. From a retailer's or third-party logistics provider's perspective, the attention includes costs related to packaging material and packing. Distribution has evolved over time and well-established settings of interconnected and embedded resources provide complexity in terms of opportunities for change. This paper investigates this embeddedness in terms of analysing e-commerce packaging as a resource interfacing with other resources such as products (including product packaging) in three network settings; the product development setting, the packing setting, and the sorting setting. The paper shows how the embeddedness of e-commerce packaging makes efforts to change a complicated matter due to the complex set of resource interdependencies. The study highlights why some network settings may be given more attention by firms involved in retail distribution, and others less. Furthermore, the study shows that although much attention is given to adjust the packing setting, it is important to understand the history of this setting and how adaptations of other settings, such as the product development and sorting setting, entail opportunities for change.

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## KEYWORDS

Sustainability; retail; distribution; packaging; e-commerce

## Introduction

The introduction of e-commerce has led to increased global competition and changing buying behaviour (Nisar and Prabhakar 2017). It is not uncommon with high demands of free and fast deliveries, free and convenient returns, and instant price comparisons between suppliers (Stephens and Pine 2017). The growing e-commerce has also led to increased attention to sustainable retail distribution (Escursell, Llorach-Massana, and Roncero 2021). This development means both challenges and opportunities for actors involved in the retail sector, where many retailers have acknowledged that sustainable development is not only a prerequisite for long-term survival, but it can also provide competitive advantages (Ruiz-Real et al. 2019). One issue relating to this is the role of packaging in retail distribution, for example the use of packaging material and how manufacturers, brand-owners and retailers pack and deliver their goods.

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The current production and distribution structure is a result of a long period of 'traditional' physical sales as the dominant business logic. This means that various production and distribution facilities, as well as business routines, have been developed and adapted to fit this logic (Spruit and Amemar 2021). This, in turn, has resulted in that products as well as packaging have been developed accordingly. For example, products and consumer packaging have been primarily adapted for shelf display in physical retail stores, and transport packaging is adapted to fit deliveries of large batches of products on pallets to such outlets (Regattieri and Santarelli 2013). Hence, the increasing e-commerce, where single products are shipped to end-consumers in parcels, does not necessarily fit into this established distribution structure, originally developed for distribution of large batches of products to retail outlets (Ibid.).

For consumers, this mismatch becomes especially apparent when small products (in their packaging) are shipped in large transport parcels, often with a lot of excess air (Oh et al. 2019). For transport and logistics firms, there is often a mismatch in the material handling activities since the sorting equipment used in parcel processing centres is not designed to handle the diverse range of e-commerce parcels (and the products within). Furthermore, the excess air in e-commerce parcels means that the capacity in transport and logistics resources, for example vehicles and load carriers, is often low. For retailers, the challenges lie in matching the choice of packaging material, and how to pack an e-commerce order, to the conditions of the products and the requirements set by logistics and transport firms (Barnes 2016). For product producers, it becomes challenging to treat e-commerce orders separately from orders directed to physical outlets, by, for example, adapting products and consumer packaging depending on if they are directed to an e-commerce distribution set-up, a physical store distribution set-up, or a multi-(or omni) channel distribution set-up (Freichel, Wollenburg, and Wörtge 2020).

All in all, it is challenging for firms dealing with e-commerce to try to adapt to the 'existing structure' that was originally developed to fit a different business logic. Based on this, the aim of this paper is to identify challenges and opportunities for firms involved in e-commerce in contemporary distribution structures. A specific focus is set on packaging as a central resource for distribution in e-commerce.

The paper is structured as follows. First, a brief literature review elaborating on the development of the current distribution structure and the increasing e-commerce and its effects is provided. Furthermore, the role of packaging in this context is discussed. Second, this is followed by a conceptual framework that enables the description and analysis of the current distribution structure with a focus on packaging and its impact on today's situation with e-commerce. Third, a section on methodology describes the underlying method of the study on which the paper is built. Fourth, the empirical material is analysed with the use of the conceptual framework. Fifth, the paper ends with a concluding section with managerial and theoretical implications.

## Literature review

This section is divided into two parts. First, a brief discussion of the current multi- and omni-channel distribution structure is provided. Second, the role of packaging in retail is discussed.

### ***Towards multi-and omni-channels***

Retailing is evolutionary to its nature. Dynamics and turbulent times have been a recurring and natural part in retail (Evans 2011). Even though retailing is an ancient activity, the view of 'modern' retail originates from the Industrial revolution (Ibid.). Retail chains were introduced in the early 1800s and since then such chains account for a large share of retail sales (Robertson 1997). Since the mid-1990s, the Internet has enabled electronic commerce. Nowadays retailers often integrate digital and physical shopping experiences for their customers (e.g., in-person, online, mobile, etc.) and try to integrate these into distribution systems that provide a united experience of the company regardless of the consumer's choice of channel. This type of integrated multi-channel retailing is often referred to as omni-channel retailing (Beck and Rygl 2015).

With established retailers traditionally relying on sales in physical retail outlets entering e-commerce, new challenges must be overcome. For example, trade-offs between process integration and separation between different channels need to be considered (Agatz, Fleischmann, and van Nunen 2008). The 'distribution layer' of the supply chain has become increasingly important, due to, for example, the increase in geographical distances between suppliers and consumers (Vafaei et al. 2020). Also, the design of warehouses (Johnson and Meller 2002), the decisions on inventory and capacity management (Ayanso, Diaby, and Nair 2006), and manufacturing operations are challenged by the entry of multi-channel operations (Kolbe, Calderón, and Frassetto 2021).

During the last two decades, the annual growth of e-commerce sales has been over 20%, and in 2019 14,1% of retail sales worldwide were made online (Statista 2021). The influence of the Covid-19 pandemic has accelerated the e-commerce sales during 2020. The increase of e-commerce and the growing use of digital tools used by consumers as well as retailers and logistics firms enables more options for consumers but it also leads to increased complexity in retail distribution (Boysen, de Koster, and Weidinger 2019). Electronic and physical retail are today more interconnected than before and boundaries between different sales channels are vanishing (Brynjolfsson, Hu, and Rahman 2013). To integrate electronic and physical retail channels into omni-channels may hold advantages relating to shopping convenience and logistical efficiency, but is complex with regard to implementation (Hübner et al. 2016). The complexity also relates to the increasingly blurred geographical boundaries, where both national and international distribution facilities need to be connected, each with its own operational and locational characteristics (Rodrigue 2020). This has resulted in products being sent longer distances in a wide range of different channels, each having certain demands on packaging both in terms of consumer experience, handling, and transport efficiency. Furthermore, the high return rates in e-commerce put pressure on the distribution system.

### ***The role of packaging in contemporary retail***

In distribution channels directed to physical retail outlets, packaging is often adapted to a 'steady flow' of goods, and the packaging system is developed from the perspectives of protection, handling, and communication with a main focus on sales in physical stores

(Livingstone and Sparks 1994). The 'steady flows' and packaging being adapted to physical stores are now being challenged by an increased request for digital visualisation and adaptations to e-commerce distribution (Barnes 2016). Freichel, Wollenburg, and Wörtge (2020) propose that different packaging requirements for physical stores and e-commerce deliveries complicate integrated inventories and logistics efficiency. They also raise awareness around how the adaptations of the packaging system may hold the potential to manage the operational challenges of integrated distribution. The packaging system includes several interrelated levels of packaging; (1) primary packaging (often referred to as consumer packaging) involving the packaging closest to the actual product, (2) secondary packaging (often referred to as transport packaging) contains one or more primary packages and an e-commerce parcel is an example of such packaging, and (3) tertiary packaging, for example pallets and roll containers, containing one or more secondary packages (Hellström and Saghir 2007; Pålsson 2018). To incorporate the different requirements of the various sales channels into a multi-functional packaging solution, considering the interrelated levels, improved collaboration between the actors within the distribution network is required (Freichel, Wollenburg, and Wörtge 2020; Pålsson and Hellström 2018). A study conducted by Pålsson and Hellström (2018) highlights the importance of understanding the trade-offs between packaging requirements from different actors enabling informed decisions.

Within the area of retail distribution, sustainability is a recurrent argument when it comes to aims and choices related to packaging (Svanes et al. 2010). Lindh et al. (2016) explore how packaging through its functions and features directly and indirectly can contribute to sustainable development. They show that direct effects of packaging occur during production of packaging materials, transport, and recycling. Indirect effects are linked to the services that packaging provides for the content and the users in distribution, including consumers.

Packaging may be considered an unnecessary cost that should be minimized, or a necessary resource to avoid product waste by providing adequate protection and preservation of its contents (Lindh et al. 2016). Hence, there is a delicate trade-off between how much material to use to sustain functionality, and at the same time keep resource utilization low by not using excess material. In the same line, Silvenius et al. (2014) argue that the environmental analysis of packaging has to be contextual. Adding to that, research shows that the actual product inside the package has to be considered when making choice of packaging (Grönman et al. 2013; Williams and Wikström 2011). This means considering both the kind of product (for example, food, textiles or technical products) and the environmental impact of the product. Relating to this, if a product has a strong negative environmental impact, it is important to reduce product waste by using 'better' packaging. This further means that if a product has a low negative environmental impact packaging material should be used carefully to keep down the negative impact of the actual use of packaging material (Williams and Wikström 2011). A packaging context may also include how, where, and for how long a parcel is transported and what impact on the environment a damaged product has if returned, wasted and if a new product needs to be delivered to the consumer (Scott Matthews, Hendrickson, and Soh 2001). Lydekaityte and Tambo (2020) show that development of packaging is highly linked to increasing environment-, marketing-, and consumer-related concerns and innovative and 'intelligent' packaging is driven by increased competitiveness, the growing

number of possibilities for digital interaction, changes in consumer demand, increased interest in product security and increased consumer awareness of environmental impact. However, the importance of different factors varies among different actors involved in a distribution network.

Since consumers are the ones that buy, open, close, reuse, recycle and dispose the final packaging (e.g. primary packaging and in e-commerce the 'e-commerce packaging') they are often viewed as the ultimate user of packaging (Mumani and Stone 2018). The introduction of so-called 'smart packaging' challenges the current model of packaging functions and Lydekaityte and Tambo (2020) suggest an alternative model of the main packaging functions, including an increased focus on the interaction between packaging and consumers.

### Conceptual framework and research questions

The underlying theoretical approach applied in the paper is the Industrial Network Approach (Håkansson and Snehota 1995). This theoretical framework enables the conceptualisation of packaging as a focal resource embedded in a distribution network, in turn involving many various resources. All resources have features which can be exploited dependent on the context. Some features can be 'shaped and applied' by suppliers but others can only come to the fore in relation to a specific use context (Baraldi, Gressetvold, and Harrison 2012). Examples of resource features are weight, form, dimensions, place, etc. From a packaging perspective, the features of packaging material can, for example, be related to thickness of the material or how moisture resistant it is. With regard to a parcel, volume can be a feature of importance. Furthermore, resource interfaces are the 'interconnections between two or more entities at a shared boundary' (Dubois and Araujo 2006, 22) and symbolize the 'match' between two resources when used together. Hence, the adaptations of resources into larger constellations over time enable interfaces to develop which make the resources rather fixed in this structure in the short run (Jahre et al. 2006). For example, when a firm invests in an automated packing machine, many other resources, such as packaging material need to be adapted to this resource. For firms, it therefore becomes imperative to try to economize on the different resources they have access to, both within their formal firm boundaries and through their business relationships (Jahre et al. 2006). The specific model used to scrutinize resources and how they are connected is the 4R-model (Håkansson and Waluszewski 2002), distinguishing between two types of physical resources (products and facilities) and two types of organisational resources (business units and business relationships). Products are defined as what is exchanged between a supplier and a customer. Facilities are defined as resources that are used to, for example, develop, produce, distribute, transport, and consume products. Business units incorporate the skills, competencies and capabilities needed to combine the physical resources, i.e. products and facilities, within and across firm boundaries. Business relationships are resources in themselves enabling access to resources from other actors and they also provide access to other business relationships. (Ibid.) Furthermore, the model suggests that resources are interrelated and hence get embedded with regard to each other. Relating to the focus of this paper, packaging can be regarded as a product when exchanged between a buyer and a seller in a business

exchange, for example when a retailer sources packaging from a packaging supplier. However, packaging can also be regarded as a facility when used in activities relating to materials handling, transportation, logistics and distribution.

Furthermore, discussing innovation, Håkansson and Waluszewski (2007) identify three kinds of settings in which an innovation (a resource) needs to relate; the developing setting, the producing setting, and the using setting. Inspired by this reasoning any resource needs to relate to various 'network settings', each having its own business logic and set of involved actors.

### **Problem analysis and research questions**

To recapitulate, the aim of this paper is to identify challenges and opportunities for firms involved in e-commerce in contemporary distribution structures. As hinted above, the paper especially focuses on packaging as a key resource for distribution of products in e-commerce.

With this said, we identify packaging in e-commerce (henceforth referred to as e-Com packaging) as a focal resource for analysis, to scrutinize how this resource is embedded in a network of other resources and how interaction over time among these resources leads to a more or less locked-in set of resource interfaces. We categorise this focal resource (the e-Com packaging) as a facility embedded in various network settings in which it interacts with other resources (other facilities, products, business units and business relationships). Inspired by the work on 'settings' by Håkansson and Waluszewski (2002), two research questions are identified for further scrutiny:

Research question 1: How are e-Com packaging embedded with other resources in different network settings and how are these network settings related?

Research question 2: What are the effects of the embeddedness in network settings for different actors involved in e-commerce in their efforts towards more sustainable distribution?

### **Methodology**

The paper relies on a single case study with embedded sub-cases focusing on investigating the embeddedness of packaging in the Swedish retail distribution context. A case study is considered appropriate when investigating social entities, or situations, by collecting several sources of data and through an interactive research process develop a description of the phenomenon (Easton 2010). For this study, a case study approach was found useful since retail distribution networks are featured by ambiguity, continuous change and unclear boundaries (Langley 1999).

Data collection took place between September 2020 and September 2021. The main source of data was interviews (see detailed list in Table 1), complemented with study-visits and secondary data such as firm documents, websites and seminars. A snow-ball method was used (Cassell and Symon 1994), and the starting point was two representatives from one packaging supplier and one logistics service provider (LSP). From these initial interviews, other interviewees at those firms were identified, as well as other relevant firms and interviewees. The snow-ball method enabled (1) an active search for resources that have interfaces with e-Com-packaging, (2) to identify interviewees within the network who

**Table 1.** Summary of interviews.

Firm category	Interviewee	Major themes discussed
Packaging Supplier 1	Design Manager, Nordic Sales Manager	Packaging development, collaboration
	Packaging Specialist	Packaging automation
	Customer Value Manager	Package development, Value tools
	Operations Compliance Lead	Recycling, re-use
	Pack Right Centre Manager	Packaging development, customer projects
Logistics Service Provider 1	Head of Security and Claims	Safe packaging, reasons for claims
	Senior Project Manager, Process Manager	Production, processes, work environment
	Key Account Manager	Service points
	Marketing Manager	Design of consumer delivery bags
	Packaging Consultant	Damaged and lost packages
	President and CEO	Cooperation, sustainability, strategy
Retailer 1 (Home appliances)	Transport Manager Outbound	Outbound logistics, omni-channel logistics
	E-Com fulfilment Operations lead	Feeder store logistics
	Internal Procurement Manager	Purchasing, packaging supply
	Packaging Manager	Designing product packages
	Sustainability Manager	Sustainability, sustainable packaging
Packaging Supplier 2	Sales, Packmaster	Packaging, load carriers
Packing Machine Supplier 1	Business Developer Manager	Package automation
Packing Machine Supplier 2	Marketing Manager, Area Sales Manager	Packaging machines, logistical challenges
Packing Machine Supplier 3	Engineer and consultant	Innovation, automation
Third Party Logistics Provider	Sustainability Manager	Processes, sustainability, strategies
Retailer (Beauty products 1)	Communication and Sustainability Manager	Packaging strategies, transportation
Retailer (Beauty products 2)	Purchasing and Logistics	Logistics of e-com adjusted products
Retailer (Daily commodities)	Chief Logistics Officer	Logistics, packaging machines
Retailer (Furnitures)	Senior packaging specialist	Packaging strategies, supply chains

have knowledge about relevant issues, (3) to identify interviewees that can provide input to questions that have not yet been answered, (4) and to elaborate and validate earlier findings. Some interviewees provided detailed information concerning a specific firm- or context-related issue and others were more of ‘packaging experts’ providing more general knowledge in the area of packaging. According to Bogner and Menz (2009) expert interviews can be used to explore a field of study and to provide a thematic structure. The interviews cover two packaging suppliers, three packing machine suppliers, five retailers (representing the beauty sector, home appliance sector, and daily commodities sector), one third party logistics provider (TPL) and one logistics and transport provider (LSP). The ‘snow-balling’ continued until the researchers found a saturation of data in relation to the research questions. At that time no further interviews were considered necessary. All in all, 25 interviews were conducted with in total 27 interviewees. Hence, the number of interviews was not decided in advance.

Since we used a snow-ball method the respondents were not selected in advance. However, there were some criteria that directed the search for respondents. First, all should be active in the (Swedish) retail distribution context. Second, they should all be involved in the distribution of a wide range of products (e.g. regarding weight, volume, and sensitivity). This was important since we were interested in capturing variety and complexity in distribution (whether it is a retailer, a third-party logistics provider, a logistics service provider, a packaging supplier or a package automation supplier).

All interviews except one, which was conducted face-to-face, have been conducted through video-calls by Zoom or Teams and the interviews have lasted from 30 minutes to 3 hours. The reason for not conducting more study visits and interviews face-to-face was the restrictions related to the Covid-19 pandemic during 2020–2021. The interviews were semi-structured with guiding themes rather than specified questions. The themes discussed varied depending on which representative that was interviewed and are indicated in Table 1. The themes for discussion were communicated with the respondents in advance so that they could prepare. Each interview started with an introduction of the researchers and aim with the interview. This was followed by an introduction of the respondent and its specific area of knowledge. This enabled the interviewees to bring up aspects that could not have been foreseen in beforehand and for them to provide their perspectives without direction from indicative questions. Each interview was recorded and transcribed and the transcribed data has been analysed thematically based on the 4R-model (i.e. describing resource interfaces), which has been the foundation of the analytical framework. In addition, one study visit at a TPL has been conducted that helped the researcher to observe the embeddedness of packaging with their ‘own eyes’. Hence, the case developed as a result from the learnings that came from various sources; the partly diverse and partly similar views from respondents, the researchers’ own experiences from the study visit, videos on various processes shown during interviews, drawings and examples of packaging and parcels, and data sheets on, for example, product dimensions.

## Analysis

The case illustrates how e-Com packaging is embedded in a network of other resources and how interaction over time among these resources leads to a more or less locked-in set of resource interfaces. The paper illustrates this embeddedness in three different network settings; the product development setting, the packing setting, and the sorting setting. First, the e-Com packaging plays an important role in what we label the product development setting, where features of another resource (the product) impact decisions relating to choices concerning the e-Com packaging. This is exemplified by the interface between a product packaging (i.e. primary packaging) and the e-Com packaging. Second, the e-Com packaging is important in the packing setting when the product is packed. This network setting is exemplified by the interface between packing personnel (a business unit) and the e-Com packaging. Third, the e-Com packaging also appears in the sorting setting illustrated by how the e-Com packaging interacts with the sorting equipment (a facility) of a logistics service provider.

Hence, in the forthcoming sections, we analyse e-Com packaging as (1) embedded in a network of other resources, (2) in its product development setting with a focus on its interface with the product packaging, (3) in its packing setting with a focus on its interface to packing personnel, and (4) in its sorting setting with a focus on its interface to sorting equipment. In the analysis, the resources are categorised in accordance with the 4R-model: products, facilities, business relationships, and business units.

### *E-Com packaging embedded in a network of other resources*

Figure 1 shows some of the resources that have been found to have resource interfaces with the focal resource e-Com packaging, here categorised as a facility.

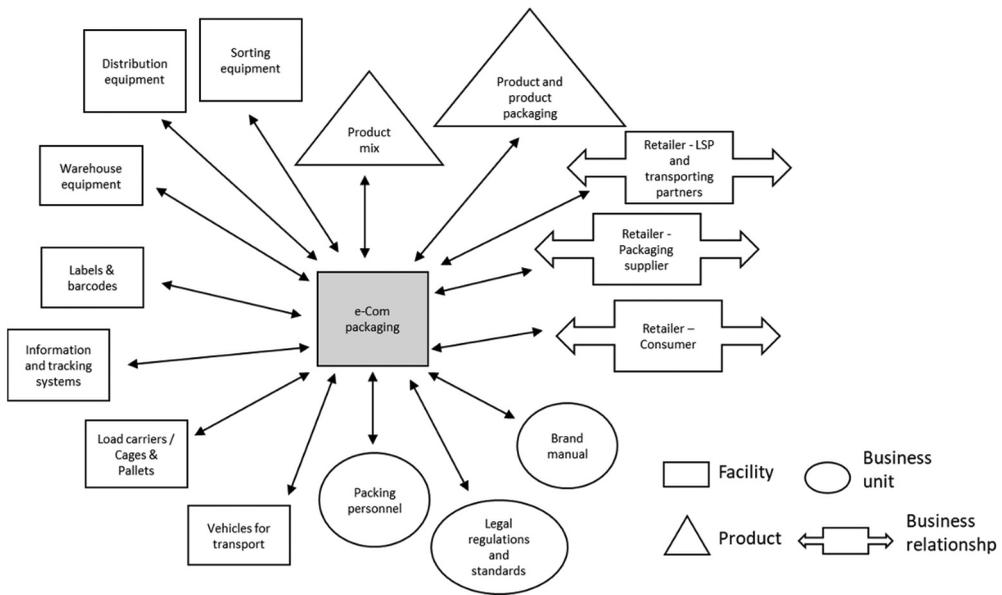


Figure 1. E-Com packaging embedded in other resources.

With regard to **products**, first the features of the actual *product*, such as form, size, weight, and value, including the *product packaging*, will impact the choice of e-Com packaging. Second, the variation in the *product mix* available at the organisation performing the packing (e.g. retailer or third-party logistics provider) also needs to be taken into consideration since high variation with regard to certain features in the product mix create challenges relating to e-Com packaging.

Regarding **facilities**, e-Com packaging may interact with *warehouse equipment*, such as packing machines, packing stations and logistics systems. For example, automated packing solutions are related to large investments and are expected to last many years. This means that such investments lock the retailer into a specific solution for many years. An automated packing machine can improve efficiency regarding speed of packing, and sometimes also adapt the form and size of packaging in relation to the products. However, the packing machines often have limitations regarding what packaging materials that can be used, which might restrict changes from, for example, plastic-based packaging, to paper-based packaging. Furthermore, the packing machines have limitations regarding dimensions of packaging. This means that a retailer often needs to combine automated packing with manual packing for orders involving products that do not match the dimensions required by the machine. When the e-Com packaging interacts with LSPs' facilities, such as *sorting equipment*, certain conditions for the e-Com packaging must be met. The sorting equipment is often optimized for speed in sorting rather than delicate handling of parcels. In e-commerce distribution the e-Com packaging is interdependent with *distribution equipment* such as retail stores, pick-up points, consumer homes, delivery boxes and post- and mailboxes. The choice of logistics

services (e.g. letter, parcel, pallet) decides which of these resources that are activated in the distribution of a certain product. Regarding post- and mailboxes these have certain standard form features that set limitations to types of shipments that can fit into these. These boxes are adapted primarily to the 'letter logistics service', restricted by specific product terms. Products sent with the 'parcel service' can be small enough to fit the post- and mailboxes but will still be delivered through pick-up points or by home delivery due to the choice of logistics service. For pick-up points (e.g. service stations and convenience stores) that handle many parcels, packaging plays a crucial role for how they can utilize their storage space. The packaging is also linked to the manual handling of parcels by personnel and is thereby also related to work environmental issues. Another facility related to packaging is so called delivery boxes for collection of goods bought online. These boxes have certain dimensions that set restrictions for dimensions in packaging. Furthermore, how the capacity in *vehicles for transport* and *load carriers* (such as pallets and cages) can be used is depending on the weight, form and volume of the parcels. If weight limitations are not reached, how the volume capacity is used is crucial for transport efficiency. If parcels are loaded into cages, the main issue is the form and size of parcels and how these fit together in the cage in order to enable high fill-rates. It is the loading of the cages that is critical since the number of cages that a certain vehicle (e.g. a truck) can carry is fixed. However, sometimes parcels are loaded directly into a vehicle. In this case the loading of these parcels is decisive for how much of the volume capacity that can be utilized. Some packaging allows for stacking of parcels and some not which put restrictions on loading. Furthermore, in one example in our study, the truck used had a capacity of 3 meters in height but due to the work environment law, manual loading of parcels is restricted to 1,7 meters, hence setting restrictions for loading, and capacity utilization. In relation to *information- and tracking systems* the e-Com packaging has an important role as carrier of information. *Labels and barcodes* such as the STE-label, carry a lot of information, such as receiver name and address, sender name and address, as well as information about the shipment as such. This standard label (STE) is required by many LSPs, in turn relating to an established infrastructure of optical scanners and IT-systems. Furthermore, the standardization of label sizes and barcodes also restricts the minimum dimensions of packaging.

With regard to **business units**, the competence and skills of *packing personnel* is vital. How this competence is embedded in other resources will be explored later in this chapter. There are several *legal regulations and standards* that impact on packaging. First, the work environment law provides some restrictions as discussed above. Second, the law ordinance of producers' responsibilities for packaging stipulates that sellers are obliged to pay a fee per kilo packaging material introduced on the market in relation to their products. Beside laws, industry standards might impact on packaging. For example, the use of standard transport labels, such as the STE-label, which comes in standard sizes sets restrictions for the size and shape of packaging. The design of e-Com packaging often includes branding and is guided by *brand manuals*.

Regarding **business relationships**, those of *retailer – consumers, retailer – packaging suppliers and retailer – LSP's and their distribution partners* influence how e-Com packaging is utilized in the distribution process. There are also other business relationships

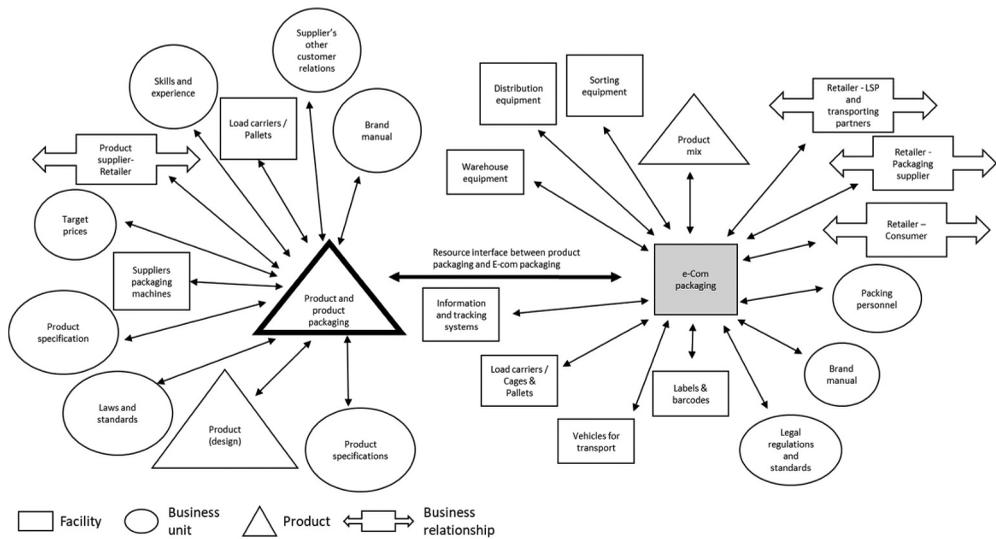
influencing the e-Com packaging, as for example packing machine suppliers and system providers. However, in this paper, we mainly focus on the business relationships inherent in the three network settings in focus.

**Embedded resource interface between product (including its product packaging) and e-Com packaging in the product development setting**

Figure 2 illustrates the resource interface between the focal resource, the e-Com packaging, and the product (including product packaging).

The development of a product often includes product packaging. The design of a product and product packaging is in many cases guided by brand manuals, created in cooperation between a consultant brand strategist and the organisation’s marketing department. Also, product specifications, defined by a product specialist, provide guidelines to manufacturing of product and packaging features, target prices, laws, and standards. Retailers that have a history from a ‘physical store context’ often focus more on product and packaging design from a shelf display perspective and are thereby guided by how display, sales and safety in stores are organised. They are also steered by the established way of organising logistics to physical stores. Furthermore, the business relationship between the product supplier and retailer impacts on packaging. It is not uncommon that the product suppliers provide suggestions to the retailers regarding packaging, based on their skills and experience, available packaging suppliers, and available packing machinery.

The features of a product (including its packaging) set conditions for how the e-Com packaging later may be designed. Features as the amount of air in the product packaging may lead to larger packaging and more packaging material than necessary for the product



**Figure 2.** The embedded resource interface between a product (including its product packaging) and the e-Com packaging.

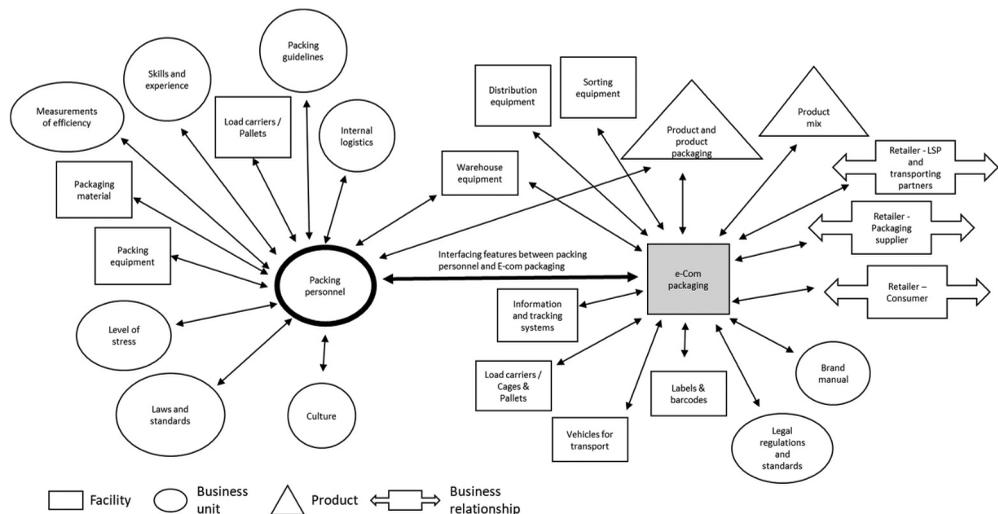
in question. Also, the product may have sensitive features, as for example containing liquids or glass, which means that if the product packaging is not designed to protect the product sufficiently, the e-Com packaging must provide this kind of protection.

The product development setting is decisive for how the e-Com packaging may be designed and how e-commerce packing can be performed. The embedded resource interfaces in this network setting have evolved based on the involved actors' shared focus on short time-to-market and low purchase prices. This lock-in of resource interfaces makes it difficult for the same actors to adapt to a changing business landscape, where product development adapted to e-commerce distribution may become a crucial part of the business logic on which e-commerce rests.

**Embedded resource interface between packing personnel and e-Com packaging in the packing setting**

In order to prepare products, including their original product packaging, for distribution to end-consumers, they are packed in e-Com packaging. The process of doing so often involves manual packing by packing personnel. Even though retailers with high order volumes and large turnover tend to invest in automated packing equipment, several retailers still have personnel executing the packing manually. Figure 3 illustrates the resource interface between the resource packing personnel and e-Com packaging.

The packing personnel may be located at a central warehouse or a 'feeder store'. Packing guidelines provide more or less detailed descriptions of how packing should be conducted and how the desired end-result should look like. Even so, the organizational culture has high influence on the outcome, where the balance between efficiency (in terms of speed) in packing and thoroughness (in terms of effort to optimize each packing activity) may have high impact on the final results with regard to the choice of packaging



**Figure 3.** The embedded resource interface between packing personnel and e-Com packaging.

material, degree of filling of parcels and use of access material. Also, the volatility in incoming consumer orders provides peaks for the personnel which may result in high stress levels. In this case, the experience and packing skills of the personnel have effect on the results. Packing personnel is also highly interdependent on the availability of packing equipment and packaging material; hence, their work relies on the internal logistics to provide suitable equipment.

The packing setting may be seen as a bridge, or an enabler, between the product development setting and the sorting setting. Since the development of products and their packaging in most cases are embedded in resources not supporting the e-Com distribution, the packing setting has become a crucial necessity to prepare the products for the requirements of the sorting setting, which will be discussed next.

**Embedded resource interface between sorting equipment and e-Com packaging in the sorting setting**

Logistics Service Providers (LSPs) use sorting equipment to scan, spread, and sort shipments to organise transport to end-destinations. Figure 4 illustrates the resource interface between sorting equipment and e-Com packaging.

For a parcel to be handled by the sorting equipment, different requirements need to be met. These are mediated through guidelines formulated by the LSP and forwarded to its customers, for example retailers. The sorting equipment has resource interfaces to other resources such as, for example, parcel cages that are used in distribution and used for tipping parcels onto the conveyor belt. It also has resource interfaces with various information scanners and the personnel at the LSP that are monitoring and assisting the sorting equipment.

A sorting equipment is developed to fit the resources to which it has resource interfaces with at the time of the development. In today’s distribution networks, many such sorting equipments were developed during a time where e-commerce was not

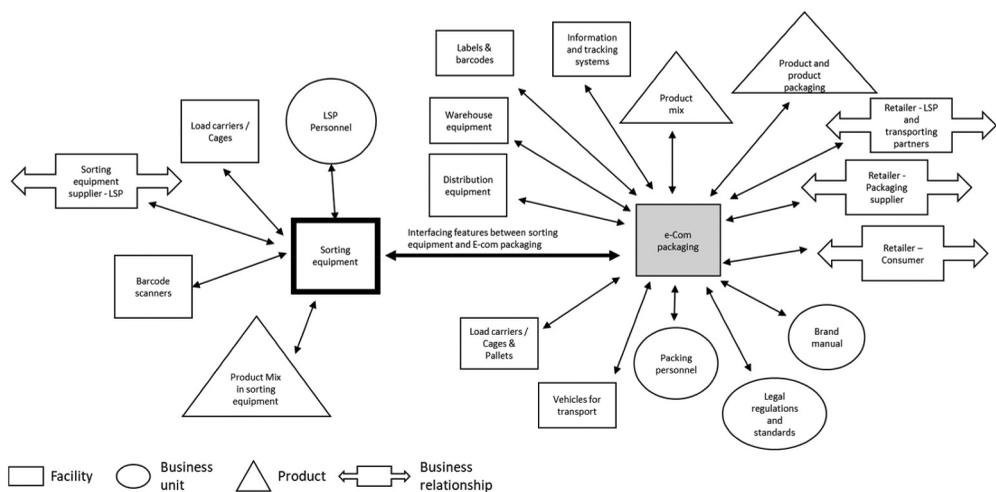


Figure 4. The embedded resource interface between sorting equipment and e-Com packaging.

considered an 'important type of business' and hence the equipment was primarily adapted to other business logics. Due to the heavy investments that are involved in this type of equipment, these facilities can be regarded as rather fixed in the short run, even though minor adaptations can take place. This means that features of the sorting equipment, such as for example, height of fall, speed and width of conveyer belt, and technology for information retrieval (e.g. scanners), need to be matched to e-Com packaging. Due to this interface, e-Com packaging has developed features as stableness, readable labelling and packaging for 'a worst case scenario'. Regarding cost for packaging, for low-value products the packaging cost is often reduced to a minimum and for high-value products the packaging cost is often subordinate to the importance of protection and safety. With the increased flow of parcels, often including low-value products with minimum packaging, LSPs are challenged by customers 'under packing' creating incidents such as when one parcel affects several other shipments, for example a leaking broken bottle of soap or a string stuck in the sorting equipment, which in turn lead to that the sorting needs to be stopped.

Our study shows that how the sorting setting is organised in contemporary business does not 'match' how the product development setting is organised. Furthermore, the packing setting often acts as a buffer, or bridge, between these two other network settings. The discrepancy between the product development setting and the sorting setting highlights the role of the packing setting in e-commerce.

## Conclusions

The analysis shows how the development of product packaging is (still) adapted to sales, safety and handling in physical stores and how actors involved in designing, developing, producing products, and packing products have made investments that support this context. This in turn, hinders certain efforts to adapt to the e-commerce logic in the short run. The same is true for the sorting setting which has also been adapted (over a long time) to handle other types of shipments than those related to e-commerce.

Regarding the three different network settings identified in the paper, the product development setting and the sorting setting are hence characterised by resource interfaces that have been developed and embedded in their respective network setting during a long time and directed to a 'brick-and-mortar' retail context. With the new type of business that e-commerce implies, the packing setting gets the role to 'match' these other two network settings, and thereby act as a bridge between the other two. This is due to the fact that the packing setting is not characterised by as many historical resource interfaces and has therefore become the network setting that is given the most attention – and blame – concerning its impact on the efficiency and sustainability in e-commerce. Our analysis suggests that perhaps an unreasonable amount of attention is given to this network setting, as the other two settings (product development and sorting) may have even higher potential in contributing to more efficient and sustainable retail distribution. However, the adaptations required in these two network settings to make this kind of contribution might be hard to accomplish due to the heavy embeddedness of e-Com-packaging with other resources as shown in this paper.

The fact that the packing setting acts as a buffer between the product development setting and the sorting setting points to the fact that depending on which network setting that is in focus for the analysis, different views of what are the 'most important' features of packaging will emerge. It is seldom so that it is the same actors that are involved in these network settings meaning that various actors will have different perspectives on this issue.

### ***Theoretical implications***

The paper contributes by showing how e-Com packaging, here conceptualised as a facility (resource), is embedded in an intrinsic network of other resources (other facilities, products, business units and business relationships). Furthermore, the study shows that the resource interfaces between packaging and other resources are more or less visible for firms in the distribution network and that these various features are more or less visible in the different network settings.

Furthermore, the paper adds to the concept of 'settings' introduced by Håkansson and Waluszewski (2007) by developing this to cover also other types of network settings that can be relevant to understand how a certain resource 'fits' with regard to other resources. With regard to e-Com packaging, we especially identify three relevant network settings (product development, packing and sorting) of interest to explore the role of packaging in retail distribution. We believe that this extended scope of analysis in terms of the various network settings 'hidden' interdependencies relating to the embeddedness of e-Com packaging that affect the development of sustainable packaging solutions in retail distribution, can be brought to the fore.

By this said, we do not see that this theoretical approach is limited to the study of e-Com packaging. This means that other resources (other packaging but also other resources) can be analysed in this way. In such studies, new relevant network settings might be identified, depending on the unique context of the specific study.

### ***Practical implications***

The embeddedness of e-Com packaging shown in this paper creates both restrictions and opportunities for various possible actions and changes concerning packaging that an actor, by themselves, or jointly with others, might want to accomplish. Furthermore, our study shows that the involved actors, such as retailers, packaging suppliers, packing machine suppliers, logistics service providers, third party logistics providers, all have their unique perspective(s) on which are the most central features of packaging from their point of view, be it with regard to for example degree of filling of packages, load-factors of vehicles or load carriers, material handling in distribution centrals, durability of packaging material, consumer experience etc.

However, even though firms have very different perspectives on packaging the study points to a strong inherent effort of many of the involved firms to strive for what Jahre et al. (2006) refer to as economizing with regard to packaging in different ways to increase cost efficiency and to reduce environmental impact. For firms related to e-Com packaging, and involved in different (but partly also the same) network setting(s), it is therefore essential to share perspectives on packaging in order to identify joint actions that can contribute to more sustainable distribution.

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## References

- Agatz, N. A. H., M. Fleischmann, and J. A. E. van Nunen. 2008. "E-fulfillment and multi-channel Distribution – A Review." *European Journal of Operational Research* 187 (2): 339–356. doi:10.1016/j.ejor.2007.04.024.
- Ayanso, A., M. Diaby, and S. K. Nair. 2006. "Inventory Rationing via drop-shipping in Internet Retailing: A Sensitivity Analysis." *European Journal of Operational Research* 171 (1): 135–152. doi:10.1016/j.ejor.2004.07.060.
- Baraldi, E., E. Gressetvold, and D. Harrison. 2012. "Resource Interaction in inter-organizational Networks: Foundations, Comparison, and a Research Agenda." *Journal of Business Research* 65 (2): 266–276. doi:10.1016/j.jbusres.2011.05.030.
- Barnes, C. 2016. "Omni-Channel Retail—Challenges and Opportunities for Packaging Innovation." In *Integrating the Packaging and Product Experience in Food and Beverages*, ed. P. Burgess, 59–76. Duxford, UK: Woodhead Publishing.
- Beck, N., and D. Rygl. 2015. "Categorization of Multiple Channel Retailing in Multi-, Cross-, and Omni-Channel Retailing for Retailers and Retailing." *Journal of Retailing and Consumer Services* 27: 170–178. doi:10.1016/j.jretconser.2015.08.001.
- Bogner, A., and W. Menz. 2009. "Introduction: Expert Interviews — An Introduction to a New Methodological Debate." In *Interviewing Experts*, edited by Bogner A, Littig B, Menz W, 1–13. London, UK: Palgrave Macmillan.
- Boysen, N., R. de Koster, and F. Weidinger. 2019. "Warehousing in the e-commerce Era: A Survey." *European Journal of Operational Research* 277 (2): 396–411. doi:10.1016/j.ejor.2018.08.023.
- Brynjolfsson, E., Y. Hu, and M. Rahman. 2013. "Competing in the Age of Omnichannel Retailing." *MIT Sloan Management Review* 54: 23–29.
- Cassell, C., and G. Symon. 1994. "Qualitative Research in Work Contexts." In *Qualitative Methods in Organizational Research*. 113
- Dubois, A., and L. Araujo. 2006. "The Relationship between Technical and Organisational Interfaces in Product Development." *The IMP Journal* 1 (1): 28–51.
- Easton, G. 2010. "Critical Realism in case Study Research." *Industrial Marketing Management* 39 (1): 118–128. doi:10.1016/j.indmarman.2008.06.004.
- Escursell, S., P. Llorach-Massana, and M. B. Roncero. 2021. "Sustainability in e-commerce Packaging: A Review." *Journal of Cleaner Production* 280: 124314. doi:10.1016/j.jclepro.2020.124314.
- Evans, J. R. 2011. "Retailing in Perspective: The past Is a Prologue to the Future." *The International Review of Retail, Distribution and Consumer Research* 21 (1): 1–31. doi:10.1080/09593969.2011.537817.
- Freichel, S. L. K., J. Wollenburg, and J. K. Wörtge. 2020. "The Role of Packaging in omni-channel Fashion Retail Supply Chains - How Can Packaging Contribute to Logistics Efficiency?" *Logistics Research* 13 (1): 1–20. doi:10.23773/2020\_1.

- Grönman, K., R. Soukka, T. Järvi-Kääriäinen, J.-M. Katajajuuri, M. Kuisma, H.-K. Koivupuro, M. Ollila, et al. 2013. "Framework for Sustainable Food Packaging Design." *Packaging Technology and Science* 26 (4): 187–200. doi:10.1002/pts.1971.
- Håkansson, H., and I. Snehota. 1995. *Developing Relationships in Business Networks*. London: routledge.
- Håkansson, H., and A. Waluszewski. 2002. "Path Dependence: Restricting or Facilitating Technical Development?" *Journal of Business Research* 55 (7): 561–570. doi:10.1016/S0148-2963(00.
- Håkansson, H., and A. Waluszewski. 2007. *Knowledge and Innovation in Business and Industry: The Importance of Using Others*. Vol. 5. London, UK: Routledge.
- Hellström, D., and M. Saghir. 2007. "Packaging and Logistics Interactions in Retail Supply Chains." *Packaging Technology and Science* 20 (3): 197–216. doi:10.1002/pts.754.
- Hübner, A., J. Wollenburg, A. Holzapfel, and C. Mena and Michael Bourlakis. 2016. "Retail Logistics in the Transition from multi-channel to omni-channel." *International Journal of Physical Distribution & Logistics Management* 46 (6/7): 562–583. doi:10.1108/IJPDLM-08-2015-0179.
- Jahre, M., L.-E. Gadde, H. Håkansson, D. Harrison, and G. Persson. 2006. *Resourcing in Business Logistics* Malmö, Sweden: Liber and Copenhagen Business School Press.
- Johnson, M. E., and R. D. Meller. 2002. "Performance Analysis of Split-Case Sorting Systems." *Manufacturing & Service Operations Management* 4 (4): 258–274. doi:10.1287/msom.4.4.258.5732.
- Kolbe, D., H. Calderón, and M. Frassetto. 2021. "Multichannel Integration through Innovation Capability in Manufacturing SMEs and Its Impact on Performance." *Journal of Business & Industrial Marketing, ahead-of-print(ahead-of-print)*. doi:10.1108/JBIM-04-2020-0204.
- Langley, A. 1999. "Strategies for Theorizing from Process Data." *Academy of Management Review* 24 (4): 691–710. doi:10.5465/AMR.1999.2553248.
- Lindh, H., H. Williams, A. Olsson, and F. Wikström. 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. doi:10.1002/pts.2197.
- Livingstone, S., and L. Sparks. 1994. "The New German Packaging Laws." *International Journal of Physical Distribution & Logistics Management* 24 (7): 15–25. doi:10.1108/09600039410070957.
- Lydekaityte, J., and T. Tambo. 2020. "Smart Packaging: Definitions, Models and Packaging as an Intermediator between Digital and Physical Product Management." *The International Review of Retail, Distribution and Consumer Research* 30 (4): 377–410. doi:10.1080/09593969.2020.1724555.
- Mumani, A., and R. Stone. 2018. "State of the Art of User Packaging Interaction (UPI)." *Packaging Technology and Science* 31 (6): 401–419. doi:10.1002/pts.2363.
- Nisar, T. M., and G. Prabhakar. 2017. "What Factors Determine e-satisfaction and Consumer Spending in e-commerce Retailing?" *Journal of Retailing and Consumer Services* 39: 135–144. doi:10.1016/j.jretconser.2017.07.010.
- Oh, J. Y., H. J. Jo, S. U. Suh, and G. E. Lee. 2019. "A Study on the Waste Reduction of Parcel Delivery Packaging." *Korean Journal of Packaging Science & Technology* 25 (2): 23–29. doi:10.20909/kopast.2019.25.2.23.
- Pålsson, H., and D. Hellström. 2016. "Packaging Logistics in Supply Chain Practice – Current State, trade-offs and Improvement Potential." *International Journal of Logistics Research and Applications* 19 (5): 351–368. doi:10.1080/13675567.2015.1115472.
- Pålsson, H. 2018. *Packaging Logistics: Understanding and managing the economic and environmental impacts of packaging in supply chains*. London, UK: Kogan Page .
- Regattieri, A., and G. Santarelli. 2013. *The Important Role of Packaging in Operations Management*. M. Schiraldi,ed.London, UK: Intechopen.
- Robertson, K. A. 1997. "Downtown Retail Revitalization: A Review of American Development Strategies." *Planning Perspectives* 12 (4): 383–401. doi:10.1080/026654397364591.
- Rodrigue, J.-P. 2020. "The Distribution Network of Amazon and the Footprint of Freight Digitalization." *Journal of Transport Geography* 88: 102825. doi:10.1016/j.jtrangeo.2020.102825.
- Ruiz-Real, J. L., J. Uribe-Toril, J. C. Gázquez-Abad, and J. De Pablo Valenciano. 2019. "Sustainability and Retail: Analysis of Global Research." *Sustainability* 11 (1): 14. doi:10.3390/su11010014.

- Scott Matthews, H., C. T. Hendrickson, and D. L. Soh. 2001. "Environmental and Economic Effects of E-Commerce: A Case Study of Book Publishing and Retail Logistics." *Transportation Research Record* 1763 (1): 6–12. doi:10.3141/1763-02.
- Silvenius, F., K. Grönman, J. M. Katajajuuri, R. Soukka, H. K. Koivupuro, and Y. Virtanen. 2014. "The Role of Household Food Waste in Comparing Environmental Impacts of Packaging Alternatives." *Packaging Technology and Science* 27 (4): 277–292. doi:10.1002/pts.2032.
- Spruit, D., and E. Amemar. 2021. "First Market Study in e-commerce Food Packaging: Resources, Performance, and Trends." *Food Packaging and Shelf Life* 29: 100698. doi:10.1016/j.fpsl.2021.100698.
- Statista, D. C. 2021. "Worldwide e-commerce Share of Retail Sales 2015-2024". <https://www.statista.com/statistics/534123/e-commerce-share-of-retail-sales-worldwide/-statisticContainer>
- Stephens, D., and J. Pine. 2017. *Reengineering Retail: The Future of Selling in a Post-Digital World*. La Vergne, United States: Figure 1 Publishing.
- Svanes, E., M. Vold, H. Møller, M. K. Pettersen, H. Larsen, and O. J. Hanssen. 2010. "Sustainable Packaging Design: A Holistic Methodology for Packaging Design." *Packaging Technology and Science: An International Journal* 23 (3): 161–175. doi:10.1002/pts.887.
- Vafaei, A., S. Yaghoubi, J. Tajik, and F. Barzinpour. 2020. "Designing A Sustainable multi-channel Supply Chain Distribution Network: A Case Study." *Journal of Cleaner Production* 251: 119628. doi:10.1016/j.jclepro.2019.119628.
- Williams, H., and F. Wikström. 2011. "Environmental Impact of Packaging and Food Losses in a Life Cycle Perspective: A Comparative Analysis of Five Food Items." *Journal of Cleaner Production* 19 (1): 43–48. doi:10.1016/j.jclepro.2010.08.008.