

Freichel, Stephan L. K.; Wollenburg, Johannes; Wörtge, Johannes K.

Article

The role of packaging in omni-channel fashion retail supply chains: How can packaging contribute to logistics efficiency?

Logistics Research

Provided in Cooperation with:

Bundesvereinigung Logistik (BVL) e.V., Bremen

Suggested Citation: Freichel, Stephan L. K.; Wollenburg, Johannes; Wörtge, Johannes K. (2019) : The role of packaging in omni-channel fashion retail supply chains: How can packaging contribute to logistics efficiency?, Logistics Research, ISSN 1865-0368, Bundesvereinigung Logistik (BVL), Bremen, Vol. 13, Iss. 1, pp. 1-20,
https://doi.org/10.23773/2020_1

This Version is available at:

<https://hdl.handle.net/10419/297178>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

The role of packaging in omni-channel fashion retail supply chains – How can packaging contribute to logistics efficiency?

Stephan L. K. Freichel¹, Johannes Wollenburg^{2*}, Johannes K. Wörtge¹

Received: 01 August 2019 / Accepted: 17 December 2019 / Published online: 09 January 2020
© The Author(s) 2019 This article is published with Open Access at www.bvl.de/lore

ABSTRACT

Omni-channel retailing changes the distribution structures of retail companies. Integrating existing facilities, resources and processes may hold advantages regarding customer satisfaction and shopping convenience, as well as logistical efficiency, but are complex in the implementation. Since the logistical requirements for the packaging system in stationary and distance channels are different due to varying shipment structures, this hinders seamless channel integration. This paper investigates the role of the packaging system in omni-channel fashion distribution and identifies the respective challenges retailers and associated supply chain partners face regarding packaging when integrating sales and logistics channels. By means of a qualitative research approach including nine interviews from field experts, the current practices of retailers, packaging manufacturers and logistics service providers regarding packaging in Omni-Channel retail are derived. The results indicate that the requirements towards packaging in the different channels, especially in integrated DC structures, interfere with a seamless channel integration. With regard to the role of stores in omni-channel retailing, channel-adequate packaging types need to be used for store pick-ups, and related process-changes are necessary for heightening efficiency. Packaging represents a restriction for distance shipments, fulfilled by stores. Primary packaging is an opportunity to support channel integration. However, this requires

early and cross-company collaboration. The main theoretical contribution of this paper lies in identifying packaging related challenges preventing seamless channel integration into omni-channel distribution, stating initial packaging solutions to overcome those and providing an outlook towards future requirements for packaging in an omni-channel world. The paper has also strong managerial implications for retailing companies implementing integrated omni-channel structures, processes and services.

KEYWORDS: omni-channel retail · distribution, packaging, fulfilment · retail logistics

1. INTRODUCTION

For the last two decades, worldwide eCommerce sales have increased with annual turnover growth of more than 20%, reaching approximately \$3.5 trillion in 2019, adding up to 14.1% of all retail sales [1]. This also applies to the fashion sector, for which eCommerce accounts for 21% of total sales in 2019 and for which high growth continues to be expected [2]. This increasing competition forced traditional Brick & Mortar (B&M) retail companies to progressively add new internet based sales channels (such as their own web shops, platform offers or mobile commerce) into their business model, were former B&M fashion retailers began as one of the first to do so [3, 4]. A retailer with multiple sales channels which are operated in parallel but are not coordinated with each other is called a “Multi-Channel Retailer” [5]. Today, virtual and physical retail is more and more interconnected, hence, the boundaries between different sales channels are vanishing [6]. Consumers start to switch seamlessly between different “touchpoints” (e.g. email advertisement, online rating, online shop, physical store, etc.) during the different phases of the “customer journey” (pre-purchase, payment, delivery, return) [7]. Fashion retailers, who are typically confronted with

✉ Stephan L. K. Freichel¹
Johannes Wollenburg^{2*}
Johannes K. Wörtge¹

¹ TH Köln, Cologne University of Applied Sciences, Cologne, Germany

² Catholic University Eichstätt-Ingolstadt, Ingolstadt, Germany

* Corresponding Author: Dr. Johannes Wollenburg; johannes.wollenburg@ku.de; +49 841 9372 1995

ephemeral consumer trends and a high impulse buying rate [8], have a particularly high need for customer orientation and product availability, hence they strive to integrate all available sales channels from the view of consumers, as well as from the view of intra- and inter-organizational processes and structures [9–11]. This may hold advantages in customer loyalty and increased sales and revenue [4, 12], as well as increased operational efficiency [11].

This development is a much discussed field in marketing and sales management, but the potentials of integrated “eCommerce” and “B&M” supply chains progressively come into the minds of researchers and practitioners. As B&M supply chains show differences versus eCommerce supply chains [13] and are therefore hard to integrate, retailers tend to keep at least specific functions and departments isolated [14] while extending their business from single- into multi-channel. Only gradually, the advantages are becoming clear and retail companies begin to switch towards integrated omni-channel distribution systems with shared capacities and resources. Integrated supply chains may lead to increased efficiency due to inventory pooling, shorter lead times or reduced transport volumes [11]. The logistical challenge now is to efficiently manage an integrated logistics system in terms of the distribution network, inventory and capacity management and delivery planning and execution [10]. Integration of stores as logistics facilities, which formerly operate exclusively as a point of sale, state advantages from a customer’s point of view [12] but also a challenge from an operational perspective [10, 15]. Summarized, omni-channel retail strives to integrate all available sales and distribution channels, leading to complex and interrelated supply chain configurations [10] - all this under the conditions of constant and channel-independent high service levels at lowest possible cost.

Fashion retailing is an international industry with a high division of labour, characterised by strong competition, short product life cycles, high volatility, low predictability and impulsive buying behaviour [8, 16]. Fashion retailers sell either exclusively or to a very large extent fashion products which, according to Christopher et al (2004), contain “an element of style which is likely to be short-lived” [8]. This retail segment is reliant on short lead times and cost reduction due to short trend cycles [17], in the case of fast fashion companies up to 24 seasons per year [18]. Fast fashion companies (such as H&M, Zara, Uniqlo, Asos or Boohoo) strive to satisfy consumer demand at its peak [19], hence have more seasons than traditional fashion companies [18], have to cope with very unpredictable demands [20] and therefore “reduce the processes involved in the buying cycle and lead times” [19]. Due to the short lead time and supply chain responsiveness required, the production of fast fashion products is carried out closer to the places of demand [19]. The relationships with the suppliers are not very pronounced, so that it is possible to

switch between them quickly [20]. The supply chains are correspondingly complex. Traditional retailers primarily sell seasonal fashion and basic fashion whose product life cycles are typically longer, hence, these companies can produce in more distant countries and maintain longer relationships with a number of core suppliers [20]. While fast fashion companies have strong control over the supply chain and often integrate vertically [21], traditional retailers tend to focus on their core competencies of design, sourcing and distribution [20]. However, for fashion retail in general, flexibility and responsiveness, especially in logistics structures, increasingly becomes an immense source of competitive advantages [20, 22, 23]. Against this background, it becomes clear that the synergetic integration of online and offline sales and distribution channels is of great importance for the competitiveness of fashion companies.

The packaging system, i.e. the formation of logistics units (including e.g. boxes, pallets, handlebars, containers, as well as labels), is existent in almost every logistics process and is of rising importance in eCommerce, not only since the vastly growing number of outbound shipping volumes and related cost and service aspects. However, packaging systems have been explored scarcely in the context of omni-channel retail research so far, especially regarding logistics. As online sales increase, packaging volumes increase due to the nature of small order sizes in B2C-retail. The worldwide parcel market has delivered about 75 billion parcels in 2017 and growth is estimated up to 100 billion parcels until 2020 [24]. High return rates in eCommerce, especially for fashion products, which were the most frequently returned goods in Europe in 2018 [25], support the growth of the parcel business. As consumers are increasingly unwilling to pay for shipping cost, stating an important criterion for the choice of a retailer [26], the retailers’ revenue is directly linked to forward and backward distribution costs. The total expenses for packaging material and packaging processes are often not transparent, as a variety of aspects needs to be considered. Being a core element in the supply chain, the packaging system directly influences cost efficiency. The packed unit creates the first physical contact with the consumer and also impacts the ecological footprint of the retailer [27, 28]. Challenges can be identified e.g. in the areas of warehouse productivity, insufficient volume utilization, product damage due to improper packaging functionality and non-transparent cost accounting [29]. In the light of omni-channel distribution, one persisting aspect, similar in each distribution configuration, is the product and its packaging, which have the potential of being a cross-channel integrator [30].

The remainder of the paper is structured as follows: In the following section, a brief literature review is given, as well as the scope of research and the research questions are described. Following, the methodology applied is illustrated. Next, the results gathered are

presented, guided by dimensions emerged from the data. The following section discusses the findings in the light of existing literature by presenting the theoretical contribution and managerial implications. This leads to six distinct propositions for forming a theory around omni-channel packaging logistics. Finally, we continue to discuss open research gaps.

2. LITERATURE REVIEW, RESEARCH QUESTIONS AND SCOPE OF RESEARCH

Literature review

There is an increasing body of literature connected with the challenges of integrated logistics systems, arising from omni-channel retail. Swaminathan and Tayur [31], Agatz et al. [32] and Galipoglu et al. [33] reviewed existing literature of e-Commerce, multi-channel and omni-channel supply chains. Several papers [34–37] develop frameworks for categorizing distribution networks and delivery modes in omni-channel supply chains. Huebner et al. [3], Agnihotri [35] and Cao [36] explore the challenge when transforming from a multi-channel to an omni-channel (logistics) approach. Xing et al. [38], Lim et al. [39] and Murfield et al. [40] analyse the implications for logistics service providers in OC-distribution. The operational challenges of integrating e-Commerce and B&M supply chains are discussed in terms of inventory (re-)allocation [41, 42], picking processes [34], vehicle routing [43] and warehouse design [10].

There is also a solid literary basis in the field of packaging systems in logistics systems (for a detailed literature review, see Azzi et al. [44]). Different company divisions impose requirements on the packaging system and thus influence it. Marketing and logistics are of particular relevance. The former requires foremost an attractive design to capture the attention of customers and to promote the brand image [45–47]. The latter demands a focus on an efficient logistics process. In addition, production departments and product development also have an influence on packaging design [28, 45, 48]. These different requirements often lead to conflicting objectives on company levels [48]. In the context of a supply chain, the design of the packaging system becomes even more complex as more actors with different requirements are involved [28]. The logistics perspective is comparatively new and illustrates significant efficiency gains and thus cost savings through increased cooperation between packaging design and logistics [49, 50]. From a logistics perspective, packaging protects the products during distribution, facilitates handling and transport, makes them storable and manipulable, and can be used to transmit information [44, 48, 51]. From a holistic perspective, the packaging system is subdivided hierarchically into the levels of primary packaging (the

packaging directly surrounding the product), secondary packaging (containing several primary packages or serving as transport packaging in eCommerce) and tertiary packaging (different secondary or primary packaging units on a pallet or roll container) [27, 28]. The interplay of all levels need to be considered for efficient distribution throughout the supply chain [28].

In retail supply chains, packaging plays an important role both as marketing and logistics medium. Packaging was investigated for traditional B&M [e.g. 16, 41–43], as well as for eCommerce configurations [e.g. 15]. It becomes clear that the most important requisite across both sales channels is the protective function. In addition, compatibility with automatic logistics processes is becoming increasingly significant [55]. In the B&M sales channel, simple handling at the point of sale (e.g. opening perforations on secondary packaging) and an attractive appearance are decisive [55]. This also applies to the eCommerce sales channel, where the transport packaging must be easy to open. In addition, the returnability of the packaging is an important factor [27]. However, the mutual implications between packaging and omni-channel distribution systems have not yet been investigated sufficiently and lack in-depth analysis and understanding. In our research we could only identify one paper [30] which explicitly deals with packaging in omni-channel distribution systems in more detail. Barnes explores the role of the packaging system from a marketing and logistics point of view. From a marketing perspective, he discusses how customer purchasing behaviour affects different sales channels and how this determines the packaging system. Logistically, he points out that the fragmented and complex omni-channel distribution systems challenge the packaging system with regard to its protective function and the cost and environmental perspective. Moreover, he concludes that the packaging system, as it is present in every sales and logistics channel, might have the potential of being a channel integrator. The technology connectable with the packaging (QR- or Bar-Codes, Smart Paper, Augmented Reality, etc.) represents, although still in an early development phase, a linking element between the virtual and physical world.

Scope of Research

As the topic is not much explored, we need to further narrow down the research field (Figure 1).

Accordingly, we limit our research to five dimensions:

- **Discipline:** As mentioned above, packaging is connected with marketing, production, product development and logistics. Further, other aspects like environmental impact or ethics can be considered [45]. Each of these fields can be an interesting topic for further research in the light of omni-channel retail. However, we focus exclusively on logistics aspects.

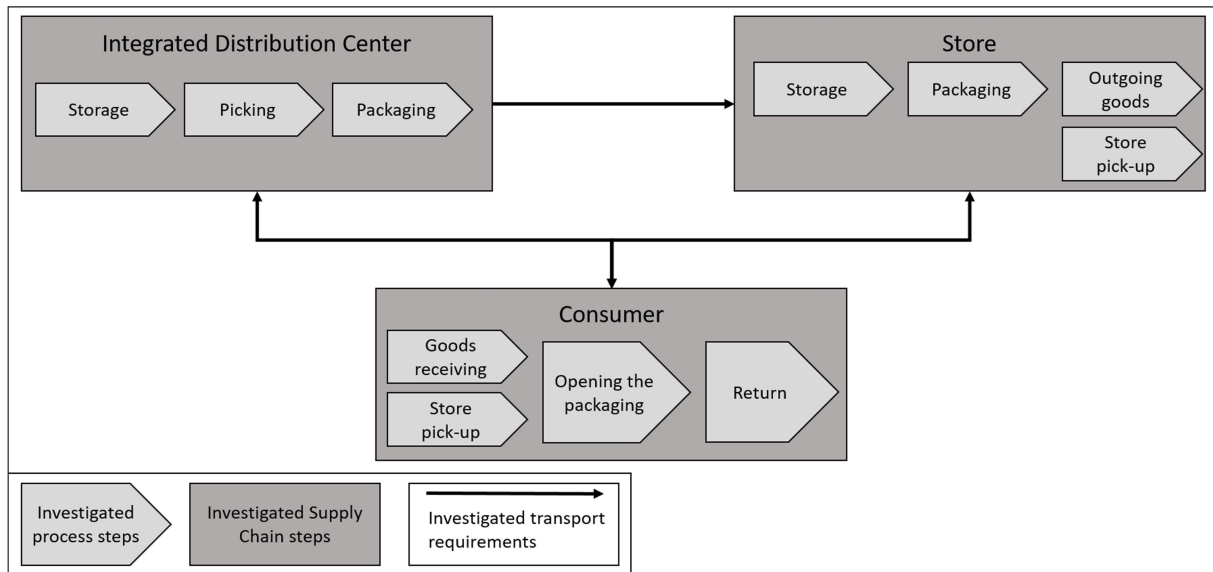


Figure 1: Scope of research

- **Retail sector:** Due to their individual contexts, different retail sectors have different characteristics with regard to their (omni-channel) logistics configurations [10]. We focus our research on former B&M fashion companies and exclude fast fashion companies. We do so, as the business models and respective distribution structures and processes are quite different (see section I) and analysing both in parallel would lead to unclear results.
- **Supply chain area:** Retail companies act as intermediaries between suppliers and (end) customers, receiving goods, composing them according to customer demands, and making them available to customers via stores or shipping channels [56]. In our analysis, we focus on the packaging design for end customer delivery with the respective store replenishment cycles.
- **Omni-channel delivery form:** Customers expect “channel-independent logistics”, so that purchasing as well as returns can be carried out via all available distribution channels [57]. In addition, a high level of service is required in terms of delivery time and availability of goods [36, 57]. In order to meet this requirement, various channel configurations are available in the customer frontend (e.g. Click&Collect, Click&Reserve, Return-to-Store, etc.) and logistics backend (Dark Stores, Ship-from-Store, Integrated and Separated DCs, etc.) [3, 10]. When investigating the interrelationships between the omni-channel distribution processes and the packaging system, in the backend we limit ourselves to integrated DCs and Ship-from-Store solutions. In the customer frontend we concentrate on Click&Collect (with order picking at DC level).

- **Packaging level:** Due to the above-mentioned focus on end customer delivery and delivery forms, in our study we deal in particular with primary packaging, as well as secondary packaging in the form of transport packaging for eCommerce and store replenishment.

Research Questions

Even though there is an increasing number of publications on the topic of omni-channel logistics, the role of packaging systems in retail supply chains, as well as a first approach to connect both, there is still a research gap. This leads us to the following two research questions:

RQ1: What role does packaging play in omni-channel fashion retail supply chains now and in the future?

RQ2: Which challenges do omni-channel fashion retailers and associated supply chain actors face regarding packaging and how do they handle them?

3. METHODOLOGY

We used a qualitative research study approach. We consider qualitative research as appropriate for the study, as the role of packaging in omni-channel distribution is a little explored field in research with limited conceptual basis to build up on. Qualitative research is appropriate for unexplored research areas [58, 59], in particular suitable for generating new theoretical perspectives in retail logistics and supply chain management [60]. As primary source of information, we used in-depth expert interviews. Interviewing experts is a common

method for data collection as experts have a detailed knowledge of processes and can give valuable insights into companies and their strategic intentions [58]. For triangulating our gathered results, we included further market data from relevant companies in the field of omni-channel retail, parcel delivery and packaging manufacturing [61]. In order to use an interpretative research approach, we gave voice to managers actually dealing with packaging in omni-channel logistics and further interpreted the data gathered in a first-order analysis [62]. Our task as researchers is to gain deeper theories in the form of second-order interpretations from the results obtained [63]. In a third analysis step, we grouped our second order themes into aggregated dimensions by examining the relationship among first-order concepts and second order themes. This helped us to condense a set of complementary groups, highlighting different aspects of packaging in omni-channel logistics.

Data Collection

For getting insights into the field, at least three dimensions need to be taken into account. As we focus on logistics, these are the perspectives of retail companies, parcel service providers and packaging manufacturers. To provide these perspectives, we used multiple sources of data, including market data, newspaper articles and face-to-face interviews with the main actors in the distribution process. Table 1 gives an overview on the data collection process.

Market data

For selecting appropriate interview partners, we collected market data connected with the packaging perspective in omni-channel logistics. We included the last three annual reports, as well as websites, newsletters, strategic papers and so forth from the 25 highest grossing omni-channel retailers in Germany.

The same was practiced with the data from the five biggest Parcel Logistics Providers worldwide, as well as from five globally operating packaging manufacturing companies with a strong focus on end-consumer packaging. The data were analysed with regard to the concrete terms (in English and German) “packag*”, “parcel”, “box”, “omni” and “multi”. In a first step, the importance companies attach to the packaging system in general and to it in the context of omni-channel retail in particular should become clear. The role of packaging, at least in the annual reports, was not much addressed by retailers and parcel service providers. Retailers associated packaging in particular with sustainability, brand image and cost aspects. Parcel service providers also mentioned traceability, product protection and the packaging dimensions and weight as associations. Packaging manufacturers, on the contrary, mentioned a range of functionality, as well as customer and market requirements associated with the packaging system. The connection between omni-channel retail and the packaging system was not discussed further in the annual reports. This underlines that an explorative study based on expert interviews is necessary. However, these documents and the gained knowledge, especially from the packaging manufacturers, helped to facilitate discussion with the interviewees.

Expert Interviews

In order to determine the relevance, role, requirements and success factors of the packaging system in omni-channel distribution, nine semi-structured interviews were conducted with experts from retail, parcel services, sustainable logistics and the packaging industry. The experiences of practice experts are highly relevant as data sources because they are well informed about current practices and future challenges [60, 64]. All interview partners have at least 5 years

Timeline	Source of data	Explanations
May 18 – Jul 18	Market data	Annual reports and websites of top 25 omni-channel retailers (Germany), top 5 parcel service providers (globally) and top 5 packaging manufacturers (globally)
Jul 18 – Sep 18	Expert interviews	Interviews with executives from – Omni-channel retail (4) – Packaging manufacturers (2) – Logistics service providers (1)
Sep 18 – Dec 19	Further market data	Enriched market data published in the meantime, professional journals, etc.
Oct 19	Expert interviews	Interviews with experts from – Logistics service providers (1) – Sustainable logistics (1)

Table 1: Timeline of the data collection process

of experience, have a senior position in the immediate logistics environment and are firm with the concepts and challenges of omni-channel retail.

An overview of the participating companies and interviewees is provided in Table 2.

Due to the distances between interviewer and interviewee, six interviews were conducted over the phone and three were conducted face-to-face. The interviews lasted 45 minutes on average. An abbreviated version of the interview guide is attached in Appendix 1. The guidelines for the interviews were roughly sorted into three sections:

- i. **Introduction**, in which the interviewee was asked about his understanding of omni-channel retail, the packaging system and its elements, as well as the distribution channel, its structure, and the connections between packaging and distribution.,
- ii. **Relationship between packaging and (oc-) distribution system**, in which the requirements and functionality of packaging systems were examined in the context of omni-channel retail in general, as well as relevant metrics and success variables were inquired, and
- iii. **Specific packaging system configuration in omni-channel distribution systems**, in which the concrete design of the packaging system for different omni-channel services and the most important packaging functionalities for this were interrogated.

However, the interview itself was held freely and questions could be asked at any time, in order to allow the conversation to flow naturally [65]. The interviews were recorded and later on transcribed. Field notes were written during the questioning and discussed directly after the interview. At least two researchers coded and interpreted each interview to guarantee objectivity.

Data Analysis

As stated by Alvesson and Kärreman [66] “data is inextricably fused with theory”, which is why we neither followed deductive logic nor followed a strict grounded theory approach. To gain a deeper knowledge about packaging in omni-channel logistics, we cycled among data, emerging theory, and relevant literature. During the analysis, the data obtained were coded and categorised (Miles et al., 2013) using the qualitative data analysis software “QDA-Miner 2” to form relevant categories for the purpose of building a theory of packaging systems in omni-channel distribution (Trautrimis et al., 2012). The data gathered were coded and categorized until preliminary theoretical saturation was reached [67]. This is the case as soon as the codes repeat themselves frequently, patterns emerge and the additional experiences gained through the interviews become negligible. Two researchers coded the data independently from each other, followed by a discussion in the complete research group, to ensure objectivity and trustworthiness [68, 69].

In a first analysis step, we coded the interview and meeting transcripts into a detailed coding scheme consisting of relevant terms, phrases and descriptions [62]. This allows traceability from the individual code to the original source. Further, we consolidated them, into 22 first order categories, based on underlying similarities between them [69]. By means of axial coding, we searched for relationships between and among the first order categories to form 8 second-order categories, which allowed us to view the data at a higher level of theoretical abstraction [69]. By examining the relationships among first-order concepts and second-order themes, we were able to emerge three aggregated dimensions. Figure 2 shows the data structure and our first order concepts, second order themes and the aggregated dimensions.

Company	Sector	Role of interviewee
1	Fashion retailer	Director logistics
2	Department store	Head of logistics
3	Retail consulting	Managing Director
4	Retail consulting	Head of logistics
5	Packaging manufacturer	Head of e-commerce solutions
6	Packaging manufacturer	Marketing Director
7	Parcel service provider	Sales Director International & Retail
8	Transport services	Senior Consultant
9	Sustainable logistics	Senior Consultant

Table 2: Overview of interviewees



Figure 2: First order concepts, second order themes and aggregated dimensions

4. EMPIRICAL FINDINGS

In this section, the role of the packaging system in omni-channel distribution is analysed according to the empirical results gathered. The results shown are based on the experiences and actual operations of different actors involved, unless otherwise indicated. Our aim is to find out about the role of packaging in integrated omni-channel fashion distribution settings, and about the challenges and initial solutions of omni-channel retailers and their associated supply chain partners

regarding the interplay of packaging and omni-channel distribution.

The results of the first dimension examine the factors influencing the design of packaging systems in omni-channel supply chains. The results obtained here can (unless otherwise indicated) be applied to all omni-channel distribution configurations. The second dimension analyses the interplay between packaging and specific omni-channel distribution processes. We focus here, if not indicated otherwise, on integrated DC settings and ship-from-store distribution structures.

The last dimension investigates how the packaging system now and in the future may support the integration of logistics and sales channels, as well as other supply chain actors.

Omni-channel packaging system design considerations

Protecting goods in the distribution process

The main task of the packaging system in every (omni-channel) logistics scenario is to protect the goods to be distributed. Adapting the stability of the packaging to the goods to be shipped is crucial, to at least withstand the average logistics handling processes.

The protective function must also be considered in the context of returns, especially in the light of further increasing returns rates. The transport packaging to be used must at least enable an undamaged reverse transport, as otherwise a subsequent inventory return at the retail company as an “A article” cannot be guaranteed.

One trend that all experts have taken up in this context is the flexible adaptable shipping packaging, which can be individually adjusted to the shipment volume. Such manually and automatically adaptive packaging protects the product better during distribution. In addition, filling material can be saved, which often only serves the purpose of preventing the individual articles from moving inside the transport packaging.

Setting up the packaging system for heightening the unboxing experience

Omni-channel retail aims to generate a seamless customer experience across all channels, hence a retailer’s brand image should be consistent across all channels. The reception experience of a distance shipment is therefore becoming increasingly important. This is made up from the actual reception process, the condition of the shipment when it is received and ultimately the opening experience.

“For the customer, the aspect of the receiving experience is becoming increasingly important. This plays a role both at the level of the reception process, i.e. how well a customer gets his goods, and at the level of the packaging condition itself.”
– Company 7

For an omni-channel retailer, the opening experience is particularly important, as it represents a first image of the company. The three topics “Branding”, “Security and Price Labels” and “Polybag” were identified as relevant in the context of the packaging system in omni-channel distribution.

Branding: The interviewees disagreed as to whether the brand logo should already be present on the shipping unit or not. As an advantage, offensively displaying the brand logo may result in a higher reception experience, because the customer is excited about the arrival of the

shipment. On the contrary, there could be an increased risk of theft, especially with luxury retailers. Further, elaborately designed packaging solutions can get marks of usage during distribution and thus cause an opposite, negative customer perception. A possible approach to increase customer satisfaction is the use of internal packaging printing. This could also compensate for the two disadvantages mentioned above.

Security and Price Labels: When using “Ship-from-Store”, as well as integrated DC solutions, the same inventory is used for both the distance channel and the stationary channel. Regarding the security and price labels, there are different requirements in the respective sales channels. Stores require security labels to protect against theft, which are removed at the cash registers. In contrast, customers who find security labels in their distance orders are dissatisfied and in most cases return at least the affected product, if not the entire shipment. Price labels are also necessary at stores for the customers, but unnecessary for distance customers. If the labels are attached to the goods and both channels are served from one common inventory, distance customers may receive products with a different price indication than paid in the online channel. Customers who pay a higher price in distance selling than the one indicated on the product react dissatisfied. In contrast, they are satisfied if there is a higher price on the price label than originally paid.

Polybag as primary packaging: The polybag, especially with textiles, is usually already attached to the goods when delivered by the suppliers to protect the products. For the store presentation this primary packaging is initially removed by warehouse employees to store them “ready-for-shelf”. In distance selling, in contrast, the premise currently applies that customers regard this polybag as a proof of new goods. The conflicting requirements lead to additional logistics processes in integrated DC configurations, as reversal activities are necessary at the outgoing goods are on DC level. The retailers interviewed are currently testing tissue paper as a replacement for the polybag, but disagree here as to whether this represents a procedural relief.

Designing the packaging system for customer convenience

A relevant point in retail is the aspect of “customer convenience”. In the context of packaging, this concerns the opening of the packaging, the possible return and the first contact at the handover point.

Convenient opening and return: Customers demand packaging that is easy to open. For some years now, there have been easy-to-use opening mechanisms for this purpose, which are either used or manufactured by the interviewed companies themselves. A less popular issue is that the shipping packaging is frequently used as return packaging. This is an argument against the widely used polybag in the fashion industry, which tears easily when opened, thus making returns more

difficult for the customer and often leading to increased use of packaging material (e.g. parcel tape). In the context of returns, the majority of interviewees spoke of adaptable folding boxes. These can be manually reduced in volume by the customer. This functionality is useful for fashion products which differ in size. Customers tend to order several sizes with the intention of keeping only some of them. Adjustable packaging can avoid excessive air-transport that would otherwise be generated.

Channel-adequate packaging: A challenge for the retail companies interviewed regarding omni-channel packaging is the store pickup. Although in some cases the respondents use the store inventory to satisfy distance orders, mostly they use warehouse inventory. From a process perspective, the Click&Collect orders are treated as distance orders in the warehouse and sent to the stores via CEP providers, where they are stored in the shipping packaging. This may not be the ideal pick-up format for the customer as it forces them to carry an unhandy parcel back home. Hence, retailers observe customers unpacking the shipment at the store, try them and take only the goods they want and those they fit with them. For this purpose, the medium of a bag is preferred.

Establishing sustainable packaging solutions

The subject of sustainability affects the packaging system on various levels. In particular, the interviewed companies are currently dealing with the aspects of plastic packaging, incompletely filled transport packaging and unpacked shipments at store pick-ups.

Plastic packaging: The usage of polybags as transport packaging is politically and medially controversial. The manufacturers of packaging materials pointed out that cardboard packaging also contains environmentally unfriendly substances. These are in particular the adhesives used, which are often not produced in an environmentally compatible way on a starch basis. The general statement of environmentally friendly cardboard packaging must therefore be critically questioned. The usage of polybags makes sense depending on the case, as shipment volumes can be saved, positively impacting on the ecology.

“The [sustainability] discussion is a recurring theme in industry, especially after the switch from plastic to folding boxes in the context of the “Think of your plastic use” debate. [...]. The folding box is not much more sustainable, because even in cardboard packaging there are materials and ingredients that are not environmentally friendly. [...] The use of polybags makes sense in some cases and should not be demonised in general.”

– Company 5

Incompletely filled transport packaging: In distance channels, transport shipments which are not adapted to the volume of the products to be shipped are a frequently

mentioned phenomenon. This results in unnecessarily large volumes in all logistics processes, which is ecologically and economically disadvantageous. This is another benefit of flexibly adaptable transport packaging or polybags. As already mentioned, the phenomenon of too large transport packaging for returns is also counteracted by adjustable packaging solutions. By using these packaging systems across companies, relevant transport volumes could be reduced in the future and hence the transport distances travelled in the long term, at least on CEP main runs.

Avoiding packaging at store pick-ups: From the perspective of the retail companies interviewed, the use of the stores as pick-up stations offers the possibility of partially avoiding disposable packaging. The avoidance of packaging will become increasingly important in the future, as new legal regulations regarding (packaging) waste recycling have been in force in Germany since the beginning of 2019. These require both plastic and cardboard waste to be recycled to their raw materials at a higher rate. As this process is more expensive than thermal recycling, it is likely that costs will soon be allocated to distributors such as manufacturers and retail companies. As a result of direct customer pick-up of the goods, which, as already described, tend to prefer packaging appropriate to the channel, individual single-use transport packaging is not required in all cases. In the future, deliveries can be made using reusable containers, which are already being used for store replenishment. This, however, requires adjustments to store deliveries.

The packaging system in the omni-channel logistics process

Setting up packaging for efficient omni-channel distribution processes

The packaging system determines the logistics costs on two levels, as material expenses and process expenses. The material only accounts for a small portion of overall logistics cost. More important are the effects on distribution process efficiency, since packaging determines the logistics process costs at almost all points and for all actors involved in the supply chain. Hence, the packaging system must always be viewed in the context of total costs.

“Packaging must always be seen in the context of total cost, not just as a negligible cost factor. [...]. This includes, in particular, transport, handling and return costs. [...]. Ultimately, it is important to check which costs are incurred due to inefficient packaging. Our experience here has shown that packaging that is individually tailored to the logistics system and thus enables efficient logistics processes can result in savings of 30-40%.”

– Company 5

Primary packaging in integrated DC-solutions: Packaging enables simplified handling and automation in DCs. Automated processes are limited without primary packaging, especially with fashion goods in the form of polybags. Without the homogeneous structure of the packaging, the effort in the logistics processes for heterogeneous products increases. Conveyor belts and suction robots for textiles were mentioned here as examples. In addition, primary packaging in warehouses protects the products during mechanical logistics processes and long storage times.

Regarding omni-channel distribution, the packaging system poses a major challenge in integrated DC solutions, as there are different requirements for stationary and distance channels. As one common inventory is used for both, the storage condition already needs to be selected at goods receiving, usually the required one of the channel with the higher share of sales. This is heightening the logistics complexity, as in some cases, additional or reversal packaging activities need to be performed. This is especially with fashion products. The goods are delivered by the supplier with polybags, which are removed at goods receiving to store them “ready-for-shelf”. For using the same inventory in the distance channel, the polybag needs to be attached again in the dispatch area, as customers demand primary packaging as a quality seal of new goods. Therefore, additional processes are necessary, to fulfil this specification. Moreover, different types of polybags need to be stored at the dispatch tables, leading to higher space requirements. The same problem also applies to returns, which have to be put back into stock. At the time of goods receipt, it is not clear in which channel the article will be remarketed. Accordingly, additional effort may be required to put the product back into stock, only to ultimately reverse these activities.

Retailers increasingly use tissue paper as primary packaging, but they disagree as to whether this will bring about a procedural improvement. However, this is easier to attach to the products, has lower space requirements and is heightening the unboxing experience for customers, as it looks high quality. In the case of security and price labels, process inefficiencies are obvious, as they are either already attached by the supplier or are attached at retailers’ goods receiving areas. As described above, the requirements towards both differ in the stationary and distance channels, stating a challenge in integrated DC solutions. At dispatch, a detailed examination of every product to be shipped is necessary. Although there are automated solutions for security labels, they do not guarantee 100% recognition. For price labels, a manual inspection is also necessary, which slows down the packaging process. None of the retailers surveyed found a more efficient solution to this problem at this point.

Flexible secondary packaging: A further factor in the context of efficient logistics systems are potential savings through adaptive packaging solutions with

regard to a lower damage rate, lower capital costs and simplified logistics effort at the dispatch tables. This is because fewer different types of packaging have to be stored in the warehouse. Moreover, less packaging assortment has to be kept at the dispatch tables, reducing spatial requirements and lowering complexity for dispatch employees. In terms of transport, packaging systems not tailored to the shipment lead to excessive “air transport” and thus to inefficiencies in the entire transport system. Flexible packaging solutions may be a good solution for both challenges and may be applied in any (omni-channel) retail logistics system.

Efficient packaging for Click&Collect delivery: Stores serve as logistical hubs in omni-channel distribution systems, either as pick-up or as distance order fulfilment location. As stated above, current logistics processes lead to channel inadequate packaging solutions for Click&Collect, as they are treated as distance orders. They are delivered via CEP providers with standard packaging solutions. Accordingly, packaging material and transport cost is used unnecessarily for a channel-inadequate packaging. The changeover to a delivery system, either by means of a specially created transport system or by integration into the store replenishment process, is being considered in the short to medium term, but is not in practical use by any of the companies interviewed. Organizational challenges at employee level were also mentioned in this context. Unsealed transport containers reserved for Click&Collect customers could be used by employees without authorisation for serving store customers. This would make Click&Collect customers dissatisfied, as they would only be able to pick up a portion of their goods ordered. However, the change from current practices to a system with reusable packaging and existent store replenishment may increase backend complexity but also increase distribution efficiency. This is because of savings in transport and packaging cost, higher customer convenience in terms of channel-appropriate packaging for Click&Collect, as well as possible reduction of environmental pollution.

Mind Ship-from-Store in omni-channel distribution when setting up the packaging system

By integrating the sales and logistics channels into omni-channel retail, the store is taking over a logistics functionality in addition to its role as a point of sale. The interviewed companies, especially the retail companies, called the omni-channel functionality “Ship-from-Store” in the context of the packaging system challenging, regarding limited space in stores and the responsible employees.

Limited space in stores: Both the technical solutions typically used in warehouses and the variety of packaging types kept are restricted in stores due to spatial limitations. Hence, packaging types must be found that can be easily used without automation and can cover a wide range of different shipment structures. As a possible solution, flexibly adaptable packaging

and polybags are being tested at store level, which can be adjusted manually. These require little space, can be flexibly adapted to the shipment to be sent and, at least the polybags, are easy to handle.

“For Ship-from-Store, we need a simple, at best flexible, packaging standard that can be used for a wide range of different shipments. Folding boxes, which can be reduced in height, could be a good approach here. Polybags are also a thankful thing that should be used where they make sense. Polybags take up very little space and are very easy to handle and set up.” – Company 2

Filling material, which is typically produced by machines in warehouses, is also not available to the same extent for stores. Retailers therefore try to avoid filling material at store level if possible.

Ultimately, the packaging system limits the selection of orders that can be sent from the store. Hence, distance shipments need to be supplied from both decentralised and central stocks. This means that either partial shipments are necessary or consolidation at a central point is required.

Employee dimension: “Ship-from-Store” requires employees to carry out the logistics activities at the store. A common approach is to utilise existing store employees for this purpose, especially if the throughput for store shipments is still low. In this context, employees like sales associates are currently carrying out packaging activities only as a secondary task in most cases and therefore have little experience in this area. Accordingly, the packaging solutions to be used have to be easy to handle. The polybag is one such type of packaging.

In this dimension, it should also be noted that due to the decentralized structure of Ship-from-Store, there is a risk of different packaging qualities. This bears the potential of dissatisfaction among distance customers and ultimately higher return rates.

“Increasing return rates can be a problem when using Ship-from-Store, as the different stores produce different packaging qualities.” – Company 2

Packaging as integrator between channels

Consider universal packaging for different channel requirements

The requirements on the packaging system for distance channel and stationary channel are different. The integration of the stores into the logistics system as a logistics hub adds further complexity to the packaging system. The diversity makes a full integration of the different logistics channels difficult and leads to inefficiency in the entire logistics system due to parallel packaging systems.

“[T]he integration of the different channels in the meaning of “seamless integration” is actually more prevented by [different requirements on] the packaging system.” – Company 4

To achieve seamless integration from the retailer’s and customer’s point of view, packaging systems must be developed which meet the different requirements of the different sales channels in parallel. To avoid or mitigate this duality, packaging manufacturers and logistics service providers in particular see potential in the primary packaging of products. These are currently mainly designed for an attractive appearance, but not for the protective function necessary to enable logistics processes. If it is possible to develop a packaging solution that meets both the visual requirements of the store and the logistical requirements of distance shipping, the duality of the packaging system can be eliminated, at least for individual shipments with only one order item at a time. This requires a rethinking during product development, which will require parallel packaging design in the future.

From the point of view of the interviewed experts, two aspects have to be considered in detail – the selection of suitable products and the product development cycle.

Selection of suitable products: To develop a packaging that has both logistics and aesthetic characteristics, so that it can be used universally for all channels, is not worthwhile for all product categories. Products that have a low value can be excluded, as can those that are perishable in nature. Nor does it make sense to develop this for products which traditionally have a particularly high share of sales in stationary sales channels – e.g. groceries. Also, products with completely different presentations in the different channels – e.g. clothing – are omitted. For the development of a universal packaging such products are predestined to which the mentioned restrictions do not apply and which are dispatched in particular as single products. The interview partners identified bulky items such as electronic products.

Product development cycle: As the design of the primary packaging takes place at the manufacturer, for setting up universal packaging, product development is of particular importance. So as to meet the conflicting requirements for an integrated, cross-company packaging solution, some experts consider it necessary to involve packaging designers right from the start of product development. A jointly defined catalogue of requirements of all involved supply chain actors, focusing on the end customer, may have the potential of an integrated packaging system for all respective sales channels.

“The new [omni-channel retail-driven] retail logistics requirements cannot be met by the individual logistics players alone, but require a global approach that involves them all and focuses on the needs of the customer.” – Company 5

Although the experts agreed that a common approach could be beneficial, they were sceptical about its implementation. It is questionable who will be the initiator of such a project and who will be responsible for it. It also remained open whether all actors would like to join forces in this way.

The packaging system as integrator between the flow of information and the flow of goods

The packaging system is usually the first point of contact for all players and all instances of the supply chain. By means of identification features (barcodes, QR codes, RFID, etc.) attached to the shipping unit, various information about the shipment can be stored and retrieved. Accordingly, the packaging system, in interaction with internal and external databases, is the interface through which the physical goods are coupled with virtual information. Accurate and real-time information about the shipment, its location, the products it contains and additional information are already and will become increasingly important in the future. From the retailers' point of view, this information is particularly important at the interfaces between suppliers and central warehouses, and during all transport processes involving CEP providers.

Supplier-Warehouse-Interface: To identify, prioritize, and efficiently put away incoming shipments at goods receiving, warehouses (or stores in the case of store delivery) require information about the contained products. This information is currently transmitted to the interviewed retail companies via a scanning process using the barcode. However, the problem is that not all suppliers are able to use the barcode standard, which is why the shipment information is transferred using paper-based delivery notes. This leads to additional effort in goods receipt, as the packaging first has to be opened, the delivery note has to be manually checked and transferred to the retailer's own enterprise resource planning system by hand. This process is time-consuming, ties up employee resources and ultimately prevents fast customer delivery in case of drop shipping and out-of-stock situations.

CEP-Providers: CEP providers take over store supply for "Click&Collect", distance orders from stores and distribution warehouses, as well as the returns of distance customers to the return destination. For CEP providers, the packaging system, respectively the shipping label on it, represents the interface for the shipment information. The location and status of the shipment can be identified by regular scanning processes in the distribution structures. This is also important for the customers, as they can call up this information using the shipment number and the tracking systems of common parcel services. By this they are informed about arrival times and possible delivery complications.

Customers: The packaging functionality as an information carrier offers the potential to provide

comprehensive information virtually, which today is provided by package inserts. This bears advantages for manufacturers and retailers, as paper can be saved. Moreover, they no longer have to keep different package inserts in case of different sales countries. The decisive factor here is customer acceptance, which can be achieved through easy access and usability.

"The area of "connectivity" in the context of packaging will offer further potential in the future. This can be seen in the real-time checking of the shipment status, which is already working well. In addition, it also offers the potential to get away from the entire package leaflet and provides product information on the Internet. The packaging then serves as access and interface between the physical product and the virtually stored information." – Company 5

5. DISCUSSION AND THEORETICAL CONTRIBUTION

In this section, the main findings are discussed in the light of literature. The aim of this paper is to identify the current and future role of packaging in omni-channel distribution, focusing on fashion retail. We examined the challenges of omni-channel retailers and associated supply chain partners regarding packaging when integrating the sales and logistics channels. Furthermore, we identified initial solutions used and examined by the companies to tackle them. We contribute through this study to three main issues.

- (1) We identified challenges regarding the packaging system when integrating the distribution network in omni-channel fashion retailing.
- (2) We determined the role of primary and shipping packaging for efficient omni-channel distribution and finally,
- (3) showed future considerations for designing packaging in omni-channel distribution.

An overview of the main results in the form of empirically identified propositions is shown in Figure 3 using a schematic illustration of an omni-channel distribution system.

(1) The results of our research show different requirements for the packaging system in distance shipping, as well as stationary sales and logistics channels for fashion goods. Especially omni-channel retailers in fashion industry tend to integrate their distribution centres in terms of facilities, processes and inventory [10]. Advantages are synergy effects regarding inventory pooling [70, 71]. Downsides are operational challenges due to complex, mainly intra-warehouse related, processes [e.g. 23,45]. We contribute to the literature, as we deepened the existing

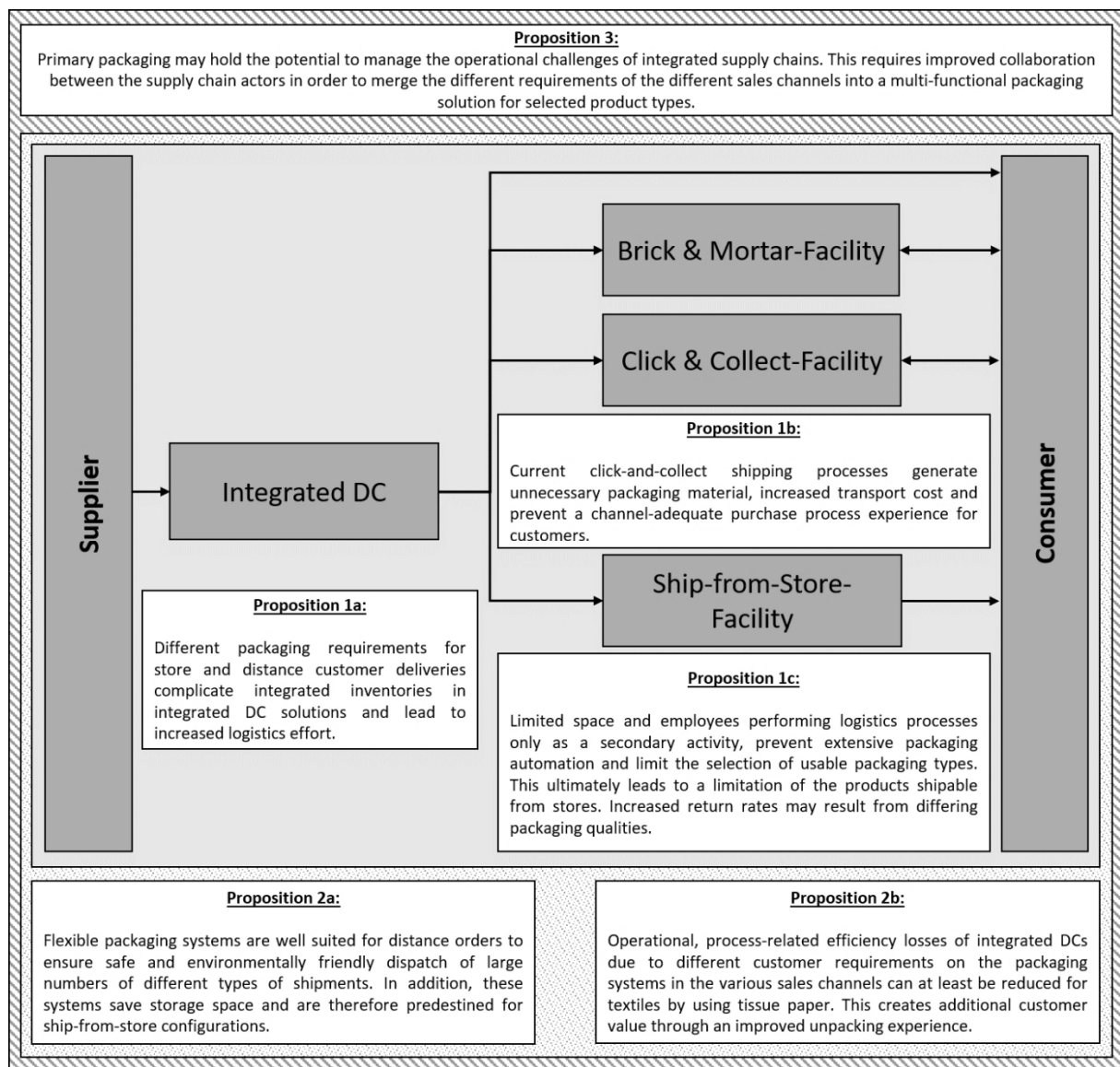


Figure 3: Challenges, solution approaches and future considerations of the packaging system in omni-channel distribution

knowledge about operational processes necessary for integrated DC-solutions in fashion supply chains. To supply both channels from one common stock structure, additional packaging processes are necessary for dispatch provision. In order to relieve stores from the process work, textiles are already freed from primary packaging during putaway and stored for “ready-for-shelf” delivery. Distance customers, however, require such primary packaging as a proof of new goods, especially for fashion products, as unworn goods are expected. Accordingly, additional handling is necessary to repack goods into a primary packaging in the outgoing goods area. Similar complications arise in the case of price and security labels, both of which are already present or attached during storage. These are necessary for store display, but can lead to dissatisfaction with distance customers. The

managerial implication of this result is to consider the additional logistics effort of packaging in integrated DC-solutions. Depending on the companies’ situation, a separate eCommerce DC may be considered to allow efficiency gains for both channels. Based on the previous argumentation, we formulate the following proposition:

Pla: Different packaging requirements for store and distance customer deliveries complicate integrated inventories in integrated DC solutions and lead to increased logistics effort.

The store has an essential role in omni-channel retailing [57], serving both as pick-up and distance order fulfilment location [3, 10, 73, 74]. In fashion

retail, using stores as logistics facilities is promising, as often seasonal goods are only stored at store level and shorter delivery times can be achieved. On the contrary, operational and cost related challenges arise in this type of delivery concept [10]. Our empirical results give a more detailed perspective to the operational challenges at store level when performing omni-channel distribution.

Packaging systems in the context of store pickups: As one of the basic omni-channel service, “Click&Collect” enables customers to pick up goods ordered online at a store of their choice [75]. Advantages of this service are increased customer convenience, as customers get an additional delivery option. Goods ordered online may be tested directly in stores. From the retailer’s point of view, savings can result for the last mile delivery as well as increased traffic in the stores [3, 10]. Challenges are operational in nature. Additional areas have to be reserved for pick-up. Additional employees have to be planned for service. Moreover, few companies have been able to send Click&Collect orders with alternative, specific transport systems, avoiding CEP providers, which require transport packaging [75]. The *theoretical contribution* of this paper lies in a more detailed understanding of customer requirements regarding packaging in context of Click&Collect in fashion retail. Currently, customers who use Click&Collect often receive regular shipping packaging at the store. However, this may be unhandy and not suitable for convenient pickup. As a result, customers in the store tend to open the packaging, test the goods directly and then only take home those they want and those they fit. The medium used for this is a bag or even no packaging at all. Accordingly, unnecessary packaging is used in the logistics process. The *implication for practice* is to re-design pick-up stations at store level, offering direct testing possibilities, simple return options and suitable packaging solutions for convenient pick-up, for heightening customer satisfaction. The usage of reusable transport containers for Click&Collect, which are delivered with store replenishment transports, should be considered. Changing the current Click&Collect processes state a major challenge, as the own fleet must be used and the store replenishment cycles need to be adjusted accordingly. Furthermore, boxes must be sealed to prevent employees from removing goods for store sales. The following proposition is derived from the results:

PIb: Current Click&Collect shipping processes generate unnecessary packaging material, increased transport cost and prevent a channel-adequate purchase process experience for customers if the package originates in the DC.

Packaging systems in the context of Ship-from-Store: Using stores as a fulfilment location for distance orders is a frequently addressed topic in academic literature [e.g. 6,27,47–52]. Since stores are not designed for

logistics processes, they are not efficient in terms of picking and packaging [10]. However, this configuration allows the entire inventory of the retailer to be made accessible for both distance shipments and other stores, thus offering the advantage of increased product availability [e.g. 48]. Moreover, in fashion industry with their roots in stationary retail, fast changing, seasonal clothing products are pushed to the stores and DC inventory for those is low [10]. Our empirical results *contribute to the literature* with a better understanding of the operational challenges as well as a better understanding of the packaging requirements at store level. It became clear that not the entire inventory of all stores can be used for online orders, as only a limited range of packaging materials can be stored. This ultimately restricts the number of shipment types, fulfilled by the store. Orders containing other products must be processed by upstream supply chain instances. Furthermore, large-scale use of automation typical for DC packaging systems is precluded. Particularly in the start-up phase of Ship-from-Store, sales employees will carry out logistics processes, not being trained to do so. This states a limiting factor for usable packaging types and may lead to different qualities of shipping packaging, which may ultimately result in higher return rates. *Practical implication* is a detailed revision of the assortment at the retailers for deciding which products are to be sent from the store and which are not. It is necessary to determine packaging types that allow the highest possible number of different distance shipment types and are also easy and manual to operate. Only such packaging should then be kept at store level. We derive the following proposition from the previous arguments:

PIc: Limited space and employees performing logistics processes only as a secondary activity, prevent extensive packaging automation and limit the selection of usable packaging types. This ultimately leads to a limitation of the products shippable from stores. Increased return rates may result from differing packaging qualities.

(2) Besides the challenges regarding packaging in omni-channel distribution our empirical results identified packaging system solution approaches used by retailers to increase logistics efficiency and enable channel integration. It was shown that both flexible packaging systems and alternative primary packaging help to meet the challenges presented.

Flexible Packaging: Packaging systems are determining the performance of logistics systems [51, 79] and influence the costs of each logistics activity [80]. In particular, they influence warehousing and transport processes [81]. Packaging has to fulfil various functionalities, in particular protection of goods, product promotion, convenient handling and storing of products and cargo space utilization [82]. We *contribute to the literature* by showing that the

packaging systems currently utilized in omni-channel distribution are often inadequate from an ecological and efficiency point of view. This applies not only to fashion retail, but also to distance retail as a whole. For covering the various shipment structures, a large number of different packaging types is required. Despite this diversity, often oversized packaging continues to be used for distance shipping. This leads to a poorer protective function, increased use of filling material and unnecessarily high volumes, which are transported through the entire supply chain. This also applies to returns, as customers often place a distance order with the intention of keeping only part of it and returning the rest. This in turn can be observed particularly frequently in the fashion industry. We show that flexible packaging may be suitable for counteracting both forward and backward distribution challenges. Although these solutions are more expensive than standard packaging, our empirical results suggest that this is amortized by a smaller packaging spectrum which must be kept available, the elimination of filling material and a lower damage rate. Since a smaller range of flexible packaging can cover a larger spectrum of different shipments, flexible packaging is a promising solution for Ship-from-Store. Shipping packages that can be reduced in size are also useful for returns, as the customer can manually reduce them to the correct size. This saves freight capacity at transport companies and adds an environmental component that may enhance the brand image of a retailer. This leads to the *managerial implication* which suggests retailers to examine their packaging solutions more closely. Especially during the integration of stores as a shipping location, the introduction of flexible packaging systems could enable the efficient use of most of the store inventory for distance shipments. It is also conceivable that, due to a lower weight-volume ratio, better parcel prices will be enforceable with parcel service providers. To achieve this, it is necessary for this to be verifiable lower in the long term. Scaled to cross-company use, the overall transport volume can be reduced in the future, thus also reducing transport distances, at least in the CEP main runs. We conclude the following proposition:

P2a: Flexible packaging systems are well suited for distance orders to ensure safe and environmentally friendly dispatch of large numbers of different types of shipments. In addition, these systems save storage space and are therefore predestined for Ship-from-Store configurations.

Primary packaging in omni-channel distribution: The different requirements towards packaging in integrated DCs are heightening operational complexity and leading to higher logistics effort. This underlines the results, posed by Huebner et al. [3, 34], which examined the network design considerations in omni-channel retail. At this point it is unclear if a complete integration of the processes in an integrated

warehouse is the final goal of an omni-channel logistics strategy. The *theoretical contribution* of our empirical investigation brings the component of primary packaging into consideration. Our research showed for fashion products that customers in stationary retail prefer unpacked goods, whereas in distance channels they want primary packaging. As shown above, this poses intralogistics challenges and additional processes. To reduce the arising complexity, retailers increasingly use tissue paper as a primary packaging solution in distance channels. On the one hand, this reduces complex processes to generate a distance shipment from an integrated inventory stored “ready-for-shelf”. This is due to the fact that a few sheets of tissue paper can cover the majority of all fashion shipments, whereas a large number of different primary packaging has to be kept in stock when polybags are chosen as primary packaging. Nevertheless, returning products back into any sort of primary packaging, be it a polybag or tissue paper, states extra process effort. From a customer point of view, tissue paper is preferable, as it looks high quality and can therefore replace the polybag. Also from an (at least customer-oriented) environmental point of view, tissue paper is preferable to plastic packaging. Another approach to overcome the procedural challenge could be a joint cross-channel storage zone. In this area, products could initially be stored unspecifically regarding primary packaging. Only after the goods are required, they are then transferred to a channel-specific picking zone where they are processed according to the respective packaging requirements of the distribution channel. From a *managerial perspective*, our results imply that the packaging system and associated processes must increasingly be taken into account when considering the integration of channels, especially their inventories. The use of tissue paper should be considered as it can reduce operational complexity (especially for fashion) and furthermore provide added value from the customer’s point of view. We conclude the following proposition:

P2b: Operational, process-related efficiency losses of integrated DCs due to different customer requirements on the packaging systems in the various sales channels can at least be reduced for textiles by using tissue paper. This creates additional customer value through an improved unpacking experience.

(3) *More collaboration between the supply chain partners to develop a universal packaging for integrated channels:* The reason for enhanced collaboration between the individual supply chain players in retail is that shared resources create a competitive advantage [83]. The integration of suppliers as additional shipping locations in an omni-channel distribution system increases the availability of goods and the available assortment, as well as the

reduction of capital and process costs [10]. However, the required increase in data exchange can lead to customer dissatisfaction and potentially generate higher transport costs [10]. In omni-channel configurations, suppliers either distribute directly to the distribution centres of retail companies, the stores, or the end customers [72, 77, 84]. We *contribute to the literature* by adding the aspect of collaboration in omni-channel retail with regards to primary packaging. It has already become clear that, due to different requirements for packaging in the distance and stationary channels, the channel integration leads to operational challenges for logistics. Transport packaging currently has the two main functions of protecting goods and consolidating multi-position orders. Considering the fact that the current shipment structure increasingly tends towards small consignments, particularly the packaging manufacturers raise the question of whether primary packaging will not be able to meet both optical store requirements and protective distance requirements for individual shipments in the future. In this context, the importance of stronger collaboration and integration of the supply chain members in omni-channel retail becomes clear. In order to achieve an efficient and seamless integration of the sales channels, upstream suppliers may be leveraged as omni-channel enablers. In the future, it may be important to develop packaging, suitable for both stores and eCommerce, during product design. This can lead to lower packaging consumption in the entire supply chain and reduce or eliminate parallel processes at retail DC levels. For this it is necessary that the packaging requirements are identified from the point of view of the manufacturer, the retailer, the logistics service provider and the customer. The collected catalogue of requirements then needs to be integrated in the product design. This approach is not only limited to fashion retail, but can also be applied in other retail sectors. Whether such an approach is ultimately implemented depends on the fact that all actors also have an added value. Moreover, one authority with enough power to influence all necessary supply chain parties needs to assume the responsibility. The *managerial implication* lies in suggesting a more holistic view towards the packaging system and to encourage all supply chain members to more participation. Moreover, a detailed analysis of suitable products for universal packaging is necessary.

P3: Primary packaging may hold the potential to manage the operational challenges of integrated supply chains. This requires improved collaboration between the supply chain actors in order to merge the different requirements of the different sales channels into a multi-functional packaging solution for selected product types.

5. CONCLUSION AND FURTHER AREAS OF RESEARCH

The logistical challenges of omni-channel retailing are a relatively new field of research in literature, facing in particular the distribution network with its facilities, inventories and capacities. Operational challenges of integrated channels are scarcely examined. This also includes the packaging system, which is omnipresent in all omni-channel distribution configurations. With our empirical research we aim to provide a foundation for this field of research. We examine the role of packaging in selected omni-channel configurations and the associated challenges retailers and their supply chain partners face when integrating the channels. As this field of research is little covered, we use an empirical research approach to find out the current state of practice. We concentrated on omni-channel fashion retailing and the logistics challenges regarding packaging in the consumer distribution. Moreover, by involving packaging manufacturers and experts from transport services, we were also able to generate generalizable statements regarding the use of flexible packaging systems and future development considerations for a packaging solution that can be used across channels.

Our main findings can be summarised as follows: The requirements of the different sales channels and their respective customers regarding packaging in fashion retail are different. Integrated logistics infrastructures and resources serving all omni-channel options lead to additional processes for packaging at the DC level. One critical factor is primary packaging. At the store level, packaging systems are a challenge, since the current logistics processes for Click&Collect lead to channel-inadequate and thus not customer-oriented pick-up solutions and cause unnecessary packaging waste and transport costs. The packaging system for Ship-from-Store services is limited by spatial and employee-related restrictions. A possible solution to the primary packaging problem is currently the use of tissue paper as a substitute for the polybag, which is used for distance shipments. To enable channel-adequate packaging solutions for Click&Collect, companies are currently working on converting their existing processes – avoiding CEP providers while establishing specific transport solutions capable of handling reusable packaging solutions. For enabling lower capital employed and lower inventory costs for the broad spectrum of packaging assortments to be held in stock, as well as to reduce air-transport at distance shipments, flexible packaging solutions adaptable to the volume of shipments are of increasing importance. Such solutions can also be useful for Ship-from-Store concepts, since a large number of shipments can be processed with a limited number of packaging types. However, the packaging system represents a restriction for the selection of Ship-from-Store orders. In total, it turned out that the packaging system in its current form

interferes with the integration of logistics channels. Hence, new solutions have to be established. One possible approach is the development of a universally applicable packaging system for all channels that fulfils the visual requirements of the store as well as the logistics requirements of distance shipments in parallel. Intensified collaboration of the different actors of the supply chain is necessary in order to create a common catalogue of requirements and to already integrate this into the product development phase.

Overall, we were surprised that so far little research has been done about the packaging system in integrated retail logistics systems. The ubiquitous presence of packaging, taking into account the different requirements in each channel, is a strategic and operational challenge in channel integration that deserves more attention. We were particularly impressed by the packaging manufacturers' forward-looking thinking, especially the idea that channel integration should start at supplier level. We also found the idea of cross-channel packaging interesting. We are of the opinion that both aspects should be further investigated in the future.

Limitations of our empirical investigations allow further in-depth analyses for future research. First, our research was conducted with experts operating in Germany and Austria. Accordingly, the geographical and quantitative component represents a limitation of the research. With regard to integrated DCs and the role of stores, we consider that the results should be transferrable, but further research may yield different findings, especially in countries with different shipment structures or different levels of omni-channel maturity. Secondly, we have worked with a small group of experts from fashion retail, packaging manufacturing and logistics service. Therefore, only a limited overview can be given about the role of the packaging system in omni-channel distribution systems. Further research with a larger and more diverse group of retailers and their supply chain partners can provide further insights into the utilization, challenges and packaging solutions in omni-channel distribution. Third, the research was limited to fashion retailers and their associated partners. Another interesting field could be grocery retail distribution, which is a complex system with different packaging requirements. Fourth, the aspect of profitability and measurable efficiency in the interaction between the packaging system and the omni-channel distribution system was not further investigated. More accurate quantitative models are available as a research field for future studies. Overall, other research methods may be used to investigate the role of packaging in omni-channel distribution systems.

BIBLIOGRAPHY

1. Lipsman A (2019) Global Ecommerce 2019. <https://www.emarketer.com/content/global-ecommerce-2019>. Accessed 13 Dec 2019
2. Statista (2019) Apparel - Worldwide. <https://www.statista.com/outlook/900000000/100/apparel/worldwide>. Accessed 13 Dec 2019
3. Hübner A, Wollenburg J, Holzapfel A (2016) Retail logistics in the transition from multi-channel to omni-channel. *Int J Phys Distrib Logist Manag* 46:562–583. <https://doi.org/10.1108/IJPDLM-08-2015-0179>
4. Wollenburg J, Holzapfel A, Hübner A, Kuhn H (2018) Configuring Retail Fulfillment Processes for Omni-Channel Customer Steering. *Int J Electron Commer* 22:540–575. <https://doi.org/10.1080/10864415.2018.1485085>
5. Beck N, Rygl D (2015) Categorization of multiple channel retailing in Multi-, Cross-, and Omni-Channel Retailing for retailers and retailing. *J Retail Consum Serv* 27:170–178. <https://doi.org/10.1016/j.jretconser.2015.08.001>
6. Brynjolfsson E, Hu YJ, Rahman MS (2013) Competing in the Age of Omnichannel Retailing. *MIT Sloan Manag Rev* 54:23–29. <https://doi.org/http://dx.doi.org/10.1108/17506200710779521>
7. Saghir S, Wilding R, Mena C, Bourlakis M (2017) Toward a three-dimensional framework for omni-channel. *J Bus Res* 77:53–67. <https://doi.org/10.1016/j.jbusres.2017.03.025>
8. Christopher M, Lowson R, Peck H (2004) Creating agile supply chains in the fashion industry. *Int J Retail Distrib Manag* 32:367–376. <https://doi.org/10.1108/09590550410546188>
9. Rigby D (2011) The Future of Shopping. *Harv Bus Rev* 89:65–76
10. Hübner A, Holzapfel A, Kuhn H (2016) Distribution systems in omni-channel retailing. *Bus Res* 9:255–296. <https://doi.org/10.1007/s40685-016-0034-7>
11. Wollenburg J, Hübner A, Kuhn H, Trautrim A (2018) From bricks-and-mortar to bricks-and-clicks. *Int J Phys Distrib Logist Manag* 48:IJPDLM-10-2016-0290. <https://doi.org/10.1108/IJPDLM-10-2016-0290>
12. Herhausen D, Binder J, Schoegel M, Herrmann A (2015) Integrating Bricks with Clicks: Retailer-Level and Channel-Level Outcomes of Online-Offline Channel Integration. *J Retail* 91:309–325. <https://doi.org/10.1016/j.jretai.2014.12.009>
13. Metters R, Walton S (2007) Strategic supply chain choices for multi-channel Internet retailers. *Serv Bus* 1:317–331. <https://doi.org/10.1007/s11628-006-0016-5>
14. Gallino S, Moreno A (2014) Integration of Online and Offline Channels in Retail: The Impact of Sharing Reliable Inventory Availability

- Information. *Manage Sci* 60:1434–1451. <https://doi.org/10.1287/mnsc.2014.1951>
15. Freichel SLK, Wörtge JK (2018) Facility design in omni-channel retail: A logistics point of view. In: Proceedings of the 18th international scientific conference “Business Logistics in Modern Management.” Josip Juraj Strossmayer University of Osijek, Faculty of Economics, Osijek, Croatia, pp 243–263
 16. Čiarnienė R, Vienažindienė M (2014) Agility and Responsiveness Managing Fashion Supply Chain. *Procedia - Soc Behav Sci* 150:1012–1019. <https://doi.org/10.1016/j.sbspro.2014.09.113>
 17. Masson R, Iosif L, Mackerron G, Fernie J (2007) Managing complexity in agile global fashion industry supply chains. *Int J Logist Manag* 18:238–254. <https://doi.org/10.1108/09574090710816959>
 18. Remy N, Speelman E, Swartz S (2016) Style that’s sustainable: A new fast-fashion formula. In: McKinsey. <https://www.mckinsey.com/business-functions/sustainability/our-insights/style-thats-sustainable-a-new-fast-fashion-formula#>. Accessed 13 Dec 2019
 19. Barnes L, Lea-Greenwood G (2006) Fast fashioning the supply chain: Shaping the research agenda. *J Fash Mark Manag An Int J* 10:259–271. <https://doi.org/10.1108/13612020610679259>
 20. Perry P, Wood S (2019) Exploring the International Fashion Supply Chain and Corporate Social Responsibility: Cost, Responsiveness and Ethical Implications. In: Fernie J, Sparks L (eds) *Logistics and Retail Management*, 5th ed. Kogan Page, London, New York and New Delhi, pp 97–127
 21. Bureau L (2017) From Traditional to Fast Fashion Retail: The Supply Chain Transition. <https://www.logisticsbureau.com/traditional-to-fast-fashion-retail/>. Accessed 10 Dec 2019
 22. Chan ATL, Ngai EWT, Moon KKL (2017) The effects of strategic and manufacturing flexibilities and supply chain agility on firm performance in the fashion industry. *Eur J Oper Res* 259:486–499. <https://doi.org/10.1016/j.ejor.2016.11.006>
 23. Turker D, Altuntas C (2014) Sustainable supply chain management in the fast fashion industry: An analysis of corporate reports. *Eur Manag J* 32:837–849. <https://doi.org/10.1016/j.emj.2014.02.001>
 24. Pitney Bowes (2018) Pitney Bowes Parcel Shipping Index. <https://www.pitneybowes.com/content/dam/pitneybowes/us/en/shipping-index/pitney-bowes-parcel-shipping-index-infographic-2018.jpg>. Accessed 12 Jul 2019
 25. PostNord (2018) E-commerce in Europe 2018. Stockholm
 26. JDA & Centiro (2017) Customer Pulse 2017. http://now.jda.com/rs/366-TWM-779/images/JDA_and_Centiro_Customer_Pulse_Report_2017_UK.pdf
 27. Palsson H (2018) *Packaging Logistics: Understanding and Managing the Economic and Environmental Impacts of Packaging in Supply Chains*. Kogan Page Limited, London
 28. Hellström D, Saghir M (2007) Packaging and logistics interactions in retail supply chains. *Packag Technol Sci* 20:197–216. <https://doi.org/10.1002/pts.754>
 29. Ströhmer M (2009) Verpackung in der Logistik: Ein wichtiger Effizienzfaktor
 30. Barnes C (2016) Omni-Channel Retail-Challenges and Opportunities for Packaging Innovation. In: Burgess P (ed) *Integrating the Packaging and Product Experience in Food and Beverages: A Road-Map to Consumer Satisfaction*. Woodhead Publishing, Amsterdam, et al., pp 59–76
 31. Swaminathan JM, Tayur SR (2003) Models for Supply Chains in E-Business. *Manage Sci* 49:1387–1406. <https://doi.org/10.1287/mnsc.49.10.1387.17309>
 32. Agatz NAH, Fleischmann M, van Nunen JAE (2008) E-fulfillment and multi-channel distribution – A review. *Eur J Oper Res* 187:339–356. <https://doi.org/10.1016/j.ejor.2007.04.024>
 33. Galipoglu E, Kotzab H, Teller C, et al (2018) Omni-channel retailing research – state of the art and intellectual foundation. *Int J Phys Distrib Logist Manag* 48:365–390. <https://doi.org/10.1108/IJPDLM-10-2016-0292>
 34. Hübner A, Holzapfel A, Kuhn H (2015) Operations management in multi-channel retailing: an exploratory study. *Oper Manag Res* 8:84–100. <https://doi.org/10.1007/s12063-015-0101-9>
 35. Agnihotri A (2015) Can Brick-and-Mortar Retailers Successfully Become Multichannel Retailers? *J Mark Channels* 22:62–73. <https://doi.org/10.1080/1046669X.2015.978702>
 36. Cao L (2014) Business Model Transformation in Moving to a Cross-Channel Retail Strategy: A Case Study. *Int J Electron Commer* 18:69–96. <https://doi.org/10.2753/JEC1086-4415180403>
 37. Ishfaq R, Defee CC, Gibson BJ, Raja U (2016) Realignment of the physical distribution process in omni-channel fulfillment. *Int J Phys Distrib Logist Manag* 46:543–561. <https://doi.org/10.1108/IJPDLM-02-2015-0032>
 38. Xing Y, Grant DB, McKinnon AC, Fernie J (2011) The interface between retailers and logistics service providers in the online market. *Eur J Mark* 45:334–357. <https://doi.org/10.1108/03090561111107221>
 39. Lim SFWT, Rabinovich E, Rogers DS, Lasester TM (2016) Last-mile Supply Network Distribution in Omnichannel Retailing: A Configuration-Based Typology. *Found Trends® Technol Inf Oper Manag* 10:1–87. <https://doi.org/10.1561/02000000045>
 40. Murfield M, Boone CA, Rutner P, Thomas R (2017) Investigating logistics service quality in

- omni-channel retailing. *Int J Phys Distrib Logist Manag* 47:263–296. <https://doi.org/10.1108/IJPDLM-06-2016-0161>
41. Gallino S, Moreno A, Stamatopoulos I (2017) Channel Integration, Sales Dispersion, and Inventory Management. *Manage Sci* 63:2813–2831. <https://doi.org/10.1287/mnsc.2016.2479>
 42. Bendoly E (2004) Integrated inventory pooling for firms servicing both on-line and store demand. *Comput Oper Res* 31:1465–1480. [https://doi.org/10.1016/S0305-0548\(03\)00102-3](https://doi.org/10.1016/S0305-0548(03)00102-3)
 43. Aksen D, Altinkemer K (2008) A location-routing problem for the conversion to the “click-and-mortar” retailing: The static case. *Eur J Oper Res* 186:554–575. <https://doi.org/10.1016/j.ejor.2007.01.048>
 44. Azzi A, Battini D, Persona A, Sgarbossa F (2012) Packaging Design: General Framework and Research Agenda. *Packag Technol Sci* 25:435–456. <https://doi.org/10.1002/pts.993>
 45. Vernuccio M, Cozzolino A, Micheline L (2010) An exploratory study of marketing, logistics, and ethics in packaging innovation. *Eur J Innov Manag* 13:333–354. <https://doi.org/10.1108/14601061011060157>
 46. Orth UR, Malkewitz K (2008) Holistic package design and consumer brand impressions. *J Mark* 72:64–81. <https://doi.org/10.1509/jmkg.72.3.64>
 47. Schoormans JPL, Robben HSJ (1997) The effect of new package design on product attention, categorization and evaluation. *J Econ Psychol* 18:271–287. [https://doi.org/10.1016/S0167-4870\(97\)00008-1](https://doi.org/10.1016/S0167-4870(97)00008-1)
 48. Prendergast G, Pitt L (1996) Packaging, marketing, logistics and the environment: are there trade-offs? *Int J Phys Distrib Logist Manag* 26:60–72. <https://doi.org/10.1108/9781786359513-037>
 49. García-Arca J, Prado-Prado JC, Antonio-García-Lorenzo (2006) Logistics improvement through packaging rationalization: a practical experience. *Packag Technol Sci* 19:303–308. <https://doi.org/10.1002/pts.723>
 50. Gustafsson K, Jönson G, Smith D, Sparks L (2005) Packaging logistics and retailers’ profitability: an IKEA case study. 13th Res Conf Eur Assoc Educ Res Commer Distrib July, Lund Univ Lund, Sweden 1–15
 51. Pfohl H-C (2018) *Logistiksysteme*, 9th ed. Springer Vieweg, Berlin
 52. Broekmeulen RACM, Sternbeck MG, van Donselaar KH, Kuhn H (2017) Decision support for selecting the optimal product unpacking location in a retail supply chain. *Eur J Oper Res* 259:84–99. <https://doi.org/10.1016/j.ejor.2016.09.054>
 53. Wensing T, Sternbeck MG, Kuhn H (2018) Optimizing case-pack sizes in the bricks-and-mortar retail trade. *OR Spectr* 40:913–944. <https://doi.org/10.1007/s00291-018-0515-5>
 54. Pålsson H, Hellström D (2016) Packaging logistics in supply chain practice – current state, trade-offs and improvement potential. *Int J Logist Res Appl* 19:351–368. <https://doi.org/10.1080/13675567.2015.1115472>
 55. EHI Retail Institute (2012) *Verpackungsanforderungen in der automatisierten Handelslogistik*. Köln
 56. Fernie J, Sparks L (2019) Retail logistics: Changes and Challenges. In: Fernie J, Sparks L (eds) *Logistics and retail management: emerging issues and new challenges in the retail supply chain*, 5th ed. KoganPage, London, New York and New Delhi, pp 1–34
 57. Piotrowicz W, Cuthbertson R (2014) Introduction to the Special Issue Information Technology in Retail: Toward Omnichannel Retailing. *Int J Electron Commer* 18:5–16. <https://doi.org/10.2753/JEC1086-4415180400>
 58. Creswell JW, Creswell JD (2018) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th ed. SAGE Publications, Los Angeles
 59. Yin RK (2018) *Case Study Research and Applications; Design and Methods*, 6th ed. SAGE Publications, Thousand Oaks, California
 60. Trautrimms A, Grant DB, Cunliffe AL, Wong C (2012) Using the “documentary method” to analyse qualitative data in logistics research. *Int J Phys Distrib Logist Manag* 42:828–842. <https://doi.org/10.1108/09600031211269776>
 61. Jick TD (1979) *Mixing Qualitative and Quantitative Methods: Triangulation in Action*. *Adm Sci Q* 24:602. <https://doi.org/10.2307/2392366>
 62. Maanen J Van (1979) The Fact of Fiction in Organizational Ethnography. *Adm Sci Q* 24:539. <https://doi.org/10.2307/2392360>
 63. Bryman A, Bell E (2015) *Business Research Methods*, 4th ed. Oxford University press, Oxford, United Kingdom
 64. Flynn BB, Kakibara SS, Schroeder RG, et al (1990) Empirical Research Methods in Operations Management. *J Oper Manag* 9:250–284
 65. Lindlof TR, Taylor BC (2011) *Qualitative Communication Research Methods*, 3rd ed. SAGE Publications, Los Angeles, et al.
 66. Alvesson M, Kärreman D (2007) Constructing mystery: Empirical matters in theory development. *Acad Manag Rev* 32:1265–1281. <https://doi.org/10.5465/amr.2007.26586822>
 67. Glaser BG, Strauss AL (1967) *The Discovery of Grounded Theory: strategies for qualitative research*. AldineTransaction, New Brunswick and London
 68. Eisenhardt KM (1989) Building Theories from Case Study Research. *Acad Manag Rev* 14:532. <https://doi.org/10.2307/258557>

69. Gioia DA, Corley KG, Hamilton AL (2014) Seeking Qualitative Rigor in Inductive Research. *Organ Res Methods* 16:15–31. <https://doi.org/10.1177/1094428112452151>
70. Mahar S, Bretthauer KM, Venkataramanan MA (2009) The value of virtual pooling in dual sales channel supply chains. *Eur J Oper Res* 192:561–575. <https://doi.org/10.1016/j.ejor.2007.09.034>
71. Bhatnagar A, Syam SS (2014) Allocating a hybrid retailer's assortment across retail stores: Bricks-and-mortar vs online. *J Bus Res* 67:1293–1302. <https://doi.org/10.1016/j.jbusres.2013.03.003>
72. de Koster R (Marinus) BM (2002) Distribution structures for food home shopping. *Int J Phys Distrib Logist Manag* 32:362–380. <https://doi.org/10.1108/09600030210434152>
73. Berman B, Thelen S (2004) A guide to developing and managing a well-integrated multi-channel retail strategy. *Int J Retail Distrib Manag* 32:147–156. <https://doi.org/10.1108/09590550410524939>
74. Lang G, Bressolles G (2013) Economic Performance and Customer Expectation in e-Fulfillment Systems: A Multi-Channel Retailer Perspective. *Supply Chain Forum Int J* 14:16–26. <https://doi.org/10.7137/scfj/14.1.16>
75. Hübner A, Kuhn H, Wollenburg J (2016) Last mile fulfilment and distribution in omni-channel grocery retailing. *Int J Retail Distrib Manag* 44:228–247. <https://doi.org/10.1108/IJRDM-11-2014-0154>
76. Alptekinoglu A, Tang CS (2005) A model for analyzing multi-channel distribution systems. *Eur J Oper Res* 163:802–824. <https://doi.org/10.1016/j.ejor.2003.11.005>
77. Bendoly E, Blocher D, Bretthauer KM, Venkataramanan MA (2007) Service and cost benefits through clicks-and-mortar integration: Implications for the centralization/decentralization debate. *Eur J Oper Res* 180:426–442. <https://doi.org/10.1016/j.ejor.2006.03.043>
78. Liu K, Zhou Y, Zhang Z (2010) Capacitated location model with online demand pooling in a multi-channel supply chain. *Eur J Oper Res* 207:218–231. <https://doi.org/10.1016/j.ejor.2010.04.029>
79. Fernie J, Sparks L (2009) Retail logistics: changes and challenges. In: Fernie J, Sparks L (eds) *Logistics and retail management: emerging issues and new challenges in the retail supply chain*, 2nd ed. Kogan Page, London and Sterling, VA, pp 1–25
80. Bowersox DJ, Closs DJ, Cooper MB, Bowersox JC (2013) *Supply Chain Logistics Management*, 4th ed. McGraw-Hill, New York
81. Fernie J, McKinnon A (2003) The grocery supply chain in the UK: improving efficiency in the logistics network. *Int Rev Retail Distrib Consum Res* 13:161–174. <https://doi.org/10.1080/0959396032000051693>
82. Rushton A, Croucher P, Baker P (2017) *The Handbook of Logistics and Distribution Management*, 6th ed. KoganPage, London, New York and New Delhi
83. Sparks L (2010) Supply Chain Management and Retailing. *Supply Chain Forum Int J* 11:4–12. <https://doi.org/10.1111/j.1745-493X.2000.tb00084.x>
84. Kuhn H, Sternbeck MG (2013) Integrative retail logistics: An exploratory study. *Oper Manag Res* 6:2–18. <https://doi.org/10.1007/s12063-012-0075-9>

APPENDIX 1 – ABBREVIATED VERSION OF THE INTERVIEW GUIDELINE

1. Introduction

- What does “omni-channel retail” mean to you?
- What are the logistical challenges of omni-channel retail?
- What does it mean to be successful as an omni-channel retailer?
- Which connections exist in your opinion between the packaging system elements and the distribution system structure?

2. Relationship between packaging and (OC) distribution systems in general

- Which role does the packaging system have in omni-channel distribution?
- Which requirements are placed on the packaging system in omni-channel distribution by the different Supply Chain actors and instances?
- How is the packaging system designed to meet your logistics and sales requirements?
- How can the packaging system support the success of an omni-channel strategy now and in the future? What modifications are required?

3. Specific packaging system configurations

- Which omni-channel services state which challenges for the packaging system?
- How does the packaging system need to be designed in order to meet those challenges?