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ORIGINAL RESEARCH

Distribution systems in omni-channel retailing

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Abstract The growing importance of online sales means that traditional bricks-and-mortar retailers need to create new distribution systems to serve customers through multiple channels. Building an effective and efficient omni-channel (OC) distribution system, however, leads to multiple challenges. The questions arise for example, from where online orders should be fulfilled, how delivery and return processes can be organized, and which context-specific OC distribution systems exist. Answering these questions retail research and practice require an overall view of the distribution concepts for direct-to-customer and store deliveries in OC retailing, including the associated return processes. This overall picture is still missing in the literature. We conducted an exploratory study to close this observable gap in the literature. This exploratory study is based on semi-structured interviews with major OC retailers in German-speaking countries and was complemented by market data research and discussions with further experts in the field of OC retailing. Based on the results of the study, the forward distribution system in OC retailing is characterized by the sources (supplier DCs, retailer DCs, stores) and destinations (home, store) which describe the options for store delivery, home delivery, and store pickup. Return processes are likewise characterized by the sources (store, home) and destinations (store, DC, return center). This framework forms the foundation for analyzing contextual criteria, identifying when the different conceptual designs are applied, determining industry-specific characteristics,

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and illustrating ways to further advance OC retailing. The present paper, therefore, contributes to the literature in three main areas: (1) it identifies and systematizes the forward and backward concepts in OC retailing, (2) it reveals application and development areas for achieving excellence in OC fulfillment and logistics, and (3) shows the need for developing sector- and context-specific OC distribution systems.

Keywords Omni-channel retailing · Retail supply chain management · Logistics archetypes · Exploratory study

1 Introduction

The share of online sales in retail is growing globally (Biggs and Suhren 2013; Forrester 2014). It is driven by an increase in sales in existing online channels, as well as by the ongoing market entry of bricks-and-mortar retailers into e-commerce. As retailing develops towards a seamless omni-channel (OC) shopping experience, the distinctions between physical bricks-and-mortar stores and webshops will vanish (Brynjolfsson et al. 2013). This OC revolution was triggered by the recent reaction of bricks-and-mortar retailers to the new service offers from pure online retailers (Banker and Cooke 2013). The majority of bricks-and-mortar retailers, therefore, now serve customers via multiple sales channels. Additionally, distance retailers, such as pure online players, are establishing physical stores to expand their service offerings (PwC 2013; Verhoef et al. 2015).

The growing number of channels also increases complexity from a logistics point of view (Handfield et al. 2013). The fulfillment process is no longer linear, because bricks-and-mortar retailing is increasingly overlapping with distance retail (Beck and Rygl 2015). Before, supply chain management was responsible for delivering goods to a retail store. The store was the end point of the transaction (Baird and Kilcourse 2011). Online retailing has now placed distribution systems on the front line, since retailers need to offer a variety of options for finding, buying, and returning goods across bricks-and-mortar stores and webshops (Mercier et al. 2014; Bell et al. 2014). Bricks-and-mortar stores today are only one of a set of channels. With this new set of channels, retailers must simultaneously accommodate and anticipate demand and ensure availability, meet varying lead-times, and keep costs down for each channel (Handfield et al. 2013).

Essen and Leeuw (2013) show in their global report of 1000 webshops that product flows and logistics systems are not yet fully linked across channels. For example, less than 40 % of webshops that belong to a retailer with bricks-and-mortar stores offer the possibility of returning orders to the store. Similarly, store pickup of online orders is not provided by about 70 % of the retailers with multiple channels. These relatively low shares of cross-channel connections may not be surprising, as even the simplest form of cross-channel fulfillment leads to multiple challenges. For example, if a retailer offers buy online and pick-up in-store, it needs answers to questions such as where inventory will come from and will the products be picked in-store, in an e-commerce distribution center (DC) or in a bricks-and-mortar DC. Retailers rapidly find themselves descending into the midst of a strategic

review of their entire supply chain network (Baird and Kilcourse 2011). Moreover, customers demand perfect order fulfillment and are unwilling to listen to excuses (Handfield et al. 2013). This requires "real-time, channel agnostic visibility" across the distribution systems (EY 2015). It is not surprising, therefore, that four of five retailers believe their supply chain does not fit the purpose of OC retailing, and requires re-engineering of its physical product flows (EY 2015).

This requires OC retailers to set up connected physical flows of goods and operational structures across channels without sacrificing their business model due to growing complexity. Thereby retailers are increasingly facing the challenge of re-engineering their processes to enable seamless logistics across all channels. The Vice President SCM of an electronic retailer formulates this in the following way:

> *"Some rules of the game we had to learn in bricks-and-mortar business do no longer apply with the advent of e-business. We can no longer think in the bricks-and-mortar business model."*

To complicate matters, return logistics capabilities must be built up to manage the relevant volume of returns, because most online customers demand an easy and convenient way for returning their products (Handfield et al. 2013). All this requires distribution systems for forward and backward processes that serve customers in stores and simultaneously offer personal deliveries, e.g., store pickup and home deliveries, as well as in-store return of online orders. Integration across channels is changing and the challenge is to implement it in the most effective and efficient way, rather than deciding whether or not to do it (Gallino and Moreno 2014; Herhausen et al. 2015).

Due to these recent and ongoing transformational challenges, retail research and practice lack a structured view of the design options for OC distribution systems, because delivery and return options, and customer preferences are evolving over time. In particular, the field requires the generic systematization of goods distribution within multiple retail channels.

This includes an analysis of operational challenges, service impacts, contextual factors, and application areas for OC forward distribution and return concepts developed in retail practice. Practitioners are seeking guidance on how to merge these structures (PwC 2013; Mercier et al. 2014; Bell et al. 2014; Gallino and Moreno 2014). Kozlenkova et al. (2015) conclude from a literature review that multiple channel research is needed to optimize the system of different distribution configurations.

This paper, therefore, lays the groundwork for OC distribution systems and extends the literature, because it is the first study to provide a comprehensive perspective on OC distribution based on empirical data. The term "comprehensive" in our context refers to an overall perspective of the major OC retail sectors and all the subsystems in forward and backward distribution. We discuss the advancements in and the advantages and requirements of these concepts. Theoretical insight is gained from demonstrating how the addition of a new distribution channel can alter our understanding of retail logistics management.

To streamline distribution issues, we focus on non-food distribution, which differs fundamentally from food distribution in terms of its requirements (e.g., Kuhn

and Sternbeck 2013; Hübner et al. 2013b or Hübner et al. 2016a). Nowadays non-food is still the main sector for OC concepts (Forrester 2014). Non-food distribution is characterized by made-to-stock and non-perishable items that can be shipped regardless of freshness and temperature constraints. Non-food home delivery in Europe is usually fulfilled by carrier, express, and parcel providers (CEP), and without customers having to be at home (Fernie et al. 2009). As online retailing also displays country-specific patterns and shopping behavior and because of the different international delivery models, we concentrate on the largest European retail market, i.e., the German-speaking countries. This also allows a comparison of (national) logistics systems between retailers.

The remainder of this paper is organized as follows: Sect. 2 elaborates the setting for OC distribution. Afterwards Sect. 3 presents an overview of related literature and identifies the need for further research. We then present the methodology, the research process we employed, and the interview sample in Sect. 4. Sections 5 to 7 present the findings, identify relevant areas, systematize and discuss OC forward distribution and return concepts. Sections 8 and 9 summarize findings, relate them to the literature and discuss further areas of research.

2 Conceptual background and basic terminology

This section structures the research field by defining OC distribution, which is required before the related literature can be identified and analyzed (Kotzab et al. 2005). We compile current concepts of distribution in OC retailing (Meredith 1993) and define basic terms (Seuring et al. 2005).

We focus on the distribution concepts of retailers who operate both bricks-and-mortar stores and a distance channel, and refer to these retailers as "omni-channel" retailers. In practice, several different terms and definitions have been developed for retailing in multiple channels. Among others, "multi-channel", "cross-channel", and "omni-channel" are often used interchangeably and without clear distinction (Banker and Cooke 2013; Beck and Rygl 2015). However, Verhoef et al. (2015) claim that recent concepts from literature and practice tend towards seamless OC retailing, where the boundaries between physical and online retailing disappear (see Baird and Kilcourse 2011; Rigby 2011; Brynjolfsson et al. 2013; Beck and Rygl 2015). This definition of "omni-channel" is based on the customer's point of view. It underlines the difference between it and "multi-channel", where distance and bricks-and-mortar retailing do not overlap from a customer's perspective, even though a retailer operates in both fields. By this definition, the channels are not physically linked in multi-channel retailing.

Because we want to get the broadest possible view of the logistics systems relevant in practice, we refer to distribution in multiple channels as "omni-channel" distribution, since this is the overarching term and most advanced concept (Beck and Rygl 2015; Hübner et al. 2016a; Verhoef et al. 2015). Consequently, we investigate the structures and processes needed for OC distribution, where retailers aim to integrate operations and physical product flows to provide a seamless shopping experience (Brynjolfsson et al. 2013; Beck and Rygl 2015). The

overarching idea is to analyze the distribution systems that enable customers to complete a purchase and receive orders from any channel they choose. For example, a customer can buy a product in a webshop and choose either home delivery or in-store pickup, and may have similar options for product returns (see also Banker and Cooke 2013). Since we concentrate on operational distribution systems, we do not make a distinction between the customer interfaces for shopping, e.g., in-store, webshop, mobile commerce, catalog, or phone. We investigate how operations and logistics function for physical stores, the direct-to-customer channels, and the links between channels.

An OC retailer's distribution system encompasses not only the delivery of goods to stores and customers, but also backward distribution concepts, since products purchased online require options for customers to return products, if they do not want to keep them. As seen from the perspective of an OC retailer, the forward (1) and backward (2) distribution systems must therefore be taken into account.

(1) The forward distribution system is usually characterized by its sources (=dispatching locations), destinations (=points of reception) and associated links. To understand distribution systems within OC retailing, we need to consider the different types of sources (e.g., DCs and stores) and destinations (e.g., stores and customers) in the physical distribution structure, as well as possible delivery processes and modes, i.e., shipments to customers and stores (e.g., Fernie and Sparks 2009; Hübner et al. 2013a).
(2) The backward distribution system encompasses the physical flow of product returns from the customer to the retailer, and the locations where returns are processed (e.g., return centers) (Agatz et al., 2008). Backward distribution therefore covers shipments from customers and stores. An alternative name for this dimension would also be "returns" or "reverse logistics" (Fleischmann et al. 1997; Brito and Dekker 2004).

3 Related literature and research questions

The literature review follows the guidelines for systematic review (Fink 1998; Tranfield et al. 2003; Seuring et al. 2005; Kotzab et al. 2005). First, we defined the scope (as in Sect. 2), and then identified the related literature. The identification step included the material collection/selection and category selection (see 3.1). Finally, we completed a qualitative content analysis (see 3.2) (Mayring 2011). This builds the foundation to develop the research questions in 3.3. Prior to the literature review, we contacted a range of experts in practice and academia in the field of OC distribution to learn on what they believe are the relevant questions for both industry and research. These preliminary discussions helped to define the scope of the research and to set the boundaries of the literature search. We developed a review protocol, including a conceptual discussion of the research problem and a statement of its significance. Finally, we developed the research questions in multiple rounds by iterating literature reviews, updating the review protocol and conducting discussions with experts.

3.1 Literature collection/selection and category selection

The development of distribution concepts for OC retailing has emerged in practice very recently (see e.g., PwC 2013; EY 2015), and the number of related scientific publications is still limited. Against this backdrop, a structured literature review in the form of a qualitative content analysis is seen as a practicable method for obtaining evidence-based management knowledge (Easterby-Smith et al. 2008; Tranfield et al. 2003). Our systematic literature review covers two lines. First, because the topic is relatively new and discussed in practitioner-oriented forums, we conducted an Internet search in this field. Second, we conducted a search of peer-reviewed, international research journals.

The first search included a review of practitioner-oriented publications (without a peer-review process). The topic of OC retailing currently is a practice-driven effort. Most reports on related topics are published by consultants and associations. To get an updated view of the market, we therefore leverage these sources in our empirical findings.

The second search, completed simultaneously as an iterative review, included all major international journals that publish research on distribution management and/or OC retailing. Furthermore, we utilized initial search results from open databases (Google Scholar, ssrn), library service databases (Ebsco, Scopus, Metapress), and major publishers (Emeraldinsight, Informs, Sciencedirect, Springerlink, Taylor & Francis, Wiley), and checked literature cited in identified papers. Related keywords in the full text searches included all forms of e-tail, e-commerce, online-, cross-, multi-, omni-channel retailing, including plural forms (e.g., "channels"), delimiters (e.g., "omni-channel"), prefixes (e.g., "across"), and suffixes. All forms of the keywords from logistics relating to supply chain management, distribution, logistics, physical product flow and returns were also selected. The related keywords from retailing and logistics were combined for the search.

However, it is important in a literature review to define distinct boundaries (Seuring et al. 2005; Mayring 2011). Because we focus on operational systems, we excluded literature that strictly covers general management, marketing and service management issues, and does not discuss logistical aspects at all. This literature mainly addresses customer behavior in multiple channels and the organizational relations between channels. Furthermore, due to the advent of online commerce in the late nineties, we limited the search to issues published after 2000. Although OC retailing has some features that are related to pure online retailing, we excluded literature from single-channel e-commerce, since it is unclear how the requirements for online retailing will apply to OC (see also Agatz et al. 2008; Brynjolfsson et al. 2013; Bell et al. 2014). Because we focus on non-food retailing, we also excluded papers restricted to food distribution. We used a qualitative content analysis to identify the conceptual content that is related to our field of research (Ryan and Bernard 2000; Seuring et al. 2005; Mayring 2011). Papers were assessed based on whether they address problems of physical product flows and/or operational logistics interfaces between channels.

To increase the reliability of the research, databases, journals, and individual papers were checked by a second researcher and updated iteratively during the revision cycle of the paper by the entire team of authors.

3.2 Literature review

To structure the content analysis, the literature review distinguishes between the overarching structural dimensions of the forward and the backward distribution system (see also Sect. 2).

3.2.1 Literature on forward distribution

Swaminathan and Tayur (2003) identify in their review article that channel integration has advantages for supply chain management with respect to profit, inventory reduction, and customer service, but central control is necessary. They describe among other issues supplier relationships, pricing, customization, and real-time decision technologies that have grown in importance with the prevalence of e-business in traditional supply chain management. They present an overview of analytical research models for e-commerce supply chains. Inventory allocation and coordination constitute the major areas of their research, where distribution designs are already determined. Within the e-fulfillment context, Swaminathan and Tayur (2003) further review certain papers presenting drop-shipment strategies (i.e., direct deliveries from suppliers) and see those as a way of improving supply chain and inventory efficiency.

Within their literature review, Agatz et al. (2008) analyze among other topics the distribution network design. They systematize possible network designs into integrated fulfillment (common DCs for the different sales channels), dedicated fulfillment (dedicated DCs for the different sales channels), and store fulfillment. They point out the trade-off between inventory pooling and delivery efficiency. The models analyzed by Swaminathan and Tayur (2003) and Agatz et al. (2008) mainly take on a single-channel perspective, focusing on e-fulfillment. Agatz et al. (2008) therefore conclude that there is a lack of literature dealing with the logistics interactions between e-commerce and traditional retailing, thus missing a perspective across channels. Lang and Bressolles (2013) derive from the literature four different e-fulfillment systems for retailers that operate multiple channels. They structure it according to order preparation (in a central DC or store) and delivery to the customer (home delivery and pick-up in—store). The authors summarize their discussions with eight French retail companies about these e-fulfillment types and economic performance as well as customer expectation indicators. However, they do not analyze the synergies with store fulfillment, and they discuss effects based only on a limited number of case studies.

In addition, a first set of papers looks at the inventory location problem. Alptekinoğlu and Tang (2005) analytically study whether online orders should be fulfilled from physical stores or from a DC. They conclude that expanding bricks-and-mortar DCs for OC distribution pools inventory risks. Liu et al. (2010) develop a capacitated location model for retailers with multiple channels. In doing so, they

decide which of a retailer's existing bricks-and-mortar DCs should be extended to fulfill distance retail demand, thus making them OC operational. Therefore, within the model, they decide whether a retailer should rely on a full integration of bricks-and-mortar and distance retail channels or on a mix of dedicated bricks-and-mortar DCs and integrated structures. Netessine and Rudi (2006) analyze the dual strategy in a non-cooperative game between retailers and wholesalers, where retailers use their own inventory as a primary source and rely on wholesaler's drop-shipping as a backup. They derive conditions under which either traditional retailing, drop-shipping or dual channels with a separate manufacturer and retailer customer interface are beneficial in terms of inventory holding costs and risk pooling aspects. According to their findings the drop-shipping markup and the differences in transportation costs are the main drivers of the choice of channels. Also Chiang and Monahan (2005) review different forward distribution strategies, where items are stocked at a manufacturer DC or a retail store. A complete separation of channels, however, is not taken into account. Although their main focus is on inventory policies and allocation, they show by examining different distribution designs (store-only, distance-retailing-only, OC) that OC outperforms single-channel strategies.

Neslin et al. (2006), Wolk and Skiera (2009) and Cao and Li (2015) analyze the financial and economic performance of strategic decisions for opening an Internet channel in terms of e.g., channel mix, channel design, level of channel independence, and resource allocation across channels. However, the specific design of the distribution systems remains open. Further literature exists that focuses on OC fulfillment issues, such as inventory management, allocation and control (e.g., Schneider and Klabjan 2013; Bhatnagar and Syam 2014) or capacity management (e.g., Xie et al. 2014), but it does not analyze the effect on distribution. Hübner et al. (2015) provide a framework of OC warehouse operations designs and interdependencies without investigating concepts for physical distribution.

Focusing on OC destinations, McKinnon and Tallam (2003) classify the main forms of unattended home delivery, whereas Fernie et al. (2009) classify home delivery options in general. Agatz et al. (2008) identify the advantages of store pickup concepts, namely bridging the "last mile" and any positive effects on cross-channel sales. They highlight service components that are inherent to e-fulfillment. An online channel not only involves a physical product, but also several related services, most notably delivery. Their analysis is based on Boyer et al. (2002), who examine e-service strategies, including delivery processes. Rabinovich et al. (2007) show why strictly Internet-based retailers leverage external logistics service providers (LSPs) for distribution, whereas Rao et al. (2009) show that retailers with web offerings and stores outsource their logistics to a lesser extent than web-only retailers. Rabinovich and Bailey (2004), Xing and Grant (2006) and Xing et al. (2010) investigate the physical distribution service quality differences between pure players and MC retailers. Pure players are perceived to deliver higher service quality. In this context, Xing et al. (2010) develop a framework for order fulfillment to achieve electronic physical distribution service quality. Xing et al. (2011) analyze the interface between LSPs and retailers and the impact of LSPs on customer

perception. Gallino and Moreno (2014) analyze the demand effect of "buy-online, pick-up-in-store" and show a cross-selling and channel-shifting effect for the stores. Bell et al. (2015) investigate the migration effect when retailers introduce a showroom store for product testing, but deliver items to the customer's home.

3.2.2 Literature on backward distribution

Product returns for distance sales have been viewed as an unavoidable cost of doing business. Brito and Dekker (2004) classify them as reimbursement guarantees that "give customers the opportunity to change their minds about purchasing [. . .] when their needs or expectations are not met." Fleischmann et al. (1997) survey the field of reverse logistics and develop a general framework. They identify three planning areas related to returns, namely distribution, inventory, and production. Brito and Dekker (2004) develop a general framework for reverse logistics by structuring according to return reasons, product types, recovering processes, and involved parties. However, they do not discuss the specifics of retailing and home delivery. We further refer to Carter and Ellram (1998), Dekker et al. (2004), Bernon et al. (2011), Rogers et al. (2012) and Govindan et al. (2015) as overviews, compilations of reverse logistics frameworks and case studies on general return management problems.

While there is extensive literature on return policies to minimize customer returns in online retailing (e.g., Su 2009; Asdecker 2014; Gelbrich et al. 2015) and estimate return volume (e.g., Krapp et al. 2013), very few publications exist that deal with how retailers organize the backward process of customer returns (Min et al. 2006). Only a few studies address the number and location of return centers where returned products are collected and reprocessed.

Koster et al. (2002) and Hübner et al. (2015) discuss operational return-handling processes in warehouses, but do not focus on physical product flows to and from stores and customers. Agatz et al. (2008) consider return handling as part of distribution service design. They remark on the scarcity of optimization models for return policies in e-fulfillment, especially in contrast to end-of-life returns. Yalabik et al. (2005) model with game theory return systems for buy-back contracts for supply chain coordination with regard to logistical efficiency and marketing effectiveness, showing the trade-off between both. Min et al. (2006) develop an algorithm for a multi-echelon reverse logistics network design for an online retailing case. The model makes location/allocation decisions for the initial collection points and centralized return centers, based on the trade-offs between freight rate discounts and inventory cost savings resulting from consolidation and transshipment. Ruiz-Benitez and Muriel (2014) assess the impact of returns on wholesale price, order quantity, and the coordination of a decentralized supply chain with a single manufacturer and a single retailer. They analyze how consumer returns impact the decision-making processes of the retailer and the manufacturer, and the resulting order quantities, transfer prices, and related coordination mechanisms. In a similar setting, Bernon et al. (2013) explore practices that enable supply chain integration between manufacturers and retailers in retail product return processes.

3.2.3 Summary of related literature

Swaminathan and Tayur (2003) and Agatz et al. (2008) are the first to derive from the literature basic design options for distribution issues in e-business. They identify a closer interaction between fulfillment for e-commerce and stores as a future area of research. Further literature focuses either on single planning problems, or is based on predetermined distribution structures. These papers are mostly relevant for pure online retailing. The insights on e-business are only partially relevant for OC distribution (Brynjolfsson et al. 2013; Bell et al. 2014), because the OC concepts require integration of the bricks-and-mortar channel with the distance channel. Specific analyses of the operational implications for distribution systems of retailing across channels remain scarce (Lang and Bressolles 2013). Boyer et al. (2002) identify the assessment of the different distribution design options as a future area of research. Rao et al. (2009) see a "very interesting question for future research" in how OC retailers can piggyback on their existing infrastructure to integrate the logistics for online and store fulfillment. Gallino and Moreno (2014) also see the need to explore the integration of online and offline channels. Because this is a recent phenomenon, they conclude that it is not surprising that there is limited literature on the subject. Grant et al. (2014) call for further research in the area of integrated on- and offline retailing to get a broader scope of opinions and obtain a more representative result. Kozlenkova et al. (2015) underline the lack of knowledge on the operational implications of innovative distribution channels. "Both theory and practice will be improved if research develops a better understanding of the effects of adding/removing channels to existing distribution systems" (Kozlenkova et al. 2015). This requires the systematization and analysis of multiple channel distribution.

Hence, because of the underdevelopment of the systematization of distribution in OC retailing, and the dearth of extant literature on the operational aspects of OC retailing, there is a strong need to study and structure physical product flows for forward and backward distribution, their application requirements, contextual factors, and pros and cons. Furthermore, the vast majority of research papers in the area address distribution using analytical models and do not derive or test the findings empirically.

To extend the literature within this new area of OC distribution, we conducted an exploratory study. Exploratory studies are appropriate to investigate the hows and whys of a little-known area (Brinberg and McGrath 1985; Stebbins 2001; Creswell 2003; Yin 2014), also for logistics topics (see e.g., Ellram 1996; DeHoratius and Rabinovich 2011). Trautrims et al. (2012), and Randall and Mello (2012) identify qualitative methods as a path to provide new insights into retail supply chains. They see qualitative research as appropriate particularly to uncover so far unknown problems using a holistic approach.

3.3 Research questions

In view of the gap in the literature, we formulated three main objectives for our research to close this gap: The first objective is (1) to learn more about the relevant

issues influencing logistics services and costs in OC retailing. On this basis, we then want (2) to understand what the present structures and processes are in OC distribution, how they can be systematized, and what the fundamental requirements are for their applicability. The second objective leads to the third (3), i.e., to determine the advantages which these concepts offer for logistics services and costs, the challenges that emerge when implementing and using these concepts, and the development phase of an OC distribution system in which these concepts are appropriate to use. In an exploratory study, where a vast amount of qualitative data are collected, the research questions should address general topics (Gioia et al. 2013) and in our case are formulated as follows:

RQ1 Which issues in OC distribution are relevant for achieving excellence in an OC logistics system?

RQ2 What are the existing structures and operating modes of OC distribution? How can these concepts be structured?

RQ3 Why are different forward and backward distribution archetypes applied, and what are the requirements, important contextual differences, criteria, and development areas for implementing them?

The research questions are worthwhile addressing for at least three reasons. First, OC retailing is a very recent phenomenon. So far the key issues from a practical point of view for achieving excellence in OC distribution in terms of service and cost remain open. Therefore, one contribution is to identify the top issues that retailers face when establishing and developing OC distribution systems. This builds the basis for an understanding of OC distribution designs and the strategic rationale behind certain configurations and developments.

Second, OC retailing is increasing the need for seamless product flows across channels and, therefore, requires an up-to-date overview of potential logistics concepts. As a result, the literature lacks an empirically proven and systematic perspective on OC distribution structures. Another contribution, therefore, is to identify and systematize OC distribution designs and typologies across non-food retail sectors.

Third, as noted in the previous literature, it is still unclear which degree of integration, delivery modes, lead times or shipping models are the keys to success in OC retailing. It is, therefore, of interest to understand which distribution concepts retailers rely on today, how they are configured, and why retailers apply them. Virtually all retailers currently are assessing their options for creating service- and cost-optimized distribution concepts across the channels. Therefore, it is of further interest to know how logistics concepts for multiple channels can lead to OC retailing and, if well-executed, how they increase company performance while maintaining customer satisfaction. Another contribution, therefore, lies in deriving the qualitative benefits of the concepts. This also requires a discussion of cross-industry and industry-specific challenges, areas of application, and contextual factors.

4 Methodology

Our structured literature review showed that physical product flows for forward and backward distribution in OC retailing are not yet systematically studied. Hence, the research questions target to identify and systematize distribution designs, key issues, and contextual factors. The research questions, therefore, focus on an open and unexplored area. Exploratory studies are appropriate for such conditions (Brinberg and McGrath 1985; Stebbins 2001; Creswell 2003; Yin 2014).

The primary source for our exploratory study were semi-structured interviews with OC retailers as suggested, e.g., by Trautrims et al. (2012). Quantitative market data, reports, and discussion with further experts in the field served as a source of triangulation for the ideas that emerged from the qualitative data (Jick 1979). To meet the criteria for trustworthiness during data collection, we used multiple approaches as suggested by Lincoln and Guba (1985) and detailed below. We adopted an interpretive research approach, which, in the interpretation of concepts in a first-order analysis, gives voice to the managers actually designing OC distribution concepts (Maanen 1979). The insider's point of view was the foundation of our inductive analysis. Following this, we as researchers took on the task of formulating deeper, more theoretical, and conceptual second-order interpretations (see e.g., Bryman and Bell 2011).

Section 4.1 details the methods applied for data collection. Section 4.2 then presents how we derived the results from the data collected.

4.1 Data collection

First, we provide details about our semi-structured interviews (see 4.1.1), before we shortly portray our sources of triangulation (see 4.1.2).

4.1.1 Semi-structured interviews

We selected a semi-structured research design based on face-to-face and direct communication with executives. Expert interviews are a suitable instrument for data collection because the experts' knowledge of the design, implementation, and control of solutions stems from their position within the companies (see e.g., Flynn et al. 1990; Ellram 1996; Creswell 2003; Trautrims et al. 2012). The aim of these exploratory discussions was to gather information and systematize structures without formulating restrictive hypotheses in advance. Knowledge was gained in a recursive dialogue between researchers and reflective practitioners (Corley and Gioia 2011).

Prior to collecting primary data, we used pilot interviews with consultants to understand the current status and challenges in OC distribution. The main goal of these interviews was to become familiar with the key change issues. We selected this particular group for pilot interviews because of its lead role in developing distribution and return concepts.

Following the pilot interviews, formal interviews were conducted over a six-month period until we reached theoretical saturation (see details on sample below). The interview guide used for the initial round of interviews was based on the product flow from the retailer to the customer and vice versa, tested and refined in initial pretest interviews (see appendix). Questions could be asked at any time to allow the conversation to flow naturally (Lindlof and Taylor 2011). The interviews lasted between 60 and 120 minutes. The anonymity of participants was protected through a written agreement and did not allow interviews to be recorded. Field notes were, therefore, written during and immediately after the interviews.

To meet the criteria for trustworthiness, we interviewed in teams and discussed and checked the information gathered. All interviews were conducted by two of three interviewers, one of whom attended all the interviews to guarantee comparability. As one interviewer handled the questions, the other recorded notes. This enabled us to interact personally with informants, while the note-taker retained a different, more distant view (Eisenhardt 1989). Given that the interviews relied on multiple informants from different companies, however, no informant's interpretation dominated the study. The interviewers met regularly with other members of the research team to debrief them on preliminary findings. This means that team members not involved in the interviews were able to probe for further insights, suggest means of gaining additional clarification, recommend next steps, and challenge the interviewers by suggesting alternatives for tentative initial findings.

Challenges and options of distribution concepts were discussed from multiple perspectives. The initial interviews focused on structures of OC distribution systems, strategic issues, and most recent developments in the market. As nine themes (see data analysis) emerged from the data, we focused the interviews on investigating those themes in greater depth, which facilitated our effort to uncover both patterns and differences across retailers and to identify relationships among concepts.

During the sampling process we first identified potential participating companies, before identifying interviewees from these companies. We used theoretical sampling in four steps until we reached preliminary theoretical saturation with regard to insights from additional interviews (Glaser and Strauss 1967). The target retailers had to fulfill four criteria: (1) OC retailers, (2) operating in non-food retailing, (3) with significant experience in the business (i.e., at least one year in distance retailing via an online shop and at least five years in bricks-and-mortar business), and (4) of a significant size in terms of sales and number of outlets (i.e., at least EUR 200 m. annual sales and at least ten outlets in German-speaking countries). The scope of the investigation covers OC retailers only. Retailers are referred to as belonging to OC retailing if they have a distance sales channel as well as bricks-and-mortar outlets. Furthermore, the retailers had to have been active at least for one year in both channels. OC retailing is more advanced among non-food retailers (see e.g., PwC 2013). To get a broad understanding and avoid looking only at product-specific phenomena, we invited non-food retailers across multiple sectors, namely fashion, consumer electronics, DIY, and specialty retailers. The challenges for integrating on- and offline distribution concepts are especially relevant for large retailers with established distribution networks and economies of

scale in this area. The company sample was, therefore, derived based on the latest industry rankings of official statistical data, which use annual sales as a criterion.

We started by inviting the top 25 retailers with OC business (Statista 2013). Ten of these 25 participated. After the interviews, we further reviewed practitioner-oriented journals to identify retailers who published recent changes in their OC business models. We invited ten additional retailers who met the above criteria and had not yet been included. Three of ten agreed to participate. Because we were still gaining more insights from every interview after an intermediate data analysis, we assumed that we had not yet reached saturation level (Glaser and Strauss 1967) in the data, and invited further top 25 OC retailers from sector-specific rankings (i.e., the top 60 fashion retailers, top 5 in consumer electronics, and top 10 in DIY; see also LZ.net 2014 and Hübner et al. 2013b). We also wanted to balance our sample better in terms of origin (distance or bricks-and-mortar channel as the first channel), experience in OC logistics (more than five years vs. less experience), and across non-food sectors. This resulted in another 15 retailers that participated. The coding and categorization did not significantly change further during the completion and analysis of this sample set, especially with the last retailers in this set. No further advances, advantages or requirements were gained for the various concepts in OC distribution. We were, therefore, able to identify clear patterns and replicate the development of the theory, but not extend it further (Eisenhardt 1989).

A participation rate of approximately 50 % was achieved, with 28 retailers taking part in total. These included 14 retailers from fashion, two from consumer electronics, five from the DIY sector, and seven other retailers (e.g., specialized retailers, department stores). The participating retailers have their headquarters in a German-speaking country and operate in 21 countries on average. The retailers' total annual sales average EUR 5.9 bn, with a maximum of more than EUR 40 bn and a minimum of EUR 200 m. In Germany, participants' sales represent about 40% of total sales in the OC fashion market, about 60 % in OC consumer electronics and almost the entire market for DIYs. The companies interviewed have been active in OC retailing—including operating an online shop—for between one and more than ten years.

During the interviews we learned that logistics service providers also play a key role in OC distribution. Therefore, we expanded the scope and invited the top 10 service providers in retail logistics (Hübner et al. 2013b), of which five participated.

We assume that people constructing their organizational realities are "knowledgeable agents". Experts in organizations know what they want to achieve with their actions and can explain their intentions (Corley and Gioia 2011; Gioia et al. 2013). The consequence of this assumption for conducting research is profound (Stebbins 2001; Gioia et al. 2013). The interviews were conducted exclusively with board members, managing directors, and division managers, who have a holistic view of the distribution structures. Current actions are strategic decisions in this context. Therefore, it seems appropriate to use top managers as knowledgeable agents.

In total, we interviewed 43 top managers from the first and second hierarchy level with responsibility for supply chain management (27 managers), e-commerce (eight managers), or cross-functional units (eight managers). The selection of experts was

based on the fact that they are informed and experienced in OC forward and backward distribution, i.e., they have been directly involved in the planning and execution of such systems.

4.1.2 Primary market data

We also amassed market data relating to OC logistics for triangulation (Jick 1979). We collected primary data from 100 large retailers' websites and their offerings in OC distribution. Other documents included strategy statements, newsletters, performance reports, and articles in professional journals. We used the documents as a secondary data source, providing insight into the context and for substantiating constructs. These documents also helped to facilitate discussions with the informants about the themes that emerged from the data. Although this information was not extensively used, it helped us to appreciate the context in which systems are enacted.

4.2 Data analysis

Our inductive analysis is neither driven by deductive logic nor follows a strict grounded theory approach (Randall and Mello 2012; Manuj and Pohlen 2012), because "data is inextricably fused with theory" (Alvesson and Kärreman 2007). We cycled among data, emerging theory, and relevant literature to develop a deeper knowledge of OC forward and backward distribution systems. Our approach relies on continuous comparison of data and theory development and the overlap of data collection and data analysis (Eisenhardt, 1989). During the analysis, the transcripts were rephrased, reflected, and compared to create typologies (Eisenhardt 1989; Trautrims et al. 2012).

We used two major methods to ensure the trustworthiness of our data analysis. First, we used three distinct coders, compared codes with each other, and reached a sufficient degree of similarity (Mayring 2011; Gioia et al. 2013). We further used two outside coders to assess our coding scheme independently to increase confidence in our assignment of codes to appropriate categories (Gioia et al. 2013). Disagreements, either between the researchers or between the researchers and the outside coders, were discussed until a consensus was achieved. This additional step helped to ensure the repeatability of our findings and the emergent theoretical framework (Lincoln and Guba 1985). Second, we triangulated the emerging findings with literature and further market data and completed "member checks". During this phase we leveraged related literature from retail forward and backward distribution (both bricks-and-mortar and e-commerce) to refine articulation and emergent concepts and relationships (Gioia et al. 2013). Furthermore, we conducted "member checks" with our interviewees to gain confidence that the emergent theoretical framework was sensible as well as realistic and validated by those in charge. We developed an intermediate report of our findings, shared this with all participants, and asked them for feedback, which was also incorporated. Early results have additionally been discussed at multiple research conferences.

Our initial approach was a first-order analysis involving a thorough coding of the interview and meeting transcripts (Maanen 1979). We developed a detailed coding scheme consisting of 51 first-order codes (Maanen 1979) in the informants' language and consolidated them into 18 informant-centric categories (Gioia et al. 2013). Using the constant comparative method, we repeatedly compared data over time and across interviews to discern the major concepts of interest. We relied on the retailers' own language as the source of our concept labels wherever possible (Corbin and Strauss 2015). We used short phrases expressed in first-order terms in cases where a code was not directly available or violated confidentiality agreements. We used an appropriate software application designed to aid in coding and analyzing text throughout the entire process.

To discern themes that might constitute a basis for developing a theory, we used a structured second-order analysis to view the data at a higher level of theoretical abstraction (Gioia et al. 2013). We again used constant comparison techniques and the relationship between second- and first-order themes (Glaser and Strauss 1967). After again examining category nesting and overlaps, nine second-order themes emerged: fields of action in OC forward and backward distribution, level of network integration, development plans for network configuration, forward distribution structure, qualitative criteria in forward distribution, development plans for forward distribution, return processes, qualitative criteria for return structures, and development plans for return processes.

In the third stage of our analysis, we grouped our major themes into aggregated dimensions. This process involved the relatively straightforward task of examining the relationships among first-order concepts and second-order themes and distilling them into a set of more simplified, complementary groupings. Three aggregate dimensions resulted: Excellence in OC distribution, forward distribution (containing a typology and related archetypes for OC dispatching locations and destination concepts), and backward distribution (containing a typology and associated OC return modes and processing locations).

This also provides us with a structure for our findings in the remainder of the paper, summarized in Fig. 1. Section 5, therefore, answers RQ1 by identifying the major issues encountered when striving for excellence in logistics services and costs in OC distribution. This leads to a discussion of distribution typologies for forward and backward distribution in Sects. 6 and 7. Section 6.1 answers RQ2 by developing a typology for forward distribution. This builds the framework required for investigating RQ3 in relation to dispatching locations (Sect. 6.2) and destination concepts (Sect. 6.3) in forward distribution. Section 7 first develops a typology for backward distribution in the same way (Sect. 7.1) and then investigates return modes and return processes (Sects. 7.2 and 7.3). As a result, the main sections analyze the prevalent archetypes for these areas, investigate the pros and cons of these archetypes, and develop a typology for forward and backward logistics in OC distribution.

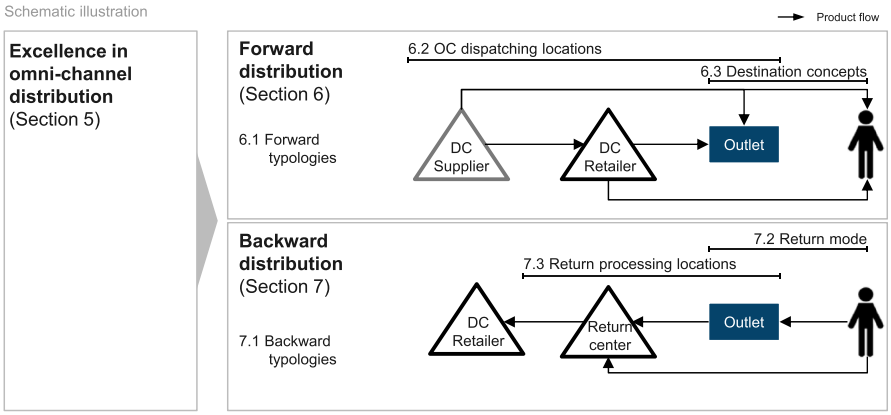

Fig. 1 Overview of areas in omni-channel forward and backward distribution systems

5 Excellence in omni-channel distribution

At the beginning of each interview, we asked the managers without prompting them, which areas in OC retailing are relevant achieving excellence in OC fulfillment and logistics. The experts then had to prioritize the topic. On average, every retailer named four to five fields of action. The explanations were aggregated, grouped into categories, and ranked according to the interviewees' priorities. Forward and backward distribution topics are the most relevant topics when it comes to striving for excellence in OC operations. The ranking produced the following top five topics that are all associated with forward distribution issues:

(1) *Developing and optimizing modes of delivery* to the customer is the most important topic for fulfilling distribution requirements, according to the retail experts. Planning problems arise in connection with new delivery modes, particularly in terms of integrating the retail outlets into the delivery concept.
(2) The importance of *increasing delivery speed* is based on the fact that most customers want to receive a delivery the day after placing the order, or two days later at most.
(3) Interviewees described *inventory transparency* as another leading issue. It means simultaneously providing customers with information on the availability and delivery times of products in all channels. Customers then have an opportunity to choose the channel, online or offline, they would prefer purchasing the products they want.
(4) The aim of *optimizing the cross-channel processes in DCs and stores* is mainly to improve operations in OC retailing. This means processing varying order volumes between the distance channel and the stores, as well as adapting DC processes. In the retail outlets, processes for integrating the distance channel have yet to be developed, e.g., due to online reservations of customers.
(5) *Inventory integration and allocation* is mentioned as another critical issue by the interviewees. Consolidating online and offline inventories reduces overall inventory level and, therefore, reduces logistics cost.

What is noticeable is that hot topics (1) to (3) mostly relate to expanding services in OC retailing, while secondary topics (4) and (5) focus more or less on reducing logistics costs. Further topics with lower relevance that were mentioned multiple times aim to improve overall warehouse and store operations, make it easier to expand to additional markets and integrate the IT landscape across channels. Almost all participants stated that improving and enhancing forward and backward distribution concepts plays a dominant role in designing fulfillment and logistics systems for OC retailing. These fields of action and the associated explanations will further be used to inform the discussion of distribution typologies and to investigate the associated contextual factors.

Beside the main distribution process in OC retailing, i.e., fulfilling customer orders, additional ancillary processes emerge. For example, in the online business, efficient return processes are required, ensuring that returned products are instantaneously worked up and reintegrated into the forward distribution system. The following two sections develop typologies for OC forward (Sect. 6) and backward distribution (Sect. 7) and analyze the associated concepts.

6 Concepts of omni-channel forward distribution

Within forward distribution, we first provide an overview of prevalent concepts existing in practice and develop a typology. We then discuss the concepts within two subsystems, namely the OC dispatching location (=source of distribution) and the OC point of customer reception (=destination of distribution).

6.1 Omni-channel forward distribution typology

By analyzing the literature on related e-commerce retailing (see Sect. 3), practitioner reports, primary market data (e.g., webpage search, retailer reports) and ultimately the results of our interviews, we have been able to develop a comprehensive overview of forward distribution design concepts existing in practice. Figure 2 illustrates the different concepts of deliveries which are denoted from (1) to (6). They can be structured into the following overarching categories. First, store delivery (SD) represents traditional distribution concepts of bricks-and-mortar distribution resulting in in-store buying. Second, there are home delivery (HD) concepts, and third, different store pickup (SP) concepts. Thereby (SD) and (SP) have the bricks-and-mortar store as a destination, while (HD) serves customers at home or alternative pickup locations. Within each category there are different design possibilities which are summarized below.

SD Bricks-and-mortar stores and customers buying in-store (1) constitute the traditional part of OC retailing for retailers originating from the bricks-and-mortar business. The stores are thereby served directly by the supplier or by the OC retailer's DCs. In an OC context, the DC can either be bricks-and-mortar-specific if the retailer relies on separate distribution channels or integrated in terms of fulfilling bricks-and-mortar and distance retail orders.

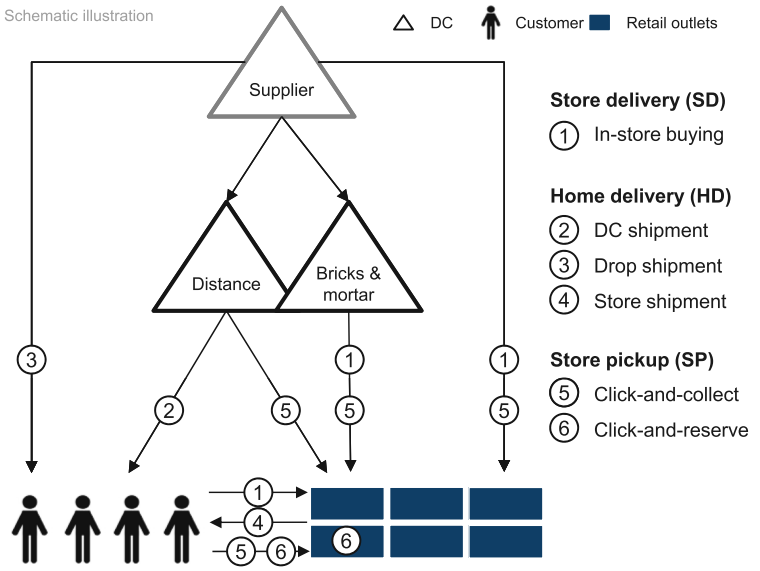

Fig. 2 Typology of omni-channel forward distribution

HD Home delivery concepts constitute the classic form of forward distribution for distance retailing. There are three basic types depending on the source of the forward distribution process (2)–(4). The first type is home delivery from the DC (2). An alternative is a drop shipment strategy (3), where customer orders are directly served from the suppliers. In an OC context, the physical stores are the third pillar for home delivery concepts (4), where retailers ship orders directly from the store.

SP The different types of store pickup (="buy online, pick up in-store") (5)–(6) are fundamental elements of OC forward distribution concepts as they lead to a convergence of channels. This gives OC retailers the chance to integrate their retail outlets to bridge the "last mile" of delivery. The first type is click-and-collect (5), where orders are shipped in customer-ready picked parcels from a retailer or supplier DC to the stores. Applying separate channel structures to the retailer DCs, the parcels are dispatched at the distance retail DC and then shipped to the outlet as in standard home delivery. When integrated DC structures are used, click-and-collect orders can be shipped as part of the regular bricks-and-mortar store delivery from the DC or separately with CEP deliveries. This mainly depends on the store delivery frequency. Supplier drop shipments are a further delivery concept for click-and-collect from a warehouse to the store. If retailers are able to establish real-time data access to in-store inventories and in-store picking capabilities, the click-and-reserve concept (6) can be implemented and online orders can be served directly from the available store inventory.

These OC forward distribution types that exist in practice can be combined in a portfolio of delivery options. When defining the individual retailer's portfolio, the

trade-off between service for the customer, required delivery velocity, processing costs as well as process complexity must be offset. As the forward distribution concepts combine of different dispatching locations and destination concepts, we will discuss these areas in more detail in the following two subsections. The qualitative analysis will help retailers to define their mix of OC forward distribution types.

6.2 Archetypes of omni-channel dispatching locations

OC retailers basically have three types of locations from which they fulfill customer orders. Direct customers, for example, can be supplied from a retailer's DC (see Sect. 6.2.1), one of its outlets (see Sect. 6.2.2), or directly from a supplier's DC (see Sect. 6.2.3). In contrast, store orders generally are supplied from a retailer's DC or a supplier's DC.

6.2.1 Retailers' DCs

Retailer DCs are the basic source for OC forward distribution concepts. They are used for store delivery in classic in-store buying concepts, as well as for home delivery (DC shipment) and click-and-collect. An OC retailer's DC structure can be further differentiated according to (A) the degree of integration of distance retailing and bricks-and-mortar DCs and (B) the level of centralization within the retailer's OC network.

When analyzing the retailer DCs, we initially have to distinguish between integrated and separate DCs. Integrated means that the retailer operates common DCs for both, bricks-and-mortar and distance retail, whereas operating channel-specific DCs is classified as a separate DC structure. Both types of DCs are equally common throughout all retail sectors surveyed.

Retailers establish *integrated DCs* for bricks-and-mortar and distance retailing because they allow them to leverage inventory pools and allocate inventories to stores and distance retail orders flexibly in the line with demand. This is especially important as online sales are still quite difficult to forecast due to high dynamics and the growth of e-commerce. Therefore, pooled DCs and inventories support the availability of goods. The Head of Logistics of a specialty retailer, that recently opened an integrated DC after previously operating channel-specific DCs, describes this well as follows:

> *"Using centralized inventories allows us to postpone the inventory allocation for distribution as long as possible."*

Other participants with integrated DCs see the advantages of having synergies across the entire supply chain that enable better coordination of inbound logistics and rapid allocation of goods to the channels with one inventory control system. Furthermore, integrated DCs enable picking capacity to be allocated more flexibly. According to the experts, it is easier to integrate the processes if the shipment sizes for direct-to-customer deliveries are similar to those for store delivery. This is often the case if retailers operate small outlets (e.g., shoe stores) and when the outlets are

supplied very frequently (e.g., daily). Integrated DCs also offer advantages if they are the dispatching location in a click-and-collect concept. Click-and-collect orders can then be shipped as part of the regular bricks-and-mortar store delivery from the DC. A joint DC, therefore, offers cost advantages in the event of a high or growing share of store pickup, because shipment fees for click-and-collect parcels can be saved.

Former distance retailers have advantages in establishing integrated DCs compared to former bricks-and-mortar retailers, as they have the process know-how for the more complex task of handling direct customer orders in warehouse operations. Furthermore, integrative DCs can be established more easily if the products are applicable for handling in (semi-)automated picking and sorting machines. This requires relatively homogeneous products with regard to their picking characteristics. Shoe retailing is a good example of such conditions, as is fashion retailing in general. For other sectors, such as consumer electronics and especially DIY, the product heterogeneity in terms of the picking characteristics is a greater challenge. But strategies exist even for these sectors which support the operation of common DCs for both bricks-and-mortar and distance retailing. For example, a DIY retailer operates an integrated DC for storing and picking all those product ranges that are easily shippable in parcels. Nevertheless, regardless of the integration strategies, integrated DC locations for both channels increase the complexity of warehouse operations.

Separate structures are, therefore, a way for simplifying processes at the DCs. The COO of a fashion retailer explains the reasons for separation as follows:

> *"We use a separate and external fulfillment center for our distance retail shipments. Our main business is in brick-and-mortar retailing. We do not have the experience for distance retailing nor the space in our DC for additional direct-to-customer picking processes. We treat the e-commerce fulfillment center like an additional store."*

All participants with separate DCs argue with the process-related advantages of picking. Separate DCs simplify picking processes as these are different for customer packets vs. pallets for stores. This is especially true if the order volumes and the variety of different items within one order in distance retailing differ greatly from bricks-and-mortar store replenishment. The store order size depends on delivery frequency and ultimately also on store shelf space and the trade-off between inventory holding and transportation costs. For example, shoe retailers replenish their small stores daily. Small order sizes are shipped by parcel services just like for home delivery. In contrast, fashion retailers usually replenish their stores only once or twice per week with large order sizes. DIYs consolidate orders to minimize transportation costs (e.g., for bulky items) and use their large stores to hold inventory, whereas consumer electronics retailers replenish with high delivery frequencies and small order sizes to save the inventory holding costs generated by expensive slow-movers. The customer order size mainly depends on the product type. For example, basket sizes of consumer electronics are only a few items, whereas fashion retailers need to pick multiple items for one customer order. Some logistics managers argue that their bricks-and-mortar logistics system is simply not

capable of additionally handling customer picking. This indicates that investments, especially in flexible or automated picking systems, are necessary for the execution of integrated DCs. If retailers try to avoid such investments, separate DCs are the logical consequence. The retailers with separate DCs also see the advantages in minimizing the risk when entering a new channel by using separate legal entities for each channel. Some retailers with separate DCs rely on external service providers for operating one of the DCs. However, as our focus is on physical flows, the responsibility for the DC fulfillment is rather a side issue and will not be differentiated in the following.

Summarizing the results of the above discussion, two types of DCs can be derived: separate channel-specific DCs and integrated omni-channel DCs. From a customer service perspective, integration ensures greater product availability. From an operational perspective, integrated DCs are preferable if the retailer fulfills the prerequisites for integration in terms of resources and capabilities in such a way that integrated operations can be executed efficiently. In addition, integrated DCs reduce transportation costs in a click-and-collect setting. Retailers can separate logistics to simplify structures and outsource ancillary functions to avoid investment risks. Separate distribution structures are, therefore, often an initial concept in OC forward distribution, whereas integrated DCs and consolidated inventories are advanced and more complex solutions. Table 1 summarizes these findings.

Table 1 Summary of omni-channel retailer DC integration levels

Integration level	Separate channel-specific DC	Integrated omni-channel DC
Advantages	Simplified operational processes; economies of scale through specialization	Bundling effects for inbound logistics; higher overall service level through pooling inventory; lower average inventory levels; no inter-warehouse transshipments; lower shipment costs when applying click-and-collect; economies of scale in warehousing; capacity balancing effects
Challenges	No cross-channel bundling effects for inbound logistics; higher average inventory levels; additional transportation costs for click-and-collect; inter-warehouse transshipments	Higher process complexity in picking and inventory management; higher space requirements at the DC; ability to execute heterogeneous orders efficiently
Contextual factors favoring the respective type of DC	Large difference in order sizes between channels; large outlets; heterogeneous picking characteristics; manual picking systems; origin in bricks-and-mortar business	Small difference in order sizes between channels; small outlets that are replenished frequently; homogeneous picking characteristics; products suitable for parcel shipment; automated or flexible picking systems; origin in distance retailing business
Development stage	Initial solution	Advanced solution

The second issue in the analysis of omni-channel DC structures is the *level of centralization*, i.e., the area in which a DC is responsible for supplying customers or stores. A distinction can be made here between centralized DCs responsible for a large part or all of a customer or store area and regional DCs responsible only for a specific area of customers or stores. Regional DCs usually keep fast-moving items in their inventories. Most bricks-and-mortar retailers rely on several regional DCs to supply their stores from regionally distributed locations, the purpose being to shorten replenishment time and decrease transportation costs. Conversely, centralized DCs mainly keep slow-moving items for pooling inventories. Most items are stored exclusively at one of these levels, i.e., centralized or decentralized. Items stored at a central DC are delivered directly to stores and customers. If at all, regional DCs are used only as transshipment points for such products.

Concerning the requirement of short lead times for *direct-to-customer shipments*, the unanimous point of view of all experts interviewed is that the lead time within European retail networks for next-day delivery within one country cannot be improved via decentralization by using multiple regional DCs that are closer to the customers. If a retailer's DC is close to a hub of a CEP, later cut-off times for orders can be realized, as transportation time between the DC and CEP hub is shorter. The goods can be shipped overnight and arrive at the customer usually on the next day. OC retailers argue that late cut-off points for orders are more important for short lead times than creating regional DCs. Nine out of ten OC retailers surveyed use one single DC for direct orders. This is also due to the fact that the capacity of one DC is still sufficient to meet distance retail demand for the majority of retailers. Therefore, the prevalent type of DCs for direct orders of OC retailers is one centralized location for one market. Only a few fashion retailers with mature structures in distance retailing operate multiple distance DCs.

The picture for *bricks-and-mortar store distribution*, however, is different. Most of the OC retailers use further regional DCs for store replenishment. This is due to the fact that most large OC retailers used to be pure bricks-and-mortar players, who have a high proportion of sales in physical stores, have developed mature forward distribution structures in this channel, and operate a significant number of stores. A central DC has lower store delivery frequencies on average to realize bundling effects for longer distances to the stores. However, as stores benefit from shorter replenishment cycles and higher delivery frequencies that enable faster reactions on demand development, OC retailers continue to rely on regional DC systems for their bricks-and-mortar business, as several experts interviewed claim. This enables shorter cost-efficient replenishment cycles for the major part of their store assortment. Regional DCs can be found in all sectors surveyed. In the DIY sector, regionalization is very prevalent, one reason being that a large proportion of the items sold at DIY stores are very space-consuming or have special storage requirements, which can be better managed with multiple storage locations (e.g., plants).

Table 2 summarizes the findings on the level of centralization. Some of the issues raised are not only valid in an OC context, but also for other forward distribution structures (e.g., shorter lead time with decentralization).

Table 2 Summary of centralization of omni-channel retailer DCs

DC type	Centralized DCs	Decentralized DCs
Advantages	Inbound bundling effects; higher overall service levels through inventory pooling effects; economies of scale in warehousing and picking; one centralized distance warehouse location sufficient for next-day delivery	Lower average transportation distance allows shorter lead time for store delivery and potentially higher delivery frequencies; potentially shorter lead time for customer deliveries
Challenges	Higher average distance for home and store delivery, potentially resulting in higher lead time; heterogeneity of product ranges	Decentralized inventories; complex transshipment and cross-docking policies for central DC deliveries
Contextual factors favoring the respective type of DC	Limited number of outlets and/or limited distance sales volume; geographically concentrated delivery area	High number of outlets and/or high distance sales volume; geographically extended network
Main application	Distance channel	Bricks-and-mortar channel

Today, most store orders are compiled and shipped from the retailers' DCs, because this offers several economies of scale in inbound transport, warehousing, inventory holding, and outbound transport. This also applies to distance retail fulfillment as customer orders can be batched at the DC, enabling efficient cross-customer picking and automated sorting to be used. Nearly three-quarters of the OC retailers surveyed exclusively apply the physical flow via DCs for store and customer orders. This is, for example, the distribution design used exclusively in fashion retailing. There are, however, two other possibilities that are still not sufficiently developed, but may gain more importance in the future. These alternative strategies are distribution from the outlets and direct distribution from the suppliers.

6.2.2 Retailers' outlets

OC outlets are showrooms and DCs at the same time. Outlets as dispatching locations are relevant for home delivery as well as for the store pickup concept click-and-reserve. Dispatching from an outlet is also required when retailers transship between stores. Transshipments are often applied at the end of the season to reduce inventories and to avoid stockouts and high discounts on leftovers. The focus of the OC-related analysis, however, will be on dispatching customer orders at the stores.

Only one-tenth of the OC retailers surveyed regularly use *outlets for distributing* direct-to-customer shipments. The first type of OC retailers using this strategy already delivers items bought at the store to the customers. Examples of this type are the distribution of bulky goods in the DIY sector or white goods in consumer electronics. The product characteristics determine the distribution path, regardless of any OC activity. The second type of OC retailers operating customer shipments from the outlets is in sectors with large outlets, where every store represents a kind

of warehouse. DIY, electronics, and department stores are typical examples. These retailers take advantage of the opportunity to offer a broader assortment via distance retailing if items are stored only at outlets. Fashion retailers, however, do not at present use the store as a dispatching location, although this might be an option for very large fashion outlets.

Forward distribution from the outlets increases the amount of handling effort at the stores and creates the need to establish processes to be able to handle distance retail orders efficiently. However, this will remain less efficient than order picking and distribution from the DC, as processes at the DC are specialized on parcel handling and the volumes that have to be handled are much larger. *"In-store picking is our main cost driver as our outlets are optimized for presenting articles, not for efficient picking of online orders,"* argues a logistics manager at a department store retailer that already uses outlets for forward distribution. Furthermore, shipments from stores require real-time data access to store inventory and an integrated enterprise resource planning (ERP) system. In-store picking and packing also require dedicated space that cannot be used for the showroom. Store assortments are smaller than the assortment offered online at around two-thirds of the OC retailers surveyed. Deliveries from outlets to online customers, therefore, are very rarely applied by the OC retailers surveyed.

The challenges are similar when items are not shipped from the outlets, but *reserved online* by a customer and picked up at the store afterwards (click-and-reserve), as the IT requirements and the picking efforts are identical. Only the packing of a parcel is not required. Therefore, only about one-fifth of the OC retailers currently use this concept. However, click-and-reserve is expected to grow in importance, as it offers also several advantages compared to click-and-collect. It enables shorter order-to-delivery cycles than click-and-collect, as the desired goods can be picked up by customers immediately. Furthermore, click-and-reserve reduces the average transportation costs compared to click-and-collect. However, picking costs are higher at the outlets than at the DC. Click-and-reserve ultimately results in better product availability as orders can be supplied from both inventories at the DC and at stores. While click-and-reserve has been tested in most of the non-food sectors, it is only used to a very limited extent at present in fashion retailing because of several availability challenges. First, the high variation in cuts and colors leads to very few items being available in stores. This limits the number of available units for online reservations, since customers at the store may simultaneously be trying on these items or may have put them into their shopping basket. Second, items may be misplaced by store customers and their current location in the store might not be detectable with affordable effort.

Shorter order-to-delivery cycles are also an advantage for shipments from the outlet to customers, and they enable OC retailers to offer *same-day delivery*. This gives OC retailers a clear advantage in offering a same-day service compared to pure online retailers as they can leverage their outlets. Today all OC retailers' same-day orders are shipped from their stores. However, only about one-fifth of OC retailers place importance on same-day delivery. These have already implemented it or are piloting it for dedicated areas. Despite PR reasons, DIY and electronics retailers offer this service because customers might take advantage of same-day

service in urgent situations, e.g., when working at buildings sites. However, the concept is not used in fashion retailing. Most OC retailers neither consider same-day delivery to be of value in future, nor have they implemented it or plan to do so. All retailers surveyed argue that customers do not expect same-day delivery services for non-food products and are only willing to pay for them to a very limited extent. Shipping fees, however, are high due to the increased effort required for processing and picking and the high costs of courier services, resulting in unprofitable same-day delivery concepts.

6.2.3 Suppliers' DCs

The third alternative dispatching location for customer and store orders is a supplier's DC. A customer or store order is placed at the retailer's interface and a supplier is responsible for the fulfillment. Such a strategy can be used for in-store buying, store pickup (click-and-collect) as well as for home delivery.

OC retailers apply this for different reasons. Direct-store delivery from a supplier's DC is a standard flow for bricks-and-mortar replenishment, instead of processing this through a retailer's DC. This may have advantages in inventory and processing costs. Direct shipments (also called drop shipment) from the supplier to the customer as well as to stores in a click-and-collect concept are used by OC retailers for dedicated articles that cannot readily be stored at the retailer's DC due to their physical characteristics and extensive storage requirements. Again here, certain product ranges in the DIY sector and the white goods sold by consumer electronics retailers are examples of this alternative distribution concept. Furthermore, drop shipment makes it possible to include slow-movers in the assortment that cannot be stored economically in the retailer's DC. None of the retailers surveyed, however, argued that drop shipment is used to buy in operations competencies when opening a new channel. Major drawbacks mentioned by the participants are the significantly longer lead time for suppliers' direct deliveries, and the obstacles in real-time data exchange, e.g., for updated availability information at the webshop. Another problem lies in the fact that retailers usually strive to serve direct customer orders with only one parcel for customer convenience and transportation cost reasons. Outsourcing a part of the assortment handling to suppliers, therefore, can result in higher transportation costs, lower customer convenience or the challenge of consolidating order parts from different dispatching locations. In total, less than 20 % of the OC retailers surveyed use a mix of drop shipment and retailer DC for direct distribution. Drop shipment is thereby only carried out for articles that cannot be economically stored at a retailer's DC. Only a few retailers experiment with drop shipment strategies regardless of article-specific considerations.

6.2.4 Summary of dispatching locations

Table 3 summarizes the findings on different dispatching locations and their impact on OC forward distribution design.

Table 3 Summary of omni-channel dispatching locations

Dispatching location	Retailer DC	Store	Supplier DC
Advantages	Inventory pooling; economies of scale in warehousing and picking; reduced in-store handling effort; larger assortments/item ranges than in-store	Leveraging of store inventory for distance retailing; enriching delivery concepts with possibilities for click-and-reserve and same-day delivery; lower transportation costs applying click-and-reserve	Lower inventory and processing costs for retailer; possibility to enlarging assortment (bulky items, slow movers)
Challenges	Achieving efficient picking processes and economic inventory holding; shipment costs for click-and-collect to the store	Additional handling effort and two-stage picking (in DC and store); lower picking efficiency at store; store space requirement; real-time data exchange and IT requirements; higher transportation costs for home delivery	Higher lead times; advanced collaboration and data exchange with supplier required; lower customer convenience through limited options for order consolidation; potentially higher transportation costs
Forward distribution concepts	In-store buying; DC shipment; click-and-collect	Store shipment; click-and-reserve	In-store buying; Drop shipment; click-and-collect

The focus of this study is on principle concepts and typologies and not on operational problems for vehicle routing and shipment policies. However, regarding the links between source and destination, we determine the following: the non-food OC retailers surveyed use CEPs exclusively for direct-to-customer deliveries and a mix of own vehicles and third-party logistics service providers for store delivery as in single-channel distribution. In the next section, we focus on the destination concepts.

6.3 Archetypes of omni-channel destination concepts

Optimizing of the "last mile" is the central driver for developments in OC forward distribution. A cross-channel shopping experience for customers generates opportunities for attracting and retaining customers (Verhoef et al. 2007). OC delivery modes need to fulfill customer requirements across the channels. A COO of a DIY retailer states that the main objective is "to create consistent, cost-efficient, and functioning delivery modes." This also changes the way the logistics department needs to think, as a Head of IT and Logistics at an electronics retailer that originates from bricks-and-mortar business denotes:

> *"In multi-channel retailing, logistics is always in direct contact with our customers. Each mistake results in dissatisfied customers."*

Besides traditional in-store buying, the archetypes of OC destination concepts can be divided into home delivery and store pickup. For non-food forward distribution, home delivery constitutes all delivery concepts that CEPs apply to bring parcels to the customers, e.g., to the door or to parcel stations. At least nine out of ten distance orders of the OC retailers surveyed are fulfilled via home delivery, but a growing importance is placed on store pickup, as the Head of Logistics of a fashion retailer describes:

> *"Store pickup is our major growth driver. The additional process costs are justified, as store pickup increases customer frequency and opportunities for cross-selling."*

Store pickup increases the variety of delivery modes for higher customer convenience by allowing them to choose the preferred delivery location. Ultimately, outlets can act as pickup locations as an alternative to a parcel station. Especially OC retailers originating from bricks-and-mortar business consider store pickup to be an essential format for OC distribution. It allows them to generate higher frequency at their stores. Furthermore, the additional assortment available for pickup enhances the variety of products in the outlets. Almost 70 % of the OC retailers interviewed have already implemented store pickup solutions.

As the online trade is growing, this strategy can also be used to stabilize declining bricks-and-mortar sales and increase store managers' acceptance of an integrated OC strategy. Originally bricks-and-mortar retailers, furthermore, have a clear competitive advantage regarding store pickup as they have a widespread store network. However, they usually do not charge shipping fees on store pickup to increase store frequency. Retailers, therefore, need to bear the shipment costs, if stores have to be supplied separately via CEPs, which is the case for all the fashion retailers surveyed. Stores with a sufficient number of items per SKU on stock at their outlets can, however, leverage their store inventory for distance retailing. A prerequisite for this is an adequate IT system. In particular the large stores in the DIY and consumer electronics sectors have the privilege of using this concept.

In contrast, from the perspective of former pure mail-order retailers, store pickup is generally a costly service. The costs come from the additional in-store handling effort compared to home delivery and margin losses through bearing the shipping costs instead of earning a fee from customers for home delivery. Store pickup is, therefore, offered, but not actively advertised by this type of retailers. This highlights one of the major drawbacks of additional delivery modes, "they are costly." Shipping fees are only relevant for direct-to-customer deliveries. The fees demanded from customers depend on the competitive environment and country-specific traditions regarding direct deliveries. For example, in Germany only some fashion retailers that compelled to do so for competitive reasons ship absolutely free of charge. The non-fashion OC retailers charge shipping fees in dependence of order value. The main reason mentioned by all participants is that shipping fees generate significant additional revenue for the retailers. As long as customers are willing to pay, they will impose shipping fees.

Table 4 summarizes the various aspects of the destination concepts. The delivery modes offered represent an additional service for customers which increases their

Table 4 Summary of omni-channel destination concepts

Destination concept	In-store buying	Store pickup	Home delivery
Advantages	Direct customer contact; higher efficiency in DC picking and transportation; reduced risk for product returns	Direct customer contact; reduced risk for product returns; additional store frequency; virtual shelf extension; increased customer convenience	Increased customer convenience
Challenges	Fixed costs for bricks-and-mortar presence; limited assortment/item range and shelf space	Cross-channel IT requirements; increased in-store handling effort; shipping costs for click-and-collect	Picking costs; lead time; potential shipping fees; handling of bulky items
Relevant forward distribution concepts	In-store buying	Click-and-collect; Click-and-reserve	DC shipment; drop shipment; store shipment

convenience. This additional service is highly relevant with respect to customer satisfaction and loyalty. In the future, retailers will expand the variety of delivery destination concepts. Almost all OC retailers are currently assessing new forward distribution options and pushing for a convergence of distance retailing and outlet processing. The COO of a DIY retailer summarizes his effort in terms of delivery concepts in a way that also reflects the discussion above:

> *"Our objective is to offer each delivery velocity and delivery service a customer wants to have and is willing to pay for."*

7 Concepts in omni-channel backward distribution

An OC retailer's distribution system also requires a backward distribution concept, since online customers demand options for returning the products they purchased if they do not want to keep them. Return processes are almost as important as forward distribution and attract major attention from OC retailers. They are crucial for customer satisfaction, especially in the fashion sector, since it is difficult for customers to choose an ideal product online. Some fashion retailers post return rates of between 40 % and 50 %. The director of a fashion retailer summarizes: *"Returns are reality. We need to integrate them cost-efficiently into our business model."*

7.1 Omni-channel backward distribution typology

As with forward distribution, we leveraged early (e-commerce) literature (see Sect. 3) and the insights from our interviews to inform a typology of OC backward distribution concepts. Hereby, we classify the concepts first according to the return

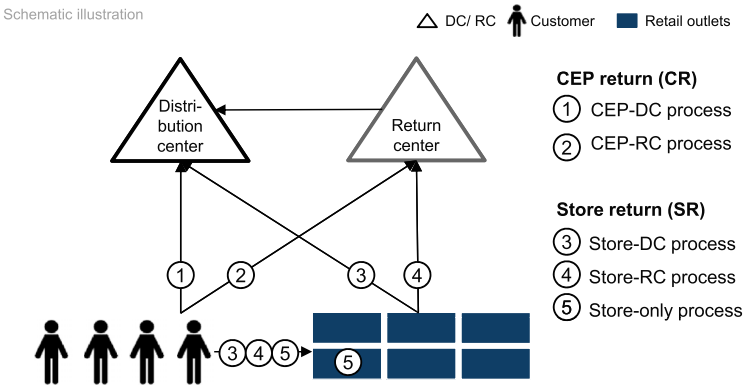

Fig. 3 Typologies of OC backward distribution

mode (CEP return (CR) and store return (SR)) and then further distinguish between the different processing locations. The different types (1)-(5) are depicted in Fig. 3.

CR The standard return mode is returning items via CEP. The returns are then shipped either to (1) a retailer's distance DC or (2) a specialized returns center (RC).

SR It is obligatory for OC retailers to establish in-store return options additionally for distance purchases. There are three different ways in which returns can be dealt with. On the one hand, in-store employees can send the returns to the DCs (3) or RCs (4) for further processing. On the other, returns can be processed and reworked directly at the store and added to the stores' inventory afterwards (5).

We will discuss these types in more detail within the following two subsections: focusing on the return modes and the processing locations that constitute the different concepts.

7.2 Archetypes of omni-channel return modes

Before entering the OC business, bricks-and-mortar retailers mainly had processes in place for returns of defective or rejected goods. The goods were returned at the outlet where they had been bought. The requirements for return processes are unequally complex within OC retailing. This starts with the return options which build the first pillar of our return process typology.

The standard mode is returns via CEP delivery. This reduces integration and process challenges for retailers across channels. Returning goods at the stores, regardless of whether they were ordered in the distance retail channel or bought in-store, is the second basic return mode. The following statement of the Head of Logistics of a fashion retailer is a prime example of this:

> *"We allow product returns in each outlet as a matter of course, regardless of where the product was bought."*

Table 5 Summary of omni-channel return modes

Return mode	CEP return	Store return
Advantages	Simplified processes and reduced complexity for the retailer	Higher customer convenience; access to direct customer feedback; cross-selling potential; fast reintegration into the sellable store inventory
Challenges	Additional transportation costs; time requirements for reintegration into sellable inventory	See CEP return if further processed with CEP to DCs/RCs; refunding issues and related IT requirements; in-store handling effort
Development stage	Initial solution	Advanced and extended solution

OC customers also want to select their preferred channel for returning items. Although all OC retailers surveyed agree that this is obligatory in the long run, it is not yet standard for all. While all retailers offer return with a delivery by a CEP, only half of the OC retailers surveyed explicitly state that they allow returns of goods ordered in the distance channel additionally at their outlets. The additional effort at the outlets, refunding issues, and IT requirements are reasons why retailers hesitate to roll out in-store return processes. Multiple return options for customers mean adjustments for in-store processes and the ERP infrastructure for cross-channel communication, but result in higher convenience for the customers. From this point of view, the most sophisticated OC stage with regard to return modes is reached when products ordered in distance retailing can not only be returned, but can also be directly refunded at the outlet. In-store returns can, however, bring further advantages for the retailer other than offering customers a convenient service. The direct contact with the customer who returns items can help to get information that contributes to tackling high return rates. Additionally, alternative items to the ones returned can be offered to the customer, thus leveraging cross-selling potential as well as possibly increasing customer satisfaction. From an operations point of view, in-store returns offer the possibility of quickly reintegrating returned items into the sellable store inventory. Table 5 summarizes the return modes discussed. Since speed is an important factor in returns handling, it is another potential advantage of in-store returns and will be further elaborated in the next sub-section on returns processing locations.

7.3 Archetypes of omni-channel return processing locations

From an operational perspective, fast and efficient return processes are necessary. As faster the return processes as sooner the reworked products are available for resale. This is particularly essential for fashion retailers due to high return rates and relatively short seasonal periods. The return processing location itself can also be separated into different categories.

Almost three quarters of the OC retailers interviewed process returns only at the *distance retailing DC*, where a dedicated area is reserved. One advantage of this processing mode is that reprocessed goods can quickly be returned to the distance

retail inventory. A common strategy, therefore, is to process returned goods directly to the picking zone after checking and preparing. Another positive aspect of processing returns at a DC is that the DC's workforce can be assigned flexibly to picking or return reprocessing. This is an important factor because of picking distance retail orders usually peaks at the beginning of a week, while returns arrive at the DC one to two days later, so this system means that the workforce can be balanced. Notifications of returns by the customers before the products are sent back are used as a lever by several retailers to further improve workforce scheduling.

Another return processing location is a *separate RC*, operated by the retailer or a service provider. It is mainly used when return handling processes become too work-intensive and DC capacities are scarce. These centers are specialized in processing returns. Outsourcing return operations can offer potential cost savings if products are reworked in low-wage countries. This is why external RCs are used most often by fashion retailers with high return rates, because they can reduce their processing costs. However, in this case, a longer lead time for reprocessing has to be taken into consideration. This in turn is a challenge for fashion retailers with high return rates. In general, fashion items are only in demand for a limited period. Long lead times for reintegration into the sellable inventory may therefore lead to a loss of sales, if items are still being reworked and are unavailable. This illustrates the ambivalent nature of separate RCs, particularly for fashion retailers. A combination of processing returns at DCs and RCs is also possible. Goods that require more complex reprocessing are then shipped to the RC, whereas simpler reworking is carried out at the DC. Dedicated RCs are, however, only used by less than 20% of the OC retailers surveyed. The items are shipped from the RC to the DC after return processing.

A further option is *processing returns in-store*. Within this processing mode, goods need to be checked and reprocessed in-store. Reusable items remain at the store, whereas other goods are further processed to a central return location. This solution can be observed at retailers with large outlets, which have sufficient space for such operations. In this case, transportation costs can be saved, but additional labor costs need to be considered as well as synchronized ERP systems across channels to update the store inventory positions. About one-tenth of the OC retailers surveyed rely on a processing mix of in-store and in-DC. Nevertheless, as the Head of E-commerce at a fashion retailer states:

> *"Direct rework at the stores and integrating the products into our store inventory is the fastest option to get the returns back into our sellable inventory. As we have established lean in-store return processes, it is the most efficient option for us."*

Table 6 summarizes the findings related to the return processing locations. For customers and retailers, it is important for returns to be processed quickly and efficiently. Speed matters for customers because they expect immediate reimbursement. Retailers want fast integration of reworked products into their sellable inventory. The preferred processing location depends on a retailer's structural conditions, e.g., available space at outlets and DCs. As discussed above, the trade-off must be resolved between time and cost for external RCs and internal

Table 6 Summary of omni-channel return processing locations

Processing location	Distance DC	Separate RC	Store
Advantages	Fast reintegration of returns into distance retail inventory; potential of workforce pooling and workload balancing	Specialized processing; potentially cheaper processing	Fast reintegration of returns into store inventory; transportation cost savings
Challenges	Space requirements; processing in case of intensive rework; additional transportation costs if shipped from store	Time for reintegration into sellable inventory; additional transportation costs from store and to DC	Space and IT requirements; higher processing costs than in DC/RC

processing. Furthermore, strategic decisions, such as where to offer returned and reprocessed goods, are an important issue. Several retailers argue that they offer returned goods only at their bricks-and-mortar stores, because distance retail customers do not accept any sign of goods having been recently tried on or tried out. For those retailers, direct reworking at the store might be an option for reducing transportation costs and handling. Other retailers use only their online store for returned goods, offering them there at a reduced price. For those retailers, direct reworking at the store is senseless.

8 Discussion

In this section, we discuss our empirical findings in the context of the literature. We contribute through this study to three main issues. We identified and systematized the forward and backward concepts used in OC retailing. We determined the areas of application and development required for achieving excellence in OC fulfillment and logistics, and finally we showed the need for developing sector- and context-specific OC distribution systems.

8.1 Systematization of concepts for OC distribution based on empirical data

The retail distribution system was traditionally built as cost-efficient approach for delivering goods to stores (Hübner et al. 2013b). However, the advent of OC retailing has made the supply chain a consumer-facing frontend (Rabinovich and Bailey 2004; Rao et al. 2009). The fast growth of pure online retailers has forced bricks-and-mortar retailers to quickly build up e-commerce capabilities. However, in this race, retailers frequently have failed to fully consider integration with traditional store fulfillment. This has resulted in inefficient supply chains and a lack

of transparency across channels. What is more, the vast majority of retailers believe they require a comprehensive transformation, rather than an incremental change (EY 2015).

To support retailers in these changes in logistics structures, we systematized forward distribution according to source location (supplier DCs, retailer DCs, stores) and destination locations (home, stores), and we elaborated options for store delivery, home delivery, and store pickup in OC distribution. Return processes were investigated in a similar manner by distinguishing between source (stores, home) and destination locations (stores, DCs, RCs).

The empirically developed typologies and comprehensive systematization constitute an addition to the literature. By analyzing market data and information from 43 interviews, we have been able to develop a structured overview of concepts existing in practice. Related framework papers are based on literature reviews and not primary market data, and they focus mainly on the aspects of e-channel fulfillment, rather than comprehensive OC requirements. Swaminathan and Tayur (2003) and Agatz et al. (2008) discuss issues and general models from an e-fulfillment perspective. Both derive their findings primarily from the literature. Similarly, Fernie et al. (2009) describe the developments in e-tail logistics based on single case studies, mainly in the context of grocery retailing. Although OC retailing has some features that are related to e-commerce, it is not clear how e-commerce lessons are valid for OC concepts (Brynjolfsson et al. 2013).

We further contribute to the literature by providing our specific findings for non-food distribution, since previous literature focused on non-food warehouse management for OC retailing (e.g., Hübner et al. 2015) and on grocery-specific distribution issues with online retailing (e.g., Kämäräinen et al. 2001; Punakivi et al. 2001; Punakivi and Tanskanen 2002; McKinnon and Tallam 2003; Boyer and Hult 2005; Grant et al. 2006, 2014; Hübner et al. 2016b).

8.2 Qualitative analyses of distribution design concepts

The broad empirical analysis supports the identification of contextual and industry-specific factors affecting design choices, and challenges in implementing the different distribution concepts. Our empirical findings show that most retailers still rely on distribution concepts via a central DC as a standard solution for achieving scale and pooling effects. For this reason, deliveries are rarely made from stores or suppliers. EY (2015) show that only 40% of retailers think that their current execution of goods distribution is effective. Every third retailer states that, "having a responsive, combined omni and traditional supply chain infrastructure is a key success factor" (EY 2015). The integration of the channels from a customer point of view, and the implied insight into inventory, is a starting point, but not enough. Successful OC retailers need to be able to fulfill demand from any channel and from any inventory location (Baird and Kilcourse 2011). In the context of multi-channel network design, Alptekinoğlu and Tang (2005) and Liu et al. (2010) conclude that

expanding bricks-and-mortar DCs for online distribution and fulfilling online orders from physical stores pools inventory risks. Our research contributes to further development in this direction by identifying which areas of OC distribution are necessary to achieving excellence in fulfillment and logistics. These key success factors from a retailer's point of view are enhanced delivery modes together with shorter lead times and flexible inventory allocation.

The literature mainly develops frameworks for physical distribution quality in e-fulfillment (see e.g., Boyer et al. 2002; Rabinovich and Bailey 2004; Xing and Grant 2006 or Xing et al. 2010). The critical elements for online purchases are availability, delivery time, condition on arrival, return options and convenience, and the perceived service quality of the logistics service providers (Lang and Bressolles 2013). But specific elements for OC distribution are discussed only marginally, if at all. Store integration, however, is important within OC distribution, because an OC retailer's greatest opportunity is to tie demand capture from all channels into in-store fulfillment (Baird and Kilcourse 2011).

A further stream of literature discusses the performance effects of adding an online channel to existing bricks-and-mortar channels. For example, Neslin et al. (2006), Wolk and Skiera (2009) and Banerjee (2014) show that a retailer's financial and strategic performance depends on an optimized channel mix, channel design and level of channel independence, as well as optimal resource allocation across channels. They identify the positive effects of well-aligned channels. However, the analysis of the concrete design of the distribution concepts remains on an aggregate level.

The typologies developed in this paper serve as a framework for investigating the criteria for OC distribution concepts. Our qualitative analysis will help retailers to define their mix of OC distribution types. We contribute to the literature by identifying the advantages, challenges, and contextual factors for each of these distribution types. The expert interviews showed that integrating distribution concepts for distance and bricks-and-mortar channels can result in the benefit of cross-channel synergies, from both an operational and a service perspective. However, the objective was not to show one correct solution for designing a successful distribution strategy, because there is no single best practice valid for every market situation. Rather, the aim was to provide a framework of concepts that can be applied to build context-specific distribution models. Thus, this paper discussed the advantages and challenges of each concept, combining forward/backward sources and destinations.

Most of the literature does not consider product characteristics for distribution across multiple channels. However, customers have higher expectations on fulfillment for specialty goods than for convenience goods. Their satisfaction levels arising from delivery speed vary accordingly. Therefore, industry-specific order fulfillment strategies based on product characteristics should be implemented (Thirumalai and Sinha 2005). We not only discussed these concepts in general for

non-food retailing, but also identified industry and product specifics for OC distribution.

Moreover, we also extended the discussion of distribution quality for return concepts. We find that return processes and processing locations are highly dependent on structural conditions. However, the only thing that matters is the quality of any reworking and the speed of reintegration. Offering customers return options with quick reimbursement on all channels improves customer service and is the target scenario for OC retailers.

9 Conclusion and future areas of research

The advent of channel-independent shopping behavior requires answers on how to configure seamless forward and backward distribution for OC retailing. The distribution concepts for OC retailing become manifold. The distribution process is much more complex as retailers need to orchestrate various dispatching locations and enable the shipment to various destination points, whereas for a single-channel retailer the physical flow of goods is more or less linear. Almost all retailers are currently assessing new distribution options and pushing for a convergence of distance retailing and outlet processing. However, retail practice and current literature lack an empirically proven, integrated, and systematic perspective on OC forward and backward distribution structures. We carried out a comprehensive exploratory study to address this gap. The study was based on expert interviews with 43 executives from 28 main OC retailers with headquarters located in a German-speaking country and five logistics service providers. This enables a broad exploration of the concepts and their applications.

The main results of our study can be summarized as follows: Expanding delivery modes, increasing delivery speed and service levels are the key topics for excellence in omni-channel forward and backward distribution. Direct-to-customer shipments are mostly executed from a central retail DC. Retailers gain economies of scale and inventory pooling effects when this DC also supplies stores. Cutting-edge OC retailers offer in-store pickup and in-store return options and can use their in-store inventory also for customer pickup. The qualitative analyses of design concepts will help managers to understand key causal relationships, contextual factors, and to identify their context-specific development options. Our typologies advance knowledge in retail distribution and guide research towards crucial questions for further areas of study in model-based and empirical approaches for OC retailing.

Our research is based on interviews with main OC non-food retailers having their headquarters in German-speaking countries. Thus, one of our core limitations is the geographical scope of the investigation. Different market conditions like higher online penetration, longer travel distances, or less developed retail structures also influence the design requirements for distribution. One example of country-specific characteristics is the extent of home delivery. In Germany, home delivery is well-

established through the catalog business, while it is used less in other countries like the US (Grant et al. 2014). Furthermore, as we focused on non-food, we did not analyze grocery distribution, which is much more complex, e.g., as it requires same-day home delivery with temperature-controlled vehicles. Moreover, this paper did not assess who carries out the operations. Choosing the service provider for the last mile is a crucial decision for home deliveries. The question of profitability is not answered with the distribution concepts developed above. Further quantification of the various characteristic attributes is lacking and should be provided in future studies.

Our empirical study can be used for further research in various directions. First, for further empirical research, the design options and typologies provided within this study can serve as a basis for hypotheses on successful OC distribution which could be tested using quantitative methods. Quantitative indicators could also be derived, such as an OC integration level or OC development stages. Additionally, the interrelations and dependencies analyzed and discussed within this study can be tested in separate surveys. Also the findings generated mainly from German-speaking countries can be transferred to other markets. Our findings are limited to non-food retailers. The findings can be further tested with grocery retailers.

Second, a quantitative-based stream can focus on modeling approaches to support forward and backward distribution decisions of OC retailers. Our literature review shows that models, which address the logistics planning problems of retailers with multiple channels holistically taking into account implications for traditional bricks-and-mortar and e-commerce business, are relatively scarce. Our study can serve as a starting point for modeling the different design options and their implications for solving the potential trade-off of service and costs. Potential models might, e.g., analyze the optimal portfolio of delivery options or network structures.

Finally, selected topics should be investigated in more depth either by case studies or modeling approaches. Such topics can cover for example questions of establishment and effectiveness of transshipments between stores, cost-efficient selection of transportation modes for cross-channel deliveries or cross-channel inventory allocation.

This research will help retailers to build their distribution strategies in the OC transformation process, while research can leverage the typologies for further empirical and model-based research.

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Appendix

Overview of questions asked within the expert interviews

OC logistics: role, network, development and integration
Please identify and prioritize characteristics of an excellent OC distribution.
What are the most relevant logistics areas for OC distribution?
Please describe your OC network.
Do you rely on integrated or separate (channel-specific) warehouse locations?
Why do you apply such a network type? What are the advantages and challenges of this type of network?
During your presence in OC retailing, have there been adjustments in the network structures?
What are future development scenarios?
OC forward distribution
Please describe your OC forward distribution systems.
Which delivery modes exist?
Why do you apply such delivery modes? What are the advantages and challenges of these delivery modes?
During your presence in OC retailing, have there been adjustments in the delivery modes?
What are future development scenarios?
How is the delivery mode related to other OC logistics areas?
OC backward distribution
What is your return quota and what are your costs for returns?
What are the reasons for these numbers?
Please describe your return processes.
Who is responsible for return processing?
Why do you apply such return processes? What are the advantages and challenges of these processes?
During your presence in OC retailing, have there been adjustments in the return processes and policies?
What are future development scenarios?
How is the backward distribution related to other OC logistics areas?
Further questions
How relevant is delivery speed for home deliveries?
How important is same-day delivery for you today/ in future? Do you apply same-day deliveries?
How relevant is store pickup for you today/ in future? Do you apply store pickup?

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