



Research Center
Finance & Information Management



Project Group
Business & Information
Systems Engineering

Omni-Channel Retail Capabilities: An Information Systems Perspective

by

Sabiölla Hosseini, Maximilian Röglinger, Fabian Schmied

to be presented at: 38th International Conference on Information Systems (ICIS),
Seoul, South Korea, December 2017

WI-683

University of Augsburg, D-86135 Augsburg
Visitors: Universitätsstr. 12, 86159 Augsburg
Phone: +49 821 598-4801 (Fax: -4899)

University of Bayreuth, D-95440 Bayreuth
Visitors: Wittelsbacherring 10, 95444 Bayreuth
Phone: +49 921 55-4710 (Fax: -844710)



Omni-Channel Retail Capabilities: An Information Systems Perspective

Completed Research Paper

Sabiölla Hosseini
FIM Research Center
University of Augsburg
Universitätsstraße 12
86159 Augsburg, Germany
sabiöella.hosseini@fim-rc.de

Maximilian Röglinger
FIM Research Center
University of Bayreuth
Wittelsbacherring 10
95444 Bayreuth, Germany
maximilian.roeglinger@fim-rc.de

Fabian Schmied
FIM Research Center
University of Augsburg
Universitätsstraße 12
86159 Augsburg, Germany
fabian.schmied@fim-rc.de

Abstract

Emerging technologies enable customers to define by themselves through which channels they would like to interact with retailers. These technologies also enable retailers to emancipate from traditional channels, to offer services anytime and anywhere, and eventually to evolve into omni-channel retailers. In fact, most interactions between customers and retailers are enabled by information technology. Nevertheless, many retailers struggle with identifying and implementing IS capabilities that help meet customers' interaction preferences in omni-channel environments. Despite this strong practical need, there is little guidance in the academic literature. To address this research gap, we present a framework of IS capabilities for omni-channel retail. Exploratory in nature, the framework is grounded on a structured review of the academic literature, practitioner publications, and an online survey involving global retailing experts. Comprising twelve operational IS capabilities, our framework is an initial attempt to structure the field of omni-channel IS capabilities.

Keywords: IS Capabilities, Digital Channels, Omni-Channel, Retail

Introduction

The retail industry is an important element of the global economy, accounting for 31% of the global gross domestic product (Falke Information 2016). The retail industry is also in a constant flux, with digital technologies increasingly transforming retail operations and blurring the lines between different channels and customer touchpoints (Rigby 2011; Trenz 2015; Verhoef et al. 2015). For instance, Tesco has created virtual stores in subway stations that allow travelers to place orders by scanning QR codes on pictures of grocery store shelves with their smartphones (Ju and Li 2011; Rigby 2011); Amazon is venturing into digitally supercharged bricks-and-mortar stores that recognize customers by their smartphones and automatically process payments without manual interaction required when customers leave the store (Grewal et al. 2017). Hummel, a European sports fashion company combined customers' in-store experience with the social media activities of the company (Hansen and Sia 2015). Customers who tried Hummel products in bricks-and-mortar stores could upload pictures of themselves on Instagram. Pictures of customers with the hashtag #hummelsport were shown on live screens in the store as well as on the global website of Hummel.

Customers, in turn, increasingly expect retailers to be available anytime and anywhere and to provide consistent experience across all retail channels and touchpoints (Hansen and Sia 2015; Straker et al. 2015). In fact, many customers use several channels during the customer journey (Mirsch et al. 2016a) and are often simultaneously present in the physical and the digital world (Nüesch et al. 2015). For instance, customers often use their smartphones to gather additional information before making a purchase decision (Lazaris et al. 2015, Mirsch et al. 2016b), which is why retailers such as Macy's have started to provide free Wi-Fi in their physical stores (Brynjolfsson et al. 2013; Tseng and Yazdanifard 2015). Other customers buy products online and then expect to be able to pick them up in physical stores (Bell et al. 2014; Hübner et al. 2016b). Consequently, retailers are not only trying to add new digital channels and touchpoints to their channel mix, but also to integrate all of them into a seamless customer experience, called omni-channel retail (Bell et al. 2014; Brynjolfsson et al. 2013; Piotrowicz and Cuthbertson 2014; Verhoef et al. 2015).

Omni-channel retail has shown to provide various benefits to retailers and customers including enhanced operational efficiency (Oh et al. 2012), increased sales (Cao and Li 2015; Gallino and Moreno 2014), improved customer experience (Herhausen et al. 2015), loyalty (Van Baal 2014), and trust (Cao and Li 2015). Unsurprisingly, a worldwide survey conducted by Retail Systems Research (RSR) showed that 84% of the retailers think that the provision of a consistent customer experience across all channels is essential (eMarketer 2013). However, the integration of different channels and touchpoints also increases operational complexity (Gallino and Moreno 2014), presenting "far greater obstacles to retailers [...] than the literature suggests" (Lewis et al. 2014, p. 60), and many retailers struggle with their transformation initiatives (Business Insider 2017; Williams and Cameron 2015).

Digital technologies clearly play an instrumental role in the retail industry's transition toward omni-channel retail (Grewal et al. 2017; Piotrowicz and Cuthbertson 2014; Rigby 2011). However, there is surprisingly little guidance in the academic literature that would allow researchers and retailers to understand and evaluate the complex web of digital technologies that underlie omni-channel retail capabilities. Particularly, the role of IS as an enabler for omni-channel retail has been under-researched (Piotrowicz and Cuthbertson 2014; Lazaris and Vrechopoulos 2014). Extant research on information systems (IS) in retail contexts has either limited its focus to the investigation of a specific digital technology (Aguirre et al. 2015; Meuter et al. 2000; Yuksel et al. 2016) or broadly focused on information systems infrastructure at an abstract level (Luo et al. 2016; Oh et al. 2012). For instance, Inman and Nikolova (2017) present an overview of shopper-facing retail technologies, but they do not focus on omni-channel retail. Lazaris et al. (2015) consider mobile apps as one single technology which is important in an omni-channel environment. Nevertheless, as ever more customer-retailer interactions are shaped by technology advancements and IT, Piotrowicz and Cuthbertson (2014) and Gu and Tayi (2017) emphasize the role of IS in enabling omni-channel retailing. To the best of our knowledge, current research has not yet systematically identified which IS capabilities retailers must develop to succeed in omni-channel environments. Within a research-in-progress conference paper, Mirsch et al. (2016b) proposed to identify dynamic capabilities for the transition to omni-channel management by conducting a multiple-case study. To the best of our knowledge, the results of their study has not yet been published. The value of extant works undisputed, a comprehensive view on operational IS capabilities for omni-channel retail is entirely missing. Thus, our research question is as follows: *What operational IS capabilities do omni-channel retailers need?*

To address this research gap, we present a framework of operational IS capabilities for omni-channel retail. Exploratory in nature, the framework is grounded on a structured review of the academic literature, practitioner publications, and an online survey involving global retailing experts. Our study is structured as follows: First, we provide background information on omni-channel management, capability frameworks, and IS capabilities. We then introduce our research method. As the core of our work, we present our IS capability framework for omni-channel retail. After illustrating the applicability of our framework, we conclude with a summary, limitations, and ideas for further research.

Theoretical Background

From Single- over Multi- to Omni-Channel Retail

In the early days of retailing, characterized by the appearance of the first department stores, retailers focused on bricks-and-mortar stores as single distribution channel (Kowalkiewicz et al. 2017). Consequently, customers had to access physical stores to make purchases. Over time, retailers began to broaden their channel mix and to provide services via additional channels such as the phone. Later, information was provided via corporate websites. For some time, customers can purchase products via different channels, such as online shops or social selling solutions. Many of today's leading retailers were founded as pure online retailers. In most traditional channels, the communication between retailers and customers was unidirectional (Mohr and Nevin 1990), whereas digital channels (e.g., mobile apps, online chats) facilitate bidirectional communication. The emergence of smart phones and smart things also enables retailers to immerse into their customers' everyday life (Rosemann 2014). In the case of smart home devices, such as Google Home or Amazon Echo customers can interact with retailers unconsciously, i.e., smart devices to infer customer needs based on sensor data or they may act as customers by themselves (Kees et al. 2015; Kowalkiewicz et al. 2017).

In line with the uptake of the Internet and the resulting emergence of digital channels, the retail industry has largely transformed over the last two decades (Verhoef et al. 2015). New, purely online based retailers like Amazon or Dell have emerged and many traditional bricks-and-mortar retailers like Walmart or Tesco have expanded their channel mix to include online channels. During the last two decades, channels were primarily considered as distribution channels. Researchers focused on determining the appropriate mix of distribution channels for each product type (Black et al. 2002). In a broader sense, channels serve as distribution or communication channels. They can be described as a retailer's contact points or media for interacting with customers (Neslin et al. 2006). Based on prior research, we consider channels as routes of communication between retailers and customers (Hosseini et al. 2015). As such, channels can be classified as offline channels (e.g., physical stores), online channels (e.g., online shop), and traditional direct marketing channels (e.g., catalogs) (Verhoef et al. 2015). Traditional online channels have been substantially extended by the emergence of additional digital channels, such as mobile channels and social media (Rigby 2011; Verhoef et al. 2015). Due to the growing importance of digital channels, Straker et al. (2015) analyzed 100 companies across 16 industries to derive a typology of digital channels, comprising 34 digital touchpoints (e.g., website, live chat, blogs). Accordingly, digital channels can be grouped as functional, social, community, and corporate channels (Straker et al. 2015).

With the provision of multiple channels, the concept of multi-channel management emerged. Many retailers were and still are facing traditionally grown siloed organizational structures and are operating and optimizing channels separately (Gallino and Moreno 2014; Nüesch et al. 2015; Piotrowicz and Cuthbertson 2014; Rigby 2011). From a management perspective, companies investigated whether to add additional channels or not (Geyskens et al. 2002, Mirsch et al. 2016a). From a customer perspective, channels were not intertwined (Beck and Rygl 2015). This drawback, however, does not reflect the fact that customers intend to use different channels simultaneously and seamlessly (Gu and Tayi 2017; Juaneda-Ayensa et al. 2016; Nüesch et al. 2015; Stone et al. 2002).

Hence, researchers proposed to focus on omni-channel management, an approach that attempts to consider all channels in a holistic and integrated manner (Verhoef et al. 2015). As such, omni-channel management can be defined as *"the synergetic management of the numerous available channels and customer touchpoints, in such a way that the customer experience across channels and the performance over channels is optimized"* (Verhoef et al. 2015, p. 176). In contrast to multi-channel management, retailers are considered as omni-channel retailers if they integrate all channels from both the customers' viewpoint and

their own viewpoint (Beck and Rygl 2015). For instance, from a customers' perspective, channels are perceived as integrated if products can be returned anywhere regardless of the purchase channel or if customers can redeem coupons across channels (Beck and Rygl 2015). From an internal perspective, channels are integrated if data such as customer, pricing, and inventory data are shared across all channels (Beck and Rygl 2015). Multiple channels are no longer seen as independent silos, but as contributors to seamless customer experience (Nüesch et al. 2015; Van Bruggen et al. 2010).

In literature, there is considerable research on better understanding the multi-, and omni-channel shopping behavior of customers. For instance, Venkatesan et al. (2007) analyze the drivers of customers' multi-channel shopping behavior. As omni-channel retail is related to the emergence of innovative digital channels, Juaneda-Ayensa et al. (2016) identify factors that influence the omni-channel shopping behavior by examining the acceptance of and the intention to use new technologies. Gu and Tayi (2017) analyze customers' behavior regarding different product placement strategies of retailers, i.e., whether a product is sold online exclusively or across all channels. Besides, Gu and Tayi (2015) examine customers' behavior with regard to distinct return policies that are implemented by retailers. Furthermore, numerous researches considered customers' channel choice and the switching behavior of customers between different channels (e.g., Gensler et al. 2012; Schoenbachler and Gordon 2002; Sonderegger-Wakolbinger and Stummer 2015; Verhoef et al. 2007).

Capability Frameworks

Capabilities are related to the resource-based view of the firm (RBV) (Wade and Hulland 2004; Wernerfelt 1984). Accordingly, organizations possess resources enabling them to create competitive advantage and superior long-term performance (Dreiling and Recker 2013; Hosseini et al. 2017). Organizations achieve a competitive advantage when they are "implementing a value creating strategy not simultaneously being implemented by any current or potential competitors" (Barney 1991, p. 102). To do so, resource configurations must be valuable, rare, imperfectly imitable, and non-substitutable (Barney 1991). Resources are split into assets and capabilities. Assets are anything tangible or intangible that can be used by an organization (Helfat and Peteraf 2003), whereas capabilities are "repeatable patterns of actions in the use of assets to create, produce, and/or offer products to a market" (Wade and Hulland 2004, p. 109). In contrast to physical or other tangible assets, capabilities provide an understanding of non-transferable resources and processes within an organization (Dreiling and Recker 2013). Hence, capabilities are inevitable to sustain competitive advantage (Helfat and Peteraf 2003; Teece et al. 1997).

Related work distinguishes operational and dynamic capabilities (Dreiling and Recker 2013; Pavlou and El Sawy 2011). Operational capabilities are dedicated to organize recurring processes, i.e., they help make a daily living (Winter 2003). Whereas, dynamic capabilities help adapt and reconfigure competences, i.e., operational capabilities, in turbulent environments (Dreiling and Recker 2013; Hosseini et al. 2017; Pavlou and El Sawy 2011). Hence, dynamic capabilities are seen as higher-order capabilities that develop over time from bundles of operational capabilities (Koch 2010; Sambamurthy et al. 2003).

Typically, capabilities are structured via capability frameworks (Forstner et al. 2014). Capabilities with similar characteristics can be grouped into capability areas (Hosseini et al. 2017). Researchers provided capability frameworks for different domains such as business process management (BPM) (Rosemann and Vom Brocke 2015), innovation management (Hosseini et al. 2017; Lichtenthaler and Lichtenthaler 2009), and intercultural management (Ang and Inkpen 2008). For instance, Rosemann and Vom Brocke (2015) provide a framework that structures BPM capabilities along six factors (i.e., strategic alignment, governance, methods, IT, people, and culture). In innovation management, Dreiling and Recker (2013) present a framework distinguishing organizational, individual, technological, and process capabilities.

IS capabilities are a central building block of IS research. In this study, we take a broader perspective on IS capabilities. By considering prior research and adapting it to the domain of omni-channel retail, we define IS capabilities as a retailer's ability to assemble, integrate, and deploy IS resources to meet customer needs and to provide seamless experience across all channels (Bharadwaj 2000; Sambamurthy et al. 2003; Wei et al. 2014). For instance, McLaren et al. (2011) develop a model for measuring the fit between a firm's competitive strategy and its IS capabilities. Niehaves et al. (2011) present a capability framework for IS-enabled business process change by distinguishing sensing, seizing, and transformation capabilities. As another example, Feeny and Willcocks (1998) developed an IS capability framework for exploiting IT. This framework includes nine core IS capabilities: leadership, business systems thinking, relationship building,

architecture planning, making technology work, informed buying, contract facilitation, contract monitoring, and vendor development. Each core capability can be assigned to at least one of the following categories: business and IT vision, design of IT architecture, and delivery of IS services (Feeny and Willcocks 1998).

Moreover, IS capabilities can be categorized as inside-out, outside-in, and spanning capabilities (Day 1994, Wade and Hulland 2004). Inside-out capabilities are internally focused and developed in response to market requirements, such as IS technical skills or IS development (Wade and Hulland 2004). Conversely, outside-in capabilities are externally oriented and focus on anticipating market requirements and understanding competitors, such as external relationship management or market responsiveness (Wade and Hulland 2004). Spanning capabilities such as IS-business partnerships or IS planning and change management are necessary to combine inside-out and outside-in capabilities (Wade and Hulland 2004). For instance, the categorization of inside-out, outside-in, and spanning capabilities has been applied by Koch (2010) who investigated capabilities that are needed to develop successful electronic marketplaces.

Research Method

To derive the framework of IS capabilities for omni-channel retail, we followed a multi-phase research process. In the first phase, we conducted a structured literature review to identify IS capabilities for omni-channel retail. In the second phase, we conducted an online search and an expert survey to derive current trends in omni-channel retail that are not yet sufficiently covered in the literature. In the third phase, we derived a set of IS-enabled customer-retailer interactions based on the identified trends and developments. This step was reasonable and necessary as the identified trends were too abstract to directly derive IS capabilities. In the fourth phase, we used these customer-retailer interactions to identify and structure IS capabilities for omni-channel retailers. Below, we provide details on each research phase.

In the first phase, we aimed to identify IS capabilities for omni-channel retailers via a structured literature review in line with Vom Brocke et al. (2009) as well as Webster and Watson (2002). We accessed three databases covering an IS and management perspective, i.e., AISel, EBSCOhost, and Science Direct. Our search strings were (1) "Omnichannel", (2) "Omni-Channel", (3) "Retail", and (4) "Capabilit*". We combined the search strings using the following logic: [(1) OR (2)] AND (3) AND (4) in all fields. This search resulted in 64 peer-reviewed articles. Following Brunswicker et al. (2012), we analyzed the abstracts of these articles and excluded irrelevant contributions. The remaining nine articles addressed important topics in omni-channel management or omni-channel transformation. Nevertheless, none of them explicitly dealt with IS capabilities for omni-channel retail.

The poor results of the structured literature review revealed that IS capabilities for omni-channel retail cannot be compiled directly and solely based on academic literature. Hence, in the second phase, we continued adopted an alternative explorative approach, as proposed by McLaren et al. (2011). We extended our research twofold. First, we identified grey literature (e.g., white papers, studies, articles of retail experts) and, second, we conducted an online survey with omni-channel retail experts. We conducted a structured literature review with two popular search engines, i.e., Google and Microsoft Bing to identify grey literature. In both search engines, we searched broadly for "omnichannel trends" and "retail trends," as we did not expect to find a considerable number of results directly related to omni-channel capabilities. After excluding irrelevant and duplicate results, we analyzed 74 contributions from grey literature.¹ Additionally, following McLaren et al. (2011), we conducted an online survey with omni-channel experts to further enrich our results. This approach was reasonable as we aimed to identify future-oriented capabilities that might not yet be covered by the academic literature, but possibly already discussed in innovative retail and consulting firms. To support the explorative character of our study, the survey encompassed open-ended questions regarding IS-related trends and developments in omni-channel retail as well as future-oriented forms of customer-retailer interactions. Survey participants were selected based on their experience in omni-channel retail. We contacted 172 experts via e-mail as well as via the online business networks LinkedIn and Xing. Thereof, 29 practitioners, particularly from consulting and retail industry, participated in the survey. The retail experts were working in different countries such as Australia, Canada, Germany, Switzerland, UK, and the US. Most participants were very experienced: 55% of the participants have been working in the

¹ We do not present the full list of articles in this paper, but we are happy to forward it upon request.

retail industry for more than ten years, 24% started their career in retailing more than 20 years ago (Figure 1). The participants had job titles such as Head of Retail, Senior Partner, Managing Partner, Senior Research Consultant, Vice President eCommerce, Omnichannel Strategist, and Manager Omnichannel Solutions.

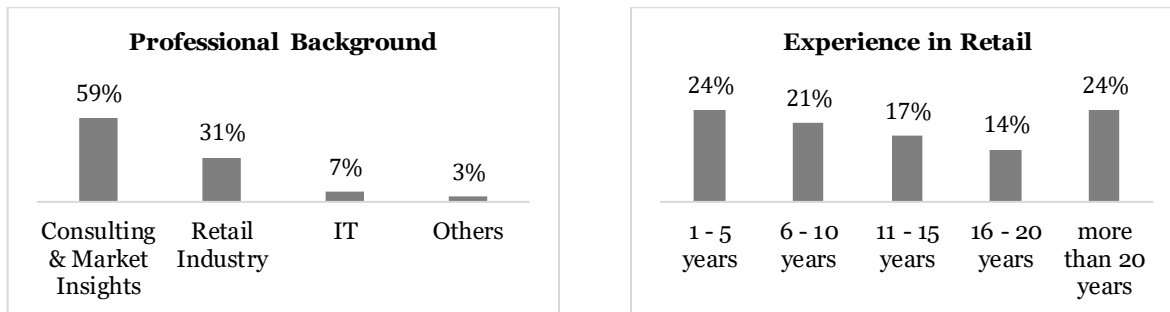


Figure 1. Information about the Survey Participants

In the third phase, we used the insights gained from grey literature and omni-channel retail experts regarding trends and developments in omni-channel retail to derive a catalog of IS-enabled customer-retailer. We considered customer-retailer interactions as a reasonable foundation for the identification of IS capabilities for omni-channel retail because interactions are at the heart of profitable long-term customer relationships (Melero et al. 2016). Further, customer-retailer interactions in omni-channel environments are enabled or at least supported by IT. In this study, we focus on more future-oriented interactions. We structured customer-retailer interactions via multiple dimensions, which we outline below. Each interaction is grounded on at least one identified omni-channel retail trend as well as on examples we found in the grey literature and in the online survey.

In the fourth phase, we used the customer-retailer interactions as foundation for compiling a framework of IS capabilities for omni-channel retail. In line with the explorative nature of our study, each author initially identified IS capabilities necessary to enable distinct customer-retailer interactions. Based on iterative discussions within the author team, we excluded capabilities that are not supported by all authors. Hence, the framework contains only capabilities that are considered important by each author. After that, we validated all identified capabilities by searching for justificatory references in academic literature. As research regarding IS capabilities for omni-channel retail is still in its infancy, the structured literature review in the first research phase did not provide relevant results. Therefore, the provided justificatory references do not include the capabilities as such, but contain statements that support the necessity of the identified capabilities. Finally, we refined the definition of the capabilities and unified their nomenclature, as far as possible. When deriving the framework, we paid attention to keep the capabilities as omni-channel-specific as possible. However, we cannot exclude that some capabilities are also relevant for traditional bricks-and-mortar retailers or pure online retailers. To ensure a long half-time of our framework and the included capabilities independent from the rapid development of digital technological, we deliberately chose a high level of abstraction. This is why we use the terms capability and capability area interchangeably below. Further, we derived a mapping of customer-retailer interactions and capabilities. The mapping illustrates the required capabilities that enable the previously identified customer-retailer interactions. Therefore, each interaction was assessed by all authors independently. The final mapping reflects the results of subsequent group discussions within the author team.

IS-Enabled Customer-Retailer Interactions

As a first result of our study, we now present a catalog of IS-enabled customer-retailer interactions that reflect the insights of our structured literature review and the online survey with retail experts. We structure the identified interactions using three dimensions, i.e., the stages within the customer journey, the customer's location, and the initiator of an interaction (Table 1). As customer-retailer interactions occur in any phase of the customer journey, we first structured the identified interactions following typical customer journey stages as presented by Lemon and Verhoef (2016). We distinguish a prepurchase, purchase, and postpurchase stage. The prepurchase stage includes the customers' interactions before purchase, such as recognition of needs, search for information, advice, and evaluation of alternatives. The purchase stage,

which is the shortest stage in terms of time, covers the purchase event itself as well as the fulfillment, i.e., the process of providing or delivering a product. The postpurchase stage comprises all interactions that follow the purchase such as usage, consumption, and after-sales service. For the purposes of our study, we focus on the transactional nature of these stages. Of course, from a long-term customer relationship perspective, the prepurchase and the postpurchase stages are blurring.

Further, we consider possible locations of customers while interacting with retailers. Due to digital channels, such as smart phones and smart watches, customer-retailer interactions may take place anywhere and anytime (Hansen and Sia 2015). Nevertheless, traditional channels, such as bricks-and-mortar stores, are still important. Omni-channel retailers aim to equip physical stores with in-store technology and to fully integrate them into their channel mix. Additionally, ever more customer-retailer interactions take place at home, e.g., by using smart phones, laptops, and other dedicated smart home devices. The importance of the customers' home as a place of customer-retailer interactions will further increase due to the emergence of smart assistants and connected home appliances as well as by smart things, such as smart refrigerators and smart washing machines. Hence, we distinguish three potential locations, i.e., at home, at a physical store, or everywhere. As customer-retailer interactions may be initiated by both customers and retailers, we finally distinguish customer-initiated and retailer-initiated interactions (Anderl et al. 2016).

	Prepurchase Stage		Purchase Stage		Postpurchase Stage	
	Customer-Initiated	Retailer-Initiated	Customer-Initiated	Retailer-Initiated	Customer-Initiated	Retailer-Initiated
Home	<ul style="list-style-type: none"> - Customers use smart devices such as virtual reality glasses to explore physical products at home. (C-1) 	<ul style="list-style-type: none"> - Retailers use smart assistants and connected home appliances to sense customer needs as well as to inform them actively and personalized about special offers, new products, and other innovations. (R-1) 	<ul style="list-style-type: none"> - Customers use smart home devices to simplify product purchases (e.g., Amazon Dash Button). (C-7) - Customers create products at home by using 3D/4D printers. (C-8) 	<ul style="list-style-type: none"> - Retailers deliver products proactively (anticipatory shipping) to customers' homes based on insights into customers' needs. (R-8) 	<ul style="list-style-type: none"> - Customers use smart assistants and connected home appliances to ask for additional information, to make complaints or to give suggestions for improvement. (C-13) 	<ul style="list-style-type: none"> - Retailers use smart assistants and connected home appliances to ask for customer satisfaction. (R-12)
Store	<ul style="list-style-type: none"> - Customers enrich the physical product information by using different digital channels. (C-2) - Customers use in-store technology to collect additional information and to enhance the shopping experience (e.g., virtual reality glasses, virtual try-on, in-store navigation). (C-3) 	<ul style="list-style-type: none"> - Retailers improve in-store advice by providing store associates with real-time information about needs of customers who are recognized via their smart phones. (R-2) - Store associates use knowledge about customer needs to prepare appropriate product bundles before customers enter the store. (R-3) - Retailers inform customers about special personalized offers while passing a physical store or being in a physical store of a competitor. (R-4) 	<ul style="list-style-type: none"> - Customers purchase products in the online shop by using interactive in-store displays or smart phones. (C-9) 	<ul style="list-style-type: none"> - Retailers provide zero-touch checkout solutions, i.e., combination of in-store technology and smart phones replace traditional checkout. (R-9) 	<ul style="list-style-type: none"> - Customers enter a physical store to ask for additional information related to a product purchase in any channel, to make complaints or to give suggestions for improvement. (C-14) 	<ul style="list-style-type: none"> - Store associates provide additional services based on information about the usage of a product (e.g., specific usage recommendations, predictive maintenance, complaint management). (R-13)
Everywhere	<ul style="list-style-type: none"> - Customers obtain product-related information and advice by using digital channels (e.g., social media, online chats, video advisory). (C-4) - Customers navigate to the nearest physical store by using their smart phones. (C-5) - Customers reserve products in physical stores and make appointments by using digital channels. (C-6) 	<ul style="list-style-type: none"> - Retailers reduce customers' idle time by informing them about special offers and providing convenient purchase opportunities in typical waiting situations (e.g., subway, airport) (R-5) - Retailers provide information and recommendations based on the preferences of customers' social networks via different digital channels. (R-6) - Retailers use self-learning chatbots to interact with customers or to provide additional information related to a product. (R-7) 	<ul style="list-style-type: none"> - Customers use smart things to automate product purchases and to negotiate with retailers (e.g., smart coffee machine, smart refrigerator). (C-10) - Customers purchase products by using social selling solutions. (C-11) - Customers choose the most convenient fulfillment option (e.g., car trunk delivery, click & collect). (C-12) 	<ul style="list-style-type: none"> - Retailers deliver products proactively (anticipatory shipping) to any location (e.g., customer's car trunk). (R-10) - Retailers provide real-time information across all channels (e.g., product availability, track & trace) to enable product purchases in any shopping environment. (R-11) 	<ul style="list-style-type: none"> - Customers use different digital channels interchangeably to get in contact with retailers, to make complaints, to ask for additional information related to a product or to give suggestions for improvement. (C-15) 	<ul style="list-style-type: none"> - Retailers provide additional services based on information about the usage of a product (e.g., specific usage recommendations, predictive maintenance, complaint management). (R-14) - Retailers use self-learning chatbots to interact with customers, to resolve complaints or to provide additional information related to a product. (R-15) - Retailers provide cross-and up-selling recommendations based on customers' preferences via different digital channels. (R-16)

Table 1. Catalog of Customer-Retailer Interactions

IS Capabilities for Omni-Channel Retail

In this section, we present our framework of operational IS capabilities for omni-channel retail (Figure 2), which is the main contribution of our study. We describe each capability area including selected justificatory references. Finally, we present a mapping of customer-retailer interactions and IS capabilities to demonstrate how the third and fourth research phase cohere. Following the classification as per Wade and Hulland (2004) as well as Day (1994), we classified the identified capability areas as outside-in, inside-out, or spanning capabilities. This is reasonable as outside-in capabilities, which focus on anticipating or reacting upon requirements from outside the company (Wade and Hulland 2004), are crucial for omni-channel retailers. Retailers must gain insights in customers, such as their needs, preferences, and contexts. Simultaneously, inside-out capabilities, which are internally focused (Wei et al. 2014), are essential to be able to manage omni-channel technology and to process omni-channel data. Spanning capabilities integrate outside-in and inside-out capabilities and require both an understanding of market requirements and internal competencies (Hooley et al. 1999; Wei et al. 2014).

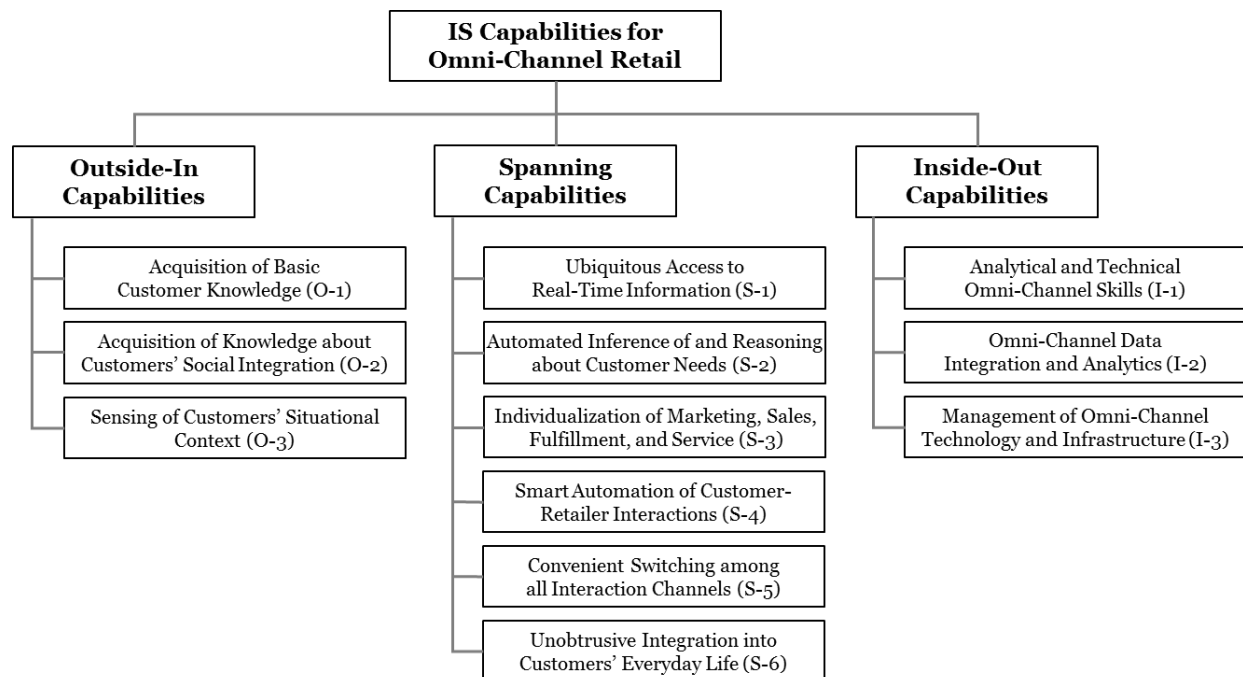


Figure 2. Framework of IS Capabilities for Omni-Channel Retail

Below, we describe each capability area. We start by considering the outside-in capabilities and the inside-out capabilities. As spanning capabilities combine outside-in and inside out capabilities, they are described in the end.

Outside-In Capabilities

Acquisition of Basic Customer Knowledge: The acquisition of basic customer knowledge is a prerequisite for most customer-retailer interactions. Basic customer knowledge stems from identification data (e.g., name, address, date of birth) and descriptive data (e.g., demographics, household structure, customer segmentation). The re-identification of customers in future customer-retailer interactions enables the mapping of transactional and contextual customer data to existing customer relationships. Basic customer data may be collected during the registration process or based on specific interactions. It can be enriched by data from traditional market research, such as information about customers purchase power in dependence on their residence. (Justificatory references: Leußer et al. 2011; Zahay et al. 2004)

Acquisition of Knowledge about Customers' Social Integration: Among other things, customer preferences are influenced by personal or social relationships (e.g., family, friends, colleagues). Nowadays, an ever larger fraction of these relationships is reflected in the customers' connectedness on social media

platforms (e.g., Facebook, Twitter). Using social media and writing product reviews, customers who do not know each other personally may mutually influence their preferences and purchase decisions. Impressions from social media affect both customers' online and offline activities. Customers' reviews may be interpreted with the help of sentiment analysis (e.g., natural language processing). Omni-channel retailers should be able to determine customers' roles in social networks, understand their sphere of influence, and their behavior. The influence of customers in social networks can be determined by using different centrality measures (e.g., degree centrality, closeness centrality, betweenness centrality). By analyzing the customers' social graph and profile information, omni-channel retailers can better leverage on psychographic and behavior-based targeting (Justificatory references: Althoff et al. 2017; Bradlow et al. 2017; Kiss and Bichler 2008; Landherr et al. 2010; Lee et al. 2006)

Sensing of Customers' Situational Context: To design more appropriate customer-retailer interactions, retailers must be able to sense the specific situational context of individual customers (e.g., timetable, location, mood, stress level, special events). Related data may be collected by using hardware and software sensors of smart phones or other smart devices. Additionally, as far as authorized by the customers, retailers could consider information from personal interactions (e.g., e-mails, chats) and customers' digital calendars to provide highly contextual offers aware of the individual customer. In combination with transactional data about customers' current behavior by using different channels (e.g., online shop, in-store tracking), contextual data might help understand customers' plans, needs, and preferences. On this foundation, retailers can avoid to interact with customers at the wrong time or place, via unsuitable channels, or using inappropriate contents that customers may perceive as spam, i.e., circumstances that may damage short-term customer experience or customer relationships in the long run. (Justificatory references: Bradlow et al. 2017; Gimpel et al. 2015; Grewal et al. 2017)

Inside-Out Capabilities

Analytical and Technical Omni-Channel Skills: The use of innovative IT and the handling of vast amounts of heterogeneous data is crucial in omni-channel retail environments. Thus, employees are required to master software tools and technologies relevant for omni-channel retail (technology skills). Additionally, they need knowledge about data analytics and statistical methods (data skills). Further, as omni-channel retailers collect and process personal data, e.g., by using loyalty cards or by tracking customer behavior in online shops, employees must be aware of data privacy, security, and ownership regulations as well as customers' expectations towards the use of their personal data to create trustful customer relationships (privacy skills). (Justificatory references: Bradlow et al. 2017; Carvalho et al. 2016; Hosseini et al. 2017; Inman and Nikolova 2017; Wade and Hulland 2004)

Omni-Channel Data Integration and Analytics: Omni-channel retailers possess and process various forms of data (e.g. customer, product, location, time, and channel data) that might be available in structured (e.g., point-of-sale data) or unstructured form (e.g., customer reviews, tweets). The process of retrieving, combining, incorporating, and structuring heterogeneous data from different sources in homogenous databases is a key challenge for omni-channel organizations. Once omni-channel data integration is mastered, retailers need appropriate tools and technologies that allow to process and analyze a substantial amount of data. By using different approaches such as visual, predictive and prescriptive analytics, data mining, deep learning and artificial intelligence, retailers can derive meaningful insights. Thereby, retailers must take care not to fall for typical big data analytics pitfalls such as sophisticated analyses of low quality irrelevant data or spurious correlations. (Justificatory references: Beck and Rygl 2015; Bradlow et al. 2017; Brynjolfsson et al. 2013; Grewal et al. 2017)

Management of Omni-Channel Technology and Infrastructure: In omni-channel environments, retailers must be able to manage a portfolio of heterogeneous technologies, including traditional and emerging technologies such as in-store technology, delivery technology, location-based technology, or communication technology. In-store technology (e.g., interactive displays, virtual try-on, self-checkout solutions) will be part of the store experience and helps provide additional information, to seamlessly purchase products in the online shop, and to reduce idle time. Delivery technology (e.g., drones, robots, 3D/4D printing) facilitates fulfillment processes. Location-based technology (e.g., smart phones, iBeacons) provides navigation functionality within and outside of physical stores. Communication technology (e.g., video chat, chatbots) helps improve the continuous communication between customers and retailers. Therefore, retailers must also be able to operate an appropriate omni-channel infrastructure that allows for

capitalizing on these technologies and their interplay. An omni-channel infrastructure has to account for multiple layers to cope with, for instance, the synergetic use of heterogeneous technologies, network communications to support connectivity, data connectivity of smart things to other business systems (e.g., CRM systems), or data storage. For instance, data need to be stored in integrated databases that allow real-time processing. Retailers can use different kinds of traditional databases (e.g., relational, document, and graph databases) or new data integration architectures (e.g., data lakes) to store their data. (Justificatory references: Brynjolfsson et al. 2013; Hansen and Sia 2015; Inman and Nikolova 2017; Porter and Heppelmann 2014; Porter and Heppelmann 2015)

Spanning Capabilities

Ubiquitous Access to Real-Time Information: As customer-retailer interactions can be initiated anytime and customers may switch between different channels continuously, the provision of and access to real-time information constitute a crucial factor for omni-channel retailers. For instance, customers' decision-making can be facilitated when having access to real-time information across all channels. Information about product availability in different channels (e.g., online shop, bricks-and mortar stores) can support the customers' channel choice. Continuous live-tracking of orders enables a more customer-centric and convenient delivery service. From a retailer's internal perspective, real-time information about product availability, customer behavior, customers' situation, and sales helps organize the flow of goods, marketing, and service. Further, real-time information are required to enable the provision of personalized and contextual advertisements, services, and offers (e.g., location-based advertising). Therefore, the ubiquitous access to real-time information along the entire customer journey is a prerequisite for successful omni-channel retail. (Justificatory references: Bradlow et al. 2017; Brynjolfsson et al. 2013)

Automated Inference and Reasoning about Customer Needs: Omni-channel retailers need the ability to automatically infer and reason about customers' needs and preferences. By leveraging on different data streams and real-time data analytics, retailers can gain valuable insights in customers' behavior (e.g., customer journey analytics). For example, customers' needs may be unveiled by analyzing dialogues with virtual advisers with the help of quantitative methodologies such as conjoint analyses. The understanding of customers' needs serves as a basis for long-term customer relationships and for many strategic and operational decisions in a retail organization (e.g., channel development, innovation management, advertising). (Justificatory references: Arnett and Badrinarayanan 2005; Bradlow et al. 2017; Narver et al. 2004; Urban and Hauser 2004)

Individualization of Marketing, Sales, Fulfillment, and Services: Omni-channel retailers need the ability to adapt advertisements, offers, and services based on customers' needs and preferences. Advertisements and offers should be personalized and provided at the right time to achieve the best effect (e.g., offers for meal deliveries when leaving the workplace). Furthermore, fulfillment processes become more individualized and contextualized. Customers may choose the most convenient option, such as home delivery at a certain time, car trunk delivery, click & collect or 3D/4D printing at any place. With the rise of customer-managed relationships, retailers have to provide more personalized service offers. For some product categories such as electronic devices, requests for customer satisfaction of maintenance offers may be adapted to the usage behavior of the customer. (Justificatory references: Grewal et al. 2017; Hübner et al. 2016a, Piccoli and Watson 2008; Piotrowicz and Cuthbertson 2014; Rigby 2011; Tseng and Yazdanifard 2015)

Smart Automation of Customer-Retailer Interactions: In the future, an increasing part of customer-retailer interactions, such as information and purchase, will be processed automatically. Omni-channel retailers have to provide smart automation that benefit both the retailer and the customer. Retailers can improve their operational efficiency, whereas customers may profit from continuous service levels. For instance, customers' orders can be placed via smart things (e.g., smart refrigerator, smart washing machine, smart coffee machine). Smart devices, once authorized by the customers, can act as customers by themselves. Therefore, omni-channel retailers need the ability to successfully communicate with smart things that are aware of preferences prescribed by their owners. Smart automation illustrates the retailers' imperative to engage in Business-to-Thing (B2T) management. Furthermore, proactive retailing to address arising customer needs or self-learning chatbots to better deal with customer requests exhibit other forms of smart automation and future retailing. (Justificatory references: Dawar 2016; Grewal et al. 2017; Kees et al. 2015; Kowalkiewicz et al. 2017)

Convenient Switching among all Interaction Channels: Omni-channel customers interact with retailers via digital and traditional channels in an ever more interconnected way (e.g., use of an online shop in a bricks-and-mortar store). Channel choice depends on various factors (e.g., personal plans, mood, weather) and may change over time. Hence, omni-channel retailers need the ability to master the increasing number of channels and touchpoints to enable seamless switchovers among all channels. This comes along with various challenges such as dissolving siloed organizational structures and managing customer data from all channels in order to enable a single customer view and to provide a consistent customer experience. (Justificatory references: Hansen and Sia 2015; Nüesch et al. 2015)

Unobtrusive Integration into Customers' Everyday Life: Due to digital channels and the emergence of digital technologies, such as smart phones and smart things, customers may interact with retailers anytime and anywhere. Today, many customer-retailer interactions are initiated at home (e.g., orders in online shops). The use of smart devices enables customers ever more to interact with retailers regardless of their current location. Further, customers want to avoid idle time and tend to initiate interactions in appropriate situations on the way (e.g. in public transport). Accordingly, omni-channel retailers should recognize such opportunities and provide appropriate offers unobtrusively. With the rise of customer-managed relationships, retailers need to immerse into customers' everyday life. (Justificatory references: Ju and Li 2011; Rigby 2011; Rosemann 2014; Trkman et al. 2015)

Mapping of Interactions and Capabilities

In this section, we present a mapping of customer-retailer interactions and IS capability areas that were presented previously. Thereby, we show which capability areas are required to enable specific customer-retailer interactions (Table 2). Omni-channel retailers may use the matrix to identify relevant capabilities for specific types of interactions with their customers.

			Outside-In Capabilities			Spanning Capabilities						Inside-Out Capabilities		
			O-1	O-2	O-3	S-1	S-2	S-3	S-4	S-5	S-6	I-1	I-2	I-3
Prepurchase Stage	Home	C-1								X		X	X	
		R-1	X		X	X	X	X	X				X	X
	Store	C-2								X			X	X
		C-3				X		X		X			X	X
		R-2	X		X	X	X	X				X	X	X
		R-3	X		X	X	X	X				X	X	X
		R-4	X		X	X	X	X			X		X	X
	Everywhere	C-4	X	X	X	X		X	X	X		X	X	X
		C-5				X								X
		C-6	X			X				X			X	X
		R-5	X		X	X					X		X	X
		R-6	X	X	X	X	X	X		X		X	X	X
		R-7	X		X	X			X				X	X
Purchase Stage	Home	C-7	X			X			X		X		X	
		C-8						X					X	
	Store	R-8	X	X	X		X		X				X	X
		C-9	X							X				X
		R-9	X		X	X			X				X	X
	Everywhere	C-10						X			X		X	X
		C-11	X	X		X					X		X	X
		C-12						X						X
		R-10	X	X	X		X		X		X		X	X
		R-11				X							X	X
	Postpurchase Stage	Home	C-13						X				X	X
R-12			X					X				X	X	
Store		C-14	X			X						X	X	X
		R-13	X			X		X				X	X	X
Everywhere		C-15	X						X					X
		R-14	X		X			X	X				X	X
		R-15	X					X	X				X	X
R-16								X			X	X		

Table 2. Mapping of Customer-Retailer Interactions and Capabilities

Illustration of Applicability

To demonstrate the applicability of the IS capability framework and its interplay with customer-retailer interactions, we briefly discuss required capabilities for three exemplary interactions. Thereby we consider real-world examples from retail industry that cover each stage of the customer journey (prepurchase, purchase, and postpurchase stage) and each location (home, store, and everywhere).

First, we consider Tesco's virtual stores in Korean subway stations as an example for customer-retailer interaction R-5 (prepurchase stage; everywhere): retailers reduce customers' idle time by informing them regarding special offers and providing convenient purchase opportunities in typical waiting situations (e.g., subway, airport). To enable the personalized addressing of customers and the delivery of products, retailers need to know and to identify them (O-1: acquisition of basic customer knowledge). Furthermore, if the customers should be provided with additional offers during the waiting situations (e.g., via their smart phones), retailers need to know a customer's current location (O-3: sensing of customers' situational

context). From an internal perspective, retailers need to integrate and analyze data from various sources (e.g., customer data, location data, product data, transaction data) (I-2: omni-channel data integration and analytics). Further, data must be stored in databases and retailers need technologies to get in touch with the customers (e.g., mobile apps) (I-3: management of omni-channel technology and infrastructure). To ensure that contextual offers, e.g., delivery of basic groceries after the arrival at the home airport, are sent at the right time, location data must be processed in real-time (S-1: ubiquitous access to real-time information). The avoidance of idle time by contacting customers in appropriate situations may be denoted as an integration into customers' processes (S-6: integration into customers' everyday life).

Second, we regard Amazon's future-oriented bricks-and-mortar store that is known as Amazon Go as an example for customer-retailer interaction R-9 (purchase stage; store): retailers provide zero-touch checkout solutions, i.e., combination of in-store technology and smart phones replace traditional checkout. In order to trigger the automated payment, customers need to be identified when leaving a bricks-and-mortar store. Usually, the identification is enabled by recognizing the customers' smart phones (O-3: sensing of customers' situational context). To enable the payment, the retailers need basic customer knowledge such as identification (e.g., name, address) and payment data (e.g., credit card information) (O-1: acquisition of basic customer knowledge). Internally, retailers must integrate payment, product, and customer data (I-2: omni-channel data integration and analytics) and provide appropriate (in-store) technology to recognize customers and products at the in-store checkout (I-3: management of omni-channel technology and infrastructure). As the payment need to be executed en passant, the relevant data must be processed in real-time (S-1: ubiquitous access to real-time information). The simplification of the check-out process is an automation of a customer-retailer interaction that otherwise would have taken place manually (S-4: smart automation of customer-retailer interactions).

Finally, we consider the use of smart assistants and connected home appliances such as Google Home or Amazon Echo as an example for customer-retailer interaction C-13 (postpurchase stage, home): customers use smart assistants and connected home appliances to ask for additional information, to make complaints or to give suggestions for improvement. To enable interactions with customers via smart home assistants, retailers need to be able to provide appropriate systems or to use existing platforms (I-3: management of omni-channel technology and infrastructure). Data that is generated during the interactions must be stored, combined with existing customer data, and processed in order to respond appropriately (I-2: omni-channel data integration and analytics).

Conclusion, Limitations, and Further Research

To account for the ever more central role of digital technologies in the retail industry and for the increasing importance of omni-channel management, we developed an IS capability framework that comprises 12 operational capability areas retailers should consider when engaging in omni-channel management. Following an explorative approach, our capability framework is grounded on a structured review of academic and non-academic literature as well as on the results of an online survey involving international retail experts, particularly from the retail industry and consulting. These data sources enabled us to capture trends and developments in the retail industry that have not yet found their way into academic literature. Our framework comprises three outside-in capabilities (i.e., acquisition of basic customer knowledge; acquisition of knowledge about customers' social integration; sensing of customers' situational context), six spanning capabilities (i.e., ubiquitous access to real-time information; automated inference of and reasoning about customer needs; individualization of marketing, sales, fulfillment, and service; smart automation of customer-retailer interactions; convenient switching among interaction channels; unobtrusive integration into customers' everyday life), and three inside-out capabilities (analytical and technical omni-channel skills; omni-channel data integration and analytics; omni-channel technology and infrastructure management).

Our study entails several theoretical and managerial contributions. From a theoretical perspective, our capability framework contributes to the body of knowledge of omni-channel retail by identifying and structuring related IS capabilities. Due to the timeliness of our research question, there are, to the best of our knowledge, no capability frameworks that deal with omni-channel retail from an IS perspective. Nevertheless, the structured literature review and the results of our online survey corroborate that IT is crucial for omni-channel retail. Researchers may use the framework as a basis for structuring their research efforts as well as for investigating specific IS capabilities in detail. From a managerial perspective, our

framework of IS capabilities provides retail decision-makers with an overview of operational capability areas they should have in mind when engaging in omni-channel management. It is important to recognize that there is no one-size-fits-all approach when engaging to omni-channel management. Different (sets of) capabilities are required for enabling distinct customer-retailer interactions. Therefore, the capabilities of the framework might vary in relevance and importance, depending on industry- or organization-specific characteristics as well as the organization's progress within omni-channel management. Organizations are advised to always keep an eye on all capabilities as well as on their interplay in order to enable successful customer-retailer interactions that occur in different stages of a customer journey. In this regard, the framework helps gain an initial understanding of omni-channel management and identify discrepancies between the requirements for omni-channel retail and an organization's status quo. Further, the presented framework helps structure decision-making when developing, prioritizing, and customizing operational capabilities from our framework against an organization's individual context and can serve as a starting point for deriving respective implementation roadmaps and omni-channel measures. By doing so, organizations might ground omni-channel initiatives on (customer-centric) use cases. By identifying needs for action and establishing appropriate projects, retailers may improve their overall omni-channel performance.

As any research, our study comes along with limitations that serve as a starting point for further research. Due to the topicality of our research topic, we could not derive IS capabilities for omni-channel retail directly from academic literature. Instead, our study is primarily based on insights from non-academic literature and an online survey. Within the online survey, we primarily addressed omni-channel retail experts. However, we did not consult customers on their expectations towards omni-channel retailers. Consequently, future research is required to validate the results of our explorative study and to test the framework for its feasibility. To do so, we plan to expand our study via semi-structured interviews with further experts from retail industry and to incorporate customers' expectations. After that, future research should examine the influence of the presented IS capabilities on customer experience, satisfaction, loyalty as well as the success of omni-channel retailers. So far, our capability framework does not consider contextual factors (e.g., retail sector, firm size). Hence, future research may account for such contextual factors as well. In line with the exploratory nature of our study, we did not operationalize the presented IS capabilities in terms of measurement scales. This should also be part of future confirmatory research. In our study, we focused primarily on operational IS capabilities as a necessary first step to understand the requirements for omni-channel retail. As a next step, future research should conduct an in-depth analysis of higher-order dynamic capabilities that emerge from bundles of operational capabilities. Despite these limitations, we believe that the results of our study are a first important step to structure IS capabilities for omni-channel retail and hope that they help fellow researchers explore the intersection of IS and omni-channel retail in their own research.

References

- Aguirre, E., Mahr, D., Grewal, D., de Ruyter, K., and Wetzels, M. 2015. "Unraveling the personalization paradox: The effect of information collection and trust-building strategies on online advertisement effectiveness," *Journal of Retailing* (91:1), pp. 34-49.
- Althoff, T., Jindal, P., and Leskovec, J. 2017. "Online Actions with Offline Impact: How Online Social Networks Influence Online and Offline User Behavior," in: *Proceedings of tenth ACM International Conference on Web Search and Data Mining (WSDM 2017)*, Cambridge, United Kingdom, pp. 537-546.
- Anderl, E., Schumann, J. H., and Kunz, W. 2016. "Helping Firms Reduce Complexity in Multichannel Online Data: A New Taxonomy-Based Approach for Customer Journeys," *Journal of Retailing* (92:2), pp. 185-203.
- Ang, S., and Inkpen, A. C. 2008. "Cultural Intelligence and Offshore Outsourcing Success: A Framework of Firm-Level Intercultural Capability," *Decision Sciences* (39:3), pp. 337-358.
- Arnett, D. B., and Badrinarayanan, V. 2005. "Enhancing Customer-Needs-Driven CRM Strategies: Core Selling Teams, Knowledge Management Competence, and Relationship Marketing Competence," *Journal of Personal Selling & Sales Management* (25:4), pp. 329-343.
- Barney, J. 1991. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17:1), pp. 99-120.
- Beck, N., Rygl, D. 2015. "Categorization of multiple channel retailing in Multi-, Cross-, and Omni-Channel Retailing for retailers and retailing," *Journal of Retailing and Consumer Services* (27), pp. 170-178.
- Bell, D. R., Gallino, S., and Moreno, A. 2014. "How to Win in an Omnichannel World," *MIT Sloan Management Review* (56:1), pp. 45-53.
- Bharadwaj, A. S. 2000. "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation," *MIS Quarterly* (24:1), pp. 169-196.
- Black, N. J., Lockett, A., Ennew, C., Winklhofer, H., and McKechnie, S. 2002. "Modelling consumer choice distribution channels: an illustration from financial services," *International Journal of Bank Marketing* (20:4), pp. 161-173.
- Bradlow, E. T., Gangwar, M., Kopalle, P., and Voleti, S. 2017. "The Role of Big Data and Predictive Analytics in Retailing," *Journal of Retailing* (93:1), pp. 79-95.
- Brunswicker, S., Hutschek, U., and Wagner, L. 2012. "'Exploration' in the open innovation front-end: the role of technologies," *International Journal of Technology Intelligence and Planning* (8:1), pp. 1-15.
- Brynjolfsson, E., Hu, Y. J., and Rahman, M. S. 2013. "Competing in the Age of Omnichannel Retailing," *MIT Sloan Management Review* (54:4), pp. 23-29.
- Business Insider. 2017. "Best Buy struggles with omnichannel," Retrieved from: <http://www.businessinsider.com/best-buy-struggles-with-omnichannel-2017-3/?r=AU&IR=T> (Accessed: 2017-04-29).
- Cao, L., and Li, L. 2015. "The Impact of Cross-Channel Integration on Retailers' Sales Growth," *Journal of Retailing* (91:2), pp. 198-216.
- Carvalho, J. V., Rocha, A., and Abreu, A. 2016. "Maturity Models of Healthcare Information Systems and Technologies: a Literature Review," *Journal of Medical Systems* (40:6), pp. 1-10.
- Dawar, N. 2016. "How Marketing Changes When Shopping Is Automated," *Harvard Business Review* (Digital Article), Retrieved from: <https://hbr.org/2016/10/how-marketing-changes-when-shopping-is-automated> (Accessed: 2017-04-10).
- Day, G. S. 1994. "The Capabilities of Market-Driven Organizations," *Journal of Marketing* (58:4), pp. 375-382.
- Dreiling, A., and Recker, J. (2013) "Towards a Theoretical Framework for Organizational Innovation," in *PACIS 2013 Proceedings*, Jeju Island, Korea, Paper 262.
- eMarketer. 2013. "Retailers Lag Behind Consumers' Omnichannel Desire," Retrieved from: <https://www.emarketer.com/Article/Retailers-Lag-Behind-Consumers-Omnichannel-Desires/1010463> (Accessed: 2017-04-04).
- Falke Information. 2016. "Overview & Evolution of the Global Retail Industry," Retrieved from: <http://falkeinformation.org/wp-content/uploads/2016/04/EN-Falke-Global-Industry-Report-Retail-2016-sample.pdf> (Accessed: 2017-05-02).
- Feeny, D. F., and Willcocks, L. P. 1998. "Core IS Capabilities for Exploiting Information Technology," *Sloan Management Review* (39:3), pp. 9-21.
- Forstner, E., Kamprath, N., and Röglinger, M. 2014. "Capability development with process maturity models - Decision framework and economic analysis," *Journal of Decision Systems* (23:2), pp. 127-150.

- Gallino, S., and Moreno, A. 2014. "Integration of Online and Offline Channels in Retail: The Impact of Sharing Reliable Inventory Availability Information," *Management Science* (60:6), pp. 1434-1451.
- Gensler, S., Verhoef, P. C., and Böhm, M. 2012. "Understanding consumers' multichannel choices across different stages of the buying process," *Marketing Letters* (23:4), pp. 987-1003.
- Geyskens, I., Gielens, K., and Dekimpe, M. G. 2002. "The Market Valuation of Internet Channel Additions," *Journal of Marketing* (66:2), pp. 102-119.
- Gimpel, H., Regal, C., and Schmidt, M. 2015. "myStress: Unobtrusive Smartphone-based Stress Detection," in *ECIS 2015 Research-in-Progress Papers*, Münster, Germany, Paper 16.
- Grewal, D., Roggeveen, A. L., and Nordfält, J. 2017. "The Future of Retailing," *Journal of Retailing* (93:1), pp. 1-6.
- Gu, Z. J., and Tayi, G. K. 2015. "Consumer mending and online retailer fit-uncertainty mitigating strategies," *Quantitative Marketing and Economics* (13:3), pp. 251-282.
- Gu, Z. J., and Tayi, G. K. 2017. "Consumer Pseudo-Showrooming and Omni-Channel Placement Strategies," *MIS Quarterly* (41:2), pp. 583-606.
- Hansen, R., and Sia, S. K. 2015. "Hummel's Digital Transformation Toward Omnichannel Retailing: Key Lessons Learned," *MIS Quarterly Executive* (14:2), pp. 51-66.
- Helfat, C. E., and Peteraf, M. A. 2003. "The Dynamic Resource-Based View: Capability Lifecycles," *Strategic Management Journal* (24:10), pp. 997-1010.
- Herhausen, D., Binder, J., Schoegel, M., and Herrmann, A. 2015. "Integrating Bricks with Clicks: Retailer-Level and Channel-Level Outcomes of Online-Offline Channel Integration," *Journal of Retailing* (91:2), pp. 309-325.
- Hooley, G., Fahy, J., Cox, T., Beracs, J., Fonfara, K., and Snoj, B. 1999. "Marketing Capabilities and Firm Performance: A Hierarchical Model," *Journal of Market Focused Management* (4:3), pp. 259-278.
- Hosseini, S., Kees, A., Manderscheid, J., Röglinger, M., and Rosemann, M. 2017. "What does it take to implement open innovation? Towards an integrated capability framework," *Business Process Management Journal* (23:1), pp. 87-107.
- Hosseini, S., Oberländer, A., Röglinger, M., and Wolf, T. 2015. "Rethinking Multichannel Management in a Digital World – A Decision Model for Service Providers," in *Proceedings of the 12th International Conference on Wirtschaftsinformatik (WI)*, Osnabrück, Germany, pp. 240-255.
- Hübner, A., Holzapfel, A., and Kuhn, H. 2016a. "Distribution systems in omni-channel retailing," *Business Research* (9:2), pp. 255-296.
- Hübner, A., Kuhn, H., and Wollenburg, J. 2016b. "Last mile fulfilment and distribution in omni-channel grocery retailing. A strategic planning framework," *International Journal of Retail & Distribution Management* (44:3), pp. 228-247.
- Inman, J. J., and Nikolova, H. 2017. "Shopper-Facing Technology: A Retailer Adoption Decision Framework Incorporating Shopper Attitudes and Privacy Concerns," *Journal of Retailing* (93:1), pp. 7-28.
- Ju, Z., and Li, Y. 2011. "Analysis on Internet of Things (IOT) Based on the "Subway Supermarket" E-Commerce Mode of TESCO," in *2011 International Conference on Information Management, Innovation Management and Industrial Engineering*, pp. 430-433.
- Juaneda-Ayensa, E., Mosquera, A., and Sierra Murillo, Y. 2016. "Omnichannel Customer Behavior: Key Drivers of Technology Acceptance and Use and Their Effects on Purchase Intention," *Frontiers in Psychology* (7:1117), pp. 1-11.
- Kees, A., Oberlaender, A. M., Roeglinger, M., and Rosemann, M. 2015. "Understanding the Internet of Things: A Conceptualisation of Business-to-Thing (B2T) Interactions," in *ECIS 2015 Proceedings*, Münster, Germany, Paper 92.
- Kiss, C., and Bichler, M. 2008. "Identification of Influencers – Measuring Influence in Customer Networks," *Decision Support Systems* (46:1), pp. 233-253.
- Koch, H. 2010. "Developing dynamic capabilities in electronic marketplaces: A cross-case study," *Journal of Strategic Information Systems* (19:1), pp. 28-38.
- Kowalkiewicz, M., Rosemann, M., and Dootson, P. 2017. "Retail 5.0: Check-Out The Future," PwC Chair in Digital Economy, Queensland University of Technology, Brisbane, Australia.
- Landherr, A., Friedl, B., and Heidemann, J. 2010. "A Critical Review of Centrality Measures in Social Networks," *Business & Information Systems Engineering* (2:6), pp. 371-385.
- Lazaris, C., and Vrechopoulos, A. 2014. "From Multichannel to "Omnichannel" Retailing: Review of the Literature and Calls for Research," *2nd International Conference on Contemporary Marketing Issues (ICCM)*, Athens, Greece.

- Lazaris, C., Vrechopoulos, A., Doukidis, G., and Fraidaki, A. 2015. "Mobile Apps for Omnichannel Retailing: Revealing the Emerging Showroom Phenomenon," *MCIS 2015 Proceedings*, Samos, Greece, Paper 12.
- Lee, M. K. O., Cheung, C. M. K., Lim, K. H., and Sia, C. L. 2006. "Understanding customer knowledge sharing in web-based discussion boards," *Internet research* (18:3), pp. 229-247.
- Lemon, K. N., and Verhoef, P. C. 2016. "Understanding Customer Experience Throughout the Customer Journey," *Journal of Marketing* (80:6), pp. 69-96.
- Lewis, J., Whysall, P., and Foster, C. 2014. "Drivers and technology-related obstacles in moving to multichannel retailing," *International Journal of Electronic Commerce* (18:4), pp. 43-68.
- Lichtenthaler, U., and Lichtenthaler, E. 2009. "A Capability-Based Framework for Open Innovation: Complementing Absorptive Capacity," *Journal of Management Studies* (46:8), pp. 1315-1338.
- Luo, J., Fan, M., and Zhang, H. 2016. "Information Technology, Cross-Channel Capabilities, and Managerial Actions: Evidence from the Apparel Industry," *Journal of the Association for Information Systems* (17:5), pp. 308-327.
- McLaren, T. S., Head, M. M., Yuan, Y., and Chan, Y. E. 2011. "A Multilevel Model for Measuring Fit Between a Firm's Competitive Strategies and Information Systems Capabilities," *MIS Quarterly* (35:4), pp. 909-929.
- Meuter, M. L., Ostrom, A. L., Roundtree, R. I., and Bitner, M. J. 2000. "Self-Service Technologies: Understanding Customer Satisfaction with Technology-Based Service Encounters," *Journal of Marketing* (64:3), pp. 50-64.
- Mirsch, T., Lehrer, C., and Jung, R. 2016a. "Channel Integration Towards Omnichannel Management: A Literature Review," in *PACIS 2016 Proceedings*, Chiayi, Taiwan, Paper 288.
- Mirsch, T., Lehrer, C., and Jung, R. 2016b. "Transitioning to an Omnichannel Approach: A Dynamic Capability Perspective," in *ICIS 2016 Proceedings*, Dublin, Ireland.
- Mohr, J., and Nevin, J. R. 1990. "Communication Strategies in Marketing Channels: A Theoretical Perspective," *Journal of Marketing* (54:4), pp. 36-51.
- Narver, J. C., Slater, S. F., and MacLachlan, D. L. 2004. "Responsive and Proactive Market Orientation and New-Product Success," *Journal of Product Innovation Management* (21:5), pp. 334-347.
- Neslin, S. C., Grewal, D., Leghorn, R., Shankar, V., Teerling, M. L., Thomas, J. S., and Verhoef, P. C. 2006. "Challenges and Opportunities in Multichannel Customer Management," *Journal of Service Research* (9:2), pp. 95-112.
- Niehaves, B., Plattfaut, R., and Sarker, S. 2011. "Understanding Dynamic IS Capabilities for Effective Process Change: A Theoretical Framework and an Empirical Application," in *ICIS 2011 Proceedings*, Shanghai, China, Paper 11.
- Nüesch, R., Alt, R., Puschmann, T. 2015. "Hybrid Customer Interaction," *Business & Information Systems Engineering* (57:1), pp. 73-78.
- Oh, L.-B., Teo, H.-H., and Sambamurthy, V. 2012. "The effects of retail channel integration through the use of information technologies on firm performance," *Journal of Operations Management* (30:5), pp. 368-381.
- Pavlou, P. A., and El Sawy, O. A. 2011. "Understanding the Elusive Black Box of Dynamic Capabilities," *Decision Sciences Journal* (42:1), pp. 239-273.
- Piccoli, G., and Watson, R. T. 2008. "Profit from Customer Data by Identifying Strategic Opportunities and Adopting the "Born Digital" Approach," *MIS Quarterly Executive* (7:3), pp. 113-122.
- Piotrowicz, W., and Cuthbertson, R. 2014. "Introduction to the Special Issue Information Technology in Retail: Toward Omnichannel Retailing," *International Journal of Electronic Commerce* (18:4), pp. 5-16.
- Porter, M. E., and Heppelmann, J. E. 2014. "How Smart, Connected Products Are Transforming Competition," *Harvard Business Review* (92:11), pp. 64-88.
- Porter, M. E., and Heppelmann, J. E. 2015. "How Smart, Connected Products Are Transforming Companies," *Harvard Business Review* (93:10), pp. 96-116.
- Rigby, D. 2011. "The future of shopping," *Harvard Business Review* (89:12), pp. 65-76.
- Rosemann, M. 2014. "Proposals for Future BPM Research Directions," in *Proceedings of the 2nd Asia Pacific Business Process Management Conference*, C. Ouyang, and J.-Y. Jung (eds.), Brisbane, Australia, pp. 1-15.
- Rosemann, M., and Vom Brocke, J. 2015. "The Six Core Elements of Business Process Management," in *Handbook on Business Process Management 1*, M. Rosemann and J. vom Brocke (eds.), Berlin: Springer-Verlag, pp. 107-122.

- Sambamurthy, V., Bharadway, A., and Grover, V. 2003. "Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms," *MIS Quarterly* (27:2), pp. 237-263.
- Schoenbachler, D. D., and Gordon, G. L. 2002. "Multi-channel shopping: understanding what drives channel choice," *Journal of Consumer Marketing* (19:1), pp. 42-53.
- Sonderegger-Wakolbinger, L. M., and Stummer, C. 2015. "An agent-based simulation of customer multi-channel choice behavior," *Central European Journal of Operations Research* (23:2), pp. 459-477.
- Stone, M., Hobbs, M., and Khaleeli, M. 2002. "Multichannel customer management: The benefits and challenges," *Journal of Database Marketing* (10:1), pp. 39-52.
- Straker, K., Wrigley, C., and Rosemann, M. 2015. "Typologies and touchpoints: designing multi-channel digital strategies," *Journal of Research in Interactive Marketing* (9:2), pp. 110-128.
- Teece, D. J., Pisano, G., and Shuen, A. 1997. "Dynamic Capabilities and Strategic Management," *Strategic Management Journal* (18:7), pp. 509-533.
- Trenz, M. 2015. "The Blurring Line Between Electronical and Physical Channels: Reconceptualising Multichannel Commerce," in *ECIS 2015 Proceedings*, Münster, Germany, Paper 184.
- Trkman, P., Mertens, W., Viaene, S., and Gemmel, P. 2015. "From business process management to customer process management," *Business Process Management Journal* (21:2), pp. 250-266.
- Tseng, E. L. S., and Yazdanifard R. 2015. "Mobility – The Revolutionary Change to Customer's Shopping Experience in Retailing," *International Journal of Management, Accounting and Economics* (2:9), pp. 1037-1047.
- Urban, G. L., and Hauser, J. R. 2004. "'Listening In' to Find and Explore New Combinations of Customer Needs," *Journal of Marketing* (68:2), pp. 72-87.
- Van Baal, S. 2014. "Should retailers harmonize marketing variables across their distribution channels? An investigation of cross-channel effects in multi-channel retailing," *Journal of Retailing and Consumer Service* (21:6), pp. 1038-1046.
- Van Bruggen, G. H., Antia, K. D., Jap, S. D., Reinartz, W. J., and Pallas, F. 2010. "Managing Marketing Channel Multiplicity," *Journal of Service Research* (13:3), pp. 331-340.
- Venkatesan, R., Kumar, V., and Ravishanker, N. 2007. "Multichannel Shopping: Causes and Consequences," *Journal of Marketing* (71:2), pp. 114-132.
- Verhoef, P. C., Neslin, S. A., and Vroomen, B. 2007. "Multichannel customer management: Understanding the research-shopper phenomenon," *International Journal of Research in Marketing* (24:2), pp. 129-148.
- Verhoef, P. C., Kannan, P. K., and Inman, J. J. 2015. "From Multi-Channel Retailing to Omni-Channel Retailing. Introduction to the Special Issue on Multi-Channel Retailing," *Journal of Retailing* (91:2), pp. 174-181.
- Vom Brocke, J., Simons, A., Niehaves, B., Riemer, K., Plattfaut, R., and Cleven, A. 2009. "Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process," in *ECIS 2009 Proceedings*, Verona, Italy, Paper 161.
- Wade, M., and Hulland, J. 2004. "The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research," *MIS Quarterly* (28:1), pp. 107-142.
- Wei, S., Liu, H., Ke, W., Wei, K. K., and Hua, Z. 2014. "Mediating Effects of Supply Chain Integration: From IT Capability to Firm Performance," in *ICIS 2014 Proceedings*, Auckland, New Zealand.
- Wernerfelt, B. 1984. "A Resource-Based View of the Firm," *Strategic Management Journal* (5:2), pp. 171-180.
- Williams, A., and Cameron, N. 2015. "Myer admits struggle to meet omni-channel customer expectations," Retrieved from: <http://www.cmo.com.au/article/570819/myer-admits-its-struggling-adapt-omni-channel-customers/> (Accessed: 2017-04-29).
- Winter, S. G. 2003. "Understanding Dynamic Capabilities," *Strategic Management Journal* (24:10), pp. 991-995.
- Yuksel, M., Milne, G. R., and Miller, E. G. 2016. "Social media as complementary consumption: the relationship between consumer empowerment and social interactions in experiential and informative contexts," *Journal of Consumer Marketing* (33:2), pp. 111-123.
- Zahay, D., Peltier, J., Schultz, D. E., and Griffin, A. 2004. "The Role of Transactional versus Relational Data in IMC Programs: Bringing Customer Data Together," *Journal of Advertising Research* (44:1), pp. 3-18.