Omnichannel Value Chain: Mapping Digital Technologies for Channel Integration Activities

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Abstract

In order to provide a seamless customer experience, researchers and practitioners have proposed creation of an omnichannel retailing environment by integrating online and offline channels. Channel integration necessitates use of digital technologies and there are myriads of technological solutions available. However, retailers are struggling with selection and implementation of suitable technologies to add value through channel integration. Despite the strong practical need, this issue has not been effectively addressed in the academic literature. This paper presents an omnichannel value chain underpinned by Porter's value chain model. We identify ten channel integration activities for value creation by carrying out a synthesis of current research on omnichannel retailing. Enabling digital technologies are then mapped to these activities using technology implementation examples and provide a guideline for retailers to select appropriate technologies for the identified value creation activities.

Keywords: Channel Integration, Omnichannel Retail, Digital Technologies, Value Chain, Technology Mapping.

1. Introduction

Retail sector is experiencing an influx of innovative methods and technologies to enhance and reform the customer experience [15, 64]. Along with this influx, there has been a huge change in the information technology (IT) provision, technology cost, and access to technology. These changes are affecting the way value creation activities are performed and the nature of the linkages among them. It is pushing the retail sector toward a new digital path i.e. omnichannel retailing [56]. Omnichannel retailing is synergic offering of all available channels and customer touchpoints to optimize customer experience and performance across channels [47, 56].

The most significant characteristic of omnichannel retailing is channel integration [40]. Channel integration has been shown to have a positive effect on customer experience and acts as a competitive advantage for retailers [25] which leads to stronger sales growth [16], an increase in the "perceived quality of the channels" [39] and the reduction of service inconsistencies [74]. Additionally, channel integration can achieve synergies such as "improved customer trust, improved customer awareness, consumer risk reduction, and coverage of diverse shopping preferences" [26]. Furthermore, it allows retailers to actively maintain customer contact and develop a proactive customer experience management strategy through increased customer insights [74]. Finally, the interconnection of channels makes it harder for competitors to imitate the company. It could increase the customer's value proposition and thus reduces the competitive pressure [26]. Despite of all above

mentioned benefits of channel integration, retailers are still not developed enough in terms of application and implementation of technology to achieve completely integrated channels and create desired value [21, 50, 59].

Technology implementation for channel integration is a major undertaking because of constantly evolving capabilities to drive the integration [47]. Retailers trying to adopt these technologies for channel integration can easily get lost by the variety of technologies to choose from [72]. Consequently, they often select technologies without examining the potential contributions to their strategies [35]. Extant literature on channel integration addressing the issues of technology implementation or technology capabilities in retail has mainly focused on use of some specific technologies such as RFID [2, 3], augmented reality [27], beacons [55], mobile technologies [48, 69] etc. The literature which studies multiple technologies has either focused on physical stores or online shop. For example, [49] studies the intention of customers in using fitting room and in-store technologies in an omnichannel physical store. Similarly, [5] and [11] investigated the use of digital technologies in-store, in order to enhance the customer experience in retail stores. [48] identifies aspects of omnichannel retailing which mobile technologies can affect while [3] and [2] studied the use of RFID as an enabler for channel integration. But a clear and comprehensive picture of the digital technologies that may be adopted to create value through different aspects of channel integration and their respective roles has yet to be revealed [59]. In this paper, we will try to address this research gap by first providing a framework of value creation activities in omnichannel and then mapping the enabling digital technologies to these activities.

For omnichannel retailing to be effective and efficient, multiple channel integration activities play a pivotal role and there are several technologies which can enable the value creation through these activities but implementation of any technology must be guided by business value creation [17]. We therefore identify activities in channel integration which are necessary for value creation in omnichannel retailing underpinned by Porter's value chain model [57] and then map to these activities the digital technologies which facilitate value creation by an extensive review of literature and real world implementation examples. Hence, this paper adds to the literature by presenting an omnichannel value chain model and mapping of the enabling technologies to the identified value creation activities.

The remainder of this paper is structured as follows. First, in section two, we introduce the research methodology followed for the presented research. Afterwards, in section three, we bring together channel integration activities which create value for omnichannel retailers. In section four, we describe enabling technologies for channel integration and real world examples of services using these technologies. In section five, we discuss contribution and managerial implications of this study. Finally, we conclude the paper by summarizing our study and establishing scope for further research.

2. Research Methodology

For the mapping of digital technologies to value creation activities of channel integration, we followed a multi-phase research process. First, we conducted a literature review to identify channel integration activities in omnichannel retailing. We followed the approach for literature review proposed by [18] and [82]. We defined the scope and goal of the review in identifying the value adding activities for an integrated retail system. We applied the search using keywords channel integration, omnichannel, technology and retail in three different databases i.e. Scopus, Science Direct and Web of Science. We used different combinations from the keywords to better understand the occurrence of the results such as ("omnichannel" OR "omni-channel") AND ("management" or "technology"), ("channel integration" OR "integrated channels") AND ("management" OR "technology") AND "retail". This search resulted in total of 635 articles. Afterwards, we excluded duplicates, articles not published in English and published before 2012. We only considered literature after 2012 as the term 'omnichannel' was coined in literature in 2011 by [58] and most of the research related to channel integration for omnichannel retailing has been published

after that.

Subsequently, we examined the sum of identified articles to evaluate whether the articles could contribute to this paper and excluded articles not topic-related, for example, articles regarding foreign market channel integration. We also excluded articles from unrelated disciplines to this research such as refrigeration science and technology, chemistry, applied mechanics etc. After screening the remaining articles for the contribution to the study, 29 articles were selected, which were then used for defining the channel integration activities for value creation. In the second phase, we identified the technologies for channel integration activities using literature and real world usage examples to explain their implementation. For initial selection of enabling technologies for channel integration, literature review was conducted. The results of search phrase ('retail' and 'technology') were analyzed to find retail technologies for channel integration activities. The search resulted in 2280 articles. We performed text analysis on these articles using Nvivo to uncover potential enabling technologies for channel integration. Only those technologies were selected which were mentioned at least five times in the identified articles to support one or more channel integration activities. To improve reliability of our analysis, we also asked retail technology experts, who are currently working in implementation of different technology solutions in retail, to come up with a final list of technologies to be analysed. To complement our analyses, we also used examples of actual implementation of these technologies to better comprehend the roles of the identified technologies[4]. In the third phase we mapped the technologies to relevant channel integration activities. The technology mapping has been based on [24]. We recognized major characteristics of the particular technologies and then identified characteristics enabling the value creation activities identified in the first phase for channel integration.

3. Value Creation through Channel Integration

Channel integration has been recognized as a key characteristic in omnichannel retailing which helps retailer remain competitive and achieve superior financial performance. Channel integration is the extent to which channels share common organizational activities as defined in Porter's value chain [57], including marketing, sales, operations, services and logistics [75]. This leads to channel synergy, which necessitates use of channels in such a way that effectiveness of each separate channel increases in providing a seamless shopping experience for the customer. Channel synergy requires organizations to communicate and leverage the brand consistently across all channels [40]. Retailers have to facilitate a system where customers should be able to perceive the company as one entity, and be offered various channel options which are seamlessly linked [47]. Most of the existing literature discusses these approaches under the terms multi-, cross- or omnichannel integration. Based on the literature review, channel integration activities to transform to fully integrated omnichannel system are introduced in the following sub-sections. These activities are then presented in omnichannel value chain model shown in Figure 1. Channel integration activities which create value in terms of improving effectiveness and efficiency of retail offering have been listed in the primary activities.

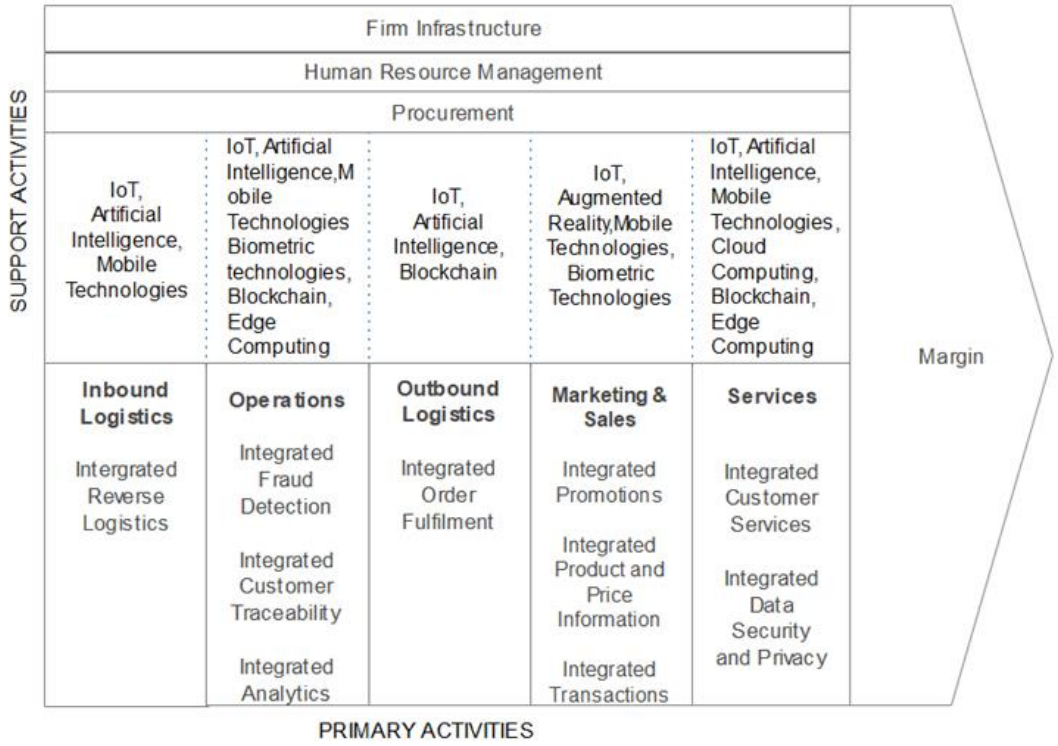

Fig. 1. Omnichannel Value Chain Model

3.1. Integrated Customer Service

Customer service integration refers to improving and enriching an interaction with a customer by blending the interaction simultaneously with other channels[12, 31]. Around 85 percent of customers who are not able to accomplish what they need in one channel such as a website will switch to other channels such as phone, mobile app, web chat, social media or email [31]. In-store customer service associates can use devices such as tablets, mobile to provide enhanced customer service, for example by looking up information through the system to assist the consumer, thus reinforcing brand values and delivering a good shopping experience [12]. To provide in-store experience online, retailer can offer services such as virtual fitting room based on virtual reality. Fits.me is a virtual reality application used by a number of fashion brands (such as Hugo Boss, Twin-Set and Thomas Pink) to provide online shoppers with service which is traditionally only available in stores[45]. It offers a virtual fitting room for online shopping and suggests the garment size that is the closest match to the shopper's measurements, and enables the user to 'try on' several sizes to identify the preferred size and fit [45]. Similarly, to provide a digital experience in physical store, services such as "on screen customization" can be used. For instance, digitally enhanced stores such as Nike Town provide screens to customize one's shoes [12]. Similarly, customer service can be improved in social media channels by utilizing services associated to retailers' website using applications such as eBay ShopBot, which deals with consumer search enquiries on Facebook messenger and a variation of the application is now available on the Google Home device.

3.2. Integrated Customer Traceability

When moving from one channel to the other, integrated customer traceability gives retailer the ability to maintain context and data continuity as the customer is moving from one channel to another channel[10, 38]. Retailers can trace the customer journey started online and finished with an offline sale [10] using mobile technologies with services such as Google's offline sales conversion tool. Retailer can track the customer who explores a product offline and then buys online[10] using Google URL Builder. Using mobile ID

tracking, retailers can use the consumers' smartphone's Wi-Fi to track their journey in the store and can know the repeat visitor and analyze the departments and parts of the store visited. Mobile Decision Support System can be used to check and compare reviews posted by consumers themselves and to extract reputations of a product from weblogs [23]. While retailers track customers across channels, they collect, store, analyze and transfer a lot of personal data from customers. In doing so, they face the challenge of protecting this data from breaches [51]. Virtual Coupons without using personal data can be used to trace the store customers online [54].

3.3. Integrated Order Fulfilment

Traceability and changeability of inventory, orders and delivery points during all stages of order fulfilment across all channels is required for a fully integrated omnichannel system[32, 60]. In an integrated channels network, a retailer needs to be able to see inventory across channels, that it knows where products are available and how fast it can get them to customers. With integrated order fulfilment, customers should be able to reserve products in store using mobile phone, web or social media (Reserve and Collect) [32] and collect products in store bought using mobile phone, web or social media (click and collect) [43]. Customers are able to reserve products in store using mobile phone, web or social media (Reserve and Collect) [32] and collect products in store bought using mobile phone, web or social media (click and collect) [43]. Customer can use their devices to re order a product like Amazon Dash Button [32] and orders can be delivered to their place of choice in real time like a car trunk using services such as Amazon Key delivery. Customers' needs can be predicted to have most of their regular buy ready in store (Anticipatory Shipment) [65].

3.4. Integrated Transactions

Providing secure accessibility to complete the transaction via all available channels constitutes integrated transactions. Regardless of how, where and within which channel the transaction is made, the relevant data should be securely retrievable by other parties in the integrated transaction system[60]. With integrated transactions, customer should be able to purchase products directly from all available channels e.g. social media outlet of retailer and to purchase products directly from an advertisement on any channel e.g. TV or news advertisement, digital signage, catalogue. Customer should be able to check out without going through a physical check out desk using other channels for payment in store e.g. Amazon Go, Mobile and Tablet check out[32], thus adding value to marketing activities of the retailer.

3.5. Integrated Product and Price Information

Integrated pricing and product information implies synchronization of the products' description, stock status, prices, and makes changes in them (e.g. discounts, availability) visible for consumers and other members of the omnichannel system instantly [60, 70]. This integration should also pick up on any mistake, mismatch, or absence of product data anywhere in the omnichannel system, and initiate the necessary corrective actions [60]. Shopify and Google's direct integration makes it easy for shoppers to discover products available in store with Google Smart Shopping campaigns. Another example of an online-to-offline relationship is Sephora mobile application[53]. Digitally enhanced stores such as Nike Town are providing i-Kiosks to look up information digitally [12]. Retailers should also provide information based on customer social network via different digital channel [32].

3.6. Integrated Promotions

Promotion data must be shared and available across all channels and the product's/brand's name, logo and motto should be consistent across all channels, and the promotions should use different channels at the same time[72]. During pre-purchase stage retailers can use

services such as digital signage showing videos, real-time pricing and product information that can be integrated with social media feeds that display consumers' reviews next to the merchandise to build the trust. Retailers can also use connected home appliances to sense customer needs and send personalized need based offers through mobile channel [32]. During the purchase stage of the consumer buying process, retailers can use consumer-facing in-store technology to inspire and engage with consumer using different channels and offering personalized offers and promotions [39]. Burberry, M&S, Nike and Macy's, for instance, have adopted interactive screens (e.g. iPads, i-Kiosks, tablet computers) through which consumers get promotions during purchase stage. Besides, adaptive digital touchpoints enable new forms of promotions. For example, by introducing firm-initiated mobile touchpoints, retailers can "provide tailored, time-sensitive, and location-sensitive advertising and promotions in store" [23].

3.7. Integrated Reverse Logistics

Integrated reverse logistics entails providing all channels for returns to customers and return visibility in all channels as well[60]. Integrated reverse logistics links among different stages of reverse logistics and different channels involved in it. So, information around the return point(s), stock keeping point(s), and product(s) reverse flow should be retrievable, traceable, and changeable using RFID like M&S [3]. retailers can easily provide services such as Buy online return in Store using RFID tagged products [75]. Retailers can therefore offer customers the ability to buy in store and return via other channel such as using the website and get the return collected from their homes.

3.8. Integrated Analytics

Predicting customer needs and take actions based on data available from all available channels is integrated analytics [32]. With different types of data available from various channels such as interaction data (POS, e-commerce), enterprise data (CRM and ERP) and unstructured data (social media data) which can be fused on one platform to predict customer intent and take informed actions [33]. At the same time the route of each customer and the times they spend in different channels deciding what to purchase can be analyzed, similarly to the way it is analyzed by checking out the clicks on an e-shop browser. If combined with data, extracted by the e-shop web analytics application will allow the company to provide better and more accurate services and make products proposals, which can lead to a more gratifying interaction and raise sales [13]. Swatch and American Apparel have implemented successfully mobile tracking in their stores to track and analyze customer journey in the store [12].

3.9. Integrated Data Security and Privacy

Omnichannel retailers should ensure that the privacy conditions are adhered to when data is integrated from different channels. Consumers are concerned about how retailers can track their location and collect data about them, and how it affects their privacy. Retailers must be aware of privacy issues, seek to comply with law first of all but also ethically use tracking and inform consumers about the type of information collected and its purpose. Appliances and sensors that upload a large quantity of personal data to centralized databases controlled by smart device manufacturers or retailers may be exposed to serious privacy problems [18]. Customers are becoming ever more concerned about their data privacy and retailer ensuring data privacy adds to the customers 'perceived value and creating trustful customer relationship [32]. Integrated data security implies keeping customers' data secure when moved from one channel to another. With the implementation of digital devices to achieve integrated channel retailers are also facing the issue of data security. Overall, this information/knowledge flow should be protected by cyber security solutions to limit data theft.

3.10. Integrated Fraud Detection

Omnichannel retailing is susceptible to frauds and needs an integrated fraud detection solution to address this new dynamic [62]. Detecting fraud when transaction involves more than one channel is integrated fraud detection .With digital and interconnected devices for channel integration, cyber-attacks becomes likely as the mobile and internet of things (IoT) devices have limited computing power to detect such attacks [73].

4. Enabling Technologies for Channel Integration in Retail

Achieving channel integration and channel synergies necessitates that retailers adopt digital technologies and solutions. Multiple digital technologies are required to achieve total channel integration in retail [52]. According to the value chain model by Porter [57], technology development is one of the supporting activities for any organization. Also, staying current with technological advances, and maintaining technical excellence are sources of value creation. Thus, it is necessary to clearly identify the most relevant technologies and solutions to support the retailers in transition towards the total channel integration in order to become omnichannel [4]. Role of digital technologies to facilitate channel integration activities identified in section 3 are explained in this section. In Table 1, these relevant technologies are described. In Table 2, real world implementation examples are presented.

Table 1. Description of Enabling Technologies for Channel Integration in Retail

Enabling Technologies	Description
Augmented Reality	Augmented reality integrates computer-generated objects with the real environment and allows real-time interactions. [6]
Blockchain	Blockchain technology consists of blocks which are linked through cryptography. [1]
Artificial Intelligence (AI)	AI augments human intelligence and for the context of this study AI refers to machine learning, natural language processing, drones and other AI based systems. [22]
Cloud Computing	Cloud computing allows sharing of IT software and hardware resources over the internet, so that information can be easily stored and accessed remotely by diverse actors. [4]
Internet of Things(IoT)	IoT is a sophisticated network of objects and things connected to the internet. The concept of IoT in retail consist of Radio Frequency Identification (RFID), beacons, camera networks and other wireless sensor networks. [7, 66]
Mobile Technologies	Mobile technologies refer to set of technologies related to smart phones including mobile apps, scan and go, location based apps etc. [22]
Biometric Technologies	Biometric technologies are automated methods of verifying or recognizing the identity of a person based on their physiological or behavioural characters. [68]
Edge Computing	Edge computing refers to the enabling technologies allowing computation to be performed at the edge of the network, on downstream data and upstream data. [61]

Augmented Reality applications narrow the gap between online and offline shopping. They provide a sense of embodiment which results from a natural interactivity and simulation of physical control over virtual offerings and sometimes exceeds what is possible in physical environments [27]. It is being used by firms like IKEA [36] to provide better product information (integrated product and price information). Mister Spex, is providing by using an AR virtual mirror an experience where customers can virtually try on different glasses from their online assortment. Walgreens offers its customers "Aisle411" application to receive digital way-finding support that helps them locate products in the supermarket aisle (Integrated Customer Service) [27].

Blockchain offers attractive security features for distributed data processing and

storage especially when used with edge computing (Data Security and Data Privacy). Such systems are being implemented and developed in other industries such as health services. For example, using hierarchical identity-based cryptography for the handshake scheme. This scheme named as cross-domain handshake (CDHS) scheme can be used to increase data security within integrated channels (Integrated Data Security and Privacy). Blockchain features can also be used for ensuring safe delivery to customers (Integrated order fulfilment).

AI tools like machine learning extracts the knowledge that is actually important in an omnichannel network. It helps retailer to make sense of data by transformation of raw data into information and then information to knowledge (Integrated analytics) [4, 34]. AI based fraud detection solutions like the ones proposed by [28] can be used for detecting point of sales (POS) fraud when the system is integrated with other channels. Delivery technology based on AI such as drones facilitates fulfillment process (integrated fulfillment). Facial recognition systems based on biometric technology are being used for identity verification e.g. Alibaba "pay with a selfie" (Integrated Transactions) [63] but the use of biometric technologies in retail is significantly affected by regulations such as GDPR in EU [51]. Methods of using biometric technologies must evolve for compliance to GDPR and sophisticated AI systems which can ensure anonymity of the personal data processed can be a possible solution.

Cloud computing is devoted to storing raw data in structured information. Such information can be accessed by and exchanged between different channels, which may, in turn, use the structured information as the input for data analytics (integrated analytics) and customer assistant(integrated customer service)[4]. Cloud services also manage all types of raw data, but with the aim of storing structured information that may be helpful for logistics (integrated order fulfilment). Cloud computing based services can manage a multidirectional flow of information which can be used to support multiple activities like integrated product and price information, integrated promotions. Edge computing for IoT with blockchain can provide a transparent and secure alternative framework for private data management in the digital physical stores (Integrated Data Security and Privacy) [73].

IoTs play a vital role in multiple channel integration activities [17]. IoT solutions can be employed by retailers to acquire several types of data (e.g. the location of a component/product, customer data). Thereby, the data flow underlying IoTs combined with machine learning(AI) becomes powerful resource for retailers to use for customer profiling (Integrated Analytics) and providing real time recommendations (Integrated Customer Service) [7]. Business to Thing Management based on IoTs can facilitate direct interactions with smart things and thus need based promotions to customer (Integrated Promotions). Edge computing is a viable way to take advantage of the explosion of Internet of Things (IoTs) which has dramatically increased the data load on networks. Integration of complex sensors, with the implementation of an efficient data fusion strategy can be used for integrated analytics and integrated customer traceability [41].

Beacon is an IoT based technology that allows retailers to send messages or notifications to consumers in the beacon's zone to promote specific products (integrated promotions) or give recommendations (integrated customer service) [20, 39]. It is used by retailers such as Macy's, Zara and H&M for communications purposes with consumers [20]. Google announced the Physical Web initiative utilizing bluetooth beacons as an IoT gateway and proximity-based service without the need for mobile apps. Beacon gateway can be used for analyzing data from customer movements in store (integrated analytics). Data for tracing customer can be collected using software sensors (IoT) and smartphone (Integrated Customer Traceability). RFID is being used to track products in a store and in delivery (Integrated order fulfilment) as well from a distance by using tiny microchips hooked up to miniature antennas (integrated reverse logistics) [29]. Retailers can use RFID to locate store inventory, keep track of inventory and products on delivery route [12, 30] . By using RFID retailers can provide customized marketing programmes (integrated promotions) for the customers at an individual level and hence increases product and brand awareness (integrated product and price information) [44].

Mobile technology is one of the main enabler of omnichannel realization [8]. To

provide services such as zero check out vision systems can be combined with other technologies and provide integrated customer service. The touchscreen functionality of mobile devices can also be exploited for reducing the physical-digital divide between the in-store and online fashion shopping experience. The QR code, a two-dimensional matrix barcode, is a technology which is changing marketing in this decade. QR code can be used to provide integrated promotions and integrated products and price information. Using mobile ID tracking, retailers can use the consumers' smartphone's Wi-Fi to track their journey in the store and can know the repeat visitor and analyze the departments and parts of the store visited. Mobile Decision Support System can be used to check and compare reviews posted by consumers themselves and to extract reputations of a product from weblogs [23]. They might either retrieve data by scanning product barcodes or QR-codes with the mobile phone camera by using special m-shopping applications [23]. H&M's have introduced a scan function in the mobile app that consumers can use in-store to scan the barcode of products and check their availability in other sizes and colors, as well as online promotions, personalized offers and matching products.

Table 2. Overview of technologies and services for channel integration activities

Channel Integration Activity	Enabling Technology	Examples of Implementation
Integrated Customer Service	Cloud Computing, Augmented Reality, Mobile Technology, AI	Clarke's Ipad feet measurement [72], Digitally Enhanced customer Assistant, Mobile Shopping Assistant, Walmart Product Finder, Ebay Shopbot
Integrated Customer Traceability	Mobile Technologies	Tesco's Virtual coupons [9], Google Offline Attribution
Integrated Order Fulfilment	IoT(RFID), AI	Reserve and Pay [32], Click and Collect [10, 43], Amazon Dash Button [32], Amazon Key Delivery, Amazon Anticipatory Shipping
Integrated Promotion	Mobile Technologies, Augmented Reality, IoT(Beacon)	Taggle, Viviono social communication [27], Mobile Mirror [72], Location based recommendations [66]
Integrated Transactions	Mobile technologies, Biometric Technologies	Instagram Shopping [19], Amazon Go [46], Uniqul Payment, Alibaba 'Pay with Selfie'
Integrated Product and Price Information	Mobile Technologies, Augmented Reality	H&M Scan and Buy, Bauble Bar Interactive Display, Loreal Makeup Genius [54], Nike's product customization [27]
Integrated Reverse Logistics	IoT (RFID)	Buy Online Return in Store, Return Collection from Home [17]
Integrated Analytics	AI, IoT	Video based emotion Analytics [67]
Integrated Data Privacy and Security	Block chain, Edge Computing	Automated access control manager [76]
Integrated Fraud Detection	AI, Biometric Technologies	POS Fraud Detection [28]

5. Discussion

The findings from this research offer several insights for value creation through channel integration using digital technologies and add to information systems literature on IT enabled value creation [37]. The study constitutes the first attempt to investigate the extensive role of digital technologies in enabling value creation through channel integration [52]. A firm's value chain is the linked activities that a firm executes to achieve

effectiveness and efficiency. Performing value chain activities in ways that would give a firm the capability to outmatch rivals is a potential source of competitive advantage [57]. The value chain concept advocates that achieving competitive advantage begins with an effort to develop deeper organizational expertise in performing certain competitively critical value chain activities, deliberately attempting to harness those capabilities that strengthen the firm's strategy and competitiveness. This research tailors the value chain model [57] to omnichannel retailing and demonstrates how retailers can add value by utilizing appropriate technologies explained in Section 4 for specific channel integration activities presented in Section 3. Another important contribution of this study is to provide comprehensive mapping of value creating activities of channel integration, thus enabling opportunities for empirical research to study implication of identified activities separately as it is likely that every activity would have different implications to value creation.

Several interesting practical findings have also emerged from this study. First, IoTs, mobile technologies and AI are required for most channel integration activities as shown in Table 3 but other technologies such as blockchain and edge computing can play a substantial role in creating value through channel integration. These are not required for numerous activities like former but are very critical for the particular activities which they support. Edge computing is a viable way to take advantage of the explosion of IoTs which has dramatically increased the data load on networks. Integration of complex sensors, with the implementation of an efficient data fusion strategy can be used for number of services which leads to better service, more sales, and lower costs [39]. For example, [13] proposed an integrated analyzer for real time analytics for the physical store and online store using mobile technologies, communication techniques which are commonly used in e-commerce applications, thus supporting hybrid systems. This method offers much better service to customers of traditional brick and mortar shops. Another important finding from our study was that there are some services which are being employed in other domains using the identified technologies which can be easily replicated in the retail sector but are not being implemented at the moment. For example, cross domain handshake scheme being used in healthcare sector can be used for data security during moving data from one channel to another. Similarly sophisticated machine learning is being used in financial services for fraud detection which can be easily adopted in retail. An ideal position for a retailer would be complete customer data integration (CDI) and a single view of the customer across channels. In the context of omnichannel retailers, facial recognition or other biometric technologies can be used as a unique identity to identify customers across different channels but there are regulatory and cultural ramifications of using these technologies which should be taken into account. For example, biometric data can only be processed in EU if consent is given explicitly.

From a managerial perspective, our mapping framework can be used as a guideline to focus on technologies identified for certain aspect of channel integration to take advantage of complementary role of all the channels. Secondly, it is important for retailers to build the internal capacity and capabilities to exploit the full potential of the aforementioned technologies to fully utilize the benefits of integrated channels [32, 42]. Retailers will only be able to implement most of the technologies (e.g. IoTs, AI) if they have built required capabilities to utilize these technologies. Retail managers must develop a systemic view of the use of digital technologies in order to better seize the current and future opportunities offered by channel integration. Some retailers (e.g. Amazon, Macy, H&M, Zara) are using identified technologies to support some of identified channel integration activities. Still retailers are not taking full advantage of benefits offered by these technologies for channel integration. For example, beacons have been mainly considered for fulfilling location based customer experience and promotions but with beacon gateway there is an aspect of using beacon technology for integrated analytics. Similarly, mobile technology is one of the main enabler of omnichannel realization [8] and its different features such as the touchscreen functionality of mobile devices can be exploited in various forms as means of reducing the physical-digital divide between the in-store and online shopping experience [45].

6. Conclusion

This paper is one of the first attempts to provide a comprehensive overview of the channel integration activities for an effective and efficient omnichannel value chain and mapping of digital technologies to these activities. This study extends our knowledge on omnichannel value chain and use of digital technologies in retail. Underpinned by Porter's value chain model [57], we presented a twofold guideline to transform the retailers from multichannel to omnichannel. First, we identified the activities required for effective channel integration and secondly we recognized the technologies and digital solutions that act as enablers for value creation. Moreover, we underlined examples of retail companies which have already attempted to integrate the channels using the identified technologies. In particular, the proposed examples reveal the important and complementary role those technologies play for channel integration.

Most of our attention has been devoted to the selection of technologies with the perspective of current level of technologies. Future research could be done to analyse developing trends of the enabling technologies using techniques such as patent analysis. Relatedly, an assessment of the impact that the implementation of those technologies may have had on firm financial and operational performance should be further examined. In the omnichannel value chain model, we described only the role of technologies as support activity. Future research can elaborate how firm structure, human resource management and procurement can support primary activities in omnichannel value chain.

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