Literature Review

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Articles List

Evolution of retail formats: Past, present, and future (Gauri et al. 2021)

Abstract

In this paper, the authors review current literature on retail formats and propose a new customer-centric framework for retailers to focus on as they continue to innovate and evolve. Specifically, they review the literature on how formats compare in their attributes and compete with each other; the role of customer behavior in format choice; and developments in multi-channel and omnichannel retailing. They propose a framework for retail formats suggesting two paths – either reduce friction in the customer journey or enhance customer experience. They discuss the challenges faced by offline (physical store-first) and online (digital-first) retailers and elaborate on strategies each type of retailer is pursuing to address these challenges. Finally, they offer directions for future research in this domain. They conclude by calling for newer digital-first and physical-first players to continue coming up with different customer-centric formats, which they predict will slowly morph into integrated retailers, leaving space for newer players to enter the market and hence keep the wheel of retailing spinning.

Brief

Role of consumer behavior in retail format choice

Consumers seek to choose a format and price level that best suits their needs in a given shopping situation. Because a retailer can survive only if it can profit from providing a given mix of services, consumers ultimately determine the market formats. Therefore, it is essential to examine the services required by consumers as they proceed through the customer journey.

The first two stages are the basic stages of the purchase process, i.e., information search and purchase. Since goods sold online are acquired only after delivery, we consider acquisition as a third separate stage of the customer journey. Since product return is a particularly important factor for online sellers, it is considered a separate and last stage of the journey.

Information search

Concerning search, Ehrlich and Fisher (1982) presented and tested a model in which consumers value advertising because it lowers their search costs. In return, they pay a higher margin that covers the cost of advertising.

As consumers do not need to travel to online stores, their online search costs should be relatively low. All three studies found that although search costs were low, consumers still did not search extensively. The finding of limited search is also characteristic of offline shopping and needs explanation.

Though conditions under which sales assistance can be useful have been conceptually outlined (Wernerfelt, 1994b), detailed empirical evidence about salespeople's role in in-store search is scarce.

Customers may search offline and buy online, a practice labeled showrooming (Ailawadi & Farris, 2017). Since showrooming leads retailers to provide information to consumers without being compensated for their efforts such as salesperson time, showrooming is a problem for offline retailers and has received considerable attention.

Buying at the store rather than showrooming is more likely when online search costs are perceived to be high, in-store sales personnel are more accessible, and consumers are under time pressure.

Since manufacturers benefit if consumers receive pre-sales services from offline retailers, they could alleviate the showrooming problem by compensating retailers for providing the appropriate level of service.

Purchase

Accessibility is a major differentiating factor for offline retailers. Consequently, there is an extensive literature on the trade-off between the attractiveness of the store (or overall trade area) and the consumer's distance from the store.

They found that the reduction in shopping trips, resulting from one-stop shopping at supermarkets, and facilitated by their broad assortment, justified this format's choice by consumers.

Studies on consumer preferences provide insights potentially relevant to practice. In a study of grocery shopping behavior, Bell, Ho, and Tang (1998) found that large-basket shoppers prefer everyday low pricing (EDLP).

There are some segmentation studies of shoppers. Ganesh, Reynolds, Luckett, and Pomirleanu (2010) found that online shopper segments were similar to offline shopper segments derived in other studies. Konus, Verhoef, and Neslin (2008) used latent class analysis of self-reported information-seeking and purchase behavior to form three clusters of shoppers: uninvolved (40%), multichannel (37%), and store-focused (23%). Psychographic and demographic variables were used as covariates. Multichannel shoppers were found to be the highest of the three clusters in innovativeness and shopping enjoyment, while store-focused shoppers were found to be highest in loyalty.

Acquisition

For online channels, acquisition (i.e., getting the product in one's hands) generally occurs after purchase and involves a consumer decision about the cost and timing of delivery. Purchase and acquisition are also commonly separated in many offline channels (for example, furniture and major appliances). The separation of purchase and acquisition leads sellers to compete on shipping fees and delivery time.

Shipping fees provide an opportunity to engage in price discrimination, and in practice, many different fee structures abound. There have been many different studies of the economics of shipping fee structures.

Returns

Returns lower the risk of buying online without personal inspection; thus, return policies are particularly important for online retailers. However, Banjo (2013) reports that around onethird of all online purchases are returned, creating operational challenges for retailers and affecting profitability. With more and more retailers serving customers through both online and offline channels, efficiently managing product returns across channels should be a key strategic focus.

Their results indicate that free shipping encourages the purchase of more risky products, leading to increased returns. Some other noteworthy findings in the literature are that a product's performance in a channel and its return rate are inversely related (Dzyabura, Siham, Hauser, & Ibragimov, 2019); availability of more product reviews, lower dispersion in ratings, and the presence of more helpful reviews all lead to fewer product returns (Sahoo, Dellarocas, & Srinivasan, 2018); and return rates for online purchases decrease after store openings (Wang & Goldfarb, 2017).

Competition between retail formats

Competition between offline retail formats

Basker (2007), who mainly summarizes her studies of Walmart, attributes its success to the interaction of superior technology and economies of scale, both of which give the retailer a cost advantage allowing for lower prices.

However, Zhu, Singh, and Dukes (2011) also demonstrated that an existing retailer could benefit if a mass merchandiser (e.g., Walmart) establishes a location nearby. The existing retailer can benefit if it sells unique items not sold by the mass merchandiser. The existing retailer loses on those items also sold by Walmart but benefits from the spillover effect of Walmart's presence on the sales of its unique items.

The magnitude of switching costs uncovered in this study may help explain why Ellickson and Misra (2007) found that competing firms tended to choose the same strategy in a given market, rather than differentiating themselves. Gauri et al. (2008) also found that competing stores tend to differentiate on either pricing or format strategy.

Competition between offline and online retail formats

Using marketlevel data from 1994 to 2003, Goldmanis, Hortacsu, Syverson, and Emre (2010) showed that the large decline in the number of small offline establishments in the travel, book, and automobile industries was associated with increased internet usage in a given market. This is consistent with their model, in which the arrival of the internet had a significant impact on the structure of these markets by reducing search costs.

Since there is no need to invest in physical stores, and no need to maintain an inventory in each store, online retailing can achieve considerable economies of scale on the supply side. Centralized distribution centers and drop shipping arrangements with suppliers allow online sellers to have very large assortments.

Due to savings in inventory costs, online retailing has a big advantage in selling less popular items (the long tail) and in removing geographic barriers to purchase.

As noted above, online sellers have an advantage in facilitating a search for information on digital attributes (including price). In contrast, offline sellers have an advantage in providing

information on non-digital attributes and providing faster delivery. This leads to the possibility that consumers will search among both online and offline retailers.

Multichannel and omnichannel retailing

Multichannel refers to the design, deployment, coordination, and evaluation of different channels through which the marketer acquires, develops, and retains customers (Neslin et al., 2006), while omnichannel refers to integrating activities within and across channels.

Since online retailing has advantages in accessibility an assortment, while offline retailing has advantages in personal inspection and immediate delivery, retailers can combine the two channels to offer all types of services.

The effect of offline retailers adding an online channel is more nuanced. In a U.S. supermarket chain study, Pozzi (2013) found that adding an online channel increased overall revenues by 13 percent. This was mainly due to reduced travel costs. Conversely, Melis, Campo, Breugelmans, and Lamey (2015) found that grocery customers tended to be loyal to the online outlet of their favorite offline chain initially, but then shopped among all online sellers after they gained more experience buying groceries online. The implication is that online outlets need to be competitive with the online outlets of other chains.

There is considerable evidence that consistency between offline and online offerings is beneficial. Badrinarayanan, Becerra, and Kim (2012) found that trust in the offline channel, and congruence between the offline and online channels, were positively associated with trust and purchase intention for the online channel.

Hammerschmidt, Falk, and Wieters (2016) found that online and offline channels should be alignable; in other words, consistent in their attributes. Emrich and Verhoef (2015) found that a homogeneous web design (consistent with the design of the offline store) had the largest effect on patronage intentions.

For a retailer with both offline and online outlets, the internet and well-conceived customer databases allow tracking consumers through many stages of the purchase process. This has led to the idea of omnichannel marketing and the development of marketing strategies for each stage in the purchase process (Verhoef, Kannan, & Inman, 2015). Consumers might encounter information about a retailer through search and display advertisements, retailer stores, referral websites, a retailer's website, or desktop and mobile devices—and each may merit its own channel strategy.

Customer-centric retail formats

We recognize that quality and price considerations alone are no longer sufficient when customers decide between multiple formats. However, because quality and price are key characteristics of a retailer's offering, they are still critical aspects of a retail format.

Yet quality and price are no longer enough. Consumers now engage with retailers using digital and mobile devices, which has fundamentally changed the customer journey. Gone are the days when the manufacturer unilaterally controlled brand communications, modeling the customer journey as a simple purchase funnel. Now, marketers map the customer journey to identify points of friction and opportunities to enhance the customer experience. We propose that the retailer take one of these two paths—either (1) reduce friction in the consumer's shopping process or (2) enhance the shopping experience. Observe that the first path takes away obstacles and impediments by shortening wait times, reducing inconveniences, and eliminating unnecessary steps in the journey. The second path creates pleasurable experiences based on customers' preferences and behaviors.

In summary, we propose that a customer-centric retail format should go beyond price and quality to either add value to or remove impediments from the shopping experience. Our framework encompasses many conceptual models that have been proposed in the literature to understand the consumer journey in retailing and the role of technology in it.

Their other dimension of social presence deals with how technology can make individuals feel as if they are interacting with others, and therefore corresponds to enhancing customer experience in our framework.

Evolution of retail formats

We delineate the customer journey into two parts – first, information search and purchase, and second, product acquisition and potential product return. We differentiate between purchase and product acquisition, as customers cannot immediately obtain their purchases in all formats. Information search and purchase primarily (though not exclusively) provide opportunities to enhance experience, whereas product acquisition and product return primarily (again, not exclusively) provide opportunities for reducing friction. We also consider challenges that offline and online formats face during this two-stage customer journey.

Offline retailers: challenges

This comfort with online shopping has leapfrogged by several timespans during the pandemic. Some of the pandemicinduced changes in consumer behavior are likely to persist.

Online sales did not incur sales tax for a long time, which reduced the final price for consumers. Furthermore, because online retailers do not incur the expense of maintaining stores and holding inventory at multiple stores, their overall cost structure can be lower.

The resulting fall in foot traffic further increased offline retailers' cost disadvantage and reduced their cost-efficiency. Another critical challenge for offline retailers is rising customer expectations regarding purchase convenience and purchase experience.

There is considerable friction (inconvenience) for the customer in getting to the store, finding parking, navigating the store, being surrounded by others, especially in the current pandemic, waiting to pay, and if required, going back to return the product.

Moreover, offline retailers find it challenging to offer the breadth and depth of assortment available through online channels. Differentiating themselves from online channels by imparting experiential aspects of purchase raises its own challenges. Improving experiential aspects of shopping and reducing friction in the purchase process require investments in, for example, technology, which further adds to the costs of offline retailers.

Online retailers: challenges

Online retailers needed to provide consumers with a reason to change their traditional purchase behavior. The most effective tool for this purpose has been the product variety and assortment that online retailers can offer. Compared to offline retailers, online retailers can afford to maintain huge inventories in a few limited locations and ship anywhere from there. Additionally, they can offer lower prices, which has helped their rapid growth.

One of the key challenges online retailers face relates to product delivery. Consumers do not get the instant gratification of acquiring their purchase, which encourages some to choose offline channels instead.

Online stores are also at a disadvantage when sensory information or ambience is vital for customers to experience or interact with the product – e.g., in apparel – or when the freshness of the product is critical – e.g., in grocery and produce. The fact that the entire transaction is conducted online also raises trust issues for some consumers who like to inspect or validate product quality before purchase. Furthermore, reverse logistics pose both financial and operational challenges for online retailers.

Can offline stores drive online sales? (K. Wang and Goldfarb 2017)

Abstract

We use evidence from store openings by a bricks-and-clicks retailer to examine the drivers of substitution and complementarity between online and offline retail channels. Our evidence supports the coexistence of substitution across channels and complementarity in demand. In places where the retailer has a strong presence, the opening of an offline store is associated with a decrease in online sales and search; however, in places where the retailer does not have a strong presence, the opening of an offline store is associated with an increase in online sales and search. Our evidence suggests that while online and offline may be substitutes in distribution, they are complements in marketing communications. Specifically, the type of marketing communication driving complementarity seems to be information about the existence of the

brand. For example, we see a large increase in new customer acquisition and sales, and little difference between fit and feel products and other products. Thus, it is the presence of the store, rather than information about the attributes of the particular products in the store, that drives complementarity.

Brief

Mahajan (2005), and Ansari, Mela, and Neslin (2008), they argue that whether substitution or complementarity dominates depends on whether conspicuous or experiential capabilities have a larger effect on the purchase process. In particular, "conspicuous capabilities" (such as immediate gratification and no shipping fees) should lead substitution to dominate as the offline store will dominate the online store in these dimensions for many consumers. In contrast, "experiential capabilities" (such as a pleasurable shopping experience and building a relationship) provide a "living billboard" that should lead complementarity to dominate over the long run. The idea is that the in-store experience enhances the brand equity across both channels. They find evidence consistent with their framework: substitution in the short run (particularly in the catalog channel) and complementarity in the long run (particularly in the internet channel).

Our primary contribution is to provide quasi-experimental evidence of the existence of a particular mechanism under which marketing communications drive complementarity: A straight billboard effect of offline stores leading to an increase in online sales. By "straight billboard effect", we mean that the store serves as informative advertising about the existence (rather than the attributes) of the brand. In identifying this particular mechanism, we aim to help understand a source of the "synergies" claimed by practitioners.

On average, we find that when a store opens offline, online sales increase (with marginal significance). This provides weak support for complementarity, on balance. However, after splitting locations by prior brand presence, we observe stronger evidence for both substitution and complementarity in demand.

We then explore the reasons why sales might increase online in response to an offline store opening. We provide four types of evidence to support a straight awareness-driven billboard effect, rather than a living billboard that is complementary to existing brand equity. First, we show that the opening of a new offline store leads to an increase in the number of first-time customers from the surrounding areas. This suggests that the offline store provides information about the retailer.Second, we demonstrate that the increase in online sales in an area after store opening is driven by these new customers and this increase persists for several months after the store opening. At the same time, the online sales from existing customers acquired before a local store opening do not appear to change after the store opens. This is true regardless of whether the customer resides in an area with a prior brand presence or not. Again, this suggests that the store provides information to these new customers. Third, we explore whether the complementarity is generated through the provision of information about

the fit and feel of the products. In this way, we do not find evidence to support the idea that the offline stores provide this important type of product attribute information. Fourth, while online product returns do fall after a store opens, we find no difference between places with a brand presence and places without such a presence, again suggesting that product attribute information does not drive the results.

Assessing the Multichannel Impact of Brand Store Entry by a Digital-Native Grocery Brand (Crombrugge et al. 2023)

Abstract

For digital-native, fast-moving consumer goods (FMCG) manufacturers that sell through their own online channel and have made headway into supermarkets, brand stores can represent the next step in a multichannel distribution strategy. In this research, the authors investigate the impact of introducing a brand store on a digital-native brand's sales in its existing company-owned online channel and independent supermarkets, as well as on the brand's supermarket distribution. By incorporating brand store sales and operational costs, this research also specifies the entry effects on the brand's top-line total brand sales and bottom-line operating profit. Based on before-andafter-with-control-group analyses of the entry of 10 brand stores by a digital-native FMCG brand, the authors show that brand store entry boosts supermarket sales, partially driven by a brand store's positive effect on the number of supermarkets listing the brand. Although they cannibalize company-owned online sales, brand store entries generate an influx of own brand store sales that offset online channel losses. Still, accounting for brand stores' operational costs reveals top-line growth is not always enough to preserve the bottom line.

A novel distribution channel for expanding physical presence involves brand stores. Brand stores are brick-and-mortar stores owned and operated by the manufacturer, carry only its brand, and are designed to sell the brand profitably and in a brand-centric environment (Dolbec and Chebat 2013; Jahn et al. 2018).1 Especially for digital natives that already sell through an own online channel and independent supermarkets, brand stores represent a next step in their multichannel distribution strategy.

Brand stores provide several interesting opportunities. Beyond enabling the reach for more potential consumers, they also offer physical exposure, which FMCG brands typically require but hat digital-native brands might struggle to attain on supermarket shelves given the steep competition from mass-market brands. By spotlighting the brand, brand stores inform and remind consumers of the brand's existence and increase brand awareness. In turn, this can increase sales in the incumbent channels (i.e., the company-owned online channel and the independent supermarkets) (Dolbec and Chebat 2013; Jahn et al. 2018). Brand stores can also spark distributor interest and prompt supermarkets to distribute (more of) the brand on their shelves. Since the number of brand stores that a digital-native FMCG brand can open

in the market is limited, such increases in distribution breadth and depth can be an important component to further drive brand sales.

Yet brand stores also entail risks. Sales in this novel channel may cannibalize sales in the incumbent channels if consumers migrate to the newly opened brand store. If brand stores signal the manufacturer's encroachment, they also could exacerbate channel conflict (Hibbard, Kumar, and Stern 2001) and prompt supermarkets to reduce their distribution of the brand. Finally, opening and operating brand stores is expensive, and these substantial operational costs put pressure on profits (Pauwels and Neslin 2015).

We also investigate brand store impact on supermarket distribution in terms of both how many supermarkets carry the brand in their assortment (distribution breadth) and how many stock-keeping units (SKUs) of the brand land on the supermarkets' shelves (distribution depth). We furthermore assess the net impact of a brand store entry on both top-line (brand sales) and bottom-line (operating profit) performance.

Using before-andafter-with-control-group analyses, we find, on average, that the brand store cannibalizes the brand's company-owned online channel sales but has positive effects on its supermarket sales. The supermarket sales increase is partially driven by greater distribution breadth for the brand, whereas we find no impact on distribution depth.

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They find the brand-centric features of a manufacturer-owned brick-and-mortar store to be key tools for brand-building, with potentially positive cross-channel effects when evoking sufficient brand attachment or equity.

However, while similarly devoted to one brand, brand stores provide a richer, more pleasurable shopping experience compared to the company-owned online channel (Dolbec and Chebat 2013), during which customers can interact with expert, brand-affiliated personnel. Furthermore, consumers can receive their products instantly, without having to wait for delivery or pay for shipping and handling (Avery et al. 2012).

Brand store entry may influence these distribution decisions. Because brand stores spotlight the manufacturer's brand, they inform and remind supermarket managers of its existence and patronage. Such brand exposure could increase supermarket interest and encourage them to distribute the brand in their stores, such that they might increase both the brand's distribution breadth by listing the brand and its distribution depth by expanding the brand's presence on their shelves.

Offline Showrooms in Omnichannel Retail: Demand and Operational Benefits (Bell, Gallino, and Moreno 2018)

Abstract

Omnichannel environments where customers shop online and offline at the same retailer are ubiquitous, and are deployed by online-first and traditional retailers alike. We focus on the relatively understudied domain of online-first retailers and the engagement of a key omnichannel tactic; specifically, introduction of showrooms (physical locations where customers can view and try products) in combination with online fulfillment that uses centralized inventory management. We ask whether, and if so, how, showrooms benefit the two most basic retail objectives: demand generation and operational efficiency. Using quasi-experimental data on showroom openings by WarbyParker.com, the leading and iconic online-first eyewear retailer, we find that showrooms: (1) increase demand overall and in the online channel as well; (2) generate operational spillovers to the other channels by attracting customers who, on average, have a higher cost-to-serve; (3) improve overall operational efficiency by increasing conversion in a sampling channel and by decreasing returns; and (4) amplify these demand and operational benefits in dealing with customers who have the most acute need for the firm's products. Moreover, the effects we document strengthen with time as showrooms contribute not only to brand awareness but also to what we term channel awareness as well. We conclude by elaborating the underlying customer dynamics driving our findings and by offering implications for how online-first retailers might deploy omnichannel tactics.

Brief

Fundamentally, retailers are attracted to omnichannel strategies because online and offline channels differ in their ability to deliver product information and execute product fulfillment, the two core channel functions (see, e.g., Coughlan et al. 2006, pp. 9–10).

Figure 1 illustrates the four combinations of fulfillment and information delivery made possible by the digital economy (adapted from Bell et al. 2014). By executing a wide palette of channel options, the retailer can counterbalance the weaknesses inherent in each single alternative.

A myriad of other retailers from Bonobos .com and Casper.com to Wayfair.com and Zappos.com recognize that uncertainty about nondigital product attributes is a barrier to purchase for large segments of customers and therefore employ free two-way shipping, pop-up stores, extensive customer reviews, and related methods to combat it.

First, showrooms increase sales within the trading area both overall and through the online channel. Estimated average effects of 7.4% and 2.9%, respectively, are statistically and economically significant. This implies that the showroom not only delivers sales in its own right but confers awareness and brand benefits that drive incremental sales in the existing online channel and is therefore accretive from a demand perspective. We further show that the showroom is, on average, the most effective customer-acquisition channel and that the brand and awareness benefits are not due to other factors, including concomitant advertising.

Second, showrooms improve operational efficiency by increasing conversion in the sampling channel, discouraging "excessive" sampling, and decreasing returns, within the trading area of the showroom.

Third, we elaborate the underlying customer behavior mechanism. Since the showroom attracts customers with the highest haptic need, customers choosing to remain in other channels even though they had the option of visiting a showroom are better aligned to them, which benefits the firm. Because showrooms attract fit-sensitive customers with the highest cost to serve, other channels are left with a more favorable consumer mix and the firm enjoys significant demand and operational benefits (in aggregate, and in the other channels) as a result.

Fourth, the benefits to the firm are amplified when serving customers who have the most acute need for the product. Our temporal estimates imply that all of the demand and operational efficiency benefits intensify with time, implying that showrooms contribute not only to brand awareness but also to what we term channel awareness, and that they deliver a lasting impact on customers' ability to align to the channel best suited to them.

Implications for Practice and Research

What type of online-first retailers are likely to benefit from opening showrooms? Our framework described in Figure 1 shows that when venturing into the offline world, online-first firms can prioritize the information or the fulfillment dimension. So-called digitally native vertical brands like Bonobos and Warby Parker selling products of their own brand with high fit uncertainty tend to prioritize the informational function in the offline world. Conversely, firms like Amazon that sell goods that are more commoditized are focused on enriching the fulfillment dimension of channels.26 These companies are less limited by a lack of product information offline, since their customers can use competitors' brick-andmortar stores to learn about product characteristics.

Showrooms offer online-first retailers substantial cost advantages compared to conventional stores, since they allow them to maintain centralized fulfillment and inventory management, which can yield very substantial inventory pooling benefits (Eppen 1979) and economies of scale. This is particularly relevant when offering high variety to the market, which is the case for firms like Warby Parker.

We anticipate that expansion through conventional (i.e., inventory-carrying) stores could create similar overall directional patterns to the ones we found for showrooms (perhaps generating even higher effects on overall demand due to the instant gratification option they provide). However, our results highlight that fullfledged stores are not necessary to unlock the demand and operational benefits of an offline presence. We have shown that even a zero-inventory store (which provides informational but not fulfillment capabilities) increases demand and operational efficiency in its trading area. Given that offline showrooms are much less costly to operate than conventional stores and maintain he benefits of centralized fulfillment, they provide a very appealing growth option to online-first firms.

Our empirical analysis supplies the following changes in sales and sampling program orders, subsequent to the opening of a showroom: total sales (7.4% increase), Web Sales (2.9% increase), HTO sales (4.5% decrease), and HTO orders (10% decrease).

Conclusion

Using a variety of models and approaches, we verify that showrooms deliver substantial demandside (marketing) and supply-side (operational) benefits. Specifically, we find two benefits: *Demand Generation.* Showrooms increase sales within their trading area, both overall and through the web channel. They are especially important to customer acquisition as they garner a higher proportion of first-time buyers than other channels do. These findings underscore awareness benefits from showrooms (we also verify that these effects cannot be accounted for by an initial boost due to concomitant advertising). The showroom induces beneficial customer sorting benefits for the firm, as customers end up in channels best matched to their need for prepurchase information, and these effects amplify, rather than dissipate, over time. *Operational Efficiency.* Customers with the highest need for tactile experience sort into showrooms, leaving those who remain in other channels better matched to those channels. Important operational consequences are: reductions in the probability that purchases are returned and that multiple samples are ordered. This leads to a lower average cost-to-serve; further, these operational benefits are amplified when dealing with customers who have the most acute need for the product, illustrating important product–channel interaction effects.

Customer Supercharging in Experience-Centric Channels (Bell, Gallino, and Moreno 2020)

Abstract

We conjecture that for online retailers, experience-centric offline store formats do not simply expand market coverage, but rather, serve to significantly amplify future positive customer behaviors, both online and offline. We term this phenomenon "supercharging" and test our thesis using data from a digital-first men's apparel retailer and a pioneer of the so-called zero inventory store (ZIS) format—a small-footprint, experience-centric retail location that carries no inventory for immediate fulfillment, but fulfils orders via e-commerce. Using a risk-set matching approach, we calibrate our estimates on customers who are "treated," that is, have a ZIS experience, and matched with identical customers who shop online only. We find that after the ZIS experience, customers spend more, shop at a higher velocity, and are less likely to return items. The positive impact on returns is doubly virtuous as it is more pronounced for more tactile, higher-priced items, thus mitigating a key pain point of online retail. Furthermore, the ZIS shopping experience aids product discovery and brand attachment, causing sales to become more diffuse over a larger number of categories. Finally, we demonstrate that our results are robust to self-selection and potentially confounding effects of unobservable factors on the matched pairs of customers. Implications for retailing practice, including for legacy, offline-first retailers, are discussed.

Brief

Against this backdrop of academic research on online–offline interactions and customer behaviors, the business press increasingly argues that given rising costs of marketing via Google and Facebook, online-first retailers are turning to offline channels as a cost-effective way to acquire customers—see, for example, Olenski (2017).

Does interaction with a brand in an experience-centric offline format alter customer behavior, and, if so, how? In particular, might this interaction change the customer's trajectory for the better (from the perspective of the retailer), relative to identical customers who experience a brand only online?

We have two objectives. The first is to document whether the "treatment" (in a causal sense) of a customer interacting with a retailer in an experiencecentric physical space changes the future trajectory of that customer. To the extent that the interaction generates positive outcomes (e.g., higher demand), we refer to customers so treated as "supercharged."

Second, we seek to understand the mechanism underlying supercharging by decomposing it into constituent parts, specifically, into effects on shopping velocity, basket composition (prices paid, items, and categories bought), and return rates, and according to the level of prior brand

experience that has been acquired by the customer at the moment when supercharging first occurs.

We find that supercharged customers have higher average order values and greater shopping velocities (shortened interpurchase times), and are less likely to return items in the future, whether shopping online or offline. Thus, retailers (as well as customers) benefit from customer exposure to the so-called zero inventory store (ZIS). The beneficial change in the return rates—which fall after an offline experience—is also consistent with the notion that customers who have shopped offline acquire deeper product knowledge. This, in turn, lowers operational fulfillment costs for the retailer. This virtuous cycle also contains a beneficial interaction effect: though return rates drop across the board, the drop increases in the price of the items purchased, meaning that the more expensive the item is, the bigger the reduction in return rate caused by ZIS experience.

A ZIS is not a store in the usual sense, but, rather, a place where customers can try on products, experience the brand, and have purchases fulfilled via home delivery. Thus, two distinguishing ZIS features are (1) an elevated customer experience and service interaction and (2) the absence of inventory for immediate fulfillment.

Conclusion

Specifically, treated customers with ZIS experience, relative to control doppelganger customers with no offline experience,

- spend up to 60% more on an average order,
- shop at a higher velocity, showing a 28% reduction in interpurchase times,
- buy in 20% more product categories, buy more expensive items, and are more likely to have a diffuse sales distribution that is less reliant on the core and signature product that anchored the brand from inception; and
- are less likely to return items overall, and disproportionately less likely to return more expensive items as well.

Manufacturer encroachment and channel conflicts: A systematic review of the literature (Tahirov and Glock 2022)

Abstract

To reach more customers, many manufacturers utilize multiple distribution channels consisting of a direct and an indirect sales channel. In particular, the strong growth of internet sales (or e-commerce) has driven companies to redesign their distribution channels to take advantage of the opportunities ecommerce offers. Opening a direct sales channel, however, also leads

to managerial challenges. The most significant one is channel conflicts that manufacturers encounter when adding a direct channel to an existing traditional channel. Manufacturers that engage in direct selling may compete with their extant independent retailers. Competition between manufacturers and retailers starts when the former intrude into the market (segment) that was traditionally served by the retailers via manufacturer-owned stores and online sales, which is commonly referred to as manufacturer or supplier encroachment. This paper aims to provide a systematic and exhaustive review of multi-channel distribution systems in a combined forward and reverse supply chain where the manufacturer competes with its independently-owned intermediaries (retailers or wholesalers). First, to organize our discussion, all works obtained during the literature search were classified and evaluated in accordance with a proposed conceptual framework. The paper then discusses the sampled works and evaluates possible research gaps. Finally, based on the analysis of the literature, managerial implications and promising future research directions are proposed.

Brief

In particular, the strong growth of internet sales (or e-commerce) has driven companies to redesign their distribution channels to take advantage of the opportunities e-commerce offers, such as reduced costs (especially in terms of overhead and operating costs), low cost/barriers for entering new market segments, and worldwide sharing of information (Webb, 2002). The increase in online sales the Covid-19 pandemic brought about induced many retailers and manufacturers to adopt online channels (He, Gupta & Mirchandani, 2021; Hong, Choi, Choi & Joung, 2021).

If a manufacturer markets its products through its website (online) or company-owned (brick-and-mortar) stores, a direct sales channel is used. In indirect sales channels, the manufacturer sells its products and provides services through intermediaries (e.g., retailers, e-tailers, wholesalers; see Coughlan, Anderson, Stern & El-Ansary, 2014, Rosenbloom, 2007).

Both analytical and empirical studies show that the conventional motives for a manufacturer to add a direct sales channel are reaching new customers, increasing profit, and achieving price differentiation (Gabrielsson, Kirpalani & Luostarinen, 2002; Tsay et al., 2004b; Vinhas et al., 2005, Chen et al., 2011). In essence, selling both via independent retailers and through an online channel provides several advantages to a manufacturer, who is usually interested in leveraging both channels simultaneously. Thus, sellers may collect profits from S&H operations, dynamic and/or personalized pricing, auctions (e.g., via platforms such as eBay), dynamic updating of product assortments, having a direct relationship with end-customers, collecting improved demand information (e.g., for forecasts), or tracking customers' preferences and behaviors (Tsay et al., 2004b). Furthermore, having independent retailers provides advantages to manufacturers in terms of sales effort activities implemented by the retailers (brand building, customer education, building product awareness, etc.; see Chen, Kaya & Özer, 2008, Tsay et al., 2004a). Therefore, many manufacturers tend to employ direct and indirect sales channels simultaneously when formulating their distribution strategy.

Opening a direct sales channel, however, also leads to managerial challenges. The most significant one is channel conflicts that manufacturers encounter when adding a direct channel to an existing traditional channel (Webb, 2002). A channel conflict occurs "when one channel member's actions prevent the channel from achieving its goals" (Coughlan et al., 2014, p. 24). In the case of manufacturer encroachment, retailers often perceive the manufacturer's direct sales activities as a threat.

Therefore, in the pre-adoption phase, the manufacturers have to consider key factors that influence this kind of strategic channel selection decision. In this regard, we propose our first research question (RQ 1): Which determinant factors induce the manufacturer to establish a direct sales channel?

Although the manufacturer may appear as a new competitor in the market, he tends to employ both channels simultaneously, rather than bypassing intermediaries (retailers). To mitigate channel conflicts, the manufacturer may apply various mechanisms such as directing customers to retailers, lowering wholesale prices, or product differentiation.

In terms of operational decisions, managing multi-channel distribution systems introduces new and changes existing operational decision problems (e.g., with respect to inventory control, delivery management, or return/refund management) that have to be solved efficiently.

Based on this discussion, we propose our second research question (RQ 2): How does the manufacturer manage multi-channel distribution systems?

RQ 1: which factors induce the manufacturer to establish a direct sales channel?

Customer preferences The fact that the direct channel could draw away customers from the retail channel induces the retailer to lower its price, which increases both the demand in the retail channel and the profit of the manufacturer.

A second customer category may generally prefer online channels regardless of the product category. These customers are often referred to as online-captive customers, and they may be another reason for a manufacturer to open a direct channel. Chen et al. (2008) modeled service competition between a manufacturer and a retailer to examine channel structures (direct only, dual, and indirect only) the manufacturer could select. They assumed that product availability, delivery time, and shopping convenience influence customers' shopping behavior. The authors further assumed that there are two customer segments: time-sensitive and time-insensitive costumers who patronize retail and online channels, respectively.

The study suggests that the manufacturer should sell all products through the direct channel if the cost of the direct channel is low and the manufacturer can implement a short delivery lead time. When the cost of the direct channel exceeds a certain threshold and the retailer inconvenience cost is high, the optimal strategy of the manufacturer is to employ both channels. Finally, when the direct channel is costly and the retailer's inconvenience cost is low, the manufacturer should still use the dual-channel, but share the profit with the retailer.

Khouja, Park and Cai (2010) for example, analyzed different combinations of distribution systems and assumed that consumers belong to one of two categories: Retail-captive customers prefer to buy from the retail channel only, and hybrid segment consumers may use either the retail or the direct channel. The authors showed that the number of consumers in the two segments, the consumers' channel preferences, and the unit product costs in the direct and retail channels are the major determinants of the channel selection decision.

Chen (2015) argued that when the manufacturer invests in his brand, the demand of manufacturer (brand)-loyal customers increases, which induces the manufacturer to sell items through his website especially if customers have a preference for the direct channel. The author showed that the direct channel outperforms the traditional retail channel in terms of profit, which increases as the brand loyal customers' preference parameter and the price elasticity of demand increase. Rofin and Mahanty (2018) compared the profits of three different dual-channel scenarios where a manufacturer either sells his brand products directly, through retailers or via e-tailers. The authors found that if the consumers' preference for an online channel is low, company stores combined with e-tailers are the best choice for the manufacturer, while in the case of a high online channel preference, traditional retail stores should be combined with a direct online channel.

Information asymmetry In a supply chain, downstream members (retailers) usually have more information about demand than upstream members (manufacturers). From the manufacturer's perspective, incomplete information makes demand forecasting and capacity planning difficult (Xie, Jiang, Zhao & Hong, 2014). To get direct access to customer demand information and to reduce the impact of demand variability on his profit, the manufacturer may open a direct channel.

Market environment The marketing literature addressed three main market environment characteristics in studies investigating distribution structures: dynamism (i.e., the volatility of a market), complexity (i.e., the number and diversity of the channel members, competitors, etc.), and munificence (i.e., the extent to which a company has access to available environmental resources) (Achrol & Stern, 1988; Aldrich, 1979).

Firms following the cost leadership strategy use a single (or a few) and mostly indirect channels in uncertain environments. Firms following a differentiation strategy, in contrast, use a multichannel strategy employing direct channels in highly uncertain environments.

Environmental concerns Today's companies consider items returned from their customers more seriously, for example because of production's environmental impact, high prices of raw materials, or customer satisfaction. To improve responsiveness in terms of return/refund procedures, many manufacturers collect used products directly from end customers (Saha , Sarmah & Moon, 2016). In this respect, having a direct channel may lead to advantages as it facilitates directly collecting used items from customers.

Manufacturer's preemptive strategy The opening of a direct channel can also be a response of the manufacturer to activities of his competitors (e.g., the introduction of a new store

brand or the forming of a retailer alliance against the manufacturer). Note that competitors may both be others manufacturers or independent retailers.

Chen, Liang and Yao (2018), for example, investigated the case where the retailer may launch a discount store to sell off-price products supplied by a different manufacturer. Depending on the channel setup cost, the manufacturer may open a direct channel to prevent the retailer from opening a discount store. The authors investigated how the opening of the direct channel and the discount store affects both parties' profits. They found that it can be beneficial to the manufacturer to introduce an online channel even at high costs, as this may accelerate competition, which prevents the retailer from selling off-price products at a reasonable price. In this case, launching a discount store will be too costly for the retailer, who thus decides against opening it.

The findings reveal that the retailer is always worse off when the manufacturer opens the direct channel, whereas the manufacturer benefits from encroachment if there is no retail service investment and the fixed setup cost for the online channel is not considered. Further, encroachment is expected to reduce the retail service level; the manufacturer, therefore, needs to evaluate the tradeoff between a loss in the retail service level and the competitive advantage gained from opening the direct channel.

Matsui (2016) considered two parallel manufacturers that introduce a direct online channel depending on the respective other's channel selection decision. Each manufacturer has three distribution policies: only retail (R), only direct (D), and dual-channel (RD). In the RD policy, two manufacturers sell differentiated products through both retail and direct channels, and both manufacturer-retailer chains compete with each other; this is referred to as inter-brand competition. Further, the manufacturers also compete with the retailers, referred to as intra-brand competition.

Conclusion

All works (179) obtained during the literature search were evaluated in light of two research questions. The first research question (RQ 1) focused on factors that induce a manufacturer to open a direct channel and to compete with his independently-owned retailers. RQ 1 addressed factors such as customer preferences, information asymmetry, environmental concerns, market environment, or preemption. The second research question (RQ 2) evaluated possible mechanisms that the manufacturer could adopt to cease emerging conflicts with the retailers and methods to handle operational decision problems.

The results of the review show that customer preferences for direct or online channels may vary by product category and purchasing attitude (i.e., there may be online- or retail-captive customers), and that customer preferences have a strong impact on the manufacturer's channel selection strategy. Most works in our literature sample studied two-tier supply chains in which a manufacturer distributes the products both directly and via a retailer; these structures are usually referred to as dual-channel supply chains. Our findings also showed that research on

multi-channel distribution systems had a strong focus on developing and evaluating contracts to resolve channel conflicts; operational problems that occur in multi-channel distribution systems have received much less attention.

Omni-channel management in the new retailing era: A systematic review and future research agenda (Cai and Lo 2020)

Abstract

Omni-channel retailing is a popular strategy in a new retailing era when digitalization, social media, big data and other emerging technologies (e.g., Artificial Intelligence (AI), virtual reality (VR), augmented reality (AR), blockchain, etc.) are transforming the retail business models. Meanwhile, omni-channel related operations impose a challenge on either well-established firms or new setups that they have to make "right" decisions to fit in the new retail environment. This review paper endeavors to reveal the established knowledge behind the omni-channel retailing literature, generate managerial implications for firms, and provides a guideline for future research. We conduct this systematic review by adopting citation network analysis (CNA). The CNA helps identify seven independent and interdependent research domains, which depict (or constitute) a whole picture of "omnichannel management". The main path analysis reveals that each identified research domain is under study. We also find that the extant literature seldom examines the roles of how new technologies play in the "omnichannel management". Moreover, the domain of supply chain management and inventory management in the omnichannel environment is absent in this systematic literature review. Therefore, we propose a prescribed framework for "omnichannel management" (PFOM), which contributes to the literature on "omnichannel management" and provides important managerial applications to the retail firms that plan to implement the omnichannel strategy.

Brief

Verhoef et al. (2015) formally define "omnichannel management" 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 are optimized." However, "multiple channel retailing management" is to provide products or services to the consumers across multiple channels (i.e., online, offline, etc.), but it does not provide synergetic management of the numerous available channels. And "cross channel retailing management" provides partial integration among the channels. The definitions show the big difference among "omnichannel management", "multiple channel retailing management", and "cross channel retailing management".

We can see that omni-channel retailing is very popular nowadays in the new retailing era when digitalization, social media, big data and other new technologies (e.g., AI, VR, blockchain, etc.) are transforming the retail business models.

Thus, omni-channel related operations impose a challenge to either well-established firms or new setups that they have to make "right" decisions to fit in the new retailing environment.

The top three research areas (based on Web of Science) are Business Economics, Operations Research Management Science, and Computer Science. The top 10 journals publishing omnichannel management related papers are the journals featured by retailing, marketing, management science, etc.

Citation Network Analysis helps identify 7 research domains and the 7 clusters are both independent and interdependent, which depict a whole picture of "omnichannel management". 7 research domains are omnichannel strategy, omnichannel retailing, omnichannel customer service, omnichannel logistics and fulfilment, omnichannel marketing and advertisement, omnichannel consumer behaviors, and omnichannel customers' preferences, the top three among which are omnichannel strategy, omnichannel retailing and omnichannel customer service.

OM research in an omni-channel environment and its related areas are not yet wellestablished. We finally identify the keywords as follows: omni-channel (omnichannel, cross channel) retailing, omni-channel (omnichannel, cross channel) marketing, omnichannel (omnichannel, cross channel) strategy, omni-channel (omnichannel, cross channel) logistics and distribution, omni-channel (omnichannel, cross channel) supply chain management, omnichannel (omnichannel, cross channel) customer experience, O2O, click & collect, and buy-online-and-pickup-in-store.

In the omnichannel environment, the product or service can be delivered to the end consumers through a series of activities like retailing, marketing, customer service, etc., and a variety of channels like online channel, offline store, video and TV channels, etc.

The "omnichannel strategy" is positioned as the strategic level, while the others are located at the operational level.

Omnichannel Strategy

Zhang et al. (2010) is the early work exploring the integration and synergies of multichannel retailing, which facilitates the development of this research domain omnichannel strategy. The authors identify opportunities for managing multiple channels' synergies which emphasize the importance of cross-channel operations, like cross-channel prices and promotions, customer communication, marketing research, etc.

Cao and Li (2015) examine the impact of cross-channel integration on sales and reveal that the cross-channel integration strategy can boost the retailers' sales growth.

Picot-Coupey et al. (2016) find that it is difficult for retailers to directly shift from multi-channel retailing to omni-channel retailing, because the retailers have to face the strategy-related challenges at the first stage in the transformative process. The authors suggest organizational learning and trial-and-error learning in the channel design for successfully implementing the omni-channel retailing strategy. Recently, Shen et al. (2018) examine the influential factors for omnichannel service usage and identify that the quality of channel integration significantly affects the users' experience across all the channels. The authors suggest that the practitioners should pay attention to the service transparency, channel choice variety and content and process consistency.

Kazancoglu and Aydin (2018) investigate consumers' purchasing intentions on omni-channel buying and generate important factors as follows: trust, situation, risk, anxiety, interaction need, and privacy. The authors suggest the retailers incorporate these factors into the omni-channel retailing from the consumers' perspective.

Based on the above analysis, we can see omni-channel strategy plays an essential role in omni-channel management. However, not every company can benefit from this strategy, due to the complexity of this retailing model. We suggest each firm should initiate a customized omnichannel strategy, because each firm may possess different channel resources and assets. For future research, we propose three perspectives: i) How to improve the omni-channel efficiency from the organization behaviors perspective; ii) How to re-visit the value chain in the omnichannel context; iii) How to gain the competitive advantage in the omni-channel retailing era (Picot-Coupey et al., 2016).

Omnichannel retailing

Omnichannel retailing aims at integrating all the channels and optimizes the retailer's total sales.

Brynjolfsson et al. (2013) identify that technology plays a crucial role in omnichannel retailing and suggests that the retailers and their supply chain partners should reshape their competitive advantages. The authors propose possible successful strategies for omnichannel retailers, like attractive pricing strategy, powerful data analytics ability, unique product provider, etc. Bell et al. (2014) demonstrate a customer-focused framework for omnichannel retailing model in which the information and products delivered to consumers are most important.

Next, Gao and Su (2017a) study how to deliver both online and offline information to omnichannel consumers effectively.

Zhang et al. (2018a) study consumer returns and order cancellation in the omnichannel context and conclude that the retailers cannot always benefit from the omnichannel strategy because the value of omnichannel retailing is subject to many factors, like "cross-selling benefit and the market expansion effect".

For future research, we propose the following directions: i) More channels' interaction and integration should be explored (for example, the interaction between social media retailing and brick-and-mortar retailing); ii) How do new technologies (e.g., VR, AI, Blockchain, etc.) transform the omnichannel retailing? iii) Manage risks associated with the omnichannel retailing (Brynjolfsson et al., 2013; Zhang et al., 2018b).

Omnichannel customer service

From Falk et al. (2007) and Kwon and Lennon (2009), we learn that cross-channel effects are different in different contexts and their correlation can be both positively and negatively related.

For future research, we suggest more attention should be paid to i) How to help the consumers to achieve the seamless omnichannel experience; ii) How to increase the consumers' "channel loyalty" through channel service quality enhancement; iii) How to design the service quality standards in a "smart city" (Burnes and Towers, 2016; Yang et al., 2013).

Omnichannel logistics and fulfilment

De Kervenoael et al. (2015) study the logistics service of online grocery retail and find that the flexibility of collection points, offline infrastructure service and premium provision are significant aspects for improving consumers' expectations.

Hübner et al. (2016) investigate the retail fulfillment in the integrated omni-channel environment and analyze the logistics options for integrated fulfillment. The authors suggest that retailers, who operate in multiple channels should design their warehouse system for channel-integrated inventory management.

The authors suggest that omni-channel retailers should consider the specifics of the country, the retailer and the customer behaviors into the omni-channel logistics design.

Marchet et al. (2018) identify 11 logistics variables in the omni-channel management strategy in four aspects: delivery, distribution, fulfilment and returns management. The authors indicate that a "one-fits-all" business logistics model is absent.

Melacini et al. (2018) conduct a systematic literature review on e-fulfilment and distribution in omni-channel retailing and investigate the issues of distribution network, delivery, and inventory management. The authors identify that many essential topics in the omnichannel context are underexplored, which includes "retail distribution networks, assortment planning over multiple channels, the logistics role played by stores in the delivery process, and the interplay between different logistics aspects." Galipoglu et al. (2018) overview the omni-channel retailing relevant literature and focus on logistics and supply chain management research domain. The authors reveal that the consideration of logistics and supply chain management

literature is limited in the omni-channel retailing context. Moreover, the authors call for more attention on the conceptual and analytical research.

Kembro et al. (2018) conduct a structured literature review on warehouse operations and design in omni-channel logistics. The authors find that less attention is paid to the domain of warehouse operations and design. Instead, more discussions are given to consumer demand changes and network design. The authors identify ten themes from the extant literature for omni-channel warehousing and generate a comprehensive and structured agenda for future research by taking into account the network design, channel management, and value proposition.

Lim and Srai (2018) investigate how the interaction between of last-mile supply networks and the underlying mechanisms affect the omnichannel performance. The authors suggest managers consider product types and delivery responsiveness, when designing an appropriate last-mile supply network. Afterwards, Lim and Winkenbach (2018) study how retailers execute the last-mile delivery to meet the omnichannel demand and establish a typology of last-mile distribution by incorporating the product variety and delivery responsiveness.

Omnichannel marketing and advertisement

Ghose and Yang (2009) study the sponsored search method in the search engine advertising. Dinner et al. (2014) examine cross-channel effects of traditional media and online advertising on offline and online sales. The authors find that paid search advertising is more effective than traditional advertising on driving offline sales.

Hilken et al. (2018) explore how the new technology augmented reality (AR) improve customers' omnichannel experiences. The authors find that seamless omnichannel experiences can be acquired through AR and the current obstacles existing in the omnichannel environment can be smoothed.

This main path has shown the essential issues of the omnichannel marketing and advertisement, which includes the effectiveness of search engine advertising, marketing resources allocation, cross-channel effects, the transformation brought by new technologies, etc. However, the current research for this area is insufficient. For future research, we outline three aspects: i) What is integrated marketing strategy for omnichannel retailing? ii) How to manage risks in social media marketing? iii) More analytical modeling research for the optimal online and offline marketing investment are needed (Kannan and Li, 2017; Verhoef et al., 2017).

Omnichannel consumer behaviors

Chiu et al. (2011) study consumers' free-riding behaviors in cross-channel purchasing, in which consumers can obtain the product information from one channel and shop in another channel.

Pantano and Viassone (2015) study how to effectively engage consumers in the integrated multichannel retailing and find that if the retailer can provide the consumers with the integrated retailing environment, consumers' switching purchasing from competitors' channels can be avoided.

Later on, Li et al. (2018a) examine how customer react on cross-channel integration in omnichannel retailing through the Push-Pull-Mooring (PPM) framework. The authors reveal that uncertainty, identity attractiveness, and switching costs play pushing, pulling, and mooring roles, respectively, in affecting customers' reaction to cross-channel integration.

For future research agenda, we propose three research questions: i) How does social influence play a role in the omnichannel retailing? ii) What are individual preferences towards omnichannel retailing? iii) What is consumers' reaction to the new technology adoptions, such as AI, VR (or AR), blockchain, etc. (Li et al. (2018a); Zhu et al., 2013).

Omnichannel customers' preferences

Brynjolfsson et al. (2009) also study product selection problems and geographical impacts in cross-channel competition between traditional brick-and-mortar retailer and Internet retailers. The authors find that Internet retailers face more competition in selling everyday products but have more advantages in selling niche products. The findings suggest managers consider the types of products sold in different retail channels.

Dzyabura and Jagabathula (2018) explore the products selection problems on both offline and online channels and address the optimal offline assortment choice to maximize both channels' profits. The authors show that measuring the impact of offline assortment on online sales gains up to 40% expected revenue. Dzyabura et al. (2019) investigate consumers' online and offline product evaluations and demonstrate a large discrepancy existing the two evaluations: one is the offline "live"; the other is online description. The authors propose two statistical methods: a hierarchical Bayesian approach and a k-nearest-neighbors approach for better evaluating the offline and online products.

Discussions and recommendation

After the main path analysis of the 7 research domains, we find that the extant literature seldom examines the roles of how new technologies play in the "omnichannel management". The technological advancements (e.g., digitalization, AI, VR, mobile apps, mobile payment, etc.) create opportunities for omnichannel retailing. As these technologies blur the distinction between the offline and online shopping and are changing the retail landscape, the retailers and their supply chain collaborators have to reconsider their competitive strategies (Brynjolfsson et al., 2013). We name the supporting technologies for "omnichannel management" as "Omnitech".

Moreover, the domain of supply chain management and inventory management in the omnichannel environment is absent in this systematic literature review.

First, PFOM can guild the retail firms to implement a comprehensive omnichannel strategy. Second, PFOM shows the emerging important elements which the retail firms should pay attention to in their omnichannel management, such as the role of omni-tech. Last but not the least, with an effective omnichannel management strategy, retail firms can possess more competitive advantage in the retailing market.

Business Model Transformation in Moving to a Cross-Channel Retail Strategy: A Case Study (Cao 2014)

Abstract

Although cross-channel retailing has become a game changer for retailers, few previous studies have looked at the problems from the inherently holistic perspective of a business model approach. Using a single case study but multiple data collection methods, including interviews, observations, and document analysis, on the biggest Chinese retailer in consumer electronic appliances, the present study examines how different aspects of the business model changed after the retailer launched its cross-channel strategy. The results identify the major changes on three fronts: redefinition of target clients, a new proposition for shopping value, and redesign of the value chain. Findings suggest that a retailer shifting toward the cross-channel strategy will follow the stage-of-adoption model, which may be in five stages, and that the physical store as a hub linking different channels will become the source of value creation. To facilitate the strategic shift, retailers should optimize rather than merge their activities across channels, reinforce the strengths of the physical store, develop co-creation value with stakeholders, and revamp their organization.

Brief

Physical retail stores appear to cannibalize direct channels initially, but over time they bring in new customers at a faster rate [3]. Moreover, separation creates the "silo effect," wherein lack of communication or coordination between operations leads to, for example, poor customer satisfaction; a poorly managed inventory, causing loss of sales or erosion of margins; and duplication of investment and efforts.

In practice, as indicated by the Aberdeen Group [1], 74 percent of multichannel retail operations were characterized by separate channels in 2010, and one year later 50 percent of leading retailers had moved to align their brand, product offering, and marketing message to offer a uniform customer experience across channels. To distinguish it from silo-operated multichannel retailing, the integrated multichannel strategy is known as cross-channel or omni-channel.

Although [44] developed this area of interest in a qualitative study of 18 firms, this study focused on the benefits that retailers might get through integrating the channels, rather than systematically analyzing the impact of adopting a cross-channel strategy on the retailers' operational and organizational management.

In this paper I aim to identify the impacts of shifting to a cross-channel strategy on each aspect of a retailer's business model. The research findings from the in-depth case study enable managers to understand this change to their business model and suggest how to use emerging and existing channels to optimize the whole business to respond effectively to consumers' expectations of a seamless shopping experience. This study especially highlights the role of the physical store with new technologies in the integrated business model: It acts as a hub to link the different channels and so provide more convenient and pleasurable shopping experiences for consumers than they would get from purely Internet-based retailers.

Retail Strategy and Business Model

Retail strategy can be broadly conceptualized as how a retailer chooses to compete in the marketplace and serve its target markets and market segments.

Integrated cross-channel retailing is a set of integrated processes and decisions that support a unified view of a brand from the perspective of product purchase, return, and exchange, irrespective of the channel (in-store, online, mobile, call center, or social). Through cross-channel integration, retailers are in search of both greater profitability and enhanced customer satisfaction.

Sorescu et al. [42] suggested that a successful retail business model incorporates three components: retail format, activities, and governance. But, from the model definition, it may be proposed that a business model should include at least three essential value-based premises:

- value proposition;
- value creation and delivery; and
- value appropriation

Value proposition covers the identification of target clients and a statement of why they should buy a product or service. Value creation and delivery are about the design of the retail value chain. Value appropriation concerns the retail profit formula. Therefore, a retail business model includes four dimensions: target clients, shoppers' value proposition, retail value chain, and profit formula.

Swoboda et al. [46] and Zentes et al. [52] showed the different primary and management-related chain activities and processes in retail, including the retail format, assortment, price, services, promotion, store location, procurement, logistics, information system, human resources (HR), financing/accounting, organization/structure, and relationship with suppliers and consumers. The profit formula is the blueprint that defines how the company creates value for itself while

providing value to the customer. It consists of revenue model, cost structure, margin model, and resource velocity.

Research Findings

Changes in Target Clients' Choices

They enjoy shopping online, but they also love to touch and see the items they are about to buy. If they cannot get a consistent shopping experience across the different channels of one retailer, they are likely to buy from its competitor.

Changes in Shopping Value Proposition

The retailer can provide more value to its target clients by shifting to a crosschannel strategy, rather than by operating the channels separately. In Suning's case, clients who purchase in physical stores can continue to enjoy the shopping experience via social contact with vendors and physical contact with the store environment and products, but pay less because the retailer lowers the in-store prices to align the online and offline rates.

Changes in Retail Value Chain

To ensure it provides the value of a seamless shopping experience to target clients, the retailer should integrate and optimize its whole value chain. In the case study company, Suning, these changes can be observed via the firm's strategic activities (Table 1), which can be classified into four types: retail concept, flow management, organization and HR management, and relationship management.

- Retail Concept To encourage and enhance its target clients' cross-channel behavior, the retailer should make the same information (product details, order fulfillment options, and price) available regardless of the channel. To do that, the retailer should work on its retail concept from different aspects, such as optimizing the store network, developing new products, synchronizing the merchandizing across channels, improving the store environment, and offering new services.

Optimizing the Store network: The cross-channel strategy enables the retailer to optimize its store network. For example, the presence of Web stores pushed Suning to restructure its physical store network to avoid cannibalization and maximize the synergy across channels.

Developing new Products: New products used to be tested in physical stores on an ad hoc basis, with no data collection or statistical analysis, which was very expensive to carry out. But now it is easy to do online.

Synchronizing the merchandising across Channels: A cross-channel strategy requires the retailer to synchronize its merchandizing, providing not only the same products but also the same price across channels.

Improving the Store Environment: The cross-channel strategy pushes the retailer to improve the store environment of its physical stores, because these are often seen chiefly as a platform to provide consumers with a shopping experience.

offering new Services: The cross-channel strategy drives the retailer to bring in new services to deliver a compelling customer experience, regardless of the channel. For example, Suning provided the option to "buy online and pick up in-store." Online consumers can also access the after-sales services (e.g., return or maintenance of merchandise purchased online) provided by the customer service center in each physical store. Moreover, the store staff—equipped with handheld smart devices—can help shoppers check the price and stock levels and purchase the item anytime and anywhere in the store. The application of these new technologies in-store make shopping faster, easier, more convenient, and more pleasurable for consumers.

Flow Management

The big challenge in implementing a cross-channel strategy is to manage the flows of goods, services, information, and cash, which involve many people on many levels and across channels. Some recommended practices for crosschannel retailers emerged from this study: integrating the information systems, centralizing procurement, optimizing the logistics network, and diversifying the sources of financing. The study also looked at how retailers can adopt new technologies and introduce suppliers to new systems to enable the rapid updating of huge amounts of data.

Integrating the Information Systems: Normally for the multichannel retailer, each channel is supported by its own separate information system. Offering a free choice of channel to consumers requires an information system for one channel to give the visibility and capability to act on the information system for another channel. The retailer should integrate the information systems across channels to ensure that the migration of activities between channels is supported by a flexible and consistent information system.

Centralizing Procurement: Traditionally, retailers have used separate operational models to purchase goods for different channels. Now, those models need to be merged so that the retailer can continue to deliver the products consumers want across any channel without losing efficiency. For example, Suning centralized its procurement at the group level.

Optimizing the Logistics Network: They must choose whether to handle express delivery themselves or outsource it. To cope with high volumes of customer parcel shipping at low cost and within a reasonable delivery time frame, Suning gave its online customers a choice of delivery methods and permitted them to pick up their order in their chosen store.

For example, benefiting from the presence of physical stores in Beijing, Suning established a delivery network (more than 80 pickup points and 60 distribution points) covering all corners of the city.

Diversifying the Sources of financing and Boosting the Cash flow: Extending the range of goods, committing to keep the same price online and offline, investing heavily in information, and so on all require the support of sufficient financial resources and efficient management of cash flow.

Suning changed the business model, with some suppliers moving away from self-conducted distribution in order to release store space. This strategy directly boosted the cash flow.

Rapidly Updating Huge Amounts of Data: A cross-channel retailer needs to provide online consumers with detailed and updated information. For offline consumers, the retailer should change pricing labels promptly to keep online and offline prices consistent.

To respond to this challenge, Suning has found a smart solution. For key suppliers, it has started to open up the supply chain system, and even to shift from self-conducted business to releasing space to the suppliers in both Web and physical stores.

After the electronic price-tag system was installed, managers could change the price within a few seconds through a terminal. This new technology enables price management to be more accurate, ensuring consistency between the price in the system and on display, and facilitating the retailer's internal control. It is also helpful for improving the store image, as perceived by consumers.

Organization and Human Resources Management

In a true cross-channel age, integration and optimization between online and offline business units present tremendous organizational challenges. The cross-channel retailer should work on various organizational aspects [10], such as a shift in the corporate culture, restructuring the organization, knowledge sharing, redesign of incentive systems, and recruitment and training in new skills.

Recruitment and Training in New Skills: Although more forward-thinking retailers redistribute talent and resources within their organization to exploit the digital media as a driver of offline sales, they still face the issue of lack of digital marketers and digital media vendors. This problem is particularly acute for Suning as a traditional physical-store–based retailer. To reduce the gap, Suning poached digital marketers and media vendors from other e-retailers, such as Amazon, Dangdang, and Yihaodian. More than that, it invested in personal training for graduate students from famous Chinese universities who have double skill profiles: retailing and e-commerce.

Relationship Management

The cross-channel strategy demands the retailer integrate and optimize functional activities both inside and outside the organizations. Sophisticated multilevel and multichannel exchanges with consumers and suppliers pose unprecedented challenges to the retailer at the level of relationship management. Analyzing consumer data, promoting loyalty programs across channels, sharing supply chain management systems with suppliers, and reassessing the original business mode may be good practices.

Analyzing Data across Channels and Tailoring Service to Consumers: Exploring data across channels can help the retailer to create a complete picture of consumer behavior, buying patterns, and trends so that it can provide them with a tailored service [8]. These surveys and data-mining analysis contribute to understanding consumers' cross-channel behavior. The insights from customer data can help Suning identify its best customers, discover the factors that drive loyalty, and learn how to improve customer profitability by adjusting the ranges, prices, and services.

Promoting Loyalty Programs Across Channels: The retailer can boost the promotion of loyalty programs to the benefit of each channel. For example, one month-long event organized in Suning's physical store was also promoted by its Web store.

Sharing Supply Chain Management Systems with Suppliers: The cross-channel strategy demands the retailer maintain stock in a very dynamic way. One way to integrate supply chain management is to open the system to suppliers. (Of course, security of information is a big issue.)

Reassessing the Business Model: The different challenges for cross-channel retailers—from financial, technological, and human resources to organizational capabilities—have been discussed. In confronting these challenges, retailers are forced to reassess their original business mode and find innovative solutions. For example, Suning started to redefine its role in the whole value chain. It planned to play the role of service provider, rather than distributor and retailer of the merchandise.

It invested in constructing an information system and a national network for distribution and logistics and developed financial instruments. All of these enable Suning to present an attractive platform to suppliers. The suppliers use this platform, accessing all the services but paying for the maintenance of product information and management of the inventory

Discussion

The results of the research for this study show that the retailer should more or less change the components of its business model, even redesign its whole profit logic, if it adopts the new strategy of integration across channels. This finding is consistent with, and empirically supports, those of [9, 42, 54]. In comparing these results to the literature, especially in the

field of e-commerce and multichannel strategy, two major theoretical insights emerge from this study.

First, the retailer should integrate and optimize its whole value chain from retail concept, flow management, organization, and HR management to relationship management in order to provide consumers with a seamless shopping experience. In fact, an increasing number of studies have recognized that the adoption of a cross-channel strategy means significant revisions for the firm at a strategic and organizational level [20, 32, 53]. Retailers should change their marketing processes and infrastructures to invest in the platform and architecture and to reconfigure their organization [10].

But how should the retailer gradually change its business model to fit its strategic shift from multichannel to cross-channel? Very little of the literature on retail discusses this question, especially through the theoretical lens of the business model. From this in-depth case study on Suning, the road map emerges of a retailer's shift toward adopting a cross-channel strategy in five stages:

1- *Solo mode* The retailer adopted a multichannel strategy but used independent business models for different channels.

2- *Minimal Integration* Major front-office operations of the business model were different yet complementary across channels, with the retailer focusing on the development of online business.

3- *Moderate Integration* The retailer integrated some operational activities of the business model across channels for optimization (e.g., "click and pick up") and invested in the back office (e.g., the information system and distribution center) to support this strategic shift (e.g., centralization of call-center services).

4- *Full Integration* The retailer aligned the offering across channels (e.g., the price and range were the same online and offline) and provided a seamless shopping experience to consumers, restructuring the organization to adapt to the full integration of activities across channels.

5- *New Business Model* The retailer redefined its role in the whole value chain of the sector by changing its profit formula or co-creating value with other stakeholders (e.g., inviting brand suppliers to open a Web store on its e-commerce platform, or providing financial and logistics services to small or medium-size suppliers).

Second, the retailer can provide more value to its target clients by shifting to a cross-channel strategy rather than by operating the channels separately. In line with the findings of [18], the integration of multiple channels can provide consumers with more confidence, convenience, control, assistance, and customization as well as a sense of safety.

The retailer itself can benefit from the adoption of a cross-channel strategy, as discussed in the literature [25, 39], from different dimensions: reinforcement, synergy, reciprocity, and complementarity. For the retailer to get these benefits from an integrated business model across channels, this in-depth case study especially highlights the important role of physical

stores for retailers, although today they risk being used for "showrooming" and need to be remodeled.

Conclusion

Interesting research possibilities would arise from generalizing the results to a broader population by a quantitative study that could link the choice of cross-channel strategy, the transition to an integrated business model, and the firm's financial performance.

E-fulfilment and distribution in omni-channel retailing: a systematic literature review (Melacini et al. 2018)

Abstract

Purpose Given the progressive growth of e-commerce sales and the rising interest in omni-channel (OC) retailing amongst academics and practitioners, the purpose of this paper is to provide an up-to-date literature review on the logistics involved when moving towards OC retailing. Specifically, we have examined the main issues relating to e-fulfilment and distribution, highlighting how the topic has been developed over time, and identifying the most promising research streams for the near future.

Design/methodology/approach A systematic literature review methodology is adopted. The review is based on 58 papers published from 2002 to 2017 in 34 international journals. The papers were analysed and categorised according to their defining characteristics, methodologies adopted and themes addressed.

Findings This paper provides an overview of the main issues relating to e-fulfilment and distribution experienced by companies shifting towards OC, mapped along three dimensions: distribution network design, inventory and capacity management, delivery planning and execution. Despite the growing interest in OC retailing, many key topics are still under-represented, including the evolution of retail distribution networks, assortment planning over multiple channels, the logistics role played by stores in the delivery process and the interplay between different logistics aspects.

Originality/value The paper offers insights into the main logistics issues in MC and OC retailing, as well as highlights potential fields for further investigation. From a managerial perspective, this paper is useful for retailers adopting an OC approach to guide their future efforts concerning their business logistics model.

Brief

Retailers initially started developing multi-channel (MC) systems to meet the additional challenges thrown up by the success of e-commerce. At the beginning, these MCs worked in isolation, leading to fragmented supply chains while retailers found it extremely difficult to offer a satisfactory consumer experience (Wilding, 2013). Several authors have recently argued that the retailing industry is moving into a new phase where the distinction between traditional and online channels is lost, known as omni-channel (OC) retailing (Beck and Rygl, 2015; Verhoef et al., 2015). In an OC system, customers can move seamlessly from one channel to another. Rather than deciding whether multiple channels should be used (Hübner, Wollenburg and Holzapfel, 2016), the newest challenge is now to understand how multiple channels can be managed synergistically to provide a satisfactory customer experience.

Retailers need to create new logistics models, evaluating the trade-off between the process of integration and separation between the different channels (Hübner et al., 2015). A total separation strategy meets the specific requirements of each channel, whereas an OC strategy can provide economies of scale and reduce total costs (Gallino and Moreno, 2014; Jeanpert and Paché, 2016).

Only a few literature reviews are already available that specifically analyse the e-fulfilment and distribution issues faced by companies selling products both online and through traditional channels.

Analysis and Synthesis

In terms of thematic scope, by recursively considering the topics found in the literature and the evidence that had emerged from our discussions with experts, we identified three key themes, each comprising several issues involved in setting up e-fulfilment and distribution in view of OC retailing:

1. distribution network design, in terms of the distribution system and the design of logistics facilities;
2. inventory and capacity management, in terms of assortment planning for the different channels and replenishment policies; and
3. delivery planning and execution, in terms of delivery services and shipment policies.

Main issues related to e-fulfilment and distribution in retailing

Opportunities and challenges relating to a defined OC strategy imply that marketing and logistics issues also come into play, and they are closely interrelated.

Distribution network design

Retailers adding the online channel to their existing channel mix need to re-design their distribution network, since the key design variable is the level of integration between online and traditional flows.

A key element in designing an e-fulfilment centre is the level of automation. According to Hübner et al. (2015), the main reasons for separate networks lie in the lack of preconditions for integration (know-how, resources, infrastructure, requirements for picking).

Alternatively, with a view to integration and synergy among several channels – a cornerstone of the emerging OC management approach – retailers can use their existing infrastructure (central warehouse, stores) to fulfill both traditional and online orders. Several contributions found in literature made a comparison between warehouse-based and store-based distribution systems as alternative methods for serving the online demand.

Bretthauer et al. (2010) proposed a model to determine how many facilities are needed to handle both online and traditional sales in order to minimise logistics costs.

Involving existing infrastructures in the e-fulfilment and distribution process also means redefining their role in the distribution network, and restructuring them properly to develop an OC system. In this development, technology is one of the primary drivers (Mirsch et al., 2016). For instance, in re-designing a store, Jeanpert and Paché (2016) underlined the need to provide sales personnel with tablets, introducing an "everything, all the time, everywhere" approach that allows staff to offer products in other stores or through the online channel and have them delivered either to the customer's home or to the store.

Retailers whose store-replenishment process is structured similarly to what is required for e-fulfillment (i.e. forward placement of inventory and store-replenishment schedule that frequently moves smaller quantities of items from a central warehouse to stores) will find it relatively easy to integrate online orders into their existing warehousing operations by developing a last-mile delivery capability (Ishfaq et al., 2016).

The retailer's allocation policy is another key element to be taken into consideration when a number of different logistics facilities are involved in the e-fulfilment and distribution process. This is the case in an OC system, in which the distinction between traditional and online channels disappears. In most existing literature, the assumption is that the location selected for handling the online sales is defined a priori (e.g. the store closest to the customer) and cannot be modified (Chiang and Monahan, 2005; Bretthauer et al., 2010). Technological development has facilitated real-time access to information along the supply chain, making it now possible to use decision models during the execution phase (Swaminathan and Tayur, 2003).

Mahar et al. (2009b) extended this study, examining how real-time information about inventory positions and online demand can be exploited to gain an economic advantage in multiple-channel supply chains by dynamically specifying which logistics facilities will handle each online sale.

Finally, another key issue for companies that are adding the online channel to their existing channel mix is how to manage the return process. The returns management process is a significant issue in non-food retail, where the online channel typically has a high return rate (Bernon et al., 2016). The literature has highlighted two new management aspects related to OC returns, returns modes (courier delivery, in-store returns) and integration across different returns channels (Bernon et al., 2016). In this vein, many authors have begun to look at using brick and mortar stores as the collection point for all returned products, including those purchased online.

Inventory and capacity management

The online channel alters the underlying economics of assortment planning by decoupling inventories from customer display (Randall et al., 2006). While the size of a traditional store determines a limit in the assortment that can be offered, in an online store a retailer can offer virtually limitless assortment (Noble et al., 2005).

In the case of an OC approach, with cross-channel objectives (i.e. total sales over channels, overall retail customer experience), retailers often carry key items that are popular sellers in both online channel and stores, and use the online channel as a means of selling highly specialised products that cannot be profitably offered in traditional stores (Berman and Thelen, 2004; Zhang et al., 2010).

Recently, some authors analysed assortment decisions faced by manufacturers selling products both online and through traditional channels, looking at the inventory costs (Rodríguez and Aydın, 2015; Matsui, 2016). From the retailing perspective, Bhatnagar and Syam (2014) demonstrated that products with high carrying costs can be profitably withdrawn from stores and be available exclusively online. Li, Lu and Talebian (2015) argued that, if a product can be delivered rapidly at a relatively low cost, the online channel is to be preferred, whereas if the delivery cost is high and consumers are impatient, the traditional channel is better.

Additionally, retailers moving towards OC need to evaluate the effect of inventory pooling and decide between a shared or dedicated inventory for the various channels. In this regard, Bendoly (2004) analysed different priority levels concerning the fulfilment of in-store and online demand, and demonstrated that inventory pooling benefits are influenced by the share of the market managed through online sales and by service-level constraints. In a related study, Bendoly et al. (2007) demonstrated that the benefits of inventory pooling are a function of the inventory's location within the supply chain, the proportion of a company's demand that is online, and the demand volume per retail store.

In an OC system, where customers can move seamlessly from one channel to another, being able to view the inventory becomes a basic requirement. As a matter of fact, inventory sharing can bring significant benefits in terms of cost reduction, but it can also generate conflicts between different channels. Having a robust information technology system is a pre-requisite

for integrated inventory management, to avoid any availability problems (Fernie and Grant, 2008).

Finally, another key factor is to have an effective inventory replenishment policy in terms of both timing and quantities. Many authors have recently focused their attention on these issues within multiple-channel supply chains. For instance, Geng and Mallik (2007) developed a theoretic game model to analyse the situation where some customers, unhappy at finding one channel out of stock, will visit the other.

Delivery planning and execution

In an OC system, retailers are looking for new delivery mechanisms that can provide a high service level in a cost-efficient way. As an alternative to home delivery, many retailers offer their online customers the choice of collecting goods bought online at specific locations, called pick-up points, in a form often referred to as Click&Collect (Weltevreden, 2008; Lang and Bressolles, 2013).

Hübner, Wollenburg and Holzapfel (2016) argued that retailers in moving towards an OC system typically introduce Click&Collect as their default delivery mode, using traditional stores as pick-up points. OC retailers can use their existing stores as pick-up points, in one of two ways (Mahar et al., 2012; Lang and Bressolles, 2013), site-to-store (i.e. the online order is supplied from the warehouse and sent to the store chosen by customer) and immediate pick-up in store (i.e. the online order is forwarded to the store chosen by customer, pickers walk down the aisles and retrieve the product/s requested).

Drivers and Technology-Related Obstacles in Moving to Multichannel Retailing (Lewis, Whysall, and Foster 2014)

Abstract

Multichannel retailing has emerged as a key strategic issue for most retailers. Yet, while there are many drivers associated with retailers' going multichannel, so too are there technology-related obstacles. By using a multicase approach to understand the key drivers and technology-related obstacles associated with retailers' moving to multichannel retailing, our study makes two key contributions. First, we extend prior theory by providing novel empirical insights into the main drivers underpinning retailers' use of a multichannel strategy. We find that meeting customer needs and increasing sales are the primary drivers behind retailers' use of the strategy, although there is diversity in the way retailers respond to these motives. Second, we provide empirical support for a proposed theoretical framework that summarizes the key technology-related obstacles retailers encounter, by stage of implementation, when going multichannel. The framework reveals that retailers face technology-related obstacles when implementing a multichannel strategy due to the need to switch/acquire resources and achieve

channel integration. Furthermore, the framework highlights that these resource and channel integration issues are often interrelated with one another and with other staff engagement and cultural issues, vary by retailer and stage of implementation, and pose greater obstacles to retailers' use of new and multiple channels than the extant literature suggests.

Brief

A further motive behind retailers' using multichannel operations is changing shopper behavior. More and more customers want to shop via a combination of channels, and as a result the multichannel shopper is becoming the mainstream, rather than the minority, customer. For instance, customers can choose which channels they use for different stages of the buyer behavior process, and so they might research a product online but choose to purchase it in-store [17, 56].

Key Drivers Motivating Retailers to Adopt Multichannel Retailing

While a limited number of retailers have historically used multiple channels to sell products and services to customers, this number has increased since the late 1990s [46].

The Internet

Although initial speculation was that the Internet would lead to the demise of traditional brick-and-mortar stores, in reality it has led to many brick-and-mortar (and catalog) retailers adding an Internet channel as part of a multichannel retail strategy [23, 50]. The Internet, it could be argued, has been a key driver behind retailers' adopting a multichannel retail strategy.

Changing Shopper Behavior

Broadly speaking, however, a customer benefit associated with shopping via the Internet is that customers can access a wider selection of products. Customers can also access vast amounts of information to reduce search costs and find the best price for a product [42]. This, however, has led customers to expect store-based retailers to match, or even better, the prices of pure-play Internet retailers, even though many store-based retailers have a higher cost base than Internet-only retailers. Store-based retailers may therefore face challenges devising a pricing strategy that is in line with customer expectations while also maintaining profitability [62].

A customer advantage of in-store shopping is that customers can purchase a product and receive it instantly. Customers can also see, hear, touch, and taste products, which is important in the purchase of experiential products such as jewelry and clothing [3].

Although there is limited literature exploring the customer benefits linked to shopping via mobile phones, existing research suggests the benefits include the following: customers can shop in an exciting and stimulating atmosphere, they can keep up with new products and innovations, and they can more easily search for discounted products [37].

Indeed, although several academics have argued that in a multichannel setting, customers evaluate channel benefits in isolation [6], others have argued that customers evaluate channel benefits in totality, and thus, in that sense, it can be argued that all channels are mutually supportive.

Going multichannel means that retailers can appeal to the "valuable" multichannel shoppers, who have a higher purchase frequency and spend more than single-channel shoppers [24]. Using multiple channels also enables retailers to appeal to new customers and increase sales. Even so, many retailers have concerns that adding new channels will not generate new sales but, rather, will cannibalize sales from existing channels [1]. Nonetheless, adding new channels, particularly an Internet channel, can help retailers to access greater amounts of customer data, which they can then use to better segment the market, identify target markets, and meet customer needs [67].

Utilizing a combination of channels, however, can help retailers to improve customer service levels [5]. For example, adding new channels increases the number of contact points a retailer has with customers, giving retailers more ways to communicate and interact with customers, and hence providing them with potentially improved customer relationship management (CRM) strategies.

Nevertheless, using multiple channels offers retailers many operational benefits, including reduced operating costs and improved efficiencies due to, for example, synergies between channels, which can help to reduce e-fulfillment costs [1, 40].

Technology-Related Obstacles Associated with Moving to Multichannel Retailing

Understanding the Need to Acquire and Change Resources

Increasing the number of channels a retailer uses to sell products and services increases the number of customer contact points. While this is an advantage associated with multichannel retailing (e.g., it leads to potentially improved CRM strategies), it also calls for retailers to build IT systems that integrate data across all channels and permit such data to be analyzed holistically. Without these systems, getting a complete view of the target customer and providing consistent service levels across channels is extremely difficult [27].

The multichannel retailing literature has a tendency to imply that retailers can use their existing logistics infrastructure to support new and multiple channels [43]. Yet in practice the addition of new channels involves retailers' redesigning existing logistics systems.

Achieving Channel Integration

According to Tate et al. [53], channel integration is the extent to which channels share common organizational resources, including departments such as marketing, finance, and logistics.

Achieving channel integration and channel synergies, however, necessitates that retailers further switch resources. Retailers have to adapt existing logistics and IT infrastructure to apply the marketing mix consistently across multiple channels and to facilitate customers' buying a product from one channel and collecting it, or returning it, in another [18].

Challenges in Acquiring/Switching Resources and Achieving Channel Integration

Retailers also encounter major challenges in getting the capital investment necessary to ensure that the IT and logistics infrastructure can support multichannel operations [1, 60].

Measuring the performance of a channel according to the sales it accounts for also fails to acknowledge "channel-influenced" sales and, as such, does not give a true reflection of the performance of individual channels. Evaluating channel performance is made more problematic because it requires innovative methods of evaluating return on investment, customer lifetime value, total number of customers, and total marketing expenses to ascertain the true performance of channels [55].

Research Method

We adopted a qualitative multiple case study research strategy, which facilitated an exploration of the phenomenon (i.e., multichannel retailing drivers and challenges) in an area that has received little theoretical development and allowed us to study multichannel retailing in a real-life context [9, 65]. The key themes to emerge from this analysis are discussed in the next section.

Key Drivers of Multichannel Retailing

Meeting Customer Needs

Each of the retailers believed that customers wanted to be able to shop via multiple channels, and therefore they had no choice but to go multichannel if they were to fulfill customer needs.

Cases 1, 2, and 3 all believed that meeting the needs of multichannel shoppers was important because these individuals spent more money and had a higher lifetime value than single-channel shoppers.

Increasing Sales

The desire to increase sales was another key driver for moving to multiple channels for cases 1, 2, and 3. However, the precise way in which multichannel retailing was used to grow sales differed by retailer. For example, the primary objective for adding an Internet channel for case 1 was to increase store sales; increasing Internet sales was a secondary objective.

In contrast, case 3 was adding an Internet channel to grow sales by enlarging its market to serve customers outside the Yorkshire area in the United Kingdom.

Case 2 took a broader view of channels than the other retailers. It was adding a store channel to generate store-based sales but was also opening physical stores to help increase sales via its Internet, catalog, and customer contact center channels. Moreover, case 2 used all channels to generate single-channel and cross-channel sales. A senior manager explained that "we've got plenty of qualitative research that says the Internet is the most powerful tool at driving people into stores, but at the same time we're not daft enough to acknowledge that everything is having multichannel impacts."

Other Drivers of Multichannel Retailing

For case 1, adding an Internet channel provided the retailer with a marketing channel. Case 2 was opening physical stores to complement its incumbent channels and be "the first retailer" to go multichannel in the do-it-yourself (DIY) market, thus gaining an advantage over competitors. A further impetus underpinning case 3's decision to use an Internet channel was that the retailer's fixed costs could be shared among its store and Internet channels.

Technology-Related Obstacles Associated with Going Multichannel

Issues Due to the Need to Acquire/Switch Resources

As a senior manager explained, information provided by the store-based logistics system, such as pallet size, was therefore irrelevant to the Internet channel. But information not provided by the store logistics channel was important to the Internet channel, including dimensions and weights of products, since this data determined how products were packaged and delivered to the customer.

Similarly, case 2 had to redesign its legacy logistics systems because its existing logistics infrastructure had been designed to support its direct channels (i.e., Internet, catalog, and customer service channels). As a senior manager commented, these systems had been "designed primarily to service smallbox-size dispatches—so everything for the direct Web and catalog channels." In contrast, the store channel needed—like the store channel of case 1—a logistics infrastructure that facilitated moving merchandise from inbound to outbound trucks with minimal handling, using information about pallet size to determine which carriers to use, size of trucks, number of deliveries in and out of the depots to stores, and optimal storage of

product in the depots. This was not provided by the existing logistics system, since it was irrelevant to direct channels.

Case 3 also had to adapt existing logistics and IT infrastructure to add an Internet channel and go multichannel. For example, the retailer did not have a computerized integrated stock control and ordering system, which caused stocking issues, especially at peak trading periods. Yet designing a computerized and integrated stock control system was extremely problematic because the retailer's products were perishable and so had a short shelf life, they were baked on different days, and they were subject to significant seasonal sales variations. Subsequently, bespoke and complex logistics and IT systems were needed.

Individuals on the board of directors across all of the retailers also had low engagement with the strategy and therefore had low motivation for making the necessary financial investment. Cases 1 and 3 further experienced problems adapting legacy logistics and IT infrastructure due to lack of staff with knowledge and expertise in this area.

Achieving Channel Integration

Case 1 had to merge its main retail and Internet channel platforms into one platform to enable the brand and marketing mix to be leveraged consistently across multiple channels. Carrying out this work had been initially delayed due to the significant financial resources required and lack of board-level commitment to make this investment.

Case 2 was in the process of implementing a new platform designed to change its multichannel order process. The new platform would eventually replace 80 percent of the retailer's existing IT and logistics systems and enable the retailer to leverage the marketing mix consistently across all channels. A further advantage was that the system would generate automated personalized product recommendations that store staff could use to upsell and cross-sell products to customers.

To implement an integrated multichannel offer, cases 1 and 2 further had to modify legacy IT and logistics systems to enable the customer to buy a product in one channel and pick it up, or return it, in another.

Using this and other new technology, then, was often an iterative process whereby retailers frequently had to go back and rectify mistakes. For example, a senior manager at case 1 commented, "We've learned a lot in the three-year journey we've been on [i.e., to add an Internet channel and go multichannel], and we're still learning a lot now.

A surprising theme was that the retailers overcame the issues related to use of click and collect and other technology (i.e., the knowledge and expertise needed to put the IT and logistics infrastructure in place) through collaborating with other retailers. This is in stark contrast to the "closed" way in which retailers, especially brick-and-mortar retailers, have historically operated.

Other Issues Linked to Multichannel Retailing

During the later implementation stages, the retailer cases continued to face resource and channel integration obstacles. Yet, analysis of the case materials reveals that the retailers also encountered cultural and staff engagement problems. For example, all of the retailers needed to change their internal culture to go multichannel.

Research Question 2: What Technology-Related Obstacles Do Retailers Encounter When Adding New Channels and Using Multiple Channels?

Cases 1, 2, and 3 faced technology-related obstacles when going multichannel due to the need to acquire/switch resources and achieve channel integration [38, 67]. However, this study reveals a novel theme: these resource and channel integration obstacles were frequently interrelated with one another and with other "softer" cultural and staff engagement problems. New findings of this study also show that these technology-related obstacles were intensified due to the novel and dynamic nature of the retailer's strategy and varied according to the type of retailer (i.e., whether a retailer was initially a brickand-mortar operation or Internet/catalog based) and stage of implementation. Broadly speaking, this study found three stages in adopting a multichannel retail strategy: early, middle, and late (see Figure 1). These stages are used to structure the following discussion of the main obstacles our case study retailers encountered when moving to multichannel retailing.

Early Implementation Stages **Acquiring/Switching Resources** In this study all of the retailers had to redesign their existing logistics and IT systems to go multichannel. For example, all of the retailers experienced problems redesigning legacy logistics and IT infrastructure due to the bespoke nature of these systems.

Case analysis also reveals that these technology-related obstacles often had a "softer" side, that is, they were frequently interrelated with staff/financial resources and board-level engagement issues.

Staff Resource Issues This study supports those findings but more clearly articulates that store staff need to possess the necessary skills to use new technology in a manner more oriented toward customer service and sales. For example, the use of "click and collect" requires staff to "sell" the initiative to customers, place customer orders via the Internet in-store, and treat product return and collection occasions as "additional touch points which permit the retailer to strengthen their relationship with customers" [67, p. 175]. Still, in line with Hart et al. [19], our analysis indicates that recruiting these staff (i.e., staff who can apply information and communication technology [ICT] skills in a customer-friendly way while maximizing sales opportunities) can be difficult.

All of the case study retailers also had difficulties ensuring staff had the necessary multichannel retailing skills, since there was a lack of training programs in this area. As a result, staff

training tended to be carried out in an ad hoc "on the job" way, which, according to Johnson et al. [22], is typical of the retail sector.

Financial Resources and Lack of Board-Level Engagement These channel performance measures posed obstacles to getting the necessary capital expenditure, but each of the retailers found it problematic to design alternative channel performance measures that, for example, acknowledged channel-influenced sales and minimized internal interchannel competition [55].

Case 1 also experienced difficulties getting financial investment due to lack of board-level multichannel engagement. This, then, demonstrates that financial resource issues associated with using new technology are often caused by limited capital expenditure and exacerbated by internal resource competition and lack of board/senior management support.

Middle Implementation Stages Case analysis reveals that during the middle implementation stages, the retailers faced the most significant problems, due to the need to achieve channel integration. Moreover, these channel integration issues were interrelated with resource and staff engagement issues.

Achieving Channel Integration Retailers faced significant issues achieving channel integration [45, 48], in part because channel integration entailed the retailers' communicating and leveraging the brand consistently across all channels [38], and this involved complex and challenging alterations to legacy IT and logistics systems. The retailers also needed to permit customers to buy a product from one channel and pick it up or return it in another [35]. Yet using click and collect meant further changes to existing IT and logistics systems, and this was problematic given that the retailers had few staff with the necessary skill set to make thes modifications.

In spite of this, there were benefits associated with click and collect; for instance, retailers shifted control over the "last mile" of deliveries to the customer [67].

Another, major barrier to the retailers' achieving channel integration was conflict between staff in different channels [49, 61]. Conflict arose between staff in incumbent channels and those in the new channels, since staff in existing channels perceived the new channels to be a threat to their sales and income [1].

Late Implementation Stages In the later implementation stages, although the retailers continued to face resource, channel integration, and engagement issues, they also increasingly experienced cultural problems. However, many of the cultural alterations needed by retailers to go multichannel related to the use of new technology.

Implications of This Research

In general, then, implementing a multichannel retail strategy calls for retailers to adopt new business models, of which the CEO and board of directors are custodians, to effectively use the strategy.

The revival of retail stores via omnichannel operations: A literature review and research framework (Hübner, Hense, and Dethlefs 2021)

Abstract

The increasing importance of integrated fulfillment concepts revitalizes bricks-and-mortar stores and puts them at the center of retail operations. So-called omnichannel (OC) concepts leverage stores to offer seamless and enhanced operations for offline and online shoppers. Stores are used to fulfill online orders, offer shorter lead times to customers, and extend the assortment across channels. The role of the store and the underlying store operations are thus impacted by profound changes. This transformation has not yet been assessed comprehensively from a practical or an Operations Research (OR) lens.

This paper identifies cross-cutting store-related planning issues and develops a planning framework for OC operations. We apply industry interviews and a systematic literature analysis to derive five planning issues. Research gaps are revealed by matching the pertinent OR literature with managerial needs. The planning issues network design of fulfillment locations, assignment of customer orders, and assortment and inventory planning have been discussed in several store-related OC publications. Demand forecasting and inventory replenishment have received less coverage, and offer significant research opportunities.

In the past, the online shop mainly supplemented stores. Now, stores not only supplement online sales but are also becoming a central piece of the customer journey across seamlessly integrated channels.

The COVID-19 pandemic has accelerated the expansion of such offerings and reinforced the store's role change from being purely a sales area to also acting as a logistics fulfillment hub. The integration of stores and digital channels is called omnichannel (OC). The store now serves as the epicenter for OC retail operations, functioning as an additional warehouse for online orders besides the traditional purpose as a customer shopping area (see e.g., Brynjolfsson et al. [2013]; Bell et al. [2014]; Gallino et al. [2017]; Gallino and Moreno [2019]; Janjevic et al. [2020]).

As stores may now be used as alternative picking locations, retailers have to decide which stores to include in their fulfillment network and from which specific location to pick each online order. In addition, assortments and inventory levels for each point of sales need to be determined, and how they are to be shared across locations. This requires quantifying, modeling and solving the trade-off between costs and operational advantages.

The overview shows that current reviews lack topicality (e.g., Swaminathan and Tayur [2003]; Agatz et al. [2008]), an OR perspective on the store (e.g., Kembro et al. [2018]; Bijmolt et al. [2021]), or an analysis of latest developments in practice (e.g., Galipoglu et al. [2018]; Melacini et al. [2018]). This is aggravated by cross-cutting OC operations topics, which are not fully discussed and evaluated by the literature reviews. Examples include an integrated

assortment for buy online pick-up in store purchases (see e.g., Rooderkerk and Kök [2019]; Hübner and Hense [2021]), the fulfillment of online orders through stores (see e.g., Ishfaq and Bajwa [2019]; Arslan et al. [2020]; Bayram and Cesaret [2020]), or the consideration of a single virtual stock for all fulfillment locations (see e.g., Aflaki and Swinney [2021]).

First, we structurally identify the most relevant store-related planning issues derived from interviews with industry experts (RQ1). Second, we match this overview with an analysis of existing literature and evaluate whether and to what extent these planning issues are covered in pertinent analytical and modeling literature (RQ2). We use the combination of RQ1 and RQ2 to ensure a structured literature analysis that responds to retailers' challenges and reveals answers in the literature. Third, the combination of both questions makes it possible to state which planning issues are not yet sufficiently covered and offer further research potential (RQ3).

OC operations imply fully integrated channels where consumers can shop without noticing the different channels operating in the background (e.g., which picking location was used). It extends the multichannel (MC) concept, which characterized retailers with various isolated sales channels, such as an online shop (henceforth referred to as "webshop") and a bricksandmortar store (henceforth referred to as "store").

The resulting OC-enabled fulfillment concepts (henceforth referred to as "OC concepts") are ship-fromstore (SFS), buy online pick-up in store (BOPS), and digital assortment extension (DAE). As "ordering at store" and "receiving at store" when taken together constitutes conventional in-store shopping and not an OC concept, we will not further study this aspect.

Buy Online Pick-up in Store (BOPS, also called click and collect) enables demand transfer from the webshop to the store. Customers can order online to pick up products in the store, possibly while observing store inventory This practice helps to shorten lead times or to substitute unavailable webshop items by redirecting customers to the store where the item is available. A variation depicts reserve online, pick-up and pay in store (ROPS), where items are reserved online but payment is only carried out in the store upon pick-up.

Ship-from-store (SFS) describes the process of accessing store inventory for online orders and using stores as an alternative fulfillment location to distribution centers (DCs) (see e.g., Hübner et al. [2016a]; Difrancesco et al. [2021]). Orders are picked in the store and shipped directly to the customer. Benefits arise from shorter transportation distances to customers compared to remote DCs and from inventory pooling across different locations.

A **Digital assortment extension (DAE)** provides an "endless aisle" to the store via demand transfer from the store to the webshop. Digital devices in the store enable access to the online assortment and expand the store's offering. In an extreme variant of DAE, the store has no sales inventory and only serves as a showroom with digital order options.

It requires the integration and coordination of operations, resources, and information systems and entails novel structures and planning systems. This creates the need to identify and analyze the planning problems that are affected the most by the transition towards OC concepts. In

particular, enhanced approaches across channels are required for the demand forecast, the selection of fulfillment locations of online orders and the assortment and inventory definition. We aim to distill the essentials of the new role of the store in OC operations. We therefore analyze OC retail settings with integrated channels. This leads us to focus on tactical and operational planning problems, which excludes strategic aspects like moving from SC or MC to OC. Furthermore, we focus on the impact of operations and stores.

The empirical findings in Section 3 are structured along five elements (demand forecasts, network design of fulfillment locations, assignment of customer orders, assortment and inventory management, and inventory replenishment) that emerged from our conceptual overview, expert interviews and literature analysis. Each element depicts one planning issue. The elements are structured along planning horizons and their relation to each other.

OC merges operations across channels. This brings forth planning questions on how to match supply and demand across channels and puts the store at the center of those operations. In particular, it requires answers as to what and how much to offer and where to process an order across integrated channels. However, integral planning implies more complex approaches with multidimensional interdependencies. Efficient planning of the entire OC operations is neither possible in the form of a monolithic system that plans all tasks simultaneously nor by simply performing the various planning steps successively.

Demand forecasting

Challenges in practice

OC retailers are confronted with issues related to accurate demand forecasts that can be clustered into three areas. First, a sufficient historical OC database and OC experiences are often unavailable due to very recent OC service enhancements and significant developments of OC shopping.

Second, demand models across channels are required to capture additional customer attributes. It becomes more challenging to understand customer needs and how customers use channels to make a purchasing decision, such as, if one channel is used for the information search and another for product purchases. Furthermore, existing SC or MC models used by retailers do not sufficiently capture OC demand flows across channels, e.g., substitutions from store to online. The positive impact of webshop promotions on online demand, for instance, may have a negative impact on store demand. To increase OC forecasting accuracy, one needs to identify relevant drivers of demand. Such drivers may include external factors such as weather, season, or the activities of a competitor and internal factors such as advertisements across or within a channel.

Third, DAE demand is greatly influenced by in-store inventory as customers often use DAE orders to buy temporarily sold out, out-of-stock (OOS) items. However, in-store inventory information is often not reliable or available in real-time, making predictions more difficult. This

may result in censored demand observations since sales are limited by the supply information the is available.

Network design of fulfillment locations

Challenges in practice

OC retailers pointed out challenges with selecting the appropriate fulfillment locations that can be clustered around three topics: development paths, operational efficiency, and heterogeneous depots.

The enduring business problem here is to define the optimal volume processed in stores. Processing in stores has benefits compared to DCs if stores are in customer proximity.

Second, the share of online sales processed via stores has operational and economic limitations despite the benefits due to lower delivery times

Finally, the location selection becomes more relevant but also more complex when retailers hold a number of heterogeneous depots, e.g., DCs and stores with different assortments and fulfillment costs.

In the course of recent introductions of OC concepts, most retailers decided on fulfillment locations based on speed and ease of implementation and only partially based on induced costs.

Mahar et al. [2012] extend the problem to offer stores for BOPS in a dynamic fashion. Each time an online customer reaches checkout, the model uses information on current inventory levels and expected demands to specify which of the stores should be presented as available pick-up locations. The policy attempts to discard stores with low inventory levels. The authors formulate a decision problem to minimize the total costs of inventory holding and backorder as well as lost sales and redirecting customers (so called customer goodwill costs).

Mahar et al. [2014] fixed setup and inventory holding costs favor central fulfillment from the DC, whereas transportation and goodwill costs favor providing pick-up/return at all stores to essentially pass “free shipping” costs to the customer and avoid any lost sales.

Future areas of research

Current literature on network design has originated from inventory allocation problems and developed since then to more comprehensive cost functions, demand models and decision criteria. However, matching challenges from practice with literature highlights some research gaps. These would range from providing models and solutions for the expanding services, using inventory pooling across stores, more deeply grounding the relevant costs empirically, extending models to include dynamic and stochastic demand effects, through to developing managerial insights and assessing the impact of new technologies related to store operations.

The question arises as to whether orders for customer pick-up in stores should directly be picked in the store (with potentially higher picking costs and lower availability), in DCs, or in other stores for delivery to the pick-up store. Furthermore, retailers will benefit from BOPS when this can be used for cross-selling opportunities in the store. This entails the research questions on how cross-selling can be materialized. A further opportunity in this context are processes and decision rules when redirecting customers to SFS or DAE is an option.

A second area of research opportunities deals with related costs. Although recent literature considers a broader set of costs (e.g., Ishfaq and Bajwa [2019]), a cost-holistic comparison of different fulfillment locations is still limited.

The third area is related to modeling approaches. In many cases independent demand models are applied that do not factor in cross-channel demand when strictly prioritizing online (e.g., Bendoly [2004]; Chen et al. [2011]) or offline (e.g., Hovelaque et al. [2007]) demand, for example.

However, the location selection problem may be a dynamic problem with opening and closures (e.g., because of seasonal demand) and therefore requires to extend the cost functions by opening/closing costs or inseason replenishment costs. Furthermore, the demand is subject to variations which then need to be built into stochastic demand models.

Extending the more comprehensive cost formulations (e.g., by Ishfaq and Raja [2018] and Ishfaq and Bajwa [2019]) by the dynamic and stochastic components and incorporating further variables (e.g., dynamic adjustments) requires advanced solution approaches. This also includes innovative approaches to take into account actual transportation costs.

Finally, there are further research opportunities with the use of new technologies. Efficiency gains via automation might come into play when process automation leads to lower fulfillment costs in certain locations.

Assignment of customer orders to fulfillment locations

Scope of the planning problem

Whereas the network problem determines the set of available fulfillment locations, the related and subsequent operational problem is the actual assignment of online orders to the locations selected mid-term. At this stage, OC retailers specifically consider the currently available inventories and picking capacities at each location as well as lead times and requested time windows.

The assignment of orders aims to minimize the total costs consisting of inventory (i.e., costs for inventory holding and overand underage), picking (i.e., processing an order at fulfillment location), and transportation costs (i.e., from inventory location to customers).

Challenges in practice

The challenges related to order assignment build upon the efficiency, heterogeneity, and capacity issues for the selection of locations discussed above. Further questions on the operational level arise from the necessity to include inventories available in real-time at each location. In a fully integrated SFS concept, customers can select all products offered in stores at the online checkout. As a consequence, it needs to be based on real-time product availability in each location.

Using inventories in stores for the fulfillment of online orders decreases the inventory available for in-store revenues and may require more store space if inventories are increased, but may decrease fulfillment costs and lead time for online orders.

Offering BOPS leads to situations where retailers have to prioritize orders, e.g., if an in-store customer wants to purchase an item that is already reserved for a BOPS order. Further, unclaimed BOPS orders take-up valuable space in the store. Moreover, the in-store customer would buy certainly the product, whereas there is also a risk that the customer who reserved the product online may not show up and buy it. OC retailers therefore require order acceptance rules and avoid accepting all orders on a first-come-first-served principle.

As one DIY retailer (DIY01) explained, order splitting requires additional processes and operations regarding downstream order consolidation before delivery or substitutions between products. To mitigate these challenges, retailers think about steering customers into other channels (e.g., SFS instead of BOPS) in the event of stock-outs, giving retailers flexibility in accessing different inventories.

Bretthauer et al. [2010] are the first to apply a two-echelon fulfillment system with a DC and multiple stores. Incoming goods are received at the DC, which serves as a break bulk facility. Goods are then shipped to the stores in equal quantities. After that, each store incurs independent store and online demand. The online demand originates from the surrounding region. They apply a static order assignment policy so that each online customer is served from the closest store.

In a further extension, Mahar and Wright [2009] introduce an assignment policy where the online orders are accumulated over time and allocations are made after a time interval. This further reduces costs. However, common across these models is that they are limited to one product and the transportation costs to customers are only modeled with direct shipments. They thus use distance metrics even when customers are served together within a tour.

Andrews et al. [2019] is the first contribution with multiple products. They apply an online optimization approach and solve a multi-criteria decision problem with an algorithm based on a primal-dual schema. Their model assigns orders to stores and a DC based on available inventory, transportation costs, lead time and picking capabilities.

Dethlefs et al. [2021] develop and apply a cluster-first-route-second algorithm that assigns orders to a heterogeneous set of picking locations. They are the first to consider locationand product-specific picking costs, vehicle routing costs, and to also assign orders to tours. They

show that integrated fulfillment from both stores and DCs can be beneficial, especially under time restrictions when orders must be fulfilled rapidly.

Future area of research

There are opportunities for further research in extending the assignment problem to BOPS and DAE concepts, enhancing models with further decision-relevant costs and criteria and last but not least, investigating lead-time aspects. The first area is related to the OC concepts. Table 3 shows that BOPS and DAE have not been studied for order assignment. However, these could also leverage the advantages of location assignment. While customers choose a specific store for order pick-up (in BOPS), the picking process can be handled in other locations with the aim of minimizing costs or using spare capacities and stocks, e.g., in particular at the end of sales season. Similarly, DAE has not been discussed, but may become relevant if online customers have digital access to inventories across stores.

The second topic area is related to the fulfillment costs considered and other factors. A holistic assignment decision consists of two cost categories: depot-specific processing costs (incl. inventory, picking) and transportation costs (incl. last-mile delivery to customers). The assignment decision depends on inventory positions, picking systems at a depot, as well as transportation means and options for routing.

One needs to further analyze the impact of order assignment on customers in stores based on current practical challenges and the primary concern of many store managers. How does a certain level of customer presence in stores impact assignment decisions? Assignment decisions may therefore be impacted not just by the available inventory in addition to costs but also by store customer presence and picking capacity. Finally, an increasing demand for shorter delivery times (i.e., same hour, same day) and the use of tight time windows raise questions regarding how these factors impact assignment decisions.

Assortment and inventory

Assortment and inventory planning is concerned with the selection of products and stocking levels across channels, DCs and stores. This is a tactical decision that needs to be accomplished with the operational inventory replenishment.

Scope of planning problem

To optimize retailers' profit, assortment planners must decide, out of all potentially available products, which set of products to list in which channel and inventory location (DCs and stores), which products to make available for BOPS, SFS, and DAE, and in which quantities.

Assortment composition and inventory target levels must be defined jointly as these decisions are interdependent when space in the store or the online DC is limited.

A meaningful allocation of products and inventories to the webshop and stores can be achieved to serve customers across channels by disentangling and quantifying demand transitions between channels and products. In OC retailing, not only in-channel substitutions but also demand transitions between the webshop and stores and vice versa are very common [Rooderkerk and Kök, 2019]. Next to OC-specific demand, OC assortment and inventory planning must consider product margins, distribution and replenishment costs as well as inventory holding costs for each inventory location. To quantify the demand fulfillment, it becomes additionally necessary to consider over- or underage costs.

Challenges in practice

Enabled through OC information systems, customers use multiple channels along their purchasing journey and frequently change channels to gather pre-purchase product information (i.e., research-online, purchase-offline behavior, and vice versa), change preferences, and substitute products. This requires demand models that integrate such cross-channel customer effects as well as inventory location and product-specific economics. Assessing these effects and costs of varying assortments across stores and the webshop on customer demand is a challenge.

A new aspect is the he product and channel complementarity. For instance, being able to offer a broader assortment in one category might convey the impression of elevated competencies in this category and lead to additional sales. On the same line, offering a complementary channel to existing channels provides both a source of supplementary information and additional substitution possibilities for customers. Transferable substitution demand, walk-rates, and cannibalization become even more crucial as a result, but also harder to estimate.

Moreover, OC assortment planning requires the incorporation of different revenue and cost structures of products and fulfillment locations via the introduction of OC concepts.

This is however often done without profound insights into channel buying and switching behavior and reduces the potential of revenue-driving OC concepts. The decision on what and how much to offer via BOPS, SFS, and DAE is often either somewhat disregarded or not based on channel-specific cost, revenue and demand implications.

Current research

The models above provide some first approaches to derive analytically inventory target levels in operations across channels. The OC concepts applied are limited to one product and disregard assortment compositions. A main limitation for the application to practice is the consideration of channels without specifying the inventory for concrete stores. Furthermore, the models are not comprehensive in terms of substitutions between and within sales locations as well as considering actual fulfillment costs.

The second related stream comprises assortment planning. Gu and Tayi [2017] use an analytical model to analyze research-offline, purchase-online behavior for a retailer with a webshop and a store with a connected DAE. The retailer decides on products, what price to sell them at, and whether to sell the products via both channels or only the webshop. In the store, customers receive information about the available product(s) and thereby fully resolve their product uncertainty on available products or reduce their uncertainty about unavailable products. Subsequent online purchases are enabled via DAE for products not available in the store. Customers can return products after evaluating the product received. Inventory levels are not defined, substitution rates are not considered, and costs are limited to handling returned products. Dzyabura and Jagabathula [2018] also formulate a NLP and propose a greedy heuristic to solve the problem. They consider showrooming as a special case of DAE where the store assortment is optimized without optimizing inventories. Out of a given set of products in the online channel, the retailer decides on the subset of products to offer in the store. The impact of the store assortment on online demand is factored into these considerations.

They apply SFS and model inventory and assortment optimization with OOS situations in the online DC. This is the first contribution with more detailed fulfillment costs. The retailer selects the assortment and inventory target levels for a store with limited shelf space and for the online channel with limited DC capacity.

Future areas of research

Current literature provides structural insights into assortment compositions and inventory levels across channels. However, many models lack the integration of comprehensive demand models with substitutions across and within channels, incomplete fulfillment costs and overly simplistic assumptions such as pre-defined online assortments and inventories.

To advance the OC operations literature, research opportunities lie in a more thorough consideration of demand effects across channels, stores as showrooms, cost and revenue parameters, safety stocks, and more solution approaches applicable for practice.

First of all, relevant customer search behavior across channels, as well as substitution, complementary, and cross-selling effects, must be taken into account when configuring OC assortments.

Alongside that, product and channel complementarity as well as cross- and upselling opportunities are worth integrating. It is also crucial to respect relevant single- and multichannel demand effects such as space-elasticity and cross-space elasticity in the bricks-and-mortar store (see e.g., Hansen and Heinsbroek [1979], Chandon et al. [2009], Eisend [2014], or Schaal and Hübner [2018]), or positioning- and salienceeffects on a web page (see e.g., Djamasbi et al. [2010], Pieters et al. [2010], or Atalay et al. [2012]).

Secondly, assortment and inventory related research is necessary for showrooms. Showrooms depict a specific case as the stores display products but only sell them through DAE.

Thirdly, OC retailers must look beyond pure unit costs and revenues and take total profitability and feasibility into account. OC retailers need to identify all decision-relevant costs, including unit and purchasing costs but also fulfillment costs, safety stock cost, salvage values, shortage costs, and hidden OC costs. This concerns products bought through cross-channel research, BOPS, SFS, or DAE, causing information provision or fulfillment costs across different channels. Feasibility, on the other hand, mainly describes whether it is operationally possible to offer OC concepts for certain products.

A further factor that has not yet been considered in inventory management in OC is the determination of safety stocks for each sales and inventory location. As one inventory location can back up others and provide substitutions across channels, this also constitutes a novel problem caused by OC operations. Finally, we have seen that in practice, many assortment and inventory models fall short of accounting in a practical manner where OC demand effects are concerned. Given the magnitude such effects can have on profits, retailers require related decision support that is not only easily applicable but also delivers efficient solutions without extensive OC data that is potentially unavailable. In these cases, algorithms to estimate demand probabilities are required to obtain inputs for more detailed demand models.

Inventory replenishment

Scope of planning problem

Inventory replenishment is the subsequent planning step after the midterm assortment and target inventory level definition. It deals with when and how much to refill. Retailers need to define the replenishment frequency (when) and quantity (how much) for each inventory location (stores and DCs) after actual customer orders have been fulfilled to meet the specified inventory target levels.

Challenges in practice

OC retailers face difficulties achieving real-time inventory accuracy, managing cross-channel product returns, and orchestrating OC replenishment rules that integrate dependent decision systems.

First, obtaining real-time inventory transparency and accuracy, i.e., "which SKU is available in which moment in which location" constitutes the most critical challenge.

The causes of this problem are manifold. A large number of OC channels and different fulfillment concepts complicate the management and recording of accurate data. Manual errors such as late checkouts of SFS products further impair the IRI in this context. Moreover, a lack of integrated POS inventory control systems across different channels and along different stages of the retail supply chain, as well as low data update frequencies, prevent real-time inventory visibility.

A further complication is the option to return online orders in the store. Finally, managers are urged to optimize inventory control to avoid unnecessary stockouts and rush orders, or overstocks, respectively.

OC demand forecasting, assortment and inventory planning, replenishment costs, and inventory accuracy serve as inputs, which are often incomplete or faulty. Such deficiencies require higher cycle inventories or safety stocks.

Current research

Govindarajan et al. [2020] extend the problem to multiple inventory locations (i.e., multiple stores and DCs), but again only for a single product. Optimal order-up-to levels are defined within a stochastic dynamic problem for each location and each review period. While store demand is fulfilled as it arrives, incoming online orders are fulfilled by shipping from DCs or SFS, depending on a threshold fulfillment policy. The model accounts for shortage, overage, inventory holding, and distance-dependent unit costs (i.e., picking, packing, labeling, and shipping), but disregards demand interactions between the channels or stores. A specialized heuristic for integrated inventory planning and fulfillment is applied.

Future areas of research

The papers analyzed above help to determine replenishment quantities in varying OC settings. However, all of the models suffer from constrained OC concepts, costs, and demand as well as problem sizes. Practically relevant future research can be obtained from models that represent real-life settings, the consideration of OC returns, the incorporation of inventory accuracy, and advances in short-term revenue management.

First, it is necessary to extend the scope in terms of products and inventory locations and OC concepts.

Second, the existing literature does not sufficiently close the gap between OC returns and inventory control. Most evidently, models considering the reintegration of returns to the stores or returns via shipment to the online DC while also looking at OC concepts are lacking. Also, the actual replenishment and return costs (e.g., picking, packing, labeling and transportation costs between DCs and stores) are so far only partially factored in by Govindarajan et al. [2020].

Third, a problem that did not seem to receive any attention in the current OC literature is the management of IRI, despite being the most critical issue in OC inventory control according to practitioners (see also Hauser et al. [2020]).

Conclusion

Last but no least, while we have outlined connections between the planning issues identified, we have not assessed the dependencies in detail. A model that quantitatively assesses the horizontal and vertical interdependencies of planning steps is still necessary. Here, one can investigate for example how designing the network of fulfillment locations can alter assortment availability. Similarly, defining assortments across channels can be analyzed by considering options for replenishment practices and returns in the channels. Moreover, there is most certainly a wide array of further dependencies with planning aspects outside our scope. Hence, we encourage embedding the store-related planning issues within a greater framework that also covers topics such as purchasing and warehousing or areas related to marketing operations such as product or delivery pricing and promotions. Setting prices for both products and delivery services heavily impacts demand, which feeds subsequent decisions.

Cross-channel effects of omnichannel retail marketing strategies: A review of extant data-driven research (Timoumi, Gangwar, and Mantrala 2022)

Abstract

The authors review 50 empirical retailing research papers that have appeared over the last 20 years to take stock of what we know, need to know better, and do not know yet about within-retailer cross-channel effects of omnichannel retail marketing strategies on (a) consumer responses over their purchase journeys, i.e., online and/or offline search, purchase intention, frequency, amount, returns, loyalty, and (b) the retail firm's aggregate outcomes (e.g., sales, costs, profits, product returns) by channel and overall. Specifically, the authors focus on five strategies: (1) the addition of online channel by an offline retailer; (2) the addition (or subtraction) of offline channels by an online retailer; (3) addition of mobile shopping channel (website and/or app) by offline and/or online retailer; (4) cross-channel integration strategies; and (5) retail marketing mix strategies. The author/s integrate findings from empirical research on these strategies into a number of 'insights' about 'what we know'. Prominent among these are the following: Adding a transactional online channel to an offline channel improves the retailer's overall sales even though offline channel sales can be cannibalized to some degree. Adding an offline channel by an online retailer, however, boosts online channel sales as well as overall sales of the retailer. Similarly, adding a mobile shopping channel usually increases customer purchase frequency and amount and overall sales of the retailer in the long-term. Strategies for greater cross-channel integration generally have a positive effect on a retailer's overall performance while online advertising has positive effects on offline channel consideration and sales as well as overall sales of a multichannel retailer. Other insights or findings that need further study or open questions are also identified. The paper closes with managerial implications of the derived empirical insights, and suggestions for future research.

a 2017 survey of 43000 shoppers of one multichannel retailer reported in Harvard Business Review found that 73% of the study participants were omnichannel customers, i.e., used multiple channels during their shopping journey (Sopadjieva, Dholakia, and Benjamin 2017).

This article is then aimed at: (1) taking stock of the data-driven insights about cross-channel effects currently available in the retailing research literature that can guide the development of effective omnichannel strategies by retailers, whether they currently be offline only, online only, or multichannel retailers; and (2) identifying questions for further research.

In the present paper, we broadly define the cross-channel effects as spillover effects of a retailer's addition or deletion of one channel, or marketing actions within that channel, on consumer responses and retailer outcomes in its other channel/s.

The focal five classes of retail marketing strategies are then: (1) 'adding clicks to bricks', i.e., adding online channel by an offline channels retailer; (2) 'adding bricks to clicks' i.e., adding (or possibly closing) offline channel outlets, e.g., physical stores, pop-up stores or showrooms by a retailer with an online channel; (3) adding a mobile shopping channel, i.e., provision of a website adapted to tablet or smartphone formats and/or a mobile app (i.e., a program that is downloaded and installed onto a user's mobile device that is another purchase channel, e.g., Liu et al. 2019) by online, offline, or multichannel retailer; (4) cross-channel integration strategies; and (5) retail marketing mix strategies.

A customer engages with the retailer along their purchase journey or path to purchase differently for different purposes at different decision stages of their journey. The customer's journey is typically depicted as a five-stage path (e.g., Levy, Weitz and Grewal 2018) comprising need recognition, evaluation, consideration, purchase, and post-purchase. In this paper, however, we follow the lead of scholars such as Grewal & Roggeveen (2020), Lemon & Verhoef (2016), Shavitt & Barnes (2020) in defining the customer journey as comprised of three stages: prepurchase (e.g., 'search'), purchase (e.g., transaction), and post-purchase (e.g., review, returns, repeat) and use this definition to explain the three main components our conceptual framework and their interactions in more depth below.

Based on the customer's journey, we can broadly conceptualize five customer types depicted in Fig. 2: single-channel customers, multichannel customers, webroomers and showroomers, and omnichannel customers.

Single-channel customers (Fig. 2a) are those shoppers who use the same channel, either online or offline, throughout their purchase journey whenever they shop, regardless of the retailer's channel strategy. Multichannel customers may use all the multichannel options of retailers, but on different shopping occasions or purchase journeys, i.e., they are singlechannel on any particular shopping occasion. Webroomers (Fig. 2b) and Showroomers (Fig. 2c) are customers who typically complete the purchase stage from the same channel (online for Showroomers and offline for Webroomers), but perform the pre-purchase stage, i.e., 'search', in the other channel

(Gensler, Neslin, and Verhoef 2017). Lastly, omnichannel customers (Fig. 2d) freely utilize different channels and may crossover at any stage – pre-purchase, purchase, or postpurchase - from one channel to another (perhaps multiple times) along a shopping journey. (In this respect, webroomers or showroomers are special cases of omnichannel shoppers.) They can buy online and pick-up from the store ('BOPS') or return products at stores ('BORS'). They can even perform the same stage in both channels, e.g., search in both offline stores and online website.

The omnichannel retailer engages in omnichannel management as defined, e.g., by Verhoef, Kannan, & Inman (2015), i.e., the synergetic management of its multiple channels and customer touchpoints, in such a way that the customer experience across channels and the performance over channels is optimized.

Lastly, we concentrated on papers that had empirical findings bearing on the following objective consumer-level response measures and retailer outcomes. Specifically, on the consumer side, one or more measures related to 'prepurchase', e.g., channel choice; 'purchase', i.e., purchase intention, purchase frequency, purchase amount (spending level); and 'post-purchase' e.g., product returns, and loyalty to the retailer. As regards retailer outcomes, we focused on papers with findings related to one or more of the following outcome measures: aggregate customer visits, retailer sales, costs, returns, profitability by channel, and overall.

Adding' clicks to bricks' (RQ1)

Insight R1.1: Cannibalization of offline channel sales by a newly added online channel can occur but this effect is highly variable, ranging from negligible to over 90%, depending on the retail setting.

"Cannibalization" of existing customers' offline sales by a newly added online channel in some defined time period is the proportion of total online sales to existing offline customers in that period attributable to sales displaced from the offline channel.

Pozzi's (2013) study found that the Internet channel led to a 13% increase in overall sales with 95% of this effect coming from increased expenditure by existing offline consumers, but with only limited cannibalization at the household level. That is, on average, for every dollar spent online by an existing customer, this study found 67 cents represented fresh business, and only 33 cents were displaced from the retailer's offline sales. However, a study by Hernant & Rosengren (2017) reported a higher cannibalization rate than the previous studies. These researchers used consumer-level data, very similar to that utilized by Pozzi (2013), but drawn from a non-grocery retail setting. They found over 90% cannibalization by a newly introduced online channel within 15 months of its opening.

This divergence is likely attributable to the different product categories, retailer settings and customer types involved in these studies but needs more investigation.

Insight R1.2: Adding an online channel by a hitherto offline retailer has a positive effect on overall retailer performance.

The Internet channel may be generating new business due to attracting new segments of customers who never utilized the offline channel (e.g., Deleersnyder et al. 2002) or, because of greater convenience (e,g., reduction in search or travel costs), growth in online equity (Biyalogorsky and Naik 2003) or diverting business from rival supermarkets and other substitutes, e.g., restaurants (Pozzi 2013).

Insight R1.3: The effects of addition of an online informational ('search') website on offline customer purchase frequency and spending amount can be negative for some product categories and customer segments.

They suggested these negative effects are attributable to more planned shopping enabled by the information available on the website and greater ability to easily compare the retailer's offerings with those of competitive stores in deciding where to shop. However, another study in the same empirical data setting by Pauwels et al. (2011) reported more nuanced findings. Specifically, lower online search costs are especially beneficial for sensory products and for customers distant from the store. Customers in some segments buy more expensive products, suggesting that online search and offline purchases are complements, while customers in other segments reduce their shopping trips, suggesting their online activities partially substitute for experiential shopping in the physical stores.

Adding' bricks to clicks' (RQ2)

Insight R2.1: B&M stores openings have a positive longterm effect on online channel sales, especially where the online presence is weak, and boost overall performance of the retailer.

Insight R2.2: B&M store openings tend to cannibalize catalog sales in the short term and increase product returns.

The authors found that while physical store openings decrease catalog sales in the short term, they had no short-term effect on Internet channel sales. Further, sales increase in both catalog and Internet channels in the long run, but more so in the online channel. Furthermore, the store openings stimulated long-run increases in first-time and repeat customer counts in the non-store channels leading Avery et al. (2012) to conclude that the addition of bricks to clicks has a long-term complementary effect, with stores acting as the brand's billboard.

Pauwels & Neslin (2015) also found that while store introduction cannibalizes catalog sales, it did not affect Internet sales. Also, while product returns and exchanges increased, so did overall sales. Transaction size of purchases, returns, and exchanges did not change.

Further, Wang and Goldfarb observe a large increase in new customer acquisition and overall sales. They conclude that although online and offline channels may be substitutes in distribution, they are complements in marketing communications that effectively inform consumers about the existence of the brand.

Kumar, Mehra & Kumar (2019) posit that a store engagement effect – the probability of interaction due to a physical store - is the reason for the increase in online purchases. They also find that allowing customers to purchase online and return the product in-store plays a significant role in increasing online sales for an omnichannel retailer. Kumar, Mehra & Kumar (2019) also found opening a physical store increases overall sales.

Insight R2.3: A well-advertised pop-up store, or showroom, has a complementary effect on sales of a hitherto online retailer.

Insight R2.4: A showroom boosts the retailer's overall performance.

Moreno (2015) report that showroom openings had a positive overall demand increase impact of 10%, while in locations with showrooms, direct sales through website increased by 7%.

Moreover, showroom openings generate operational spillovers and increase overall operational efficiency by: (1) attracting customers who, on average, have a higher cost-to-serve; (2) increasing conversion in a sampling channel; and (3) decreasing purchase returns.

Insight R2.5: Closing offline channel (e.g., catalog, stores) can have a negative effect on customers' purchase incidence and loyalty to the retailer.

Adding mobile channel

A mobile channel allows consumers to use their smartphone or tablet devices to visit, search and order from the retailer's online webstore or via a downloadable mobile app of the retailer.

Insight R3.1: Adding mobile shopping channel by onlineonly retailer cannibalizes retailer's existing online channel customers' purchases in the short term but boosts the retailer's overall sales in the long term and increases consumers' online purchase frequency and order size, especially for previously low spenders.

Specifically, the addition of the mobile channel increased the overall revenue from channel adopters by 18.4%. Mobile channel complements the online channel in time-critical searches and triggers additional transactions on the online channel.

They found, first, as customers develop the habit of M-shopping, their value to the online grocer increases since they place orders more frequently. Second, the positive effect of M-shopping on subsequent purchase behavior is more pronounced on previously low-spenders who place larger orders on a more frequent basis after adopting Mshopping. In another similar quasi-experimental study using consumer-level transaction data, Huang et al. (2015) found that after mobile channel adoption, the purchases on the web channel were slightly cannibalized;

however, the consumers' purchase frequency and purchases increased overall, suggesting that the positive synergy effect of the new channel exceeded its cannibalization effect.

Insight R3.2: Adding mobile app channel by multichannel retailer boosts customers' purchase frequency, spending amount, and returns in both existing online and offline channels of the retailer and overall, with the impact being greater on offline-only customers than on onlineonly customers, in a less competitive mobile app market. The positive effect can reverse in a market with many competitors offering mobile apps.

Narang & Shankar (2019) found, first, a complementary effect, i.e., app adopters' purchases in both, the online and offline channels increase after app launch. Furthermore, app adopters buy 33% more frequently, 34% more items, and spend 37% more than non-adopters in the period after app introduction. At the same time, they return 35% more frequently, 35% more items, and 41% more in dollar value. Overall, app adopters spend 36% more in net monetary value.

Van Heerde, Dinner & Neslin (2019) found that app access behavior of offline-only and online customers was similar across all metrics but generated more incremental sales among offline-only customers compared to online customers, especially among offline-only customers not located near the physical store. This finding supported their theory that distant and offline-only customers' needs for convenient interaction or digital engagement are not being met in the absence of the app. In other words, the "value proposition" of retailer apps is to deliver convenient access to a superior digital engagement than that provided by visiting the retailer's website directly.

Cross-channel integration (CCI) (RQ4)

Cao & Li (2015) define CCI as "the degree to which a firm coordinates the objectives, design, and deployment of its channels to create synergies for the firm and offer particular benefits to its consumers."

Following Cao & Li (2015, 2018), any or a combination of following elements contributes to CCI by a multichannel retailer: integrated marketing communications, i.e., consistent use of the same brand and messaging in all channels; integration of shoppers' order fulfillment, e.g., 'Click & Collect' options (see below), 'Buy online and return in-store (BORS)'; integration of consumer information access, e.g., access to online inventory and online orders fulfilled by staff in-store, allowing online consumers to browse the inventory in-store, linkage between store and mobile app (WiFi in-store, locating store by mobile app). More comprehensive or 'Full' CCI would include alignment of all marketing mix elements in all channels, centralization of back-end systems, and organization transformation.

Insight R4.1: In general, greater CCI by a multichannel retailer has a positive effect on customers' purchase intention, purchase value, and loyalty to the retailer.

This perceived integration reduces the customer's perception of risk associated with the potential unavailability of a desired product at a particular channel.

Swaid & Wigand (2012) studied the impact of a specific type of CCI, specifically, offering customers the option of integrated-pickup (or 'buy online and pick up in-store ', i.e., BOPS discussed in more depth below). They found that perceived online service quality or value is significantly influenced positively by integrated pick-up and in turn, has a positive impact on customer loyalty.

A third study bearing on the value of integrating website and physical store design by multichannel retailers by Emrich & Verhoef (2015) found that a homogenous design (with cues corresponding to their physical stores) rather than a prototypical design (with channel-specific attributes) for the online shop creates a positive impact on intended customer patronage especially when the customers have had good shopping experience in physical stores and show high processing intensity.

Lastly, the study by Herhausen et al. (2015) investigated the indirect effect of online-offline 'OI" integration, i.e., integrating access to and knowledge about the offline channel into an online channel, on consumers' search intention, purchase intentions and willingness to pay. They found that integration increases all three because it is associated with a higher perceived service quality by the customer and a lower perception of risk. While the positive effect of integration on the perceived service quality of the online store is through a direct effect, the positive impact on overall willingness to purchase (WTP) is through an indirect effect.

In particular, offering a comparable product assortment in the online and offline store strongly improves the transfer of chain preferences and results in a higher likelihood for the consumer to choose the online alternative of a chain.

Insight R4.2: In general, greater CCI by a multichannel retailer has a positive effect on overall retailer performance.

Cao & Li (2015) found that CCI boosts sales growth for firms with less online experience, provided they can leverage their physical stores and existing distribution capabilities. Firms with larger physical store networks benefit less from coordination activities across channels.

Tagashira & Minami (2019) performed a stochastic frontier analysis of publicly listed corporate-level data collected from Japanese multichannel retailers. They found that CCI, particularly a higher level of integrated marketing communications, is positively associated with the multichannel retailers' cost efficiency, which in turn improves firm performance.

BOPS as a CCI strategy: BOPS functionality provides customers with real-time store-level product availability information, i.e., the retailer shows online viewers the locations at which the items are available, lets customers complete transactions online, and allows customers very soon thereafter to pick up the items in a store at their convenience (Gao and Su 2017). BOPS reduces shopping transaction costs for customers since items are picked and packed by store employees prior to customer pick-up. Last but not least, BOPS transactions are considered online revenue.

A C&C option that is not materially different from BOPS from a consumer viewpoint is the 'ship-to-store' (STS) strategy. The main difference between them is from the retailer standpoint, i.e., BOPS uses in-store inventory to fulfill customer demand while STS uses centralized fulfillment and typically takes somewhat longer to fulfill (Akturk, Ketzenberg and Heim 2018).

Insight R4.3: Implementation of BOPS by non-grocery multichannel retailers has a positive effect on the retailer's total revenues, i.e., any reduction in consumer spending online is made up by spending increases offline.

Gallino and Moreno observed that while online sales dropped around 7% after BOPS implementation, B&M sales in stores increased by 6%, and given the much larger proportion of the latter sales in the retailer's total sales, ultimately implied an average net increase of 4% of the total sales. In short, this study showed BOPS implementation results in lower online sales, higher store sales, and higher store traffic.

Akturk, Ketzenberg & Heim (2018) found cross-channel customer returns of online purchases to physical stores increased while returns from store purchases were reduced. Detailed analysis of the data showed that high-value purchase customers switched from completing the online channel's STS process to completing the purchase in the brick-and-mortar channel – and often bought even more expensive products in the process!

Insight R4.4: BOPS and C&C have positive effects on customer's online and offline spending

Gallino & Moreno (2014) also found a positive effect on online purchase amount and, in fact, reported that ultimately BOPS usage can simultaneously enhance offline and online spending (in their study, about an increase of $5 in monthly spending).

We speculate that the big difference between Gielens, Gisjsbrechts & Geyskens (2021) conclusion about an increase in online channel spending as a result of C&C versus the earlier studies we have reviewed is related to the differences in retail settings of the various research studies. Specifically, grocery purchases are much more regular, planned, and familiar than the purchase of durable goods or appliances. Hence, the timing of purchase, freshness of food and convenience in ordering and pick up are key needs for consumers to buy groceries. This mix of needs can be clearly satisfied to a great degree by C&C options. In contrast, durable goods like furniture and jewelry are more 'touch and feel' and 'try' type products which could increase the temptation to channel-switch during usage of BOPS service by the retailer.

Multichannel retailer's marketing mix strategies (RQ5)

In this section, we provide empirical insights (many are, however, findings from single studies) from the extant research on cross-channel impact of marketing mix (MM) strategies pertaining to variables such as price, product assortment, marketing communications (advertising, catalogs, emails), price promotion, returns and delivery policies.

Insight R5.1: Customers of multichannel retailers are willing to pay a somewhat higher price for an item in the offline channel than its price in the online channel.

They found that customers are willing to accept at most 2% higher prices offline than online, for a broad range of products (in between very high-priced products or low-priced takeaway items, which seem to permit higher price premiums). Further investigation showed that customers' heterogeneity moderates the willingness to accept an offline premium, i.e., some customer segments are resistant while others respond less negatively to higher offline prices. Lastly, consumers seem more tolerant of offline price premiums for unplanned purchases.

Insight R5.2: Optimized product assortment offline has a positive effect on the total revenue of a retailer.

Using conjoint analysis in a lab experiment, they estimated that an optimized offline assortment increases the total revenue by up to 40%. Hence, offline assortment, which "showcases" the product attributes, impacts profits across both offline and online channels.

Insight R5.3: Online advertising by a multichannel retailer can have strong effects on offline channel sales. Hence, measuring the impact of (online and/or offline) advertising on only a single channel by a multichannel retailer does not fully account for its total impact, i.e., cross-channel effects exist and must be accounted for in deciding resource allocations.

Dinner, Heerde Van & Neslin (2014) expand on the work of Naik & Peters (2009) by considering actual purchases, carryover effects, competitive effects, and endogeneity using sales data from a large US, multichannel clothing retailer. Specifically, they found: (i) positive cross-channel advertising effects that are almost as strong as own-channel effects; (ii) online advertising, and in particular search advertising, is more effective than traditional advertising in driving overall sales, primarily due to the strength of online to offline cross-channel effects; and (iii) while traditional advertising has a positive direct cross effect on online sales, it negatively (positively) impacts click-through rates (impressions) of paid search ads.

Insight R5.4: Catalog mailings by a multichannel retailer can drive new customers' choice of shopping in a noncatalog channel (web, store) of the retailer.

Insight R5.5: Catalog mailings by a multichannel retailer can increase purchases in web and physical store channels.

Insight R5.6: Emails induce migration of catalog consumers to the Internet and a higher online channel purchase frequency.

Mark et al. (2019, p.537), in their study of a multichannel online + offline + store retailer, found email communication (after controlling for catalogs, demographics, and seasonality) have a significant positive effect on the web channel use for all uncovered segments in their consumer-level study sample.

Insight R5.7: Cross-channel effects of marketing efforts in a retailer's channels with similar (dissimilar) primary influence roles are substitutional (complementary) and asymmetric.

Insight R5.8: Price promotions in one channel of a multichannel grocery retailer can have negative and asymmetric effects on category purchases in the retailer's other channel.

They find that (1) promotions in one channel can have negative effects on category purchases in the other channel during the promotion period, (2) similar to Shankar & Kushwaha's (2021) finding, these cross-channel effects are asymmetric, (3) high promotion frequency can have negative effects on future promotion effectiveness in the other channel, and (4) cross-channel effects are more negative for more loyal customers of the chain.

Insight R5.9: Coupons that are redeemable across multiple channels have asymmetric cross-effects depending on the channel where the coupon is offered.

Insight R5.10: Reduction in delivery time of online orders can lead to increases in both online store sales and offline store sales for a multichannel online+offline retailer.

Insight R5.11: Returns period reduction may not affect online sales but can adversely affect offline store sales of a multichannel retailer.

They found that the RPP change does not have any statistically significant effect on sales and return rates for online stores, but it decreases offline sales by 8%, return rate by 2.7 percentage points, and profit by 7.3% per brick-and-mortar store, corresponding to a 2.7% decrease in annual sales for the retailer.

The decision of retailers to become omnichannel seems to be complicated further due to external forces that might influence the retailer's channel strategies. As suggested in our framework (Fig. 1) – but still greatly under-researched - competition and technology are likely to moderate the crosschannel effects of the retailer's strategies and hence, its decision to become omnichannel.

Another key insight from the literature is the positive effect of the mobile channel. We believe that retailers should rely more on this channel and improve it further. The mobile shopping experience will be bolstered by new and everevolving Artificial Intelligence tools, Machine Learning, Big Data, and the like.

Better AI algorithms for Inventory logistics and curbside pickup will help create a smoother shopping experience for customers.

With AI-enabled knowledge of customer's previous purchases, a retailer will customize a product or service for the customer. Retargeting algorithms will reinforce learning. A personalized ad targeting engine will learn about each customer through various interactions, frequency & time of order placement. The follow-up customized and curated advertisement will be delivered accordingly to ensure the maximum chance of customer making the purchase.

Adapting warehouse operations and design to omni-channel logistics - A literature review and research agenda (Kembro, Norrman, and Eriksson 2018)

Abstract

Purpose The purpose of this paper is to increase the understanding of how warehouse operations and design are affected by the move toward integrated omni-channels.

Design/methodology/approach A structured literature review is conducted to identify and categorize themes in multi- and omni-channel logistics, and to discuss how aspects related to these themes impact and pose contingencies for warehouse operations and design.

Findings The review revealed a lack of focus on warehouse operations and design in multi- and omnichannels. Instead, most articles published in scientific journals discuss changes in consumer demand and implications for the network level, concerning aspects such as the organization and management of material and information flows, inventory management, resources, actors and relationships. Ten themes in omni-channel logistics were identified and grouped into two categories: the value proposition and channel management; and the physical distribution network design. The themes and related aspects have implications for warehousing, and by combining these with general warehousing knowledge, the authors derive a comprehensive and structured agenda is derived to guide future research on omni-channel warehousing.

Research limitations/implications This paper outlines a research agenda, including detailed research questions, for advancing the theory on warehouse operations and design in omni-channels.

Practical implications – The agenda can inspire practitioners in their work to understand the upcoming challenges and address relevant issues in omni-channel warehousing, taking into consideration its interdependence with value proposition, channel management and network decisions.

Originality/value This is the first comprehensive review focusing on and synthesizing available literature on omni-channel warehousing. This topic has until now received limited coverage but is of increasing importance to scholars in the field.

Brief

In omni-channels, inventories and order fulfillment are conflated, and customers can place their orders in one channel (e.g. on a smartphone), pick up or receive through another channel (e.g. home delivery), and return products in a third channel (e.g. physical store) (Brynjolfsson et al., 2013; Piotrowicz and Cuthbertson, 2014; Saghiri et al., 2017).

Essential considerations for distribution systems (also referred to as omni-channel logistics) include, for example, how and where to keep stock and fulfill orders for store replenishment and e-commerce, and how and where to handle the increasing return flows (Bernon et al., 2016; Hübner, Wollenburg and Holzapfel, 2016).

One major challenge is, for example, to effectively combine the handling and shipment of small consumer online orders with large store replenishment orders, orders and shipments that previously were handled in separate channels (Hübner et al., 2015). As argued by Rouwenhorst et al. (2000, p. 515), "the efficiency and effectiveness in any distribution network is largely determined by the operations of the node in such network, i.e. the warehouses." Having previously been considered as a burden because of high capital and operating expenses (De Koster et al., 2007; Bartholdi and Hackman, 2016), warehouse operations are now increasingly regarded as a strategic component of supply chains and omni-channel retailing particularly (Hübner, Holzapfel and Kuhn, 2016).

We use the term warehouse as a representation of various material-handling nodes that are used in omni-channels. Such nodes include, for example, distribution centers, direct fulfillment centers (designed to handle e-commerce orders and ship directly to consumer) and forward fulfillment centers (FFCs) (using retail stores as logistic hubs located closer to the consumer). We also use the term network as a representation of a distribution system consisting of transportation links connecting multiple nodes such as material-handling centers, suppliers and retail stores.

Warehouse operations and design

Warehouses can, according to Bartholdi and Hackman (2016, p. 3), be described as "the points in the supply chain where [the] product pauses, however briefly, and is touched." The rational for using a warehouse is, for example, to match supply and demand, to consolidate a range of products and to reduce transportation costs and lead times (Faber et al., 2013).

Most warehouses have operations for receiving, put-away, storage, picking, sorting, packing and shipping (see, e.g. Van den Berg and Zijm, 1999; Petersen and Aase, 2004). Along with increased e-commerce, many distribution warehouses also have extensive return operations (Bernon et al., 2016). First, when products arrive at the warehouse, they are checked for quality and registered before being put-away in the assigned storage location (Bartholdi and Hackman, 2016). Storage includes a reserve area and a picking zone (Frazelle, 2002). The latter includes a limited quantity of each product, also referred to as a stock-keeping item (SKU), that can be easily retrieved (Rouwenhorst et al., 2000). SKUs are either dedicated or randomly assigned to a location.

Picking represents most of the operations cost and has by far been the most-researched topic in warehousing (see, e.g. Le-Duc and De Koster, 2005; Bottani et al., 2012). Picking efficiency can be improved by putting the fastest moving products in the most convenient locations (Gu et al., 2007) and by selecting the appropriate picking methods.

To make warehouse operations effective and efficient, multiple design aspects and resources must be considered, including: physical layout, e.g. placement of docks, aisle configuration, lane depth and stacking height (Huertas et al., 2007); storage and handling equipment, e.g. different types of racks and different types of forklifts for put-away and picking (Rouwenhorst et al., 2000); automation solutions, e.g. conveyors and robots (Baker and Halim, 2007); information systems, e.g. the warehouse management system (WMS) (Faber et al., 2002); and labor management, e.g. scheduling, rotation and shifts (De Leeuw and Wiers, 2015).

The contingency approach (Donaldson, 2001) of tailoring operations and design to the particular context is receiving increased attention in the warehousing theory. Lower performance would thus be expected if there were a misfit between warehouse operations and design and a number of contingency factors.

Meanwhile, understanding the characteristics and size of current and forecasted demand, including seasonality and growth of overall demand and variety within the product portfolio, is critical to assign appropriate capacities for storage and labor (Rouwenhorst et al., 2000; Frazelle, 2002; Gu et al., 2010).

Themes in omni-channel logistics

We identified ten themes in omni-channel logistics and grouped these into two categories, namely, aspects and decisions related to meeting the consumers' requirements and expectations as well as the organization and management of resources, actors and relationships in the omni-channel (referred to as value proposition and channel management); and aspects and decisions related to design and planning of the physical flow of goods from supplier to customer through the network of nodes and links (referred to as physical distribution network design).

Value proposition and channel management

Differences in demand profiles and increased assortment. The store-order size often differs significantly from the size of orders placed online by a single customer. This difference is a central challenge in the transformation to omni-channel logistics when trying to integrate store- and online orders and create time- and cost-efficient warehousing operations (Hübner et al., 2015).

Another important consideration is the increasing product assortment made available through e-commerce and online marketplaces (Wollenburg et al., 2018). This expansion may entail a higher complexity in warehousing, for example, precipitating an increased need for storage space as well as an increase in the numbers and types of storage locations visited during order picking (de Koster, 2002b; Hübner, Wollenburg and Holzapfel, 2016).

Development of channel management strategies. "the omni-channel retail logistics landscape is continuously evolving. These transitions are caused by complex dynamics which arise from actions of large online retailers, other omnichannel retailers and demanding customers."

Omni-channel retailers aim to create a seamless front-end experience for their customers, but there is still a lack of research on how companies address the increasing complexity in back-end fulfilment and to what extent they choose to integrate or separate their different channels (Wollenburg et al., 2018).

Another research stream suggests that a range of factors, such as assortment, demand profile, current distribution network, customer expectations, and market and organizational characteristics, impact the appropriateness of integrating back-end fulfilment (e.g. Lang and Bressolles, 2013; Larke et al., 2018; Wollenburg et al., 2018).

New services requiring new types of competencies and capabilities. Examples of such services include new packaging solutions, new tools for channel tracking and new solutions for customer accessibility to return points (e.g. Wallace et al., 2009).

Recent studies suggest that the ability to reallocate resources and develop new services will be highly rewarding (Oh et al., 2012; Ishfaq et al., 2016), and that it will be critical for retailers to understand the new set of capabilities and competencies that are required for these new services, e.g. store personnel's ability to manage more complex information systems. Research on this theme is, however, limited.

The role of logistics service providers (LSPs). LSPs could play an important role in developing unique capabilities and new omni-channel solutions. Engaging with specialist service providers to develop new omni-channel solutions may, in fact, become a point of differentiation for retailers (Bernon et al., 2016).

Performance metrics and incentive systems for risk and gain sharing. Similarly, Vinhas et al. (2010, p. 229) argue that retailers must update their performance metrics and compensation systems in order to promote value creation and avoid outdated channel structures. Retailers will also need to adopt an integrated approach to performance management to avoid channel conflict, which could reduce the performance of the entire omni-channel (Webb, 2002).

Mangiaracina et al. (2015, p. 584) conclude: "there continues to be a general lack of quantitative models for measuring the environmental impact of B2C e-commerce and dividing it among the supply chain players."

Physical distribution network design

Increasingly complex distribution and returns process. The decision of where an order should be picked and shipped from (e.g. manufacturer, distribution center, retail store) is complex, involving aspects such as lead times, transportation costs, handling costs, fixed operating costs, holding costs and backorder costs (Lang and Bressolles, 2013; Hübner, Kuhn and Wollenburg, 2016; Ishfaq et al., 2016).

Research has predominantly focused on the cost evaluation of omni-channel distribution networks, and only recently started to incorporate environmental impacts into the decision

(Melacini and Tappia, 2018). The complexity of the network design is further increased because of liberal return policies and increasing return flows (Bernon et al., 2016).

While generous return policies and multiple return points are convenient for the customer, they pose major challenges for retailers and raise the question of how to design the optimal network with high accessibility and low logistics cost (Hübner, Holzapfel and Kuhn, 2016).

The retail store's potential role as material-handling node. This means a store could create additional value for retailers by simultaneously being responsible for displays, marketing, customer service, direct sales, pick-ups, returns and order fulfillment for e-customers (Cao, 2014).

It may be that some of the responsibilities of the store are in conflict with each other. As an example, designing a layout for displaying products with the purpose of increasing sales is significantly different from designing a layout that supports efficient order fulfillment (Hübner, Kuhn and Wollenburg, 2016).

Inventory management in increasingly complex networks. Optimizing inventory levels in an omni-channel distribution network with several different types of material-handling nodes is a complex undertaking (Bretthauer et al., 2010; Melacini et al., 2018).

Important aspects concern the mixing of online/offline inventories and determining re-order points at the various nodes. Xu et al. (2017) underline the need for more complicated models including multi-item and multi-level models, to account for multiple points for order fulfillment, pick-up and returns where, "minimizing inventory cost is just one cost component and may not lead to a selection of online fulfillment locations that minimizes total cost (holding, backorder, transportation, handling, and fixed operating costs) for the firm" (Bretthauer et al., 2010, p. 129).

Capacity planning and allocation. One of the major challenges not only to inventory management, but also to capacity planning and allocation, concerns demand fluctuations. High uncertainty in both long- and short-term demand makes capacity planning and allocation complex (Agatz et al., 2008; Xie et al., 2014).

One measure addressing capacity issues that has received some attention in the literature is the postponement of orders across channels. This approach is used to shift e-commerce and store replenishment orders forward and backward in time primarily in order to balance the workforce in the network (Hübner et al., 2015).

Integrated information system for distributed orders and handling. In particular, development of an integrated customer database across touchpoints, and efficient information exchange with suppliers across categories, becomes a prerequisite." An integrated system could make it possible to coordinate inventory information and increase the visibility of inventory across all material-handling nodes in the network (Hübner, Wollenburg and Holzapfel, 2016). It also makes it possible to facilitate the decision-making process of how and where orders should be fulfilled in order to improve service levels while decreasing total costs, including costs for holding, backordering and transportation (Mahar and Wright, 2009).

An integrated system for handling these features is often referred to as a distributed order management (DOM) system (Napolitano, 2013). The DOM system can be regarded as an enabler of "a true [omni-channel] logistics solution resulting in a seamless [omni-channel] experience for retailer and customer" (Hübner, Wollenburg and Holzapfel, 2016, p. 578).

Implications for omni-channel warehousing

The identified themes and the change that each of them represents have a varying array of implications for warehouse operations and design. One theme can have implications for several different aspects of warehouse operations and design, and decisions regarding one aspect (e.g. level of integration in DC) may create new conditions for another (e.g. inventory management across the network). Meanwhile, multiple themes can have implications for the same operations or design aspect. This complexity of how themes and implications interact (with multiple many-to-many relationships) makes it difficult to describe a single impact that one theme may have on one aspect of warehouse operations and design. It is also worth pointing out that some of the highlighted themes and issues can be handled by already-existing technology, and new technologies are currently being implemented and tested in pilot schemes. From a research perspective, it would be beneficial to study these implementations as well as how the technologies can be used on a larger scale.

A major challenge for warehousing is the increasing number and types of warehouses and stores in a given network and the growing mix of channels (Gu et al., 2010; Marchet et al., 2018).

In order to handle incoming goods from multiple suppliers as well as increased consumer returns, retailers need to consider time windows for arrival of goods and the possibilities for the pooling and balancing of warehouse space and workforce (Petersen and Aase, 2004; De Leeuw and Wiers, 2015). Other requirements for receiving include larger areas and dedicated staff with new skills and competencies to handle registering and sorting of goods for quick input into the warehouse (Hübner, Holzapfel and Kuhn, 2016).

The integration of multiple flows in the same warehouse will also have implications for packing and shipping. Integrating storage for the online and store channels may require mixing picking and sorting methods (e.g. single vs batch picking), which are adapted to the characteristics of each channel.

Customer requirements for home delivery and shorter time windows (Hübner, Kuhn and Wollenburg, 2016) may also increase the complexity of sorting activities considering the variety of final destinations and shipping times. These complex and time-consuming sorting activities increase the need for sophisticated WMSs and functionalities (Faber et al., 2002), and may require retailers to consider automation alternatives such as conveyer belts (de Koster et al., 2007).

Various systems will also need to be integrated with each other to enable the sharing of inventory and order information across the omni-channel (Oh et al., 2012; Napolitano, 2013).

Another implication and big challenge for warehousing is that the time from order to delivery has increased in importance for omni-channels (Marchet et al., 2018). Customers expect shorter lead times, which puts pressure on reducing throughput times in warehouses, that is, the total time required from order placement to it being picked, sorted, packed and shipped (Hübner et al., 2015).

Another implication of reduced lead times is an increased level of automation of various warehouse operations to improve the speed of material handling (Hübner, Kuhn and Wollenburg, 2016).

In the long term, one of the main challenges will be insufficient warehouse space where retailers must consider leveling strategies to balance demand and capacity over time.

Particularly, integrated inventory systems make it possible for the retailers to keep less inventory and create an opportunity to achieve a higher overall service level due to inventory pooling (Hübner, Holzapfel and Kuhn, 2016, Hübner, Wollenburg and Holzapfel, 2016). Integrated inventory systems will however lead to more complex inventory management, and joint inventory for multiple channels might lead to different requirements on service levels that must be aggregated into an overall inventory policy (Agatz et al., 2008; Hübner et al., 2015).

While retailers may operate with fixed delivery patterns for stores, the online order volumes are often harder to forecast (Hübner et al., 2015). Demand fluctuations and uncertainty put pressure on warehouses to be able to quickly increase or decrease capacity, for example, by distributing or shifting labor resources over the week and across operations (Agatz et al., 2008).

Considering this escalated need for multi-faceted flexibility, companies evaluate if and what warehouse operations should be carried out in-house vs the pros and cons of outsourcing to an LSP (Napolitano, 2013; Bernon et al., 2016).

One of the main focuses will be on improving picking operations, considering their large share (often around 50 percent) of total warehouse costs (Bartholdi and Hackman, 2016). However, while integrated picking operations for store and online orders have several advantages, such as economies of scale and flexibility in short-term capacity allocation, this approach implies a more complex picking system, which requires "assimilated infrastructures, resources and know-how for picking orders of both channels to handle outlet volume and single parcel volume" (Hübner et al., 2015, p. 90).

Hübner, Holzapfel and Kuhn (2016, p. 275) add: integrated DC locations for both channels increase the complexity of warehouse operations," where integrating flows could result in too much complexity for handling the range of products and orders. Thus, retailers need to measure and evaluate if the gains from integrating inventories and pooling capacities outweigh the increased complexity in picking, or if it would be better to separate part of the flows into different warehouses.

Applying transfer learning to achieve precision marketing in an omni-channel system – a case study of a sharing kitchen platform (Chiu and Chuang 2021)

Abstract

Omni-channel marketing is an enhanced cross-channel business model involving shared data that allows enterprises to enhance and facilitate customer experience. Omni-channel opportunities shape retail business and shopper behaviours by coordinating data across all channel platforms while enabling their simultaneous use. Artificial intelligence (AI) has played an increasingly critical role in marketing analysis. With the proper training, AI can predict consumer preferences and provide recommendations based on historical data to achieve precision marketing in e-commerce. At present, however, the existent chatbots on many product-ordering platforms lack AI refinement, resulting in the need to ask customers multiple questions before generating a reliable suggestion, yet an effective way to incorporate AI in an omni-channel platform has remained vague. Hence, the aim of this study was to develop an omni-channel chatbot that incorporates iOS, Android, and web components. The chatbot was designed to achieve personalised service and precision marketing using convolutional neural networks (CNNs). A shared kitchen case study demonstrates the advantages of the proposed method, which is transferable to other consumer applications such as clothing selection or personalised services. The number of food offerings and the quality of image classifiers set the research limitations, pointing toward the direction of future research.

Brief

Many researchers now incorporate AI and promotion strategy to forecast market demands. However, because of the complexity of these newer technologies, both AI and omni-channel development have displayed difficulty with integration and scalable technology in their back-end processes. Hence, the aim of this study was to develop a chatbot for an omni-platform that contains iOS, Android and web components and that provides a model for how to accomplish precision marketing and personalised service based on convolutional neural networks (CNNs). The platform would also be designed to mitigate the service providers' effort with respect to e-commerce using a transfer learning process.

Artificial Intelligence

Wang, Kung, and Byrd (2018) singled out five big data analytics capabilities for generating business value: analytical capability for patterns of care, unstructured data analytical capability, decision support capability, predictive capability, and traceability.

The goal of data mining in marketing is to achieve strategic business value, which provides a competitive advantage for the business (Grover et al. 2018).

Chatbots can help users capture timely and effective assistance or information (Chung et al. 2018). Doshi et al. (2017) developed an automatic chatbot that responded to users immediately through an AIML interpreter. Chatbot can optimally use different functions in different channels so that the extracted chatbot knowledge is of higher quality (Abdul-Kader and Woods 2015). These virtual assistants have attracted attention from business organisations because they can help improve customer relations support, reducing the costs in customer service centres and handling multiple clients simultaneously (Reshmi and Balakrishnan 2018).

Omni-channel Retailing

The scope of multi-channel analysis was broadened by considering issues such as the management of customers across channels and the integration of the retail mix across channels (Neslin et al. 2006).

While multi-channel retail and channel selection strategies have been key issues at many retail companies (Zhang et al. 2017), the omni-channel strategies have enhanced customer service via channel substitutions and faster deliveries (Wollenburg et al. 2018).

A decade ago, the term 'omni-channel' emerged, defined as 'an integrated sales experience that melds the benefits of physical stores with the information experience of online shopping' (Rigby 2011). Fulgoni (2014) described the omni-channel as a method for meeting the desire to serve the client no matter whenever or wherever they wished to purchase merchandise.

In an omni-channel system, both improving customer value as well as operational efficiency and giving a seamless shopping experience to customers can be fully supported (Gao and Su 2016). The target of omni-channel management is to integrate multiple channels to achieve better overall performance across the supply chain (Xu and Jackson 2019).

Ailawadi and Farris (2017) highlighted important issues for retailers managing multi- and omni-channel distribution operations. Paul et al. (2019) proposed the best share capacity sharing strategy for omni-channel retail distribution. Nonetheless, omni-channel retailing still faces the challenge of developing solutions that can facilitate customer shopping experiences with ease and simplicity.

Research Gap

In response to that prior work, we address the following two points: (1) the existing chatbots on many ordering platforms lack AI optimisation, which means that multiple questions need to be asked of users before the system becomes capable of generating reliable recommendations;

and (2) identification of the optimal way to incorporate AI into an omni-channel platform remains ambiguous (Chuang and Chiu 2017).

As a desired outcome, the omni-channel platform should demonstrate the ability to better understand customer demand in a timely manner.

Methodology

There are two phases in the research framework. In phase one, this study developed an omni-channel platform that contains Android, iOS and web page elements. In phase two, this study taught the chatbot patterns and responses using transfer learning. This study collected and input 4000 images to build a CNN model with proper classifiers. During the study, if a service provider uploaded a picture of a product or a service, the system determined the labels automatically based on the CNN classifiers.

A trained ML model was used to fetch the data and calculate the relationship between a user historical data and information of all the available products, automatically deleting unsuitable options for user using classification and regression tree (CART) algorithm. Completing the process, we built an AIML chatbot that could recognise customer demands and generate recommendations. Based on the results from the CNN models and CART, the chatbot determined what questions to ask customers. An omnichannel platform with a smart recommender system was realised.

How Technology is Changing Retail (Shankar et al. 2021)

Abstract

Retailing is undergoing a remarkable transformation brought by recent advances in technology. In this paper, we provide a deep discussion of and look ahead on how technology is changing retail, starting with a classification of technologies that impact retailing, in particular, in the COVID-19 and beyond world. We discuss different theoretical frameworks or lenses to better understand the role of technology in retailing. We identify and elaborate on the drivers and outcomes of technology adoption by shoppers, retailers, employees, and suppliers. We speculate on future retail scenarios and outline future research avenues on technology and retailing. We close by concluding that technology is not only reshaping retailing, but also allowing retailing to pivot in the face of new and unforeseen circumstances.

Brief

Applications of AI in retailing include personalization and recommendation systems, sales/customer relationship management, customer service management, supply chain optimization, inventory management, and store task creation.

The dramatic week-to-week or day-to-day changes in shopping trends during the pandemic's outbreak mean that those with instant access to data would be better informed and make better investments than those using less current data.

While much research has examined how technologies such as pointof-sale, automated teller machine (ATM), and the Internet have changed retailing, not much is known about the impacts of emerging technologies such as micro-cloud computing, new robotics, fifth generation (5G) telecommunication, the Internet of Things (IoT), virtual reality (VR), augmented reality (AR), and mixed reality (MR) on retailing.

Many of the technologies are powered by artificial intelligence (AI). The integration of AI into these emerging technologies adds another layer of change to the retail ecosystem. There is a dearth of deep analyses and frameworks that enable a better understanding of the impact of these technologies on retailing. In this paper, we seek to close this gap in understanding of technologies' impact on retailing. In the next section, we begin by presenting a classification of technologies that impact retailing. We then discuss different theoretical frameworks or lenses to better understand the role of technology in retailing. We follow it up by identifying and elaborating on the drivers and outcomes of technology adoption by shoppers, employees, suppliers, and retailers.1 In the subsequent section, we speculate on future retail scenarios and outline future research avenues on technology and retailing. We close with our conclusions on how technology is reshaping retailing.

Classification of Technologies Impacting Retailing

Our operationalization of technology is focused on information and communication technologies, which are systems used for storing, retrieving, processing, and sending information. These systems require both hardware and software components.

On the demand side, these technologies create digitized services such as AI-enabled consumer choice assistance, recommendations, and ecommerce. They also help retailers build elivery capabilities such as buy online and pick up offline and develop support and payment competencies through automated customer service, digital payment service, and telemedicine service. Increasingly, these technologies are delivered through mobile devices and platforms that leverage the growing use of mobile technology by shoppers for purchase research, purchase execution, and order tracking.

From the supply chain standpoint, warehouse robots, scan drones, and scan robots are assisting humans. In some cases, these technologies are replacing humans, causing a wholesale

repurposing of the roles they play within the supply chain. Some of the demand induced digitized services are also creating a strain on the delivery side of the supply chain due to the growing instant gratification needs of shoppers.

Categorize Technologies by Stakeholder Type

Customer-Facing/Shopper-Facing Technologies

These technologies are used by customers/shoppers and facilitated by retailers to enhance customer engagement with products, services, or brands. Examples include mobile devices, wearables, smart speakers, AR, VR, and MR systems, chatbots, smart mirrors, and payment technologies. Shopper marketing research and practice suggest that such technologies have an important role to play along a shopper's shopping journey. Retailer facilitation and value creation together with shopper adoption are critical to the success of these shopperfacing technologies.

Employee-Facing Technologies

These technologies are primarily used by employees to carry out their activities or tasks. However, these technologies also impact employee-consumer relationships by providing new tools for interaction in a live environment. Examples include mobile devices, hand held scanners, price scanners, IoT, RFID, and AR technologies, and smart mirrors.

Work from home (WFH) technologies are growing rapidly during COVID-19 and beyond. More retail employees are working from home to facilitate retail ordering and delivery.

Supplier-Facing Technologies

These technologies are used by manufacturers who supply to retailers. Examples include IoT, RFID, payment, and blockchain technologies. Blockchain technology is an open, distributed, verifiable, and permanent ledger that can potentially improve supplier-retailer contracts, inventory control, and supply chain efficiency.

Categorize Technologies by Information

Another way to classify technologies in the retailing context is based on whether they are related to information or not. Accordingly, they can be classified as information technology (IT) versus non-IT. As outlined earlier, our primary focus is on information related technologies. Many of the IT based technologies are also communication technologies. IT based technologies have a large ecosystem and new technologies may have to fit into this system. Sometimes, retailers can combine IT and non-IT-based technologies to solve business problems.

Categorize Technologies by Domain or Source of Origin

researchers use classifications that may be specific to a domain or span multiple domains. Some retail technologies may span different types of retail categories, while others may be specific to a category.

Categorize Technologies by IT Competencies As Internal or External

Some technologies may be developed inhouse, while others outsourced. Similarly, technologies may be conceptualized as IT resources based on their usage as outsidein, spanning, or insideout (Wade and Hulland 2004). Some suppliers can push new technologies for retailers to adopt. In some cases, retailers can pull or push suppliers to adopt new technologies.

Categorize Technologies by Incremental or Radical in Newness

Radical technologies might require much greater adoption efforts and change management especially for retailers who may have to deploy these technologies in multiple dispersed locations.

Categorize Technologies by Its Change on Retailing Landscape

Some technologies facilitate business, while others disrupt business. Typically, disruptive technologies are hard to predict and are often recognized after the fact. Some technologies may facilitate one part of the value chain, while concurrently disrupting another part of the value chain.

Categorize Technologies by Its Broad Outcome

Based on this classification, technologies could be either commoditizing the current retail offerings or adding value to the existing offerings. For example, a comparison mobile app allows a shopper to easily compare brands or offerings based on price, effectively commoditizing the market. In contrast, the VR technology could offer a radically new immersive experience to a shopper, enhancing the value of the offering.

Theoretical Frameworks on the Role of Technology in Retailing

Much of the focus is on understanding how technologies are changing shopper experience and retailer business models. We elaborate on the role of theories and frameworks that may be used to examine the adoption of technologies in retail and highlight how retailers may use the technologies for desired ends.

- Innovation Adoption and Diffusion Models
- Technology Acceptance Model
- Privacy Lens
- Performance-Based Framework
- Options Value Framework
- Capability-Development Model

Technology Adoption by Shoppers and Retailers

We focus on the adoption by the principal stakeholders, namely, shoppers and retailers. Some factors are common to the adoption by both shoppers and retailers, some factors drive only shopper adoption of technologies, and other factors influence only retailer adoption of technologies. We examine the drivers of technology adoptions by shoppers, employees, suppliers, and retailers.

Antecedents/Drivers of Technology Adoption

- Core technology advancement/availability
- Consumer/shopper push/lifestyle changes
- Competitor innovation
- Safety and security
- Regulation

From a retailer standpoint, the key issues relating to adoption are: "what, when, and how" of technology adoption, management of technologies, and strategic versus tactical elements of technology.

Several organizational factors may drive retailer technology budget, risk, and adoption. These factors include technology readiness, organizational agility, organizational inertia, organizational stability, complacency, top management support, mergers, environmental, sustainability and governance (ESG) focus, volatility of sales environment, consumer sentiment, and leaders'/stakeholders' priorities.

- Barriers to Adoption
- Outcomes of Retailer Adoption

Depending on the stakeholder, different outcomes of retailer adoption may be important. From a shopper/customer standpoint, the key outcomes include satisfaction, purchase, and repeat purchase. From a supplier perspective, outcomes like out-of-stock/shelf and on-time delivery are important. From the retailer's own viewpoint, outcomes such as revenues, market share, customer satisfaction, profits, employee satisfaction, and shareholder value are the key consequences of retail technology adoption.

- Retailer decisions on adoption
- Retailer management of technology

A special case of third party technology management is open innovation, where the retailer relies on external solutions that address a general problem or challenge.

Making omnichannel an augmented reality: the current and future state of the art (Hilken et al. 2018)

Abstract

Purpose This paper aims to explore the current and future roles of augmented reality (AR) as an enabler of omnichannel experiences across the customer journey. To advance the conceptual understanding and managerial exploitation of AR, the paper aims to synthesise current research, illustrating how a variety of current applications merge online and offline experiences, and provides a future research agenda to help advance the state of the art in AR. **Design/methodology/approach** Drawing on situated cognition theorizing as a guiding framework, the paper reviews previously published research and currently deployed applications to

provide a roadmap for future research efforts on AR-enabled omnichannel experiences across the customer journey. **Findings** AR offers myriad opportunities to provide customers with a seamless omnichannel journey, smoothing current obstacles, through a unique combination of embedded, embodied and extended customer experiences. These three principles constitute the overarching value drivers of AR and offer coherent, theory driven organizing principles for managers and researchers alike.

Originality/value Current research has yet to provide a relevant, conceptually robust understanding of AR-enabled customer experiences. In light of the rapid development and widespread deployment of the technology, this paper provides an urgently needed framework for guiding the development of AR in an omnichannel context.

Brief

As customers no longer complete their journey exclusively in one channel (Wolny and Charoensuksai, 2014), they expect firms to integrate online and offline experiences into a seamless omnichannel experience (Cummins et al., 2016).

Further, a persistent managerial challenge is to counteract customers' showrooming or webrooming behaviours and thus prevent churn when customers switch between channels (Accenture, 2014). To address these challenges, a growing number of firms (including L'Oreal, IKEA, Akzo Nobel and Nike) leverage augmented reality (AR) applications to enable omnichannel experiences (Brynjolfsson et al., 2013).

The promise of AR is a uniquely persuasive set of "smart" technologies (Marinova et al., 2017) set to seamlessly merge online and offline customer experiences through an intuitive, context-sensitive and socially connected interface.

One main reason for such disappointing performance may lie in the fact that firms are not yet able to successfully integrate digital online and offline customer experiences (Accenture, 2016).

Existing research into AR offers little guidance to managers on how to successfully deploy AR as an enabler of omnichannel experiences across the customer journey. Identification of AR's overarching value drivers in the context of customer experience, and how these ultimately benefit customers' decision making, has been neglected to date.

Situated cognition implies that customer experiences seem most realistic when they integrate information about products and services in realtime within the immediate decision context (i.e. are embedded), allow for physical interaction with a product or service (i.e. are embodied), and provide opportunities for communication with other customers (i.e. are extended). We posit that AR is unique because it satisfies all three criteria. This combination allows linking of customer experience across channels where behaviours traditionally reserved for offline business can be expressed into the online world and vice versa.

A marketing imperative is, thus, to provide customers with an authentic omnichannel experience. For customers, a sense of authenticity and realism arises when they can naturally interact with – and make purchase decisions about – firms' products and services. Yet achieving this in both online and offline settings is a key challenge for managers.

We contend that AR blurs the boundaries between online and offline channels by providing a unique combination of embedded, embodied and extended experiences.

Strategizing Retailing in the New Technology Era (Grewal et al. 2021)

Abstract

The world of retailing is being reimagined and transformed at breakneck speeds due to new technologies, as well as due to changes in consumer purchasing behavior resulting from the COVID-19 pandemic. This dynamic retail marketplace is forcing retailers to strategize how to best position themselves to survive and flourish in this environment. Recognizing that we are at a critical inflection point in the world of retailing, we conceptualize a Strategic Wheel of Retailing in the new technology era that emphasizes technology as the core enabler of the strategies related to the 6Ps of retailing (retail place and supply chain management, product, pricing, promotion, personnel, and presentation). In particular, the articles calls for retailers to carefully their review their competitive ecosystem as they adapt to the new technologies, raises some issues, and offers new directions for further research on how technology can be leveraged to design profitable retail strategies.

Brief

Expanded applications of artificial intelligence (AI), machine learning, virtual reality, big data, and mobile apps have all contributed to frontend offerings that impact the retail interface with customers, as well as back-end technologies that facilitate retail operations.

We conceptualize these strategy decisions around the 6Ps (retail place and supply chain management, product, pricing, promotion, personnel, and presentation) as the spokes of retailing and technology as the hub.

While new retail technologies encapsulate a wide range of technologies, many can be grouped under an AI umbrella. Due to the vast volumes of customer data available across formats (e.g., grocery, drug, warehouse), AI is a powerful tool which can draw from that data to inform retail decisions. Due to the insights and information AI can provide to retailers, some predict that AI will become a dominant force in the retail industry.

The many AI applications that are not customer-facing also can facilitate the retail experience, whether by managing supply chains, enhancing demand forecasting, or performing logistical and warehouse activities more efficiently.

Retail Place & Supply Chain Management

Retail formats have continually evolved, from small, familyowned stores to vast department and general merchandise stores, as well as mass merchandisers, supercenters, convenience stores, and specialty stores. However, none of this evolution has been as disruptive as online channels facilitated by all the advancements in technology.

Across the board, the fundamental challenge has been finding a way to operate all channels in a seamless, synchronized fashion, and thereby transforming multichannel retailing strategies to a true omnichannel strategy that optimizes all customer touchpoints (Gauri et al. 2021b).

The best retailers optimize value for shoppers by enhancing their customer experience while simultaneously reducing the frictions and inconvenience associated with shopping (e.g., Lululemon, Apple, Nike, Sephora, Target, Walmart, Kroger, Warby Parker). Together with this delineation of paths to success, Gauri et al. (2021a) shine light on different retail formats including hybrid formats that allow customers to buy online and receive delivery or pick up the merchandise curbside.

Retail Product

Key components of merchandising decisions involve both understanding the role of the retailer identity that the retailer conveys through its merchandise, as well as the fine balance between national brands and store/private label brands. Careful balance of the type of merchandise and assortment carried by the retailer is important for it to create meaningful relationships with their customers.

Retailers also need to leverage the data readily available to them, using their evolving analytics capabilities to develop a "smart private-label" strategy.

These advances support greater targeting of niche segments and more precise personalization. Retailers and their design teams thus gain new insights into the needs of different segments, which has prompted them to offer a wider variety of brands (national and private label).

Retail Pricing

Pricing research generally explores the ways price information is communicated to consumers, as well as the effects of price and other types of promotions on consumer behavior. The list of potentially affected behaviors is extensive, including (but not limited to) purchases, brand switching, and complementary product purchases.

AI-powered information that retailers can extract from their existing data (Guha et al. 2021) will be integral in their future pricing strategies.

Retail Promotions

Villanova et al. (2021) consider key opportunities for retailers as the customers move through their shopping journey. This includes thinking strategically about when what, and where to communicate in their messaging to customers.

Some key areas of advancement in offering retailer promotions to consumers have been facilitated by technology, such as online offers, mobile offers and in-store offers. At the same time, retailers must incorporate privacy and data restrictions into their strategizing about promotions.

How can retailers enhance sales using a variety of in-store (e.g., digital displays, kiosks, robots) and online (e.g., bots, personalized content) technology? In this environment, does the type of product (e.g., utilitarian vs. hedonic) influence the effectiveness of promotional and communication strategies?

Retail Personnel

For the more personal interactions where the frontline worker should be familiar with the customer, retailers still benefit from customer relationship management systems that collect and store information about the customer. However, even some of those interactions are being done by AI-based bots which assist customers on their websites, reduce frictions and online shopping cart abandonment, and increase conversions.

How should retailers encourage customer engagement, in an environment where retail associates need to maintain social distance? Can technology augment retail associates' efforts to interact with customers?

Retail Presentation

The physical atmosphere (or sensory elements) of the retail store and the appearance of the online retail website has important influences on consumer shopping behavior (Biswas 2019). Roggeveen, Grewal and Schweiger (2020) showcase four central factors: design, ambience, social, and trialability.

In this new technology era, the pace of change in retailing has been accelerating rapidly. Various technologies (AI, machine learning, big data analytics, automation, augmented reality, robotics etc.) have become essential elements that impact key strategic decision areas of retailing. Using the Strategic Wheel of Retailing as our framework, we discuss key areas of strategic decision making for retailers, including technology, retail place and supply chain

management, product, pricing, promotion, presentation, and personnel. In addition, we offer suggestions for future research in each of these areas. The insights provided by this article reveal that every retailer should review its competitive eco-system, while also looking inward to use technology as a key enabler. In addition, researchers can take inspiration from the research directions and issues raised in this paper.

The role of machine learning analytics and metrics in retail research (X. (Shane) Wang et al. 2021)

Abstract

This research presents the use of machine learning analytics and metrics in the retailing context. We first discuss what is machine learning and explain the field's origins. We then demonstrate the strengths of machine learning methods using an online retailing dataset, noting key areas of divergence from the traditional explanatory approach to data analysis. We then provide a review of the current state of machine learning in top-level retailing and marketing research, integrating ideas for future research and showcasing potential applications for practitioners. We propose that the explanatory and machine learning approaches need not be mutually exclusive. Particularly, we discuss four key areas in the general scientific research process that can benefit from machine learning: data exploration/theory building, variable creation, estimation, and predicting an outcome metric. Due to the customer-facing nature of retailing, we anticipate several challenges researchers and practitioners might face in the adoption and implementation of machine learning, such as ethical prediction and customer privacy issues. Overall, our belief is that machine learning can enhance customer experience and, accordingly, we advance opportunities for future research.

Brief

Stéphane Bérubé, the chief marketing officer (CMO) of L'Oréal in Western Europe, suggests that rather than the technology being the largest hurdle, "the tough part [of AI] is finding the purpose" (Ives 2018). Industry reports suggest retailers have yet to fully realize their returns from investments in analytics (McKinsey Global Institute 2017).

AI is "defined as a system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation" (Haenlein and Kaplan 2019). AI branches out into closely related fields of computer vision, natural language processing, speech recognition, and machine learning.

ML consists of "methods or algorithms designed to learn the underlying patterns in the data and make predictions based on these patterns" (Dzyabura and Yoganarasimhan 2018). Specifically, learning is through a training experience with respect to some task, and success is judged using some performance metric.

We illustrate these concepts in the retailing context by examining the substantive question: "can researchers effectively predict the prices of products carried by online retailers?" Doing so can provide retail managers suggestions for new products, and assist in pricing and promotional decisions. We use the Amazon tablet computer dataset made available by Wang, Mai, and Chiang (2014). We match product attributes, market price dynamics, and customer reviews to obtain 2,376 observations for 438 tablet computers at the weekly level. Our variables of interest are in Table 1.

For example, a manager may wish to "listen in" to what customers are discussing in their online reviews, exploring the data to obtain useful insights. Manually reading thousands of customer reviews can be expensive and time consuming. Also, having humans read and judge the reviews may introduce inconsistencies and biases in the coding. Unsupervised algorithms, such as Latent Dirichlet Allocation (LDA), can provide an efficient solution by summarizing text data into a set of humaninterpretable topics (Bendle and Wang 2016). We apply LDA to our data of 37,562 tablet reviews and present the representative words of the uncovered eight topics in Fig. 2.

Categories of ML that have recently received attention from marketing researchers are semi-supervised learning, reinforcement learning, and deep learning. Semi-supervised learning combines elements from supervised and unsupervised learning and is often used where labeling the training data is expensive. It might well be the form of ML most used in retail. Semi-supervised algorithms are trained using both labeled and unlabeled data; the smaller set of labeled data is used to map the larger set of unlabeled data to labels.

Reinforcement learning involves an "agent" selecting and performing actions, often by trial and error at first, in return for rewards. The agent's objective is to learn the best strategy (called a policy), which is defined as the one that earns the greatest reward over time. An agent learns to balance exploration (testing new actions) and exploitation (gaining known rewards). An example in retailing that can utilize reinforcement learning is customer engagement. By specifying clicks as a reward for an agent that determines which advertisement to display, reinforcement learning can learn to present the optimal advertisements that maximize consumer engagement over time.

When conducting data analysis we conceptualize an explanatory approach as one focused on the testing of hypotheses, the formulation of which is driven by either intuition or causal theory (Shmueli 2010).

In this section, we outline the current state of ML in retailing and marketing research. We categorized articles on a customer experience journey – Awareness, Consideration, Purchase, Retention, and Advocacy (Coston 2016). Many papers can contribute at several stages but we simplify to show how ML could help solve major challenges for retailers (Table 3).

Awareness

A major challenge is "how can retailers make consumers aware of what they are offering?" Promotional activities using insights from ML can better attract customers. ML research is especially strong in market structure analysis. The abundance of user-generated content (UGC), such as customer reviews on websites and tags on social media platforms, allows retailers to conduct market structure analysis, which is an efficient alternative to the traditional methods of focus groups and surveys.

Consideration

Chen, Nelson, and Hsu (2015) combine ML techniques with neuroimaging data to predict what brand people think about. Timoshenko and Hauser (2019) use deep learning to identify emerging customer needs from reviews. Topic modelling can also help us understand customer needs (Trusov, Ma, and Jamal 2016).

Conjoint has seen a stream of ML research (Chen et al. 2017; Dzyabura and Hauser 2011; Evgeniou, Boussios, and Zacharia 2005; Evgeniou, Pontil, and Toubia 2007; Hauser et al. 2010; Huang and Luo 2016). The ability to cope with nonlinear relationships is an important strength of ML (Cui and Curry 2005).

Purchase

Retailers can use virtual reality, showrooming, or photobooths to create a dynamic, stimulating experience for shoppers. ML can even identify what is selling in real-time to help keep popular SKUs in inventory. For example, Liu, Singh, and Srinivasan (2016) combine cloud computing, ML, and text mining to illustrate how online platform content may be used for more effective forecasting. The impact of ML at the purchase stage is most notable for online retailing, where customers can receive recommendations or discounts based on items in their baskets. While identifying missing, or complementary items, can increase retail revenues. Recommendations being a great strength of ML (Ansari, Li, and Zhang 2018). Marchand and Marx (2020) even provide reasons for the recommendations which is vital for human-interpretable insights.

Retention

ML can help at the post-purchase stage covering such interactions as item returns and service requests, mostly retention but might include other post-purchase customer analysis. Delivering effective service, which includes additional product recommendations, can use ML driven insights.

Advocacy

Retailers need to better understand, and ideally influence, what is being said about them. How they can do this is another major retailing challenge, this time at the Advocacy stage. Tirunillai and Tellis (2014) use a supervised extension of LDA with customer reviews and have other work investigating chatter (Tirunillai and Tellis 2012, 2017). Homburg, Ehm, and Artz (2015) develop a community matched measure of consumer sentiment by analyzing consumer posts from online forums. Zhang and Godes (2018) analyze the impact of online opinions on consumers' decision quality. Finally, Ordenes et al. (2019) text mine Facebook posts and Twitter tweets to demonstrate the impact of message intentions on message sharing.

ML and metrics

Market Share

A better understanding of retail market structure and competitor identification can be driven by algorithms that create consumer choice sets. Yet if a market can be partitioned as a myriad of sub markets, even by each individual, what use is overall market share?

RQ7: How to combine shares of wallet where market boundaries are less than clearly defined?

Sales Prediction

There will be no obvious paper trail and plenty of choices, by humans and machines, to create such predictions. This leads to the concern that (a) the predicted sales will vary considerably between different creators, and (b) that the numbers may be cherry picked.

RQ8: How can managers, observers, even auditors, best use ML sales predictions?

Logistics

Retail is a complex business where context matters to delivering effective results (Kumar, Sunder, and Sharma 2015), which suggests ML could be especially valuable.

ML prediction using the vast amount of data and processing power should help optimize inventory levels not just at the store level but across the entire system to ensure inventory is available.

Metrics can put a dollar amount on the value of limiting both out-of-stocks and excess inventory. Further, metrics grasping the multi- and omni-channel nature of modern retail will be invaluable. Indeed, attribution modeling should become more sophisticated. Can we create widely accepted measures of the value of showrooming and webrooming?

RQ9: How can ML help improve retail supply chain logistics and put a dollar value on such improvements?

Customer Lifetime Value (CLV)

ML will assist in CLV being used at an increasingly disaggregated level. (Cohort-based CLV, though often a reasonable response, is always a second best as such approaches overvalue some customers and under value others).

ML offers the opportunity to give greater specificity to the idea of the firm as a collection of customer relationships (plus other assets).

CLV is a valuable predictive measure for managerial action, e.g., it informs acquisition and retention decisions, which fits well with ML strengths.

Using ML, CLV predictions are likely to be easiest for online retailers, given they can record all customer touchpoints. Still, store point-of- sale systems and customer systems can flash messages and offers to re-engage a customer predicted to be drifting away. In essence, ML will allow for greater use of valuable CLV methods.

RQ10: What are the most promising ways to use ML to make CLV a usable metric in every situation?

Channel design to enrich customers' shopping experiences: synchronizing clicks with bricks in an omni-channel perspective - the Direct Optic case (Picot-Coupey, Huré, and Piveteau 2016)

Abstract

Purpose

The purpose of this research is two-fold: (1) to investigate the challenges e-tailers are confronted with when synchronizing clicks with bricks into an omni-channel perspective and (2) to shed light on the possible ways to overcome these challenges in order to successfully implement an omni-channel strategy.

Design/methodology/approach

To answer our research questions, we draw on an in-depth longitudinal case study conducted within the French on-line eyewear retailer Direct Optic from January 2013 to March 2015. From an ethnographic perspective, we document the evolution of the retailing company's decisions and processes as they moved towards defining and implementing an omni-channel strategy. Research was carried out using primary (1500+ hours of participant observation and 118 interviews) and secondary data sources. A conceptualizing content analysis was conducted both manually and with NVivo software.

Findings

First, our results show that the challenges faced in shifting to omni-channel strategy are so numerous and so engaging that, de facto, it is impossible to evolve directly from a multi-channel, siloed strategy to an omni-channel strategy without any transition. Second, throughout this transformative process, our result show that the challenges faced by the company evolved gradually in terms of scope and priority, and can be categorized into two main categories: the strategy-related challenges (organizational, cultural, managerial, marketing and resources) which were the highest priority in the first stage and the development-related challenges (retailing mix, information systems and CRM) which became the highest priority during the second stage.

Research limitations/implications

We emphasize the importance of carefully orchestrating how strategy-related and development-related challenges are addressed as, for retailers engaged in going omni-channel, this involves a complete transformation of their configuration.

Originality/value

Our study contributes to channel management and retailing research by (1) deepening the conceptualization of multi-, cross- and omni-channel retailing, (2) exploring the nature, importance and sequence of the strategy-related challenges and development-related challenges when shifting to an omni-channel strategy, and (3) providing insights into how successfully navigating the transformative process to be omni-channel requires investigating different possible solutions, and further testing and re-testing them, before deploying the appropriate ones. Up to our knowledge, it is one of the first studies to empirically investigate the challenges of an e-tailer when moving towards an omni-channel strategy.

Brief

"How seamless are you?" - since 2013, Accenture has been asking retail managers this core question in order to gauge their capabilities to satisfy current consumers' expectations of living seamless, consistent and personalized shopping experiences (Rigby, 2011; Brynjolfsson et al., 2013). Indeed, consumers can nowadays ubiquitously access the Internet thanks to an increasing number of digital devices. So they expect to be able to consistently, interchangeably and simultaneously use an ever growing number of offline, online and mobile channels and touch points when shopping (Verhoef et al., 2015).

Indeed, satisfying these heightened customers' expectations through the implementation of an omni-channel strategy induces greater complexity in channel arrangement (Piotrowicz and Cuthbertson, 2014) for two key reasons. First, not only is the range of channel options larger, but it is also more varied in nature – including retail channels (physical store, online website and catalogue) as well as mobile channels (mobile devices, branded applications and connected objects), social media and customer touch points (Baxendale et al., 2015; Verhoef et al., 2015). Second, omni-channel retailing involves going further than current channel design, by adding and integrating channels to offer switching opportunities among them, and aims to blur the boundaries between the various channels and touch points (Verhoef et al., 2015).

The move from multi- to omni-channel (Verhoef et al., 2015) renews the topicality of the channel design issue and its associated challenges. Current literature provides very limited insights into this issue so far. In fact, the omni-channel literature – either theoretical or empirical – is in its infancy (Piotrowicz and Cuthbertson, 2014; Verhoef et al., 2015).

In this context, this paper raises the issue of the transformative process induced by omnichannel retailing: how can e-retailers achieve the dismantling of channel boundaries and synchronize clicks with bricks?

We thus address two research questions: RQ1: What types of challenges are e-tailers confronted with when synchronizing clicks with bricks into an omnichannel perspective? and RQ2: How can e-tailers address these challenges in order to implement an omni-channel strategy?

Distinguishing multi-, cross-, and omni-channel concepts

Considering common features of multi-channel retailing discussed in previous studies, it can be defined as the operation of multiple channels as independent entities in order to align channels to specific targeted customer segments (Zhang et al., 2010; Frazer and Stiehler, 2014).

For instance, some researchers refer to "integrated multi-channel retailing" when studying cross-channel practices (Lewis et al., 2014) while others assimilate omni-channel retailing with channel integration (Galino and Moreno, 2014). Yet, multi-, cross- and omni-channel retailing each refer to specific strategies with their own focus and scope.

Following Lewis et al. (2014) and Cao and Li (2015), multi-channel, cross-channel and omnichannel retailing are depicted on a continuum based on the intensity of channel integration. Along this continuum, omni-channel retailing exhibits four key differences in channel organization (Verhoef et al., 2015): (i) it involves more channels; (ii) it implies a broader perspective as it includes not only channels but also customer touch points; (iii) it induces the disappearance of borders between channels; and, most importantly, (iv) the focal differentiator of omni-channel retailing, customer brand experience, is highly specific.

As such, shifting to an omni-channel strategy commits a brand to a process of optimizing customer experience and re-designing channels and touch points from this perspective.

From the challenges of integrating bricks with clicks to those of blurring channels

From a thematic coding of the existing literature, we identified theoretical or empirical insights into eight main challenges. They relate to strategy, organization, marketing, CRM, management and human resources, technology – IS, finance and performance tracking.

Concerning the strategic challenges, Cao (2014) provides evidence that shifting to a crosschannel strategy requires retailers to change their business model; Verhoef et al. (2015) suggest that this is all the more necessary in an omni-channel perspective. Such transformations in retail companies have also been observed to cause organizational challenges. A shift to multi-channel retailing induces the addition of new channels, and consequently the creation of new services (Neslin et al., 2006). In a cross-channel perspective, retailers need to de-compartmentalize the different structures within the organization (Cao and Li, 2015).

Moreover, adding, integrating or blurring channels raises marketing challenges concerning the degree of coordination of the retail mix across channels (van Baal, 2014; Verhoef et al., 2015). Whether this challenge consists of combining (Neslin et al., 2006; Cao, 2014; Cao and Li, 2015), harmonizing (van Baal, 2014), integrating (Neslin et al., 2006; Lewis et al., 2014; Cao and Li, 2015), or isolating retailing-mix (Frazer and Stiehler, 2014) is disputed. It is all the more critical in omni-channel retailing where showrooming develops (Rapp et al., 2015). According to Neslin et al. (2006) and Cao and Li (2015), coordination ranges from complete separation to full coordination of price, promotion, product assortment and images, depending on the pursued objective. Moreover, previous research documents CRM challenges (Payne and Frow, 2004). In omni-channel retailing, one challenge is to keep the consumer within the brand ecosystem and to reinforce lock-in effects (Rapp et al., 2015; Verhoef et al., 2015) in order to overcome free-riding (van Baal and Dach, 2005; Chiu et al., 2011; Heitz-Spahn, 2013) or showrooming behaviors (Herhausen et al., 2015). The literature also suggests managerial challenges.

Additionally, the technical staff could have a lot of work ahead of them as the sixth challenge is a technological – IS one, due to the need to integrate or merge databases, manage big data and redesign the supply chain (Neslin et al., 2006; Lewis et al., 2014; Cao and Li, 2015).

Finally, the challenge of performance tracking is reported as being delicate when channels are integrated (Neslin et al., 2006; Lewis et al., 2014), as it could also be when they are blurred (Verhoef et al., 2015).

How to overcome challenges when synchronizing bricks with clicks

In this effort, we were left with a large number of challenges for which almost no solution was documented in the literature although we could find two very broad recommendations about what to do when addressing the challenges in the shift to omnichannel retailing: (i) revamping the retail business model (Cao, 2014; Piotrowicz and Cuthbertson, 2014); and (ii) engaging in a change process (Verhoef et al., 2015).

Concerning the management challenge, Steinfield et al. (2002) conclude that managerial actions are needed to prevent channel conflicts. As far as marketing challenges are concerned, Cao (2014) suggests that shifting to cross-channel retail requires retailers to optimize the product assortment, price and communication policies across channels, rather than merge them. She also advocates reinforcing the strengths of the physical store, with a store layout focusing on the consumer experience rather than the products. Furthermore, research puts forward examples of web to store solutions – Buy Online and Pick-Up in Store thanks to click and collect solutions (Chatterjee, 2010; Gallino and Moreno, 2014) – and web in store solutions – deployment of information technology via in-store solutions such as WIFI (Lewis et al., 2014). To address the technological IS challenges, Neslin et al. (2006) suggest that companies pursue an action plan to define their optimal level of data integration. Cao and Li (2015) indicate that the merging of IS concerns not only consumer-related information, in order to recognize the consumer at every touch point, but also marketing information, such as prices, product assortment, and logistics, that need to be synchronized across channels.

Case selection and presentation

The case had to fit our theoretical framework that suggests that substantial differences exist in the challenges faced by retail companies in the process of integrating channels, depending on (i) whether they were initially brick-and-mortar or on-line retailers, and (ii) the stage of integration between channels as well as the ultimate objective in terms of channel design. In line with these two criteria, the retail company Direct Optic was selected as the target of our investigation.

Evolving challenges along the transformation process

The challenges faced in shifting to an omni-channel strategy were so numerous and so engaging that, de facto, it was impossible to evolve directly from a multi-channel, siloed strategy to an omni-channel strategy without any transition.

Throughout this transformative process, the content analysis of the decision-makers' statements highlighted that the challenges faced by the company evolved gradually in terms of scope and priority, and can be categorized into two main categories: strategy-related challenges (organizational, cultural, managerial, marketing and resources), which were the highest priority in the first stage and development-related challenges (retailing mix, information systems and CRM)., which became the highest priority during the second stage.

While removing barriers among channels and developing collaboration, the company also had to develop an internal joint culture, shared by every touch point, "each of them dedicated to the success of the brand" (Brand Marketing Manager, January 2014). This evolution towards collaboration among teams induced a challenge of coordinating the operational modes between channels, favoring mutual understanding and developing new methods of evaluation.

From the perspective of the development-related challenges, the focus was on setup and operation management issues, including retailing-mix implementation, IS and CRM.

The original challenge was to "harmonize, rationalize and synchronize the assortment" (Brand Marketing Manager, February 2014). In other words, shifting to an omni-channel strategy required adapting the assortment to the physical store given the physical constraints, but also taking advantage of the opportunities provided by the physical environment, notably the fact that consumers can touch and feel products before purchasing them.

Our content analysis shows that another related challenge concerned the coordination of purchasing activity so that the chosen products could fit both touch point specificities. Regarding the store and website layouts, the web marketing head and the brand marketing manager explained that the challenge was to keep both layouts consistent in order to allow consumers to live a flowing experience within one touch point, but also throughout their cross-channel journey (e.g. if they have to order online, and pick up in-store). Regarding services, interviewees stressed that the challenge was to adapt them while considering each touch points' advantages.

According to the brand marketing manager, the final objective is to institute a persistent customer basket, a necessary condition for delivering a seamless experience.

Finally, the last challenge that was reported to be faced when redesigning channels to an omni-channel perspective related to improving CRM. This required identifying the different journeys a consumer can have when interacting with the company and is closely associated with the IS challenge. To deliver cross- or even omni-channel experiences, Direct Optic first had to multiply touch points, a pre-requisite for consumers to experience a flowing journey that delivers value (Verhoef et al., 2015).

Solutions applied by Direct Optic "to orchestrate the convergence of bricks with clicks"

- Hiring a project manager

In the end, the project manager hired had a degree in retailing, marketing and communication and her job was to design and implement the convergence process. She firstly undertook an internal and external diagnosis of the company. This led to identify most of the possible challenges and envision ways to overcome them.

- Operating a pop-up store

It adopted a trial-and-error learning approach with the operation of a pop-up store in Lyon (France) from May to July 2013. Operating this pop-up store is reported to have been essential to the future implementation of the project as it was a full-scale test.

Observation data cross-checked with performance data showed that the pop-up store operation allowed for the (i) testing of the attractiveness of the assortment offered both in physical stores and on the website; (ii) evaluation of the average shopping basket; (iii) refinement of the pricing strategy and, (iv) identification of the operational bridges that needed to be implemented between the on-line channel and physical stores. A similar view of the explorative role of the pop-up store format has previously been reported in the literature (Picot-Coupey, 2014).

According to the CEO and the brand marketing manager, the pop-up store operation was crucial in validating the utility of converging under one unique brand, testing to what extent the product assortment, pricing and promotions policies needed to be harmonized or adapted, and providing concrete examples to store managers and staff of the forthcoming implementation of the omni-channel strategy.

- Involving the various stakeholders

They also began to redesign the performance evaluation criteria and compensation system in order to reward collaborative behaviors between channels and the respect of brand values. As channels and touch points are combined, a customer's interaction with one channel may drive that same consumer to purchase via another one. Therefore, performance tracking must evolve to consider these spill-over effects.

Moreover, they began to develop bridges among the IS so that store managers and staff could access the systems dedicated to the on-line channel. In a forthcoming step, Direct Optic will aim to merge the IS in order to achieve synchronization between channels and touch points, allowing any touch point to not only consult the databases but also to feed information back into them.

Designing a new store concept

This new concept was implemented for the first time in June 2014 in Direct Optic's new flagship store near Paris. It is said to be a further step towards the effective implementation of an omni-channel strategy as it includes digital solutions (virtual fitting rooms connected to social networks), click-and-collect and store-toweb solutions.

Importantly, we also showed that a critical challenge consists of identifying this entire range of challenges that is induced by channel re-design. It is crucial to identify all frictions between channels and touch points in terms of customer shopping experience, and to find which organizational, marketing or management issues they raise for the retail company. Despite the fact that this challenge somewhat overlaps the strategic challenge of business model transformation discussed in prior research (Cao, 2014; Cao and Li, 2015; Verhoef et al., 2015), it does not exactly mirror it. Specifically, our findings refer to considerations of the organization of activities in a way that fits the implementation requirements of the omnichannel strategy.

We show that the fundamental values of the brand are fixed and exactly duplicated among touch points so that customers face a consistent brand experience. However, flexibility is introduced concerning the range of assortments and the services offered depending on the characteristics of the touch point. Online, mobile, and physical environments have different capabilities, which do not allow a full replication of the retailing mix across touch points. Flexible replication is the best approach given the diversity of channels and touch points, and allows the retailer to minimize the risk of losing strategic flexibility as highlighted by Neslin et al. (2006).

Practice co-evolution: Collaboratively embedding artificial intelligence in retail practices (Bonetti et al. 2022)

Abstract

Many retailers invest in artificial intelligence (AI) to improve operational efficiency or enhance customer experience. However, AI often disrupts employees' ways of working causing them to resist change, thus threatening the successful embedding and sustained usage of the technology. Using a longitudinal, multi-site ethnographic approach combining 74 stakeholder interviews and 14 on-site retail observations over a 5-year period, this article examines how employees' practices change when retailers invest in AI. Practice co-evolution is identified as the process that undergirds successful AI integration and enables retail employees' sustained usage of AI. Unlike product or practice diffusion, which may be organic or fortuitous, practice co-evolution is an orchestrated, collaborative process in which a practice is co-envisioned, co-adapted, and co-(re)aligned.

Brief

In retail, AI applications are increasingly used to augment customer experiences (e.g., smart mirrors, augmented reality phone apps, metaverse adventures) and the efficiency of retail operations (e.g., self-service checkouts, employee handheld devices, smart inventory systems) To be sustained, practice co-evolution must be recursive and enabled via intentional knowledge

transfers. This empiricallyderived recursive phasic model provides a roadmap for successful retail AI embedding, and fruitful future research avenues.

Reflecting the growing importance of AI investments, this article investigates the conditions that enable retailers to successfully embed AI and their employees' sustained usage of the technology in the long run.

Building on theories of practice originating from Bourdieu (1977) and Garfinkel and Sacks (1970) that situate mundane activities as important social acts, this article takes retail practices as the units of analysis, critically interrogating practice change caused by AI investments within formal organizations.

The article utilizes practice theories to reveal how practice participants (those who perform a practice, such as store employees) and practice champions (those who intentionally disseminate a practice, such as senior executives, local retail managers, and trainers; Dilling et al., 2013) introduce AI into the retail environment and foster its effective, long-term usage by embedding it into existing ways of working.

This article shows that employee responses to the introduction of AI (e.g., inertia, misperceived enablement, efforts to use AI adroitly) are dependent on employees' collaborative efforts to change existing practices and shape new ones.

Addressing this gap, this article reveals an orchestrated, collaborative, multi-stakeholder process that allows for intentional sustained practice change. The data reveal that practice co-evolution occurs in three phases consisting of co-envisioning how the proposed practice modification achieves organizational goals, co-adapting the co-envisioned practice to suit local retail conditions or context, and co-(re)aligning the co-adapted practice to ensure that organizational goals are achieved. The data further indicate that practice co-evolution is recursive as co-(re) aligned practices often become newly co-envisioned practices. Retail practice co-evolution should thus be viewed as a collaborative process to ensure that AI investments produce organizational benefits as employees become active partners in modifying their routines.

Second, at the practice participant level, this article identifies a mechanism that facilitates practice co-evolution termed here as practice enablement. Practice enablement is the result of intentional transfers and acquisitions of core (i.e., know-what, know-how, and know-why) and contextual (i.e., know-where, know-who, know-when) knowledge among practice participants that allow changes in the meanings, competences, or materialities (i.e., practice elements) of routines. While the extant practice literature broadly identifies practices as the site of organizational knowing (e.g., Nicolini, 2011), it remains silent about the mechanisms through which knowledge is embedded in a practice and transferred between participants. This research shows, for the first time, how these knowledge transfers unfold into organizational practices, leading to practice enablement. Our data show that retail employees' practices are disrupted by the initial AI embedding, as the materialities of their work are modified, thus requiring the acquisition of new competences through knowledge transfer that is supported by the reframing of practice meanings. Moreover, retail employees are more willing to accept AI if it is

introduced as a method of simplifying their workflow, reducing menial tasks, or enhancing job satisfaction. Findings further demonstrate that practice enablement can foster the successful and sustained use of AI among employees, which leads to the practice spreading to other employees.

How artificial intelligence will affect the future of retailing (Guha et al. 2021)

Abstract

Artificial intelligence (AI) will substantially impact retailing. Building on past research and from interviews with senior managers, we examine how senior retailing managers should think about adopting AI, involving factors such as the extent to which an AI application is customer-facing, the amount of value creation, whether the AI application is online, and extent of ethics concerns. In addition, we highlight that the near-term impact of AI on retailing may not be as pronounced as the popular press might suggest, and also that AI is likely to be more effective if it focuses on augmenting (rather than replacing) managers' judgments. Finally, while press coverage typically involves customer-facing AI applications, we highlight that a lot of value can be obtained by adopting non-customer-facing applications. Overall, we remain very optimistic as regards the impact of AI on retailing. Finally, we lay out a research agenda and also outline implications for practice.

Brief

Very broadly speaking, retailers like (say) Home Depot can increase their profits in one (or more) of three ways. That is, retailers can increase in-store sales, and/ or increase online sales, and/ or improve the efficiency of their supply chain. As such, many retailers are excited about artificial intelligence (AI), which offers the promise to (i) increase in-store sales, (ii) increase online sales and increase potential cross-sell/ upsell, and (iii) improve supply chain efficiency, improve in-store operations and make payments more efficient. The above point comports with Shankar (2018), who indicates that AI helps by (i) making omnichannel and mobile shopping more profitable, notably by sharpening personalized recommendations (ii) managing better the in-store experience, (iii) improving payments, customer service and CRM, and (iv) improving logistics and inventory optimization.

The influence of AI on retailing is projected to be substantial (Grewal, Roggeveen, and Nordfält 2017), for various reasons. First, retailing inherently involves contact with numerous customers, leading to the availability of customer transaction and attribution data. Second, these first-party data can be augmented with second-party data from external sources (e.g., rebate data from CPG firms partnering with the retailer) and/ or third-party data (e.g., social media or reports by data brokers such as Acxiom). When AI is used to analyze such data, it

can deliver real-time and personalized recommendations, both of which are significant value drivers for retailing.

In addition to the above, Morgan (2018) indicates that "AI… greatest impact could be felt across the supply chain. From anticipating orders to managing deliveries, AI has the power to drastically increase efficiency in all areas of the supply chain… ."

Noting that ANI is likely to reflect the short term (or even the medium term) of the state of AI, we propose that retailers should look to AI applications to augment (rather than replace human capabilities. For example, a version of vee | 24's 'assistance bots' works with (human) service agents to respond to incoming customer service requests. These bots then assist service agents in various ways, e.g. (i) by analyzing a customer's tone, and so providing the service agent greater insight into the customer interaction, (ii) by providing the service agents a suitably scripted response, which the agent can use as-is, or with modifications, and (iii) by allowing the service agent to handle a higher caseload. In effect, vee | 24's AI augments the service agent's capabilities. This example makes two points, highlighting (i) balancing AI and human input and (ii) that even ANI can lead to significant value.

A Farmework for AI Adoption

Given what we know about the state of AI, we now outline a framework for how retailers may develop a suitable AI strategy and think about adopting AI. The primary factor that we consider is the extent to which an AI application is 'customer-facing.' This paper builds on the work of Shankar (2018), which outlines two main ways in which AI can impact retailing: (i) demand-side applications (e.g., personalization/ recommendation systems, customer relationship management, in-store customer experience management, payment management), and (ii) supply-side applications (e.g., inventory optimization, logistics, store payout optimization).

As the examples above show, the customer-facing determination is not dichotomous but instead reflects a continuum, with AI applications differing in the extent to which they are customer-facing. At one end of the continuum, nudging bots are very substantially customer-facing as they interact directly with the customer. At the other end of the continuum, non-customer facing AI applications do not interact much (or at all) with customers, as in the example of the Tally robot or Carrefour's SAS Viya. In between are AI applications like assistance bots that listen to customer conversations but do not directly interact with customers.

How may retailers choose to adopt AI applications? Based on our discussions with senior managers, we argue that retailers choose to balance risk and return.

Customer journey management is one of the most central aspects of moving consumers from awareness to conversion, as well as getting them to consider different merchandise and service options (Grewal and Roggeveen 2020; Puccinelli et al. 2009; Grewal, Levy, and Kumar, 2009), therefore, such AI-powered nudge bots can be invaluable.

Note here that the risk associated with nudging bots is higher, as any glitch directly (and negatively) impacts customers. Therefore, consistent with sentiments expressed by various senior managers we interviewed (Table 2, interviews #1, #3, and #5), as the first element of our framework, we predict that retailers are more likely to adopt non-customer-facing AI applications (versus customerfacing AI applications).

Key variables that are likely to moderate this relationship

- Application value
  To the extent that a customerfacing application offers the promise of exceptional value, it may be adopted relatively sooner, despite the risks involved. We predict that the adoption of AI applications is moderated by the AI application's value potential. Retailers are more likely to adopt non-customer-facing AI applications (versus customerfacing AI applications), but less so when the AI application has substantial value potential.
- Online versus in-store
  Within the category of customer-facing AI applications, adoption by retailers will depend on their online/in-store status. Retailers are more likely to adopt 'online setting' AI applications because they know that online customers have fewer privacy concerns, and perceive AI applications as less intrusive into the sales process.
- Ethics
  Ethics is a complex construct involving several subconstructs (sub-issues). The first dimension relates to customer safety, and specifically, data privacy. A second dimension relates to the potential for bias. A third dimension is linked to the appropriateness of the application.

How AI Will Change the Future of retailing

AI will change the future of retailing in three ways. It will improve retailers' (i) online interactions with consumers, (ii) in-store interactions with consumers, and (iii) supply chain operations.

Sizing the potential value of AI and advanced analytics ("Sizing the Potential Value of AI and Advanced Analytics | McKinsey" 2023)

Drawing on McKinsey Global Institute research and the applied experience with AI of McKinsey Analytics, we assess both the practical applications and the economic potential of advanced AI techniques across industries and business functions. Our findings highlight the substantial potential of applying deep learning techniques to use cases across the economy, but we also see

some continuing limitations and obstacles—along with future opportunities as the technologies continue their advance.

It is important to highlight that, even as we see economic potential in the use of AI techniques, the use of data must always take into account concerns including data security, privacy, and potential issues of bias.

In a business setting, these analytic techniques can be applied to solve real-life problems. The most prevalent problem types are classification, continuous estimation and clustering.

Consumer industries such as retail and high tech will tend to see more potential from marketing and sales AI applications because frequent and digital interactions between business and customers generate larger data sets for AI techniques to tap into. E-commerce platforms, in particular, stand to benefit. This is because of the ease with which these platforms collect customer information such as click data or time spent on a web page and can then customize promotions, prices, and products for each customer dynamically and in real time.

In retail, marketing and sales is the area with the most significant potential value from AI, and within that function, pricing and promotion and customer service management are the main value areas. Our use cases show that using customer data to personalize promotions, for example, including tailoring individual offers every day, can lead to a one to two percent increase in incremental sales for brick-and-mortar retailers alone.

Artificial intelligence's impact is likely to be most substantial in marketing and sales as well as supply-chain management and manufacturing, based on our use cases.

Enhancing brick-and-mortar store shopping experience with an augmented reality shopping assistant application using personalized recommendations and explainable artificial intelligence

Abstract

Purpose

The transition to omnichannel retail is the recognized future of retail, which uses digital technologies (e.g. augmented reality shopping assistants) to enhance the customer shopping experience. However, retailers struggle with the implementation of such technologies in brick-and-mortar stores. Against this background, the present study investigates the impact of a smartphone-based augmented reality shopping assistant application, which uses personalized recommendations and explainable artificial intelligence features on customer shopping experiences.

Design/methodology/approach

The authors follow a design science research approach to develop a shopping assistant application artifact, evaluated by means of an online experiment (n 5 252), providing both qualitative and quantitative data.

Findings

Results indicate a positive impact of the augmented reality shopping assistant application on customers' perception of brick-and-mortar shopping experiences. Based on the empirical insights this study also identifies possible improvements of the artifact.

Research limitations/implications

This study's assessment is limited to an online evaluation approach. Therefore, future studies should test actual usage of the technology in brick-and-mortar stores. Contrary to the suggestions of established theories (i.e. technology acceptance model, uses and gratification theory), this study shows that an increase of shopping experience does not always convert into an increase in the intention to purchase or to visit a brick-and-mortar store. Additionally, this study provides novel design principles and ideas for crafting augmented reality shopping assistant applications that can be used by future researchers to create advanced versions of such applications.

Practical implications

This paper demonstrates that a shopping assistant artifact provides a good opportunity to enhance users' shopping experience on their path-to-purchase, as it can support customers by providing rich information (e.g. explainable recommendations) for decision-making along the customer shopping journey.

Originality/value

This paper shows that smartphone-based augmented reality shopping assistant applications have the potential to increase the competitive power of brick-and-mortar retailers.

Brief

In these troublesome times, it is even more important for retailers to understand how they can enhance customers' offline shopping experiences (von Briel, 2018). As a response to these challenges, retailers are engaging in a new form of retail referred to as "digital retail", which uses information and communication technologies (e.g. smartphones) to engage customers, drive sales and offer unique shopping experiences that are superior to pure online shopping (Lemon and Verhoef, 2016).

In this regard, personalization and interactivity are key elements for creating a positive experience, leading to positive changes in customers' behaviors and intentions toward retail (Parise et al., 2016). Therefore, traditional retailers need to develop new systems that can provide a more customized and immersive shopping experience for customers in brick-and-mortar stores.

Contemporary marketing strategies integrate new technologies to create meaningful interactions with customers (Wang, 2021). It is argued that the use of smartphones can provide an augmented and personalized customer shopping experience, driving sales in brick-and-mortar stores (Eriksson et al., 2018; Juaneda-Ayensa et al., 2016; Parise et al., 2016; Zimmermann and Auinger, 2020). A particular use case of such smartphone-based technology is an augmented reality shopping assistant application (hereafter ARSAA), which uses augmented reality (AR) to display content (e.g. tailor-made offers, product comparison and recommendations) by leveraging machine learning techniques (e.g. recommender systems) and explainable artificial intelligence (XAI). This technology enables a personalized and online-like shopping experience for customers in brick-andmortar stores. Importantly, the usage of ARSAA in brick-and-mortar stores enables retailers to blur customers' perception of online and offline channels (Carroll and Guzman, 2013).

However, since the introduction of such technologies is expensive (Berman, 2018), retailers need to know if an ARSAA is a useful tool to deliver an augmented and personalized shopping experience.

RQ1 How does a customer's shopping experience with an ARSAA differ from a shopping experience without an ARSAA in brick-and-mortar stores?

RQ2 How can the presented ARSAA prototype be improved to further enhance the shopping experience of brick-and-mortar store customers?

Conceptual background

Digital retail shopping experience in brick-and-mortar stores

Consequently, retailers have started targeting customers across different channels, giving birth to multi-channel retailing. This approach is morphing into omnichannel retailing today, which

merges all channels and touchpoints into a single seamless shopping experience (Verhoef et al., 2015).

Considering these developments, and in line with Lavoye et al. (2021), ARSAA is assumed to positively influence customers' perception of shopping experience in brick-and-mortar stores by boosting hedonic (e.g. enjoyment) and utilitarian value (e.g. usefulness, informativeness). However, it must be noted that the use of AR can create media irritation, potentially diminishing this effect (Yim and Park, 2019). Hence, for assessing the overall quality of shopping experiences, this research includes the concepts of "Usefulness", "Entertainment", "Informativeness" (Pantano et al., 2017) and "Irritation" to capture the specifics of AR shopping experience.

Perceived Usefulness" (PU) and "Perceived Ease of Use" (PEOU) are the key component of the technology acceptance model (TAM) (Davis, 1989). PU describes the degree to which a user believes that using a specific technology enhances the user's performance. PEOU describes how easy to use a system or application is.

As ARSAA uses similar design features to present information to users (e.g. interactive buttons, icons and graphics; see also Chapter 3.2), we hypothesize: **H1. ARSAA assisted brick-and-mortar shopping is perceived as more useful than unassisted brick-and-mortar shopping.**

As the ARSAA designed for this study uses multiple design elements to increase "Entertainment" (e.g. live interaction with a physical product on the smartphone) and "Informativeness" (e.g. displaying product information, giving recommendations), we hypothesize: **H2. ARSAA assisted brick-and-mortar shopping is perceived as more entertaining than unassisted brick-and-mortar shopping.**

H3. ARSAA assisted brick-and-mortar shopping is perceived as more informative than unassisted brick-and-mortar shopping.

Although ARSAA, as presented in this study, does not use banner ads, it still uses personalized recommendations to provide additional information to its users that might be perceived as similarly irritating. It is thus crucial to investigate the amount of irritation caused by ARSAA. Accordingly, we hypothesize: **H4. ARSAA assisted brick-and-mortar shopping is perceived as more irritating than unassisted brick-and-mortar shopping.**

Recommender systems in brick-and-mortar stores

These systems allow companies to understand how they can target customers throughout the customer journey (Mora et al., 2020a). Recommender systems provide utilitarian value for users by improving their efficiency during information search and product comparison (Pimenidis et al., 2018).

For in-store recommendations, applications on smartphones are currently the most popular approach (Mora et al., 2020a; Piotrowicz and Cuthbertson, 2014). Their main advantages are

the access to data inputs, personal user information (e.g. historical transactions associated with an app account), and integrated sensors.

Recommender systems are also used in omnichannel contexts. Here, Carnein et al. (2019) developed a system that gathers and integrates data from different online channels, but without in-store context awareness—an important requirement in a brick-and-mortar application (Parise et al., 2016).

Additionally, ARSAA can display product reviews made by others, thus fostering social interaction, which has been shown to have a significant impact on customer behavior (Dennis et al., 2009). Also, using ARSAA and exploring its product recommendations can motivate users to buy additional products (Ganesh et al., 2010). We therefore hypothesize: **H5. ARSAA assisted brick-and-mortar shopping leads to a higher purchase intention than unassisted brick-and-mortar shopping.**

Explainable artificial intelligence in recommender systems

With the everincreasing amount of transaction data and complexity of AI, these recommender systems have often turned into black boxes for their users (Adadi and Berrada, 2018; Omar et al., 2018). This affects users overall trust in services using recommender systems (Fu et al., 2020).

Therefore, XAI research now focuses on making AI predictions more understandable by developing transparent AI models and explanation methods (Adadi and Berrada, 2018). Indeed, explanations have the potential to support user decision-making, enhance customer shopping experience, increase trust, acceptance and adoption of AI-based technologies (Cirqueira et al., 2020b).

Here, evidence indicates that explanations can significantly impact customers' purchase intentions (Chen et al., 2019). This corresponds to Gefen et al. (2003) who showed that trust (in the context of TAM) influences customers' purchase intention during online shopping. Based on a meta-analysis, Kim and Peterson (2017) also demonstrated that trust is a robust indicator for purchase intention. This motivates this research to hypothesize: **H6. ARSAA assisted shopping using explainable recommendations is perceived as more trustworthy compared to ARSAA assisted shopping not using explainable recommendations.**

H7. ARSAA assisted shopping using explainable recommendations is superior in terms of perceived shopping experience and purchase intention compared to ARSAA assisted shopping not using explainable recommendations.

Conceptual framework

In this research, we compare the effects of different brick-and-mortar shopping scenarios on perceived shopping experience, purchase intention and trust in technology of ARSAA users.

Three shopping scenarios are investigated: a regular shopping scenario (RSS) that does not feature the use of an ARSAA in a brick-and-mortar store, an AR shopping scenario (ARSS), in which the user is supported by an ARSAA in a brick-and-mortar store, and an ARSS in which the user is supported by an ARSAA in a brick-and-mortar store, but that additionally uses explainable recommendations (XARSS).

We investigated extant taxonomies of explanation methods to select explanation types for AI recommendations to customers (Arrieta et al., 2020; Arya et al., 2019; Mueller et al., 2019; Sokol and Flach, 2020). Here, the focus was on local explanations to clarify the reasons for a particular recommendation.

Results

The Bonferroni-adjusted post-hoc analyses (see Table 8) showed that participants rated "Usefulness", "Entertainment", "Informativeness" and "Irritation" significantly higher in ARSS and XARSS compared to RSS. Additionally, "Usefulness" and "Informativeness" were rated significantly higher in XARSS compared to ARSS.

Concerning "Entertainment" and "Irritation" no statistically significant difference between ARSS and XARSS could be identified.

Regarding H1, H2 and H3, we conclude that ARSAA had a positive influence on perceived shopping experience, as the constructs "Usefulness", "Entertainment" and "Informativeness" were all significantly higher in the ARSAA assisted shopping conditions (ARSS and XARSS) than in the unassisted condition (RSS). However, this positive effect might indeed be diminished as the ARSAA assisted shopping scenarios also showed a significantly higher level of consumer "Irritation" supporting H4.

H5 was not supported as no significant differences were found between participants' "Purchase Intention" across the different scenarios. Similarly, H6 was not supported. Here the data did not reveal a significant difference in the "Trust"-level for the two ARSAA assisted shopping scenarios.

H7 was partially supported as "Usefulness" and "Informativeness" were rated significantly higher in ARSAA assisted shopping scenarios using explainable recommendations than in ARSAA assisted shopping scenarios not using explainable recommendations. However, for the constructs "Entertainment" and "Irritation" no significant influence of explainable recommendation could be observed.

Discussion

These results demonstrate that ARSAA is indeed able to positively influence the customer shopping experience. The observed effect sizes range from small to medium. This should be considered when interpreting the results. However, the difference between RSS and XARSS

showed a large effect regarding "Usefulness", which demonstrates that using ARSAA can indeed strongly support customers during shopping. As a complement to the quantitative data, our qualitative data provide evidence for the positive effects of ARSAA on shopping experience.

Additionally, we observed that nearly half the participants of our survey would be motivated by ARSAA to visit a brick-and-mortar store (Q4). The main reasons being the availability of additional information, the fun of using the interactive application and the increase in shopping speed. Furthermore, most participants stated that ARSAA could make their shopping trip more secure (Q3) as it would require touching fewer things, interacting with fewer people and possibly speeding up their shopping trip. Q1 and Q2 demonstrate that the presented ARSAA can be improved by design and functionality changes, and by including features like in-depth product information, price comparison and personalization options which could further increase effectiveness.

The economic potential of generative AI (McKinsey2023?)

Generative AI applications such as ChatGPT, GitHub Copilot, Stable Diffusion, and others have captured the imagination of people around the world in a way AlphaGo did not, thanks to their broad utility—almost anyone can use them to communicate and create—and preternatural ability to have a conversation with a user. The latest generative AI applications can perform a range of routine tasks, such as the reorganization and classification of data. But it is their ability to write text, compose music, and create digital art that has garnered headlines and persuaded consumers and households to experiment on their own. As a result, a broader set of stakeholders are grappling with generative AI's impact on business and society but without much context to help them make sense of it.

The speed at which generative AI technology is developing isn't making this task any easier. ChatGPT was released in November 2022. Four months later, OpenAI released a new large language model, or LLM, called GPT-4 with markedly improved capabilities.1 Similarly, by May 2023, Anthropic's generative AI, Claude, was able to process 100,000 tokens of text, equal to about 75,000 words in a minute—the length of the average novel—compared with roughly 9,000 tokens when it was introduced in March 2023.2 And in May 2023, Google announced several new features powered by generative AI, including Search Generative Experience and a new LLM called PaLM 2 that will power its Bard chatbot, among other Google products.

Foundation models are part of what is called deep learning, a term that alludes to the many deep layers within neural networks. Deep learning has powered many of the recent advances in AI, but the foundation models powering generative AI applications are a step-change evolution within deep learning. Unlike previous deep learning models, they can process extremely large and varied sets of unstructured data and perform more than one task.

AI trained on these models can perform several functions; it can classify, edit, summarize, answer questions, and draft new content, among other tasks.

It suggests that generative AI is poised to transform roles and boost performance across functions such as sales and marketing, customer operations, and software development. In the process, it could unlock trillions of dollars in value across sectors from banking to life sciences. The following sections share our initial findings.

Our latest research estimates that generative AI could add the equivalent of $2.6 trillion to $4.4 trillion annually across the 63 use cases we analyzed—by comparison, the United Kingdom's entire GDP in 2021 was $3.1 trillion. This would increase the impact of all artificial intelligence by 15 to 40 percent. This estimate would roughly double if we include the impact of embedding generative AI into software that is currently used for other tasks beyond those use cases.

About 75 percent of the value that generative AI use cases could deliver falls across four areas: Customer operations, marketing and sales, software engineering, and R&D. Across 16 business functions, we examined 63 use cases in which the technology can address specific business challenges in ways that produce one or more measurable outcomes. Examples include generative AI's ability to support interactions with customers, generate creative content for marketing and sales, and draft computer code based on natural-language prompts, among many other tasks.

Generative AI will have a significant impact across all industry sectors. In retail and consumer packaged goods, the potential impact is also significant at $400 billion to $660 billion a year.

Generative AI has the potential to change the anatomy of work, augmenting the capabilities of individual workers by automating some of their individual activities.

Notably, the potential value of using generative AI for several functions that were prominent in our previous sizing of AI use cases, including manufacturing and supply chain functions, is now much lower. This is largely explained by the nature of generative AI use cases, which exclude most of the numerical and optimization applications that were the main value drivers for previous applications of AI.

In 2012, the McKinsey Global Institute (MGI) estimated that knowledge workers spent about a fifth of their time, or one day each work week, searching for and gathering information. If generative AI could take on such tasks, increasing the efficiency and effectiveness of the workers doing them, the benefits would be huge.

Its ability to rapidly digest mountains of data and draw conclusions from it enables the technology to offer insights and options that can dramatically enhance knowledge work. This can significantly speed up the process of developing a product and allow employees to devote more time to higher-impact tasks.

Following are four examples of how generative AI could produce operational benefits in a handful of use cases across the business functions that could deliver a majority of the potential value we identified in our analysis of 63 generative AI use cases. In the first two examples, it serves as a virtual expert, while in the following two, it lends a hand as a virtual collaborator.

1- Customer operations: Improving customer and agent experiences

Generative AI has the potential to revolutionize the entire customer operations function, improving the customer experience and agent productivity through digital self-service and enhancing and augmenting agent skills. The technology has already gained traction in customer service because of its ability to automate interactions with customers using natural language. Research found that at one company with 5,000 customer service agents, the application of generative AI increased issue resolution by 14 percent an hour and reduced the time spent handling an issue by 9 percent.1 It also reduced agent attrition and requests to speak to a manager by 25 percent. Crucially, productivity and quality of service improved most among less-experienced agents, while the AI assistant did not increase—and sometimes decreased—the productivity and quality metrics of more highly skilled agents. This is because AI assistance helped less-experienced agents communicate using techniques similar to those of their higher-skilled counterparts.

Customer self-service Generative AI–fueled chatbots can give immediate and personalized responses to complex customer inquiries regardless of the language or location of the customer. We estimate that generative AI could further reduce the volume of human-serviced contacts by up to 50 percent, depending on a company's existing level of automation.

Resolution during initial contact Generative AI can instantly retrieve data a company has on a specific customer, which can help a human customer service representative more successfully answer questions and resolve issues during an initial interaction.

Reduced response time Generative AI can cut the time a human sales representative spends responding to a customer by providing assistance in real time and recommending next steps.

Increased sales Because of its ability to rapidly process data on customers and their browsing histories, the technology can identify product suggestions and deals tailored to customer preferences. Additionally, generative AI can enhance quality assurance and coaching by gathering insights from customer conversations, determining what could be done better, and coaching agents.

We estimate that applying generative AI to customer care functions could increase productivity at a value ranging from 30 to 45 percent of current function costs.

2- Marketing and sales: Boosting personalization, content creation, and sales productivity

Generative AI has taken hold rapidly in marketing and sales functions, in which text-based communications and personalization at scale are driving forces. The technology can create personalized messages tailored to individual customer interests, preferences, and behaviors,

as well as do tasks such as producing first drafts of brand advertising, headlines, slogans, social media posts, and product descriptions. Introducing generative AI to marketing functions requires careful consideration. For one thing, mathematical models trained on publicly available data without sufficient safeguards against plagiarism, copyright violations, and branding recognition risks infringing on intellectual property rights. A virtual try-on application may produce biased representations of certain demographics because of limited or biased training data. Thus, significant human oversight is required for conceptual and strategic thinking specific to each company's needs.

Potential operational benefits from using generative AI for marketing include the following:

Efficient and effective content creation

Enhanced use of data

SEO optimization

Product discovery and search personalization With generative AI, product discovery and search can be personalized with multimodal inputs from text, images, and speech, and a deep understanding of customer profiles. For example, technology can leverage individual user preferences, behavior, and purchase history to help customers discover the most relevant products and generate personalized product descriptions. This would allow CPG, travel, and retail companies to improve their e-commerce sales by achieving higher website conversion rates.

For example, our analysis estimates generative AI could contribute roughly $310 billion in additional value for the retail industry (including auto dealerships) by boosting performance in functions such as marketing and customer interactions.

The technology could generate value for the retail and consumer packaged goods (CPG) industry by increasing productivity by 1.2 to 2.0 percent of annual revenues, or an additional $400 billion to $660 billion.1 To streamline processes, generative AI could automate key functions such as customer service, marketing and sales, and inventory and supply chain management. Technology has played an essential role in the retail and CPG industries for decades. Traditional AI and advanced analytics solutions have helped companies manage vast pools of data across large numbers of SKUs, expansive supply chain and warehousing networks, and complex product categories such as consumables. In addition, the industries are heavily customer facing, which offers opportunities for generative AI to complement previously existing artificial intelligence. For example, generative AI's ability to personalize offerings could optimize marketing and sales activities already handled by existing AI solutions. Similarly, generative AI tools excel at data management and could support existing AI-driven pricing tools. Applying generative AI to such activities could be a step toward integrating applications across a full enterprise.

Generative AI at work in retail and CPG

Reinvention of the customer interaction pattern

Consumers increasingly seek customization in everything from clothing and cosmetics to curated shopping experiences, personalized outreach, and food—and generative AI can improve that experience. Generative AI can aggregate market data to test concepts, ideas, and models. Stitch Fix, which uses algorithms to suggest style choices to its customers, has experimented with DALL · E to visualize products based on customer preferences regarding color, fabric, and style. Using text-to-image generation, the company's stylists can visualize an article of clothing based on a consumer's preferences and then identify a similar article among Stitch Fix's inventory.

Retailers can create applications that give shoppers a next-generation experience, creating a significant competitive advantage in an era when customers expect to have a single natural-language interface help them select products. For example, generative AI can improve the process of choosing and ordering ingredients for a meal or preparing food—imagine a chatbot that could pull up the most popular tips from the comments attached to a recipe. There is also a big opportunity to enhance customer value management by delivering personalized marketing campaigns through a chatbot. Such applications can have human-like conversations about products in ways that can increase customer satisfaction, traffic, and brand loyalty. Generative AI offers retailers and CPG companies many opportunities to cross-sell and upsell, collect insights to improve product offerings, and increase their customer base, revenue opportunities, and overall marketing ROI.

Accelerating the creation of value in key areas

Generative AI tools can facilitate copy writing for marketing and sales, help brainstorm creative marketing ideas, expedite consumer research, and accelerate content analysis and creation. The potential improvement in writing and visuals can increase awareness and improve sales conversion rates.

Rapid resolution and enhanced insights in customer care

The growth of e-commerce also elevates the importance of effective consumer interactions. Retailers can combine existing AI tools with generative AI to enhance the capabilities of chatbots, enabling them to better mimic the interaction style of human agents—for example, by responding directly to a customer's query, tracking or canceling an order, offering discounts, and upselling. Automating repetitive tasks allows human agents to devote more time to handling complicated customer problems and obtaining contextual information.

Disruptive and creative innovation

Generative AI tools can enhance the process of developing new versions of products by digitally creating new designs rapidly. A designer can generate packaging designs from scratch or generate variations on an existing design. This technology is developing rapidly and has the potential to add text-to-video generation.

Factors for retail and CPG organizations to consider

As retail and CPG executives explore how to integrate generative AI in their operations, they should keep in mind several factors that could affect their ability to capture value from the technology:

- External inference. Generative AI has increased the need to understand whether generated content is based on fact or inference, requiring a new level of quality control.
- Adversarial attacks. Foundation models are a prime target for attack by hackers and other bad actors, increasing the variety of potential security vulnerabilities and privacy risks.

To address these concerns, retail and CPG companies will need to strategically keep humans in the loop and ensure security and privacy are top considerations for any implementation. Companies will need to institute new quality checks for processes previously handled by humans, such as emails written by customer reps, and perform more-detailed quality checks on AI-assisted processes such as product design.

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