Digital Disruption in Retailing and Beyond

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The increased disruption of business models through digital technologies creates opportunities and challenges for retail businesses and their network partners. Digital transformation – the process of digitalization of previously analogue operations, procedures, organizational tasks, and managerial processes in order to drive value for customers, employees and other stakeholders – is the order of the day. With that in mind, this article provides a purposeful overview of research in the field of digital transformation with a focus on retailing and customer-facing functions of digital technologies such as managing customer journeys, assessing the impact of sensory marketing and the use of service robots on the one hand, and their strategic implications for business models such as servitization on the other. This article concludes by highlighting immediate as well as long-term challenges in the field, with a focus on disruptive technologies, innovations and trends that retail marketing-management will likely face in the near future.

1. Introduction

Since the emergence of the Internet in the early 1990s, digital technologies are progressively changing the business world. Retail is among the industries that are most affected by the digital revolution (Grewal et al. 2017; Inman and Nikolova 2017; Lamberton and Stephen 2016). The recent COVID-19 outbreak has accelerated that digital revolution, consumer adoption of e-commerce in particular (e.g., Salfino 2020). The impact of digitalization on retailing revolves around the product/service portfolio offered, as well as finding new and better ways of managing relationships with customers, employees, suppliers, and other network partners. As such, nowadays retailers must be set upon offering e-services (Evanschitzky and Iyer 2007; Rust and Lemon 2001), managing social media (Laroche et al. 2013) and user generated content (Algesheimer et al. 2010; Cleveland and Bartikowski 2018; Trusov et al. 2009), conducting mobile marketing (Grewal et al. 2016), integrating mobile devices with the physical store (Hofacker et al. 2016; Shankar and Balasubramanian 2009), using digital assistants (Evanschitzky et al. 2015; Keeling et al. 2013) and virtual-/augmented-reality tools (Flavián et al. 2018; Suh and Lee 2005), as well as considering the Internet of Things, robots and drones (Ng and Wakenshaw 2017; Wirtz et al. 2018), and machine learning and artificial intelligence (Martínez-López and Casillas 2013; Van Doorn et al. 2017).

The digital revolution also accelerates globalization. Digital technologies, increased interconnectivity in particular, enable even small companies to benefit from global procurement and seek new customers from abroad (Lituchy and Rail 2000; Prasad et al. 2001). For many retailers increasing digitalization therefore involves a range of culturally sensitive tasks such as the need to understand cross-cultural online buying behavior (Mazaheri et al. 2014; Park and Jun 2003), or adapting online stores to the expectations of culturally different audiences (Bartikowski and Singh 2014; Bartikowski et al. 2016; Luna et al. 2002).

The increased disruption of business models through digital technologies force retailers to review and transform established practices, and recognize new opportunities and challenges. With that in mind, we define digital transformation as the *process of digitalization of previously analogue (service) operations, procedures, organizational tasks, and managerial processes in order to drive value for customers, employees and other stakeholders, with a view to gaining competitive advantages*. Digital transformation requires a re-evaluation of business models by evaluating whether old processes, products or services are necessary and if new digital options and alternatives could replace or improve them.

Despite the widely recognized practical relevance of digital transformation, the landscape of academic literature on the topic is highly fragmented with little interconnections between various streams of research. The objective of this article is to offer an overview of research in the broad field of digital transformation with a focus on retailing and customer-facing functions of digital technologies on the one hand, and their strategic implications for business models on the other. By broadening the focus beyond retailing, we further highlight an agenda for fruitful future research in the field with a focus on disruptive technologies, innovations and trends that retail marketing-management will face in the near future.

Intensive discussion among key authors working in the area led us to the identification of areas in which digitalization is likely to disrupt current business practices. Without claiming to be comprehensive, we have identified four areas in a broader retail/service context. These are discussed in the subsequent sections.

The *first* section stresses that research and practice still lack a clear understanding of the myriad of different retailer-owned and non-retailer-owned online and offline touchpoints that customers use along their journey. We provide a review of existing research, best-practice industry-examples, and two pieces of original research that shows how data can be used to better understand and thereby improve the customer journey. The *second* section is concerned with digitization of customer sensory experience. It highlights the importance of stimulating the senses of customers to create immersive online experiences, especially in the service area. Many human-computer interaction researchers are currently working on

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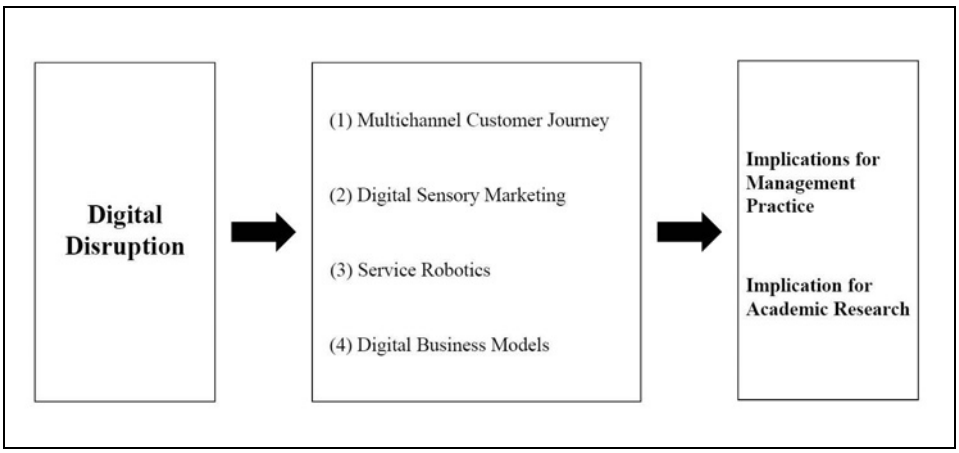

Fig. 1: Structure of the article

new multisensory interfaces that will likely transform consumers' online shopping experiences. We discuss potential applications of these technologies in the customer context, paving the way for further research. Section *three* assesses how customers interact with service robots. Findings suggest why and how service robots may play a crucial role as in-store technology in the near future. However, due to factors that impact customer perceptions and acceptance of service robots, we also identify promising avenues for further research and unearths unanswered research questions. Finally, section *four* considers the impact of digital disruption as a conduit of new business models around the idea of servitization. It establishes that digital technologies enable manufacturers to innovate service-based value propositions, and that digital connectivity between the product and the manufacturing organization is a critical first step in this process.

Our paper concludes by outlining an agenda for future research in the area of digital disruption in retailing and beyond. *Fig. 1* summarizes the structure of this article.

2. Using Data to Understand Customer Journeys

Due to the rise of new devices and channels and the explosion of digital technologies, shoppers now interact with retailers through a myriad of touchpoints (Shankar et al. 2011; Verhoef et al. 2015). Today's shoppers do not simply move from search to purchase to post-purchase by using one or two touchpoints offered by one retailer; rather, they create their very own journey that includes online and offline touchpoints operated by the retailer, its competitors, manufacturing brands, independent providers, and other customers (Grewal et al. 2016; Lemon and Verhoef 2016). Different touchpoints entail different benefits for the customer (e.g., convenience, fun) and the retailer (e.g., high margins, elevated opportunities to foster customer retention) in different stages of the purchasing process (Avery et al. 2012). Thus, the ultimate goal for retailers is to integrate touchpoints and their comparative advantages in such a way that they provide customers with an elevated and seamless experience while contributing to the retailer's profitability (Brynjolfsson et al. 2009).

Subtly steering customers to strategically important touchpoints along the journey is challenging as customers want to make their own choices and take control over their own journey (Trampe et al. 2014; Valentini et al. 2011). However, in light of the multitude of new digital touchpoints that are easily available to the consumer but hard to control by the retailer, successful customer journey management has become even more challenging. Resulting from the more extensive and versatile journeys that customers travel from search to purchase to post-purchase, retailers struggle to manage these complex journeys and to understand the motivations and unique characteristics that drive customers to travel specific paths.

Despite the large number of different online and offline touchpoints, most retailers gather information on their customers' journey solely based on the usage of their own touchpoints and, thus, fail to examine how the usage of competitor-owned, customer-owned, and independently-owned touchpoints affects the journey (Baxendale et al. 2015). Given that retailer-owned online touchpoints are easy to track through cookies, researchers typically examine how the usage and the sequence of usage of touchpoints influence short-term customer journey outcomes such as conversion or the content of shopping baskets (Anderl et al. 2016a; Becker et al. 2017). As a result, little is known about customers' combined usage of online and offline touchpoints in the customer journey, nor on long-term effects that certain touchpoints may have on customer loyalty. Understanding touchpoints in the customer journey is particularly challenging since the unique experiences that consumer make on such touchpoints are interdependent (Lemon and Verhoef 2016; Li and Kannan, 2014). Some challenges that retailers encounter due the increasingly complex, iterative, and network-structured journeys that customers travel in the course of their purchasing process can be summarized in the following five questions:

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1) How can retailers gain insights into the usage of various touchpoints and touchpoint sequences that influence search, purchase, and post-purchase perceptions in customer journeys?

2) How can retailers manage complex customer journeys successfully and create seamless customer experiences when many touchpoints used in the customer's journey are not under the retailer's direct control?

3) How do various customer touchpoints mutually influence one another along the different stages of the customer journey?

4) How can retailers identify the most valuable customer touchpoints for different segments, and how can they steer customers to them?

5) How can retailers measure the long-term effects of different customer touchpoints and touchpoint sequences?

2.1. Overview of Status quo in the Field of Customer Journey Management

In the early 2000s, researchers started to examine how retailers can make customer journeys more seamless by integrating their own touchpoints, i.e. providing access to and/or knowledge across multiple touchpoints (Bendoly et al. 2005). Since then, several studies found that integrating touchpoints may help to reduce customers' likelihood of switching to competitors (Bendoly et al. 2005), increase purchase intention and willingness to pay (Herhausen et al. 2015), customer trust (Darke et al. 2016), sales growth (Cao and Li 2015), and profitability (Oh et al. 2012). As non-proprietary touchpoints are hard to monitor and adapt, integrating owned with non-owned touchpoints is still a challenging task for retailers that is underrepresented in contemporary research.

In an attempt to shed some light on this challenging task, a few studies examined effects of both, retailer-owned and non-retailer owned touchpoints on a retailer's performance. In an online setting, Li et al. (2017) collected data from a French database consultancy to examine how customer adoption of a retailer's new online shop is influenced by their past shopping behavior at competing online shops. Results show positive spillover effects from the competitor to the retailer. Specifically, the authors show that customers who visited a competitor's online shop for their last purchase are more likely to use the retailer's new online shop for their next purchase. In an offline setting, Baxendale, Macdonald, and Wilson (2015) tracked real-time customer experiences at six different retailer-owned and non-retailer-owned touchpoints (manufacturer-paid media, retailer-paid media, communications in the physical store, word of mouth, peer observation, and earned media). They asked customers to assess touchpoint usage frequency and touchpoint valence in real-time and estimate their relative impact on changes in overall brand perception. They found that peer observations are an important but neglected touchpoint that influences brand consideration, and that in-store communications are more influential than other advertising activities. Both, information disseminated by competitors or manufacturers and communication initiated by other customers during a customer's decision journey affect purchase behavior significantly (e.g., Sands et al. 2016). For instance, attribution models of firm-initiated (TV, radio, e-mail) and customer-imitated touchpoints (referrals, price comparison sites, search engines) find that customer-initiated content is more effective than firm-initiated content in inducing conversion (De Haan et al. 2016).

In order to integrate touchpoints and create seamless customer journeys, retailers need to understand how their customers travel from search to purchase to post-purchase. Customer clickstream analysis, based on cookie data, is now widely used to examine online sequences within customer journeys. Studies in this field found that paid search touchpoints may be followed by either paid or by unpaid search (e.g., SEO) touchpoints, whereas unpaid search touchpoints are foremost followed by other unpaid search touchpoints (Anderl et al. 2016a). Moreover, research shows that online purchase propensity is highest if customers travel from a retailer-initiated touchpoint (e.g., display or e-mail advertising) to a customer-initiated touchpoint (e.g., price comparison portal, branded and generic search queries, Anderl et al. 2016b). For another example, clicks on display ads have been shown to stimulate clicks to search advertisements, which are much more likely to result in conversion than display advertisements (Xu et al. 2014). Knowledge on customer journey sequences across online and traditional touchpoints and their interrelationships is still limited. One study in this domain combined retailer advertising and online/offline store traffic data with search data from Google and electronic word of mouth data from an online data library. The authors found that more than a third of the variance in offline store traffic is created by indirect effects of TV and print ads via electronic word of mouth and organic search (Pauwels et al. 2016).

Customer journey sequences where customers search at an online touchpoint but end up purchasing at an offline touchpoint (so-called webrooming) and where customers start their journey at an offline touchpoint, but end up purchasing at an online touchpoint (so-called showrooming, Neslin and Shankar 2009) are examined in detail in research and practice. Given the prevalence of showrooming and especially webrooming behavior in today's retail landscape, several studies have investigated their drivers and consequences. Drivers of webrooming, such as perceived ease of online search and lack of trust in pur-

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chasing online (Arora and Sahney 2017), as well as consequences of webrooming, such as increased purchase intentions search process satisfaction, and choice confidence (Flavián et al. 2016) are reported. Research on showrooming shows that not only price-related factors, but also perceived gains in product quality, waiting time in the physical store, decreased online search costs, and time pressure have an impact on showrooming decisions (Gensler et al. 2017). Indeed, showrooming may be very harmful for retailers as salespeople who perceive showrooming among customers may suffer from lower levels of self-efficacy and decreased performance (Rapp et al. 2015).

2.2. Best-practice Examples of Successful Customer Journey Management

In today's digitalized world where data has become the most valuable currency, more and more online retailers are opening up physical stores in order to collect customer data also from physical touchpoints and provide their customers with a seamless cross-channel customer experience. Google opened up several Google Hardware Stores, Amazon conquered the physical world with Amazon Go and Amazon 4-Star Stores, and Alibaba introduced Freshippo (originally called Hema) in order to present the supermarket of the future. The innovative and consumer-centric supermarket Freshippo is a vivid example of how retailers may create a seamless online/offline experience for their customers. The company collects data from all of its online and offline touchpoints and processes it to add value for the customer. For instance, similar to online shops, Freshippo tracks and stores consumers' search and purchase history from mobile devices used in the store (e.g., scanned barcodes, mobile payment used) in order to determine and recommend products of interest at a subsequent in-store visit. Electronic price tags in the store enable real time synchronization of prices in accordance with the inventory status and the prices offered online. In-store high-tech elements, such as robots that carry the goods to the cash desk, cashless payment via an app or facial recognition (using Alibaba's payment service Alipay), or barcode scanning for detailed product information and customer product reviews add convenience and excitement to the purchasing experience. A sound logistics system allows Freshippo to deliver frozen food as well as warm meals to customers living in the range of five kilometers from the store within 30min.

Former pure online retailers such as Amazon, Google, or Alibaba are now disrupting retail in the digital and the physical world. Similarly, some traditional retailers have managed to react successfully to these developments and have invested in their digital transformation. For instance, Nike's House of Innovation in New York embraces technology in order to offer its customers a digitally connected journey to discover, learn about, and purchase sporting goods. In a time where more and more offline stores have to close down, Nike's business is flourishing. The company reimagined retail by delivering an immersive and frictionless customer experience via smartphones. Nike members can use the reserve & try service with digitally enabled pick-up lockers to pop in the store and quickly try on the items they reserved on the app beforehand. By scanning the QR codes on in-store mannequins, shoppers can browse every item the mannequins are wearing and check its availability online and in-store. With the help of QR codes, shoppers can also add products to a virtual fitting room; when they are finished with browsing, the app directs them to an actual fitting room where the items previously selected are waiting. There is an exclusive floor for Nike members where they can enjoy one-to-one appointments with Nike experts. Numerous selfie spots, instant check-out, same-day-delivery for products purchased in-store, and the possibility to return items bought online make the in-store experience enjoyable.

These best-practice examples show how some retailers have managed to benefit from the unique qualities of physical and digital touchpoints in order to offer their customers an elevated shopping experience. Still, with more and more digitally enabled touchpoints to evolve, offering and integrated shopping experience across numerous touchpoints will remain a challenging task that involves continuous improvement.

2.3. Empirical Evidence from Own Research

In two recent research pieces, we assessed the most prevalent customer journeys and examine how retailers may subtly steer customers to strategically important touchpoints (Herhausen et al. 2019; Kleinlercher et al. 2018). The first research work (Kleinlercher et al. 2018) examines how retailers may design their websites as information hubs in order to subtly steer customers from their website to their physical store. Findings show that informational online-to-physical channel integration on a retailer's website influences customers' online-to-physical store switching and that the density of concurrently communicated shopping benefits moderates this effect.

The second research (Herhausen et al. 2019) uses large-scale survey data from two samples of 2,443 and 2,649 customers who report on their last purchase at a multichannel retailer. Based on their usage of up to 13 retailer-owned, competitor-owned and additional touchpoints in the search phase, and two retailer-owned touchpoints in the purchase phase, we uncovered five time-consistent customer journey segments that differ considerably in their touchpoint usage, segment-specific covariates, and search and purchase patterns: *(1)* store-focused shopper, *(2)* pragmatic-online shoppers, *(3)* extensive online shop-

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pers, *(4)* multiple touchpoint shoppers, and *(5)* online-to-offline shoppers. Differentiating these five customer journey segments sheds light on customer usage of non-retailer owned touchpoints in the customer journey, interrelationships between retailer-owned and not-owned touchpoints, and the role of certain touchpoints in different phases of the customer journey. Furthermore, we find that customer product satisfaction, satisfaction with the customer journey, and customer inspiration (Böttger et al. 2017) contribute differently to long-term customer loyalty in the five segments.

In sum, a review of existing studies that use data to understand customer journeys revealed that we still need to understand how, when, and why customers use different online and offline touchpoints along their journey and how these touchpoints influence one another. Insights on customer's usage of a retailer's offline touchpoints as well as other stakeholders' online and offline touchpoints are especially important, while our knowledge about it is still limited. The two above-mentioned research works (Herhausen et al. 2019; Kleinlercher et al. 2018) provide insights into customer's usage of thirteen different touchpoints along the journey and give clear recommendations on how retailers may steer customers from one touchpoint to another. While these two studies provide some answers to the research questions listed above, more work is needed to better understand today's complex customer journeys and successfully deal with the new digital touchpoints that will evolve in the future.

3. Digitization of Customer Sensory Experience

All human senses can play an important role in how consumers experience products and services. Therefore, offline, online, and mixed reality retail environments are not restricted to just visual and, on occasion, auditory inputs alone. However, to date, only limited research is available to clarify how retailers may enhance consumers' digital multisensory experiences beyond audiovisual input. It is, therefore, necessary to consider a broader perspective on digitalization, including touch as well as other senses.

3.1. Challenge: Improving Sensory Stimulation in Digital Customer Experience

Recent technological developments in human-computer interaction (HCI) suggest that customer experiences in digital environments can embrace more senses than those currently engaged (sight, hearing, and to a lesser-extent touch). Researchers in HCI are already working on technologies to further and improve the stimulation of senses by means of digital interfaces (Obrist et al. 2017; Spence et al. 2017). Forward-thinking marketers are already using such technologies in an attempt to transform and enhance customer experiences (Hoyer et al. 2020; Petit et al. 2019a). The most engaging and memorable of experiences that consumers make involve multiple senses (Lemon and Verhoef 2016; Neff 2000; Velasco and Obrist in press). Therefore, the lack of sensory inputs in the online environment can be frustrating for customers, especially in the field of services (Lemon and Verhoef 2016 ; Petit et al. 2019b). Service experience is typically understood as "a sensation, or knowledge acquisition that emerges from being engaged with many actors at different times and places" (Chandler and Lusch 2015, p. 12). However, service experience not only assesses aspects of features, but also extends to the exploration of the emotion, subjectivity, and the context-dependent nature of services (Bolton et al. 2014). In brick-and-mortar stores, music, color, and scent are often used at different touchpoints throughout the customer journey (Kotler 1973; Lemon and Verhoef 2016) to enhance the customer's experience and contribute to a positive experience and purchase atmosphere (Hultén et al. 2009; Spence et al. 2014). By stimulating the customer's senses online, marketers might similarly enhance the aesthetic, emotional, and contextual aspects of their offering. However, in doing so, marketers face several challenges:

1) How can multisensory technologies be integrated in services to improve customer experiences?
2) How do multisensory technologies and sensory inputs affect customers' perceptions, memories, and evaluations of services?
3) How can multisensory technologies improve customer engagement with different service actors?
4) What can marketers do to facilitate consumer acceptance of multisensory technology?
5) How can multisensory technology be integrated into consumers' homes?

In order to address these challenges, it is necessary to better understand the digital disruption that these new technologies create, as well as how they may evolve in the future.

3.2. Digital Disruption through Multisensory Technologies and Possible Developments

The main digital disruptions in HCI concerns the visual sense, especially through virtual reality (VR) and augmented reality (AR). These technologies generate virtual imagery to overlay physical objects and environments in real time. For example, Kabaq is an application that allows users visualize in AR the dishes offered by a restaurant in the customer's physical environment, before deciding whether or not to order (kabaq.io). Other companies, such as Virgin Atlantic use VR to sell Upper Class experiences (VIP check-in, Clubhouse, Upper-Class cabin) (Yerman 2019). These technologies can significantly transform on-

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line customer experiences (for a review see Flavián et al. 2019). VR equipment offers users a sense of embodiment, by creating the sensation of being transported to a distinct environment outside their body (Biocca 1997; Shin 2018), while AR devices can be used to extend the users' body in their physical environment (Tussyadiah 2013). However, many sensory properties remain difficult to evaluate through visual interfaces. For example, Choi and Taylor (2014) show that VR can make it easier to assess the appearance of products (size, shape), but does not facilitate the evaluation of their material properties, such as their texture, hardness, temperature, and weight. Therefore, other technologies are needed to enable customers to evaluate these properties (Heller et al. 2019).

Technical progress has been made, in particular, on tactile interfaces. As such, it is now possible to manipulate product images on the screen with finger gests, and some innovative interfaces even allow users to create 3D physical representations, or to reproduce certain textural effects (Ablart et al. 2019; Leithinger et al. 2014). In addition, VR is no longer limited to visual/auditory stimulation. For example, Ranasinghe et al. (2018) developed "Season Traveler", a Head-Mounted Display (HMD) system that features olfactory, thermal, and wind (i.e., tactile) stimuli to simulate real-world environmental conditions. Many of these technologies will soon make it out of the prototype stage, and be commercially available. Indeed, Japan's Science and Technology Ministry notes that new technologies will make it possible to share taste sensations between people within the next 20 years (Thomson 2020). It is therefore important to understand how multisensory technologies may be implemented in retailing, as well as how consumers may react toward them.

3.3. Research Perspectives

Recent research discusses the value of multisensory technologies in relation to human senses such as touch, smell, and taste (Petit et al. 2015; Petit et al. 2019a; Petit et al. 2019b; Spence et al. 2016; Velasco et al. 2018). Petit et al. (2019a) recently highlighted how new multisensory technologies may stimulate consumers' senses online, and may offset consumers' need for touch (Peck and Childers 2003). For example, Cano et al. (2017) enhanced customer engagement through an interface that allows consumers to virtually pinch and scrunch a section of the clothing fabric with their fingertips on a tablet. Meanwhile, Brengman, Willems, and Van Kerrebroeck (2019) show the significant role of AR in evaluating products with salient material properties. In particular, the authors highlighted that interacting with these products through AR, as compared to touch and non-touch interfaces, can result in higher levels of perceived ownership. For another example, Ho et al. (2013) reported that providing auditory feedback (vs. no sound) from material products during virtual trial increased consumer engagement and willingness to pay. In summary, some existing research suggests that augmenting multisensory immersion in consumption experiences can enhance product and service evaluations.

Multisensory technologies may also facilitate consumers'' product- and service evaluations (Petit et al. 2019b ; ; Voorhees et al. 2017). For example, Scholz and Duffy (2018) demonstrated that AR devices can create intimate customer-brand relationships, as they allow users to interact with the brand in the relaxing atmosphere at home, noting that the brand is experienced more personal and self-expressive than in the store or in another virtual environments. This corroborates existing research showing that service experience within the consumer's own intimate space enhances customer experiences s (Bitner et al. 1997; Chandler and Lusch 2015). In the future, new haptic interfaces may also enhance the "digital physical contact" with service employees. Indeed, being touched by a salesperson can elicit a feeling of social attachment, which may enhance the evaluation of products and services, as well as result in prosocial behaviour, referred to as the "Midas Touch Effect" (Crusco and Wetzel 1984). Some studies found that so-called vibrotactile feedback from digital interfaces may induce positive emotions, increase feelings of telepresence, and generate a virtual Midas Touch Effect (for a review, see Huisman 2017). It would therefore be interesting to test whether the use of vibrotactile interfaces in a service context could have similar effects (Ringler et al. 2019).

To conclude, since the in-store service experience is intrinsically multisensory (Hultén et al. 2009; Spence et al. 2014), it is necessary for marketers to consider how digital touchpoints of the customer journey, multisensory digital experiences in particular, may affect consumers service experiences. We expect future customer journeys to be increasingly mixed reality, and advise marketers to not miss these developments (Petit et al. 2019b; Raisamo et al. 2019; Wirtz et al. 2018).

4. Service Robots in Retailing

Retailers increasingly confronted with new information and communication technologies that influence traditional retail business models and in many ways disrupt how retailing works. One of the latest in-store technology with a potentially wide-ranging impact on retailing is the introduction of service robots. Following Wirtz et al. (2018,. 909), service robots are "[...] system-based autonomous and adaptable interfaces that interact, communicate and deliver service to an organization's customers." With a total market value of US$288.23 million in 2017, which is forecasted to reach US$699.18 million by 2023 (Knowledge Sourcing Intelligence LLP 2018), service robots are likely

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to be a common sight for consumers. For example, more than 10,000 units of SoftBank's humanoid service robot "Pepper" have been sold worldwide since its launch in 2014 (Mende et al. 2019; Tobe 2016). Pepper is already employed by service providers such as restaurants, airports, and cruise lines, where it greets guests and helps them to navigate the location (Gallo 2019; Hornyak 2020 ; Reese 2016). It is therefore unsurprising that service robots have recently attracted increased attention from retailing managers and retailing researchers alike (Van Blut et al. 2018; Davenport et al. 2020; Van Doorn et al. 2017). The marketing literature suggests that AI-based service robotics is likely to be the key driver of rapid service innovations that will improve the experience and service quality provided to customers (Wirtz and Zeithaml 2018). Moreover, service robots have the potential to reorganize work in many service and retailing firms and improve productivity in service provision (Wirtz et al. 2018). Although the introduction of service robots in retailing has fueled various discussions, ranging from the dehumanization of work to the impact on customers' social relations with firms (KPMG 2016), studies indicate that social robots are likely to replace service personnel such as salespeople in the long run (Davenport et al. 2020). The ongoing debate about the usefulness of social robots in business contexts illustrates that further research is needed to enhance our understanding of the advantages and disadvantages of employing service robots in retail contexts. In particular, the following questions require meaningful responses:

1. How do robot design features such as gender, voice, or shape impact retail customers' acceptance and intentions to interact?
2. Which segment(s) of retail shoppers react(s) more positively to service robots?
3. How does the use of service robots affect perceived service quality in different retail/service contexts?
4. What are the benefits and costs of using service robots from in a retail/service context from the firm's as well as the customer's perspective?

Based on seminal papers in the area of service robots and human-robot interaction, we next report a study that points out significant areas for further research on service robots in retailing.

4.1. Service Robots as In-store Technology

While few studies have examined how retail shoppers perceive service robots in real-life settings, the literature on human-computer interaction (HCI) suggests that robots are generally perceived as social interaction partners (Fischinger et al. 2016). Related studies show that humans tend to bond with service robots and show compliance behavior towards their requests (Lee and Liang 2016). In the retailing context, it may be interesting to assess when retail shoppers bond with service robots in stores. For example, how should robots look like, or, are some customer segments more likely to build relationship with robots than others? Likewise, it would be interesting to learn more about the types of requests made by service robots that shoppers are willing to follow (e.g., advice to proceed to the checkout or to a specific shelf), or which robot requests retail shoppers are likely to ignore (e.g., fashion advice based on customer weight and body shape).

Research on HCI also reports that people may hold negative attitudes toward robots as members of the society (Syrdal et al. 2009), and that the presence of robots may elicity feelings of discomfort (Mende et al. 2019). As such, the perceived humanness of a robot seems to play a significant role in robot-human relationships (Bartneck et al. 2009; Blut et al. 2018; Wirtz et al. 2018), considering both, customers and employees. It is thus of significant importance that retailers develop an in-depth understanding of how service robots may be introduced. Are some retail customers more likely than others to respond positively to service robots (e.g., depending on their technology readiness)? How should retailers introduce service robots to employees? How can retailers ensure that the service robots' purpose is to support employees in their daily work, rather than to replace them (e.g., Xiao and Kumar 2019)?

A significant body of research in HCI literature has examined how users react toward human features of service robots in terms of looks, voice, and speed of reaction to requests. For example, studies show a moderate degree of human likeness to be most appealing (Mori et al. 2012), that robots with female (vs. male) voices are perceived more positively for social tasks (Rhim et al. 2014), or that service robots' mimicry of natural language using language cues such as empathy and humor influence the quality of interaction (Niculescu et al. 2013). Retailing scholars should conduct similar experiments with different robot designs and analyze retail shoppers' reaction to these. For example, should a robot employed at a car dealership have a different design, "gender," and voice compared to a robot employed in a grocery store? In addition, the robot's voice and gestures may need to differ depending on the stage of the sales process, similar to that of a real sales employee. Moreover, looking at gender perceptions might be a fruitful research avenue. Future research should explore whether female retail shoppers react more positively to a "male" or a "female" service robot, and vice versa.

4.2. Benefits and Costs of Service Robots

The service literature provides several insights into potential costs and benefits of service robots for customers and firms. It is generally argued that robot-delivered services

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have the potential to provide cost savings, leading to lower service prices (Huang and Rust 2018; Wirtz et al. 2018). Service robots are discussed to either augment or substitute service employees at a certain point in time, whereas service employees and customers act as enablers, innovators, coordinators, or differentiators (Larivière et al. 2017). Hence, retail scholars should assess which tasks in retail stores could be completed by service robots, and the cost savings that could be achieved thereby. Service robots may fully take over repetitive tasks, such as at the checkout counter, and complement human employees in complex tasks including customer service. Some retailers could perhaps even change their business model and fully rely on service robots, allowing them to pass on the cost savings to customers.

However, scholars should assess the reductions in terms of not only monetary costs but also time costs due to the implementation of service robots. Particularly in high-income countries such as the U.S., service robots can offer 24-hour service and each customer can be assigned a personal robot in the store, which would speed up the shopping process at consistent quality. Focusing on cost savings offers also be an interesting research area from the customer perspective. Not only could cost advantages be passed on to the customer, but service robots' efficiency might lead to time savings for consumers, impact consumers' convenience perceptions, and attract convenience-oriented shoppers. Besides studying the impact of a service robot's presence on individual-level outcome variables, such as the customer's time in the store and the costs of serving each individual customer, it would be interesting to assess the impact on firm-level outcomes, such as the firm's profitability and market share.

The service literature also emphasizes the tremendous opportunities associated with service robots in terms of pairing robots with humans and the potential synergies, productivity gains, and service quality to be gained therefrom (Wirtz et al. 2018). Customers often go shopping for different reasons. For example, some customers seek the highest quality when making buying decisions, some are brand consciousness and prefer branded over non-brand products, while others make impulsive decisions about purchases or purchase habitually, displaying certain habits regarding their product and brand choices. It is important for retailers to better understand which benefits service robots can provide to these customer groups, and whether some of these customers prefer being served by service robots versus humans. Scholars should develop measurement instruments that assess the various benefits service robots can provide, and test these scales for different customer groups.

4.3. Contextual Circumstances Influencing Perceptions of Service Robots

Given the novelty of this research domain, few studies have included cross-contextual comparisons on service robots. One exception is a paper from Blut and colleagues (2018), who find that positive perceptions of service robots impact brand perceptions related to the service firm in which the service robot is employed, and that this effect depends on the specific service industry. This study gives an initial indication that some service robot effects are contextual and require a comparative study design. Similarly, retailing scholars should consider the context when studying service robots. Retail firms differ, for example, in their positioning and their target customers. For example, more traditional retailers, with an older customer base, may use service robots to be perceived as innovative and younger and thereby gain the attention of a younger customer segment.

Besides studying different retailers, it would be interesting to assess shopper reactions to service robots when purchasing different kinds of products. For instance, a service robot providing shopping advice in the sportswear department may be perceived differently to a robot employed in the underwear department. In addition, shoppers in different countries may react differently to service robots. It is not clear whether cultural differences (e.g., individualism-collectivism) or economic differences (e.g., country development) impact perceptions of service robots. Retailers serving shoppers in emerging markets, where labor is cheap, might be less likely to benefit from service robots compared to those in developed countries with high labor costs.

5. Digital Business Models: Servitization and Beyond

Increasingly, manufacturers are actively exploring the opportunities of service-focused business models (BM). They are inspired by industry pioneers such as Rolls Royce with their "TotalCare" solution, who have shifted their business from selling gas turbine engines as a product to selling the capability of the engine 'thrust' as a service proposition. This shift in the business is widely termed as "servitization" (Vandermerwe and Rada 1988) where a manufacturer develops a BM based on the capability provided by the product instead of the sale of product alone (Baines and Lightfoot 2013).

Descriptions of the servitization transformation through digital disruption provide important insights of the potential these service-focused BMs have for manufacturers (Baines et al. 2009; Evanschitzky et al. 2011; Martinez et al. 2010), as well as the intricacies, challenges, and barriers

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manufacturers face in the development of these BMs (Baines et al. 2017; Raddats et al. 2015; Story et al. 2017). Additionally, the current trend of digital disruption adds another layer of challenges while also unlocking new opportunities to enable creation of service-focused BMs (Frank et al. 2019). However, the current research offers limited insights explaining the ways in which digital technology has allowed the manufacturers to eventually arrive at a position where the digitally driven service-focused BM is a successful and profitable operation (Baines et al. 2017; Dimache and Roche 2013). In particular, research still needs to address the following questions:

1. How can AI be used to provide evaluation of benefit to both customers and providers of advanced services?
2. How can combined technologies improve performance in multi-objective optimization to reduce over maintenance of assets-in-use and minimization of disruption?
3. How can visibility and integrity be provided, with intelligent decision support systems for advanced services, while ensuring the privacy of personal data involved?
4. How can AI techniques be used to improve the construction of a legal advanced service contract?
5. How can Human Computer Interaction and data science techniques be applied to help overcome organizational resistance to the adoption of advanced services?
6. How can data science techniques be used to effectively reduce and streamline the amount of data available to provide decision support in advanced services?

Arguably, the creation of such a service-focused BM is not a discrete event, but the result of a long-term on-going development, efforts of which we know very little of. Literature has focused specifically on the revenue models that facilitate capturing the value from these BMs. For example, literature commonly refers to Rolls Royce's TotalCare as "Power-by-the-hour" which essentially represents the revenue model that captures the value created from the "thrust" offered as a service. However, the design of this successful BM is a result of a synchronous alignment between other important components (Abramovici et al. 2014; Alghisi and Saccani 2015; Anderson et al. 1997; Ng et al. 2012), such as the manufacturer's value proposition, their resources and competencies to drive this value proposition, and the organization's internal and external activities to leverage these resources and competencies (Demil and Lecocq 2010) (Demil and Lecocq 2010; Bigdeli et al. 2018). Individually focusing on these components is important because it helps create a more holistic view of designing a successful servitization BM (Bigdeli et al. 2018).

5.1. Digital Technology Enabling Servitization

With new embedded technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), Augmented Reality (AR), Cloud Computing, and Machine Learning being adopted by manufacturers (Lee and Lee 2015), development of servitization BMs can be better enabled (Frank et al. 2019; Kohtamäki et al. 2020; Suppatvech et al. 2019). Rolls Royce's TotalCare is also enabled by a variety of digital technologies to make data-informed decisions that help deliver engine thrust as per the service contract (Baines and Lightfoot 2013). Their success in embracing the digital technologies can be specifically attributed to the technology's role in enabling the manufacturer's service-focused value proposition (Ardolino et al. 2016; Raddats et al. 2019). Similar to Rolls Royce, manufacturers can use digital technology as an important resource and develop the required competencies to use the digital technology to enable their new value propositions instead of letting the trend of digitalization drive and disrupt their value propositions (Coreynen et al. 2017).

Additionally, with increasing digitalization of products, customers demand value from the data generated by the use of digitalized products thus creating a new untapped market (Baines et al. 2017; Suppatvech et al. 2019). Technological conglomerates such as Microsoft, Siemens, and GE are entering this market with their data interpreting platforms such as Azure, Mindsphere, and Predix by offering their competency to interpret the data as a value proposition and thus creating new competition for the manufacturing firms (Sjödin et al. 2018). Therefore, in order to satisfy and retain customers, manufacturers have to not only digitalize their products but create new value propositions based on the collected data collected. For example, MAN Truck and Bus (UK) collaborated with Microlise Fleet Management to understand driver behavior using the data gathered from their trucks and offer performance advisory services to their customers as a new value proposition (Baines and Lightfoot 2013). On the other hand, Ishida Europe and Nederman developed in-house competencies to analyze and report back the data gathered from the use of their products thus developing new value propositions.

5.2. Current Research and Future Challenges

Although such examples exist in practice, literature does not provide detailed guidelines that inform the practitioners and scholars about how digital technology can be used to enable the manufacturer's value propositions when developing servitization BMs. To address this inadequacy, this research focuses on the question; how does digital technology enable the development of service-focused value propositions for servitizing manufacturers?

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Addressing this question will lead to the development of a guideline for manufacturers and academics to understand the role of digital technology in service-focused BMs and therefore allow the manufacturers to effectively use digital technology to enable new value propositions. Additionally, addressing this question also explores the value proposition component of BM design thus providing a new angle to explore digitally enabled servitization BMs.

Due to the exploratory nature of the research and the lack of guiding research frameworks in this area, a multiple case study approach was found to be a suitable research strategy (Fletcher and Plakoyiannaki 2011; Voss et al. 2002; Yin 2009). Only the servitizing manufacturers using digital technologies to enable their servitization efforts were chosen as suitable cases for the study. As a result, 12 manufacturing firms were finalized as suitable cases for the research. The case studies were compiled using qualitative data in the form of semi-structured expert interviews (Bogner and Menz 2009; Meuser and Nagel 2009), as well as official documentation to verify the expert responses (Story et al. 2017; Yin 2009). The collected data was analyzed using the key concepts of affordance theory as a structure to interpret the results. Affordance theory also allowed identification of opportunities perceived by the manufacturers to use digital technology and the value propositions created as an outcome of realizing these opportunities (Strong et al. 2014; Volkoff and Strong 2017). In short, the research found that digital technologies, specifically IoT, contribute to the development of new data-driven value propositions (VPs) within servitization BMs. Manufacturers with digitalized products require an established connection to their products in order to develop these VPs. Barriers to accessing the product digitally can impede the development of the VPs. Four types of VPs can be developed using IoT, namely Informative VPs, Enhancive VPs, Supportive VPs, and Demonstrative VPs.

Informative VPs refer to the use of digital technology to gather usage and performance data from the product. Manufacturers were able to create additional product information using this data such as fault reports, predictive algorithms, and additional analytical tools. Enhancive VPs refer to the use of product information to enhance uptime and maintenance of the product. Manufacturers used the information to predict maintenance requirements, plan maintenance and repairs, detect faults, and reduce the overall requirement of these maintenance services, thus enhancing the overall performance of the product.

Supportive VPs refer to the use of gathered information to develop actionable insights that support the customer's business processes. Having guaranteed the performance of their products through enhancive VPs, the manufacturers were able to educate the customer about improving the usage of the products and reducing faults to further improve the performance of their business processes dependent on the product. Demonstrative VPs refer to the use of digital technology to demonstrate the value created by the previous three VPs. Manufacturers used data sharing platforms to demonstrate how the informative, enhancive, and supportive VPs are creating additional value for the customer. They were also able to demonstrate the loss of value that customers will experience if they don't avail the services offered by the manufacturer.

It was also found that the four VPs do not exist independently but have a cascading relationship. Supportive VPs are dependent on the development of Enhancive VPs because the manufacturer cannot develop supportive VPs without the guaranteed performance provided by the enhancive VPs. Manufacturers were only able to support the customer's business process after being able to guarantee the best performance from their products in the customer's business. Similarly, Enhancive VPs are dependent on the development of Informative VPs. The enhancement of the product's performance is based on the interpretation of data gathered through the informative VPs, without which the manufacturer does not have access to product usage and performance data. Demonstrative VPs are developed simultaneously to the other VPs; however, they cannot demonstrate the value of the VPs without the development of the respective VP.

Practitioners can use these findings to structure and align their efforts with their servitization goals and focus on the specific types of VPs that they aim to develop, while being aware of the dependency between different VPs. These findings can also guide the manufacturers to choose suitable technological features that enable their specific goals behind servitization. The findings help scholars categorize and establish connection between the various ways in which digital technology can contribute to service-focused value propositions. These findings also reiterate the importance of individually identifying the different components of servitization BMs such as VPs and study them individually.

6. Digital Disruption: A Research Agenda

6.1. Summary of Immediate Challenges

Our overview of research in the broad field of digital transformation emphasizes the paradigmatic shifts brought by the increasing digitalization of products/services, processes and the entire way firms interact with customers (cf., Grewal et al. 2017). It is clear that the existing research offers many notable contributions to the area. However, numerous unanswered questions remain that future research will need to answer.

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As such, although there is a decent understanding of the impact of digitalization on customer journeys, most studies rely on a limited, static view of these journeys. Therefore, future research should consider how journeys evolve over time. We encourage researchers to analyze multisource longitudinal data on customer journeys to close this gap. Further, research and practice lack a clear understanding of the factors that make a journey "seamless" from the customer's point of view. It is unclear what constitutes a seamless customer experience and how it can be measured.

Focusing on digital sensory marketing, there is a clear lack of understanding of how new multisensory technologies might help to simulate service experiences by means of multisensory representation. It is unclear how customers react to such digital environments and whether they can improve the overall customer experience. For example, while it may be fun in the first instance to "touch" products virtually using reverse electrovibration technologies, consumers may rapidly rediscover the value of real physical experiences and refuse the former and choose the latter when possible. Similarly, since there has been more online teaching due to the recent COVID-19 outbreak, students increasingly rediscover the value of seeing and interacting with their professors live in the classroom. Moreover, it is unclear how digitization and the virtualization of product and service offerings will change the nature of customer-brand relationships. We encourage researchers to offer insights into the future role of physical environments for brand marketing, and human-human service interactions in particular.

Relatedly, research on service robots thus far mainly focusses on singular contextual situations (e.g., the personal care context). Therefore, we still need to find out whether there are generalizable insights on customer perceptions of robots or whether each context needs to be considered as idiosyncratic. For example, customer acceptance of service robots may be contingent on the type of service, ranging from low- to high financial-risk services, and/or low- to high personalization (e.g., train tickets vs. medical care). Moreover, it is important for managers to understand whether the use of robots will only be appreciated by younger, tech-savvy customers while it alienates older customers. What can marketers do to help older or less tech-savvy consumers accept service robots and interact with them? There is much to learn about perceptions of digital technologies across the entire age spectrum. Further, it remains unclear how customers react to service robots as substitutes for employees. In particular, while we know that suggestions made by service employees are largely valued by customers, it is unclear how persuasive advice given by digital technologies such as robots might be. Finally, customers may perceive retailers that substitute employees with service robots as socially irresponsible, leading to negative responses such as boycott.

At the level of business models, it remains unclear how the concept of dynamic business models in servitization will help managers understand the changing role of digital technology. In particular, the role of AI, AR and the advent of the IoT remain to be fully understood in the context of business model development.

Tab. 1 summarizes the immediate challenges in the four focal areas of digital transformation.

6.2. Fundamental Issues in Digital Disruption

Apart from the more immediate challenges that stem from the research reported in this article, digital disruption might have further, long-term consequences for the retail industry. It is worth noting that recent contributions to disruptive innovations and business model transformation have questioned some of the characteristics that constitute disruptions (e.g. Muller 2020). Christensen's (1997) disruption theory postulates that disruptors enter the market at the lower end in terms of price and quality and that the disruption (necessarily) leads to failure of (some) incumbent firms (Christensen 1997; Christensen et al. 2015). However, recent disruptions have occurred independent of entry point in a market or failure of incumbents. A new technology is disruptive if it eventually supplants the incumbent technology, and significantly changes the behavior of most of the stakeholders, customers, providers, and competitors (Muller 2020).

With that in mind, digital disruption fundamentally changes the way customers interact with firms in an attempt to create value; disruptors might enter the market at all entry points in terms of price and quality; and incumbent firms might not necessarily exit the market, but transform their business model. Such business model transformation can be successful if the reconfigured value proposition is in tune with sustained, fundamental changes in customer behavior, the transformation is not restricted to some parts of the firm but the entire organization, and the employees are seen as empowered change agents (Rudolph and Schweitzer 2019).

The "readiness" for changes in customer behavior is particularly important for success of disruptive technologies. Therefore, it is important to monitor long-term changes and trends in the wider society. One such key trend – amplified by the recent COVID-19 pandemic – is the *New Domesticity*. Centering life around the safety and comfort of "home" will have fundamental implications for the way we live, shop, and work, thereby offering windows of opportunities for digital disruption.

For instance, more research is needed to clarify and measure social and economic consequences of the *digital divide*, that is, differences between those who can fully benefit from digital opportunities and those who cannot (Bartikowski et al., 2018).

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Topic Area	Key Challenge	Research Questions
Using data to understand customer journeys	Collecting data along the customer journey	How can retailers gain insights into various touchpoints and touchpoint sequences that influence search, purchase, and post-purchase in customer journeys?
	Managing retailer-owned and non-retailer-owned touchpoints	How can retailers manage complex customer journeys successfully and create seamless customer experiences when many touchpoints used in the customer's journey are not under the retailer's direct control?
	Detecting interrelationships between touchpoints	How do various customer touchpoints mutually influence one another along the different stages of the customer journey?
	Identifying moments of truth in the customer journey	How can retailers identify the most valuable customer touchpoints for different segments, and how can they steer customers to them?
	Achieving long-term effects with touchpoints	How can retailers measure the long-term effects of different customer touchpoints and touchpoint sequences?
Digitization of customer sensory experience	Improving customer experience	How can multisensory technologies be integrated in retail and service provision to improve the customer experience?
	Understanding the impact of multisensory technologies on customers	How do multisensory technologies and sensory inputs affect customers' perceptions, memories, and evaluations of services?
	Improving customer engagement	How can multisensory technologies improve customer engagement with different service actors?
	Understanding multisensory technology adoption	What can marketers do to facilitate consumer acceptance of multisensory technology?
	Extending the reach of technologies	How can multisensory technology be integrated into customer home and become a part of their lives?
Service robots in retailing	Understanding robot adoption	How do robot design features such as gender, voice, shape, etc. impact customer acceptance as well as intention to use in different retail contexts, e.g. grocery store vs. car dealership?
	Targeted use of robots	Which segment(s) of retail shoppers react(s) more positively to service robots?
	Understanding the role of robots in the wider service context	How does the use of service robots affect perceived service quality in different retail/service contexts (e.g. luxury retail vs. discount retailers?
	Understanding the economics of robots	What are the benefits and costs of using service robots from in a retail/service context from the firm's as well as the customer's perspective?
Digital Business Models: Servitization and beyond	Assessing benefits of AI	How can AI be used to provide evaluation of benefit to both customers and providers of advanced services?
	Understanding efficiency and effectiveness of digital technologies	How can combined technologies improve performance in multi-objective optimization to reduce over maintenance of assets-in-use and minimization of disruption?
	Managing decision support systems	How can visibility and integrity be provided, with intelligent decision support systems for advanced services, while ensuring the privacy of personal data involved?
	Investigating legal implications of AI	How can AI techniques be used to improve the construction of a legal advanced service contract?
	Understanding organizational change	How can Human Computer Interaction and data science techniques be applied to help overcome organizational resistance to the adoption of advanced services?
	Dealing with big data	How can data science techniques be used to effectively reduce and streamline the amount of data available to provide decision support in advanced services?

Tab. 1: Immediate Challenges

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Further, increased *safety concerns* led a new group of customers shying away from traditional (offline) retailers and shopping online for the first time. How can retailers engage with this group in order to keep them as customers?

A related question of significant interest revolves around the *future of brick-and mortar stores*. While shopping online is on the rise, traditional (offline) retailers still command the vast majority of retail sales. It seems that customers have a strong desire to browse and shop offline, be it for functional or hedonic reasons. As such, although digital sensory experiences offer unprecedented online experiences, they may not be able to entirely substitute touching, trying, smelling and experimenting real products in a real store and in an environment that inspires them. With that in mind, how should traditional shopping destinations position vis-à-vis their online rivals in order to stay competitive?

Finally, it seems that fundamental *changes in the workplace*, the dramatic increase in working from the home office in particular, not only lead to a change in shopping behavior, but also raises questions about what firms may do to facilitate telework and improve work performance. We encourage researchers to draw from the work performance literature and study how corporate support functions (IT, HR, supervisor), as well as employer brand equity affect various dimensions of work performance.

7. Conclusion

Digital disruption is shaking-up the retail industry. While some old business models will become obsolete, others with evolve and thrive, while yet others will offer entirely new ways of satisfying customer needs and wants. Research needs to constantly monitor the long-term trends to derive useful strategies for retailers to be successful in today's dynamic environment.

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