



Innovating agri-food business models after the Covid-19 pandemic: The impact of digital technologies on the value creation and value capture mechanisms

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ABSTRACT

This paper investigates the phenomenon of business models innovation (BMI) empowered by digital technologies and activated as a response to Covid-19 crisis. In fact, during the crisis numerous digital redesigns of businesses occurred to pursue both continuity and competitive advantage. Among these, the food retail sector has undergone under the pressure of the crisis intense digital changes, which, however, have not yet been investigated under the theoretical lens of BMI. To fill this gap, the paper analyzes the digital actions taken during the pandemic crisis by two large food retailers, namely Walmart and Carrefour. Covering a wide temporal interval of the pandemic evolution and reviewing multiple geographical markets, the authors interpreted the grocer's digital responses to the crisis in terms of innovation in value creation and capture mechanisms. As a result, three phases of digital BMI have been reconstructed, each characterized by specific mechanisms of value creation and capture experienced by the two grocers during the pandemic. Leveraging these findings, the paper proposes a model capable of defining how digital BMI takes place in response to crises. Results broaden theoretical knowledge and practical suggestions on digital BMI in terms of enabling factors, actionable value mechanisms, and future business opportunities.

1. Introduction

Business Models (BMs) and Business Models Innovation (BMI) concepts are gaining a growing interest in academia and industry since they photograph the mechanisms that organizations use to create, deliver, and capture value (Osterwalder and Pigneur, 2010; Amit and Zott, 2015; Foss and Saebi, 2017; Teece, 2018), as well as seize the transformations that these mechanisms experience to ensure growth and competitive advantage in a constantly changing environment (Demil and Lecocq, 2010; Teece, 2010; Amit and Zott, 2012; Foss and Saebi, 2017).

One of the major factors inspiring new opportunities for BMI is represented by the emergence of digital technologies that are radically and quickly reshaping the business landscape (Berman, 2012; Rachinger et al., 2019; Li, 2020; Latilla et al., 2021; Vaska et al., 2021). Indeed, digital technologies generate new value creation and value capture pathways and enrich traditional ones (Parida et al., 2019; Rachinger

et al., 2019; Sjödin et al., 2020; Linde et al., 2021; Tavoletti et al., 2021) throughout the empowerment of brand portfolio, the better understanding of customer needs, the process optimization, and the improvement of products and services delivered (Vaska et al., 2021), to name a few.

The application of digital technologies for BMI purposes turned out to be particularly valuable in facing the threats and disruptive changes experienced with the advent of the Covid-19 pandemic (Priyono et al., 2020; Coskun and Tanrikulu, 2021; Kronblad and Pregmark, 2021; Mostaghel et al., 2022). In fact, as a result of what is considered the worst crisis since World War,¹ organizations rethought and redesigned their BMs (Seetharaman, 2020; Martinez et al., 2021; Martínez-Velasco and Terán-Bustamante, 2022), both in the short and long run, also exploiting the strategic opportunities incorporated in digital technologies (Kraus et al., 2020; Hazaa et al., 2021; Gkeredakis et al., 2021; Buck et al., 2022) to gain business continuity, resilience, and competitiveness

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¹ Gutierrez, A., 2020. This is a time for science and solidarity. <https://www.un.org/en/un-coronavirus-communications-team/time-science-and-solidarity>, accessed on October 19th 2021.

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(Akpan et al., 2020; Gregurec et al., 2021; Corvello et al., 2022). In this sense, the pandemic triggered and accelerated the use of digital technologies by organizations to innovate BMs, also overcoming the resistance encountered in no crisis times for this practice (IBM Institute for Business Value, 2020; Chakraborty et al., 2020; Jacobides and Reeves, 2020).

Among the sectors that have experienced the phenomenon of rapid rise of new digital BMs during the Covid-19 crisis, the agri-food stood out. Actually, across the agri-food chain, which collects the set of actors involved “from field to fork”, namely from farm equipment and production to processing, distribution and consumption (Humphrey and Memedovic, 2006; FAO, 2017), there are several actors responding to the crisis with a digital BMI. For example, agricultural producers overcame a lack of seasonal agricultural workers due to international borders closure (FAO, 2020) thanks to mechanization and smart farming technologies, which decreased the reliance on human labor (EIT Food and Lantern, 2020; Lioutas and Charatsari, 2021). At the same time, food service actors, seeing their businesses closed as a result of the national lockdowns, shifted their BMs towards innovative approaches in online food delivery (Gavilan et al., 2021), using existing platforms or developing their own (EIT Food and Lantern, 2020).

However, if these changes could be short-term modifications imposed by the contingency of the pandemic, there is a stage of the agri-food chain that during the pandemic crisis enhanced a variety of digital solutions destined to change irreversibly traditional value creation and capture mechanisms of BMs, that is food retail. In fact, to decrease the chances of contagion, food retailers have on the one hand increased self-checkout and contactless payment methods in physical stores (Aull et al., 2020), while on the other hand they have encouraged online delivery and pick-up options (Aull et al., 2020; Hobbs, 2020; Abbu et al., 2021). Therefore, food retailers used digital technologies both to redesign traditional brick and mortar BMs and to enable new e-commerce ones, which were the protagonists of a huge surge during the pandemic (Keyes, 2020; Herbert et al., 2021).

In reference to the change in food retail by virtue of Covid-19, many scholars have been interested in the rapid development of online grocery and food delivery (Dannenberg et al., 2020; Gavilan et al., 2021), in the raise of “click and collect” services (Mohamad et al., 2020) and, more generally, in the investigation of the key digital drivers and technologies used in food retail (Abbu et al., 2021) to cope with the Covid-19 crisis. However, although academics have questioned the emergence and development of changes experienced by food retailers, the digital innovation of grocers' BMs following the Covid-19 was not the subject of in-depth and detailed studies. In particular, the role of digital technologies for innovating the mechanisms of value creation and value capture of retailers' BMs to respond to the Covid-19 crisis has not been fully explored, so calling for further investigations.

To close this knowledge gap, we aim at understanding how the value creation and value capture mechanisms underpinning BMs of food retailers have changed, with particular reference to the digital initiatives that companies have adopted to cope with the Covid-19 crisis.

To reach our purpose, we chose to analyze the cases of Walmart and Carrefour. In fact, Walmart e Carrefour are two of the largest food retailers in the world and faced the pandemic with the introduction of digital changes in their models of value creation and capture, achieving extraordinary financial performance.² For this reason, we believe Walmart and Carrefour are exemplary case studies to answer our research

² Walmart, 2021. Walmart Reports Record Q4 and FY21 Revenue. http://corporate.walmart.com/media-library/document/q4-fy21-earnings-release/_proxyDocument?id=00000177-b235-d73b-a9f7-b2f591660001, accessed on October 19th 2021. Carrefour, 2021. 2020 results show further strong growth. https://www.carrefour.com/sites/default/files/2021-02/Press%20release%20Carrefour%20Q4%202020_ENG%20-%2018%2002%202021_0.pdf, accessed on October 19th 2021.

question and investigate innovation and business strategies in food retail as a response to the crisis.

Using a multiple case study approach (Yin, 2014), we analyzed the actions taken by the two grocers in the year of the pandemic (February 2020–April 2021) and we identified three clear stages representing their digital BMI, based on different value creation and capture mechanisms. In particular, findings show the succession of a phase of close synergy between digital and physical processes marked by an improvement in the level of service offered, a phase of expansion of customer portfolio in B2C and B2B domains through new shopping experience and digital platforms, and finally a phase focused on the new functionalities of physical stores aimed at transforming both back-end and front-end activities in an omnichannel perspective. In addition, the discussion of our results leads to the elaboration of a model that categorizes and evaluates the interweaving between the elements enabling a digital BMI in times of crisis. With these results, we aim at contributing to the stream of research on digital BMI (Rachinger et al., 2019; Parida et al., 2019; Li, 2020; Sjödin et al., 2020; Vaska et al., 2021) in two ways. First, we improved the understanding of how value creation and capture mechanisms can be digitally innovated during a crisis thus modifying existing BMs. Second, we framed and unveiled the positive role of this practice for innovation management in crisis times thus defining how it can lead to the definition of completely new digital BMs. Moreover, we also provided practical insights for companies to pursue a successful digital BMI path following crisis.

The rest of the article is organized as follows. Section 2 contains a review about the use of digital technologies for BMI, especially in food retail. Section 3 investigates the multiple case study methodology adopted for sample selection, data collection, and data analysis. Section 4 shows the impact of digital technologies on Walmart and Carrefour's value creation and capture mechanisms. Section 5 reports the discussion of the patterns traced in the light of the main flow of literature on BMI and digital technologies. Finally, Section 6 addresses the implications and limitations of the paper, outlining new directions for future research.

2. Theoretical background

2.1. Digital business model innovation

BMI can be defined as a business transformation process that happens when firms modify or improve at least one of the foundational elements of value creation, delivery, and capture (Abdelkafi et al., 2013; Ghezzi and Cavallo, 2020) that define BMs (Shafer et al., 2005; Osterwalder and Pigneur, 2010; Gassman et al., 2014). Specifically, organizations can innovate their value creation and capture mechanisms through new combinations of core competencies and key resources, complementary assets and value networks (Rayna and Striukova, 2016), as well as through changes to cost structure, revenue formula, and profit allocation across the value chain (Sirmon et al., 2007; Teece, 2010; Holm et al., 2013).

An effective way to act on all these mechanisms, allowing the development of new BMs and renewal in existing ones, is to employ digital technologies for promoting BMI (Kohli and Melville, 2019; Rachinger et al., 2019; D'Ippolito et al., 2019; Li, 2020; Bosler et al., 2021). In fact, in recent years digital technologies have inspired a number of innovative methods to generate and appropriate value (Sjödin et al., 2020), such as extreme personalization throughout servitization and new pricing models based on subscriptions, pay-per-use or similar methods (Parida et al., 2019; Kohtamäki et al., 2020; Vaska et al., 2021). As a result, digital BMI has been studied and implemented for gaining revenue growth, competitive advantage, and performance improvement (Zhang et al., 2016; Parida et al., 2019; Correani et al., 2020; Tavoletti et al., 2021).

Moreover, digital technologies trigger BMs transformations in very fast and not linear ways (Priyono et al., 2020), ensuring a powerful

survival in crisis times. In fact, during these times, uncertainties about the direction of technological change, demand conditions, and new market opportunities (Archibugi et al., 2013) limit the amount of time available to respond and solve problems without incurring disastrous consequences (Ardito et al., 2021; Gkeredakis et al., 2021). Thus, to respond the crisis, fast growing and dynamic firms are pushed to increase their innovative activities and explorative strategies in product and market domains (Archibugi et al., 2013), both using digital technologies and BMs changes to accelerate innovation (Ritter and Pedersen, 2020; Gkeredakis et al., 2021). At this regard, scholars have emphasized how digital technologies are able to amplify the beneficial potential of non-digital BMI to cope with disruptive environmental changes (Priyono et al., 2020), generating firm survival and long-term performance (Grewal and Tansuhaj, 2001; Lindgart et al., 2009; George and Bock, 2011; Cucculelli and Peruzzi, 2020) through modification and formulation of new value creation and capture mechanisms (Amit and Zott, 2010; Breier et al., 2021).

There are numerous examples of companies that grasped the opportunity to digitally innovate BMs during crises, such as Airbnb and Uber, born from the ashes of the 2008 financial crisis leveraging digital platforms, and Alibaba, which launched the C2C Taobao online shop as a response to the 2003 SARS epidemic crisis.

It is therefore clear that digital BMI is a potentially very profitable practice, even in crisis times, since it is capable of opening up new strategic growth path. In the next section, we deepen this issue by contextualizing it within the dynamics of the food retail sector, which has been shaped by numerous digital changes in recent times (Nosratabadi et al., 2020).

2.2. Digital business model innovation in food retail

Food retailers traditionally adopt brick and mortar BMs that have proven to be extremely rooted and hardly influenced by digital disruption, until recently (Abbu et al., 2021; Vazquez-Noguerol et al., 2021). In fact, in latest years food retailers are innovating traditional mechanisms of their BMs thanks to digital technologies (Vojvodić, 2019; Kraak, 2020; Lagorio and Pinto, 2020; Nosratabadi et al., 2020), thus resulting in a closest synergy between physical and digital channels (Yrjölä, 2014; Fagerström et al., 2017; Sturiale and Scuderi, 2017). This practice allowed reimagining the functioning of the stores, enhanced with new digital tools, as well as using these traditional assets as the fulcrum of new e-commerce BMs.

Various technologies can be applied in stores to valorize and digitalize the shopping experience. For instance, mobile apps or digital displays for providing useful information on products and shopping suggestions, as well as “scan and go” and self-service solutions for offering new checkout methods generate time and cost saving, increased transparency, and personalization, while modifying the monetization methods with semi or fully automatic payment systems (Inman and Nikolova, 2017; Sloot, 2018; Spanke, 2020; Fagerström et al., 2020; Böttcher et al., 2021; Abbu et al., 2021).

In addition to this, the use of sophisticated technologies such as robots and micro-fulfillment centers in stores optimize picking and inventory management in such an efficient way that physical stores become strategic points for quickly fulfilling orders placed online, sometimes devoting themselves entirely to this function, as in the case of “dark stores” (Grewal et al., 2020; Kraak, 2020). The use of food retail stores for activating e-commerce BMs brings new value creation and capture mechanisms, including the reduction in time spent and information asymmetries for customers (Güsken, 2018; Mason, 2019), the definition of new resources and activities to manage customer demand, transport, and fulfillment issues (Hübner et al., 2019; Davies et al., 2019; Vazquez-Noguerol et al., 2021), and the development of subscription options (Belavina et al., 2016; Wagner et al., 2021).

The BMI of food retailers guided and enriched by digital technologies has become increasingly diffused during the Covid-19 pandemic, which

accelerated rapid reorganizations of in-store and online activities with digital technologies (Abbu et al., 2021). This is because the health emergency that began in 2020 was an unprecedented event, which required rapid interventions in terms of digital innovation of grocers' BMs to reduce contacts and visit times and at the same time manage the phenomenon of panic buying. At this regard, there has been a growing adoption of cashier-less or semi-self-checkout systems and an extensive use of mobile apps for a safer in-store shopping experience (Takashima, 2020), as well as a greater reliance on delivery and pick-up services (Hobbs, 2020; Chenarides et al., 2021; Dannenberg et al., 2020) also thanks to the conversion of stores into variously automated dark stores for faster deliveries (Takashima, 2020; Končar et al., 2021).

2.3. Research gap and objective

Downstream of the review, it is evident how the digital BMI of food retailers is a recent phenomenon and how it has been accelerated by the Covid-19 pandemic, the first real huge crisis that put food retailers to the test with reorganizations of in-store and online activities with digital technologies. While some studies have analyzed the occurrence of these phenomena (Dannenberg et al., 2020; Abbu et al., 2021), there are no works in the literature that unify the digital actions of food retailers undertaken during the Covid-19 and analyze these trends under the theoretical lenses of BMI. Moreover, the topic of innovation in crisis times is of paramount importance, since emergencies affect the decisions of firms to invest or abandon innovation efforts (Archibugi et al., 2013). In fact, companies can decide to change and innovate BMs' value mechanisms as well as to adopt digital technologies to escape from, adapt to, or even thrive on opportunities embedded in crises (Osiyevskyy and Dewald, 2018; Gkeredakis et al., 2021).

Starting from this consideration and with the aim of filling the gap in the existing literature regarding the role of digital technologies for innovating the mechanisms of value creation and value capture to respond to the Covid-19 crisis, this paper undertakes to answer the following research question:

“How have digital technologies allowed food retailers to innovate the mechanisms of value creation and value capture of their BMs to respond to the Covid-19 crisis?”

We attempt to answer this question by examining the innovation actions of Walmart and Carrefour. The two food retailers have in fact exploited the pressure times of the pandemic to successfully accelerate digital driven projects within the entire organization, establishing themselves as examples of BMI in food retail during the crisis.

3. Research methodology

To achieve our research purpose, we believe that a multiple case study approach is an adequate analysis strategy. Actually, this research methodology is suitable for examining contemporary and complex events within the real-life context in order to address “how” and “why” questions (Yin, 2014). Such characteristics make the case study approach particularly effective for the aim of our paper. In fact, digital BMI in response to the Covid-19 crisis is a novel and complex phenomenon lacking in adequate understanding, on which qualitative approaches guarantee deepen exploration and effective theory building (Eisenhardt, 1989; Ghauri and Gronhaug, 2005; Myers, 2009). In addition, research by means of case studies has been widely adopted to investigate the domain of BMI and digital technologies, being able to trace the evolution of these phenomena within organizations (Abrell et al., 2016; Ghezzi and Cavallo, 2020; Correani et al., 2020; Presenza et al., 2021).

We decided to analyze two cases, i.e., Walmart and Carrefour, to obtain greater robustness and generalizability than that obtained by studying a single case, thanks to the possibility of accessing varied empirical evidence and conducting comparative analysis (Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Yin, 2014) to search for similar

Table 1
Case study overview.

	Walmart	Carrefour
Company description	At the top of all the global retail, American food retail and corporate companies' rankings ^a , Walmart's value derives from its strategy of "Every Day Low Prices" and "Every Day Low Costs"	Leading food retailer from east to west, Carrefour creates and captures value around quality, organic and traced food
Company digital background	Walmart made massive investments since 2015 in digital technologies for logistics and supply chain optimization (e.g., blockchain for transparency and faster decision making; software and hardware solutions for inventory tracking and managing; machine learning for transportation and delivery routes) and user experience improvement (e.g., expansion of online channels and integration with physical ones for more accurate profiling and customization of offers)	Carrefour released a five-year transformation plan in 2018 which provides, among others, digital measures to promote the sustainability of food (e.g., expansion of blockchain technology for higher quality and control of the supply chain) as well as the creation of an omnichannel ecosystem that leveraged stores and e-commerce (e.g., new e-commerce sites in each country, increase in pick up options, delivery and cash and carry, investments in digital payments, virtual shopping assistant)
Covid-19 impact on business performance	In the fiscal year ended January 31, 2021, Walmart's global revenue increased by nearly 7 % compared to a year earlier, thanks to massive gains in both store and e-commerce sales. In particular, Walmart U.S. e-commerce sales grew 74 % in Q1 FY21, with strong results for grocery pickup, delivery services, walmart.com , and marketplace, continuing to raise an additional 37 % across all channels in Q1 FY22	In 2020, with revenue growth of more than 7.8 % on a like-for-like basis, Carrefour has achieved its best performance in at least 20 years. In this scenario, progress in food e-commerce was vigorous with a 70 % boom in gross merchandise volume and confirmation of the appeal of organic products (+18 % revenue growth in this market). Moreover, customer satisfaction has risen sharply, with a 12-point increase in Net Promoter Score at Group level
Covid-19 impact on digital innovation strategies	The crisis has spurred Walmart's innovation by focusing on the optimization of online shopping thanks to a branched physical presence and new purchase and delivery methods, as well as on the digital efficiency of logistics and in-store activities	Carrefour reacted to the 2020 sharp increase in online traffic with adjustments on purchasing platforms, increases in pickup and delivery through expansion of convenience stores, and with the automated transformation of warehouse and in-store operations

^a National Retail Federation, 2019-2021. Top 50 Global Retailers Ranking. <https://nrf.com/resources/top-retailers/top-50-global-retailers/top-50-global-retailers-2021>; <https://nrf.com/resources/top-retailers/top-50-global-retailers/top-50-global-retailers-2020>; <https://nrf.com/resources/top-retailers/top-50-global-retailers/top-50-global-retailers-2019>, accessed on October 19th 2021.

Supermarket News and IGD, 2021. Top 50 food and grocery retailers and wholesalers in the U.S. and Canada. <https://www.supermarketnews.com/retail-financial/top-50-food-and-grocery-retailers-sales>, accessed on October 19th 2021.

Fortune, 2021. Global 500. <https://fortune.com/global500/>, accessed on October 19th 2021.

patterns in the digital BMI occurred during the crisis.

3.1. Sample

To ensure rigorous analysis and select critical and extreme case studies (Eisenhardt, 1989; Yin, 2014), the selection procedure was characterized by three criteria. First, we took in account historically leading companies in the food retail sector that have embraced or are embracing a path of digital innovation on multiple areas, to capture diversified shifts to BMs. Second, we identified companies that continued to have excellent financial and operational performance during the pandemic, emerging victorious from the crisis thanks to their digital strategies. Third, we focused our attention on companies on which qualitative and quantitative information abound, to build a detailed BM representation and trace the innovation path in detail. As a result, we selected Walmart and Carrefour, two of the most successful food retailers in the world that accelerated digital transformation initiatives and achieved leaps in sales in 2020.

Below we provide a preliminary description of the two cases and a summary of contextual information in Table 1.

3.1.1. Walmart

Founded in 1962 and with more than 10,500 stores and clubs in 24 countries constituting its core asset, Walmart's strategy is to provide consistent discounts and optimize its supply chain, operating on various formats like supermarkets, hypermarkets, supercenters, warehouse clubs, cash-and-carry stores, discount stores, neighborhood markets, and e-commerce platforms.

In recent years, Walmart accounted important investments in digital innovation, such as the world's largest e-commerce deal with Flipkart's acquisition and the co-foundation of an online grocery delivery company in China. Moreover, the retailer cultivates digital solution in its own technology incubator and partnered with specialists in cloud technologies, big data, machine learning, Internet of Things (IoT), robotics, and blockchain to improve nearly all areas of its business system.

The pandemic has accelerated Walmart's innovative drive, so much that the grocer recorded a huge climb in the ranking of the world most innovative companies of 2020 based on data from Boston Consulting Group (+29 positions compared to the previous year).³ To respond to the rise in digital ordering during the pandemic, Walmart leveraged more than 4700 physical stores located within 15 min of 90 % of the U.S. population for online order distribution. Specifically, Walmart acted on in-store automation and advanced technology solutions and took advantage from a number of strategic partnerships with startups and high-tech companies for testing new forms of grocery delivery and scaling micro-fulfillment center. At the same time, the grocer focused its efforts on optimizing online purchases with new forms of subscription, delivery, and collection without contact, based on servitization and personalization offerings.

3.1.2. Carrefour

Dated 1959 in France, the Carrefour Group is one of the Europe and South America leading food retailers,⁴ with a network of some 13,000 stores in more than 30 countries that includes hypermarkets, shopping

³ Visual Capitalist, 2020. Ranked: The 50 Most Innovative Companies. <https://www.visualcapitalist.com/top-50-most-innovative-companies-2020/>, accessed on October 19th 2021.

⁴ Statista.com, 2021. Leading supermarkets and food retail stores in Brazil in 2020, by gross revenue. <https://www.statista.com/statistics/721546/leading-supermarkets-food-retailers-revenue-brazil/>, accessed on October 19th 2021. Statista.com, 2021. French supermarket and hypermarket chains' market share of organic product sales 2020. <https://www.statista.com/statistics/1203030/market-share-supermarket-hypermarket-organic-product-sales-france/>, accessed on October 19th 2021.

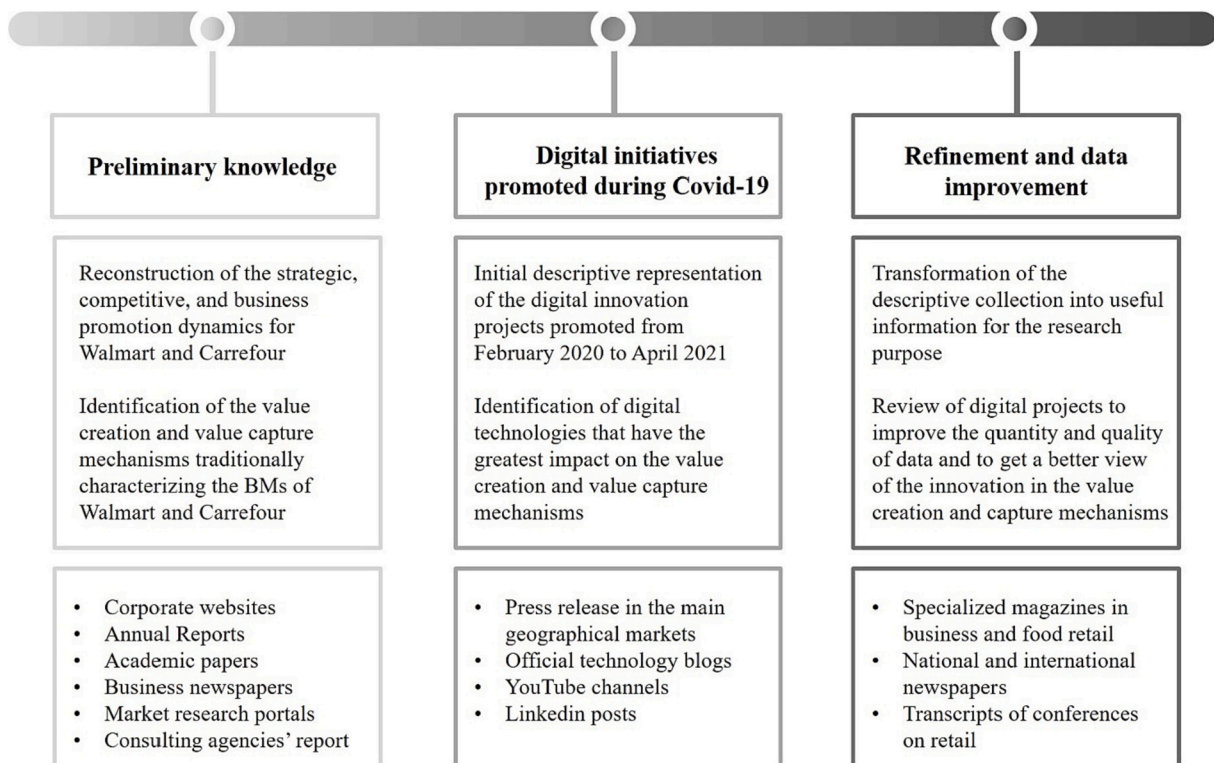


Fig. 1. Data collection strategy.

centers, groceries, convenience stores, food markets, and own commercial formats.

The grocer's business strategy is based on the promotion of food transition, encouraging access to high-quality, local, and affordable food through short and tracked distribution channels. With this aim, Carrefour has increased quality, authenticity, and traceability thanks to the introduction of the first European food blockchain, combining this initiative with the geographical expansion of convenience stores and the acquisition of food e-commerce startups (e.g., the meal kit delivery specialists Quitoque and Dejbox, the supplier of extra fresh basket from local producers Potager City) to enhance greater access to sustainable food. Furthermore, Carrefour has entered in agreements with world market leaders in big data, artificial intelligence, digital payments, and mobile services (e.g., Google, Tencent) for the improvement of shopping experience and for the joint creation of an innovation lab on acceleration of digitization in France.

In this wake, Carrefour acted during the pandemic with the release of new platforms and mobile apps and with stores' acquisition in large cities to ensure everyone to purchase food online or choose "click and collect", while proceeding with conversion of sites to dark stores, with increase in automation in fulfillment centers, and with new partnerships for delivery service.

3.2. Data collection

Once the companies were selected, we proceeded to analyze the cases as distinct and discrete experiments (Eisenhardt and Graebner, 2007) before conducting a comparative cross-case analysis (Eisenhardt, 1989). We collected data from multiple secondary sources (i.e., documentary information and archival records) to triangulate for gaining more robustness, avoiding bias, and increasing quality (Eisenhardt, 1989; Yin, 2014).

In particular, the data collection process followed a three-step strategy, each characterized by specific research objectives and specific data sources.

Initially we collected data and information useful to have a preliminary knowledge of the two cases, reconstructing the strategies [[parms resize(1),pos(50,50),size(200,200),bgcol(156)]] on and critical activities on which the grocers compete and create value, the long-term growth strategies and the digital actions they have taken or are working on to achieve business goals), as well as corporate reports and financial information. Alongside those data, academic papers who investigated the Walmart and Carrefour cases (e.g., Minadeo, 2010; Hocquet, 2014), business newspapers (e.g., Financial Times, CNBC, Bloomberg), market research portals (i.e., Statista), and consulting agencies' reports (e.g., IDC, McKinsey, Accenture) were extremely relevant to reconstruct the background and innovation strategies adopted by Walmart and Carrefour and to acquire preliminary knowledge on their digital moves.

After framing the context in which Walmart and Carrefour operate, the second step of the data collection strategy was to gather descriptive information related to the retailers' digital initiatives promoted as a response to the Covid-19 crisis, in order to identify the digital technologies that determined the greatest innovations in the value creation and value capture mechanisms for the two grocers. The main data sources for this data collection step were the newsroom sections of the Walmart and Carrefour webpages, sieved from February 2020 to April 2021. In particular, both the newsroom sections of the corporate group pages and the local websites of the most important countries in which the companies operate (e.g., USA, Canada, Mexico, Brazil, Argentina, France, Italy, Spain, Belgium, UAE, China) were examined, as well as the website of Sam's Club (i.e., the chain of membership-only warehouse clubs owned and operated by Walmart) and Majid Al Futtaim (i.e., the exclusive franchisee for Carrefour in the Middle East, Africa, and Asia). In addition to the press releases, further material useful in this phase was found in other official channels, such as the groups' blogs dedicated to digital and technological initiatives (i.e., Horizons by Carrefour, Walmart Global Tech), YouTube channels owned by the two grocers, and LinkedIn pages both of the two organizations and of the operating, commercial and innovation managers who posted trending content.

As a third step of the data collection strategy, we tracked additional

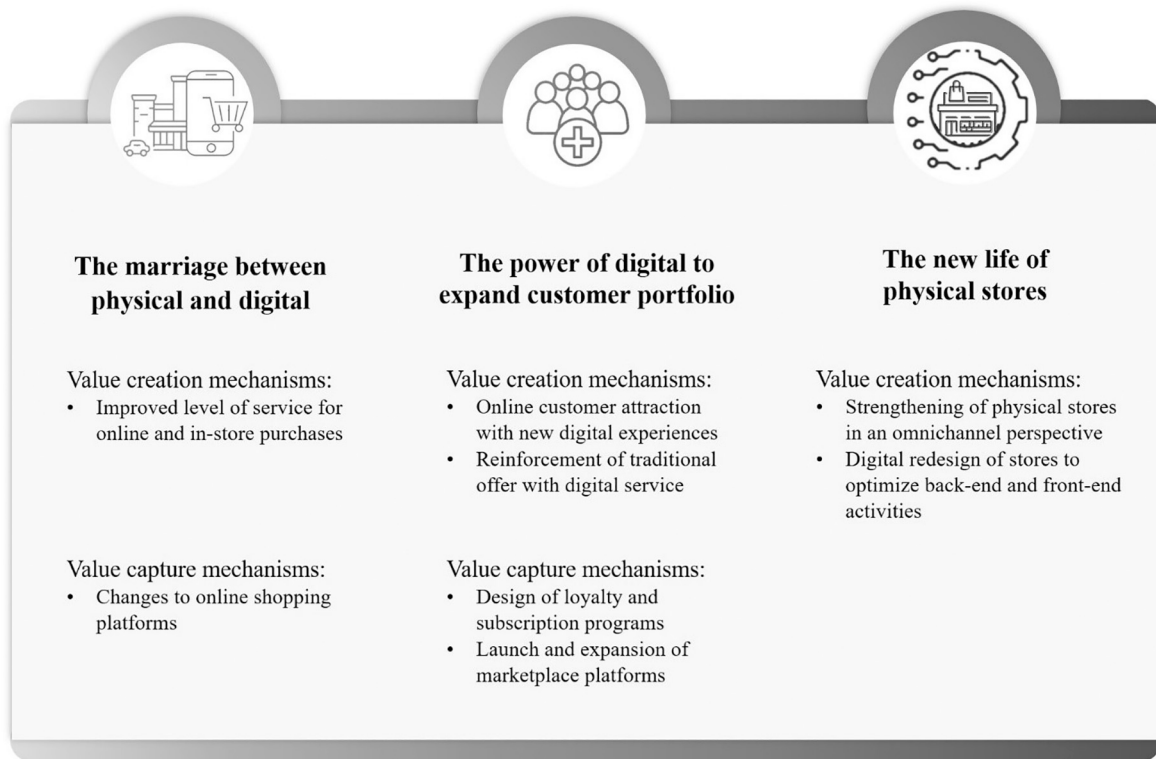


Fig. 2. The innovations in value creation and value capture mechanisms for Walmart and Carrefour.

documentary information for each action undertaken by the companies during the pandemic, to refine and improve the quantity and quality of data available for our research purpose. Specifically, we consulted sites of companies specialized in dealing with food retail and business issues (e.g., Supermarket News, Institute of Grocery Distribution), national and international newspapers (e.g., The New York Times, Le Figaro), and transcripts of conferences on retail (e.g., Bank of America 2021 Consumer & Retail Technology Conference, Morgan Stanley Virtual Global Consumer & Retail Conference). These data contained descriptive material of technological projects carried out and/or in-depth studies by qualified analysts in the evaluation of strategic and digital plans, also reporting interviews with managers and technological partners involved in the initiatives. In this way, the characteristics of each innovation were reconstructed, as well as the mechanisms that made these changes concrete.

The data collection strategy presenting the gathering phases and their contribution to research objectives, together with the archival and documentary sources used, is indicated in Fig. 1.

3.3. Data analysis

Data collected were critically and inductively analyzed following the insights of Miles and Huberman (1984), Eisenhardt (1989), Strauss and Corbin (1998), and Yin (2014), with the aim of identifying common patterns between the two companies in reference to digital BMI occurred during the pandemic crisis.

Specifically, the vast amount of data collected was ordered, organized, and structured following a specific coding scheme that allowed to identify relevant elements for our scope. The scheme was derived from the research questions and existing theoretical frameworks of BMs and BMI (Zott et al., 2000; Shafer et al., 2005; Amit and Zott, 2012; Parida et al., 2019; Sjödin et al., 2020). In this way, two first-order categories, i.e., “value creation” or “value capture”, were developed for guiding the within-case analysis. In particular, every innovation developed by Walmart and Carrefour has been grouped and tabled regarding the

association with a mechanism of value creation or capture in the retailer's BM, and was also ordered by time scale to assure a correct temporal tracking. Thanks to this first action of coding, we managed to summarize the enormous quantity of data collected, thus simplifying the comparative analysis of the cases and the extraction of patterns.

In fact, after all data were coded, we identified relationships and patterns among data. In particular, second-order themes were developed (e.g., “level of service”, “marketplace platforms”), to be the object of internal discussion and further comparisons with BMs and BMI theories. This practice continued until saturation, i.e., until no new themes were able to identify mechanisms of value creation and capture, and, at the same time, no refinement to existing themes were necessary to clarify the retailers' innovation actions. For this reason, the internal discussion has been supported by new collection of empirical data to correctly group the different value mechanisms emerged into three main phases representing the digital BMI occurred to Walmart and Carrefour following the crisis. Finally, thanks to a continuous comparison with the main literature on BMI and digital innovation in food retail, the discussion led to the development of a model answering our research question and aimed at generalizing the digital BMI phenomenon in response to the crisis.

4. Findings

This section is organized around three phases (i.e., “The marriage between physical and digital”; “The power of digital to expand customer portfolio”; “The new life of physical stores”) that indicate how Walmart and Carrefour digitally innovated their mechanisms for creating and capturing value during the Covid-19 crisis. Specifically, the first phase (i.e., “The marriage between physical and digital”) is characterized by optimization and new releases of platforms and applications to ensure a safe and effective purchase both online and in-store. Instead, in the second phase (i.e., “The power of digital to expand customer portfolio”) a more structured development of solutions to support physical and virtual shopping experiences occurs, with the aim of providing new

benefits to users, building loyalty, and exploring new proposals for additional customer segments. Finally, the third phase (i.e., “The new life of physical stores”) focuses on long-term actions that can transform physical stores into strategic units capable of satisfying physical and digital purchasing processes more efficiently and effectively.

Fig. 2 schematize the three phases of the digital BMI experienced by Walmart and Carrefour during the pandemic crisis, highlighting the changes in the mechanisms of value creation and capture for the two grocers.

4.1. The marriage between physical and digital

The fuse triggered by the pandemic determined for Walmart and Carrefour an intensification of their efforts in digital technology towards the streamlining of online and in-store shopping processes. In fact, in this first phase the two grocers focused on the digital reorganization of purchasing processes, enhancing the level of service through more effective platforms capable of improving and combining navigation on virtual and physical stores.

Carrefour had to deal with an IT infrastructure not sized for the dizzying increase in traffic recorded on online platforms, whose access was initially characterized by inefficiencies and queues. However, the French brand promptly resolved those problems and innovated its value creation mechanisms by improving the level of service in online and in-store purchases. In particular, two lines of action were elaborated to reach this goal. Firstly, Carrefour completely renewed the interface of its websites and apps with a user-centered approach, exploiting internal expertise in user experience (UX) design⁵ and collaborations with freelancers⁶ and companies specialized in e-commerce.⁷ As a result, Carrefour released new resilient and ease to use website and app versions in France,⁸ Italy,⁹ Belgium,¹⁰ Brazil,¹¹ and created an ex-novo platform in Argentina,¹² where they had never been successfully developed before. In addition, the new enhanced platforms increased the breadth of the omnichannel proposals partially experienced before the pandemic. In fact, the

⁵ Horizons by Carrefour, 2021. Supeco launches the first discount e-commerce site. <https://horizons.carrefour.com/e-commerce/supeco-launches-the-first-discount-e-commerce-site>, accessed on October 19th 2021.

⁶ Moreno, A., 2020. Online grocery shopping experience: Carrefour case. <http://anne-moreno.medium.com/online-grocery-shopping-experience-carrefour-case-c0d572d85005>, accessed on October 19th 2021.

⁷ CI&T.com, 2021. Carrefour Leads Online Grocery with its New Digital Experience. <https://ciandt.com/us/en-us/case-study/carrefour-leads-online-grocery-its-new-digital-experience>, accessed on October 19th 2021.

⁸ Carlier-Lossouarn, A., 2020. Carrefour déploie le self-scanning via smartphone. <https://www.lineaires.com/la-distribution/carrefour-deploie-le-self-scanning-via-smartphone>, accessed on October 19th 2021. ActRetail.fr, 2020. Supeco, l'enseigne discount de Carrefour, lance son site de e-commerce. <https://www.actu-retail.fr/2020/11/25/supeco-lenseigne-discount-carrefour-site-commerce/>, accessed on October 19th 2021.

⁹ Economyup.it, 2020. E-commerce, Carrefour lancia il primo sito mobile first nella GDO italiana. <https://www.economyup.it/retail/e-commerce-carrefour-lancia-il-primo-sito-mobile-first-nella-gdo-italiana/>, accessed on October 19th 2021.

¹⁰ RetailDetail.be, 2020. Carrefour lanceert vernieuwde app. <https://www.retaildetail.be/nl/news/food/carrefour-lanceert-vernieuwde-app>, accessed on October 19th 2021.

¹¹ Lozada, C., 2020. Carrefour launches new e-commerce platform in Brazil. <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/carrefour-launches-new-e-commerce-platform-in-brazil-60789248>, accessed on October 19th 2021.

¹² Horizons by Carrefour, 2020. Launching a 24H express delivery service in Argentina. <https://horizons.carrefour.com/e-commerce/launching-a-24h-express-delivery-service-in-argentina>, accessed on October 19th 2021.

platforms simplified the article search function and the view of the promotions and offers for the items available online and in the store at that moment, thus allowing customers to choose the most convenient purchase option for their frequently purchased items and shopping lists. At the same time, the app updates diffused a “phygital” shopping process among multiple division of the group. Specifically, apps were equipped with scanning functions useful to buy and check out from the stores, without any contact, and were empowered to enable “click and collect” via QR code at fully automatic grocery collection points. Besides the investments to expand safe and efficient pickups in traditional¹³ and automatic¹⁴ forms, Carrefour also worked for a greater capillarity of the delivery service.¹⁵ Indeed, the grocer strengthened existing collaborations with food delivery platforms (e.g., Glovo in France, Spain, Argentina, and Italy) and entered into new partnerships to make the service increasingly branched, accessible, and express (e.g., Uber Eats in France and Belgium; Deliveroo in France, Belgium, Spain and Italy; Glovo in Kenya and Georgia). The enhancement and development of new online shopping channels required not only IT competences, but also operational skills. In fact, since a predominant use of physical stores for multiply online orders' preparation capacity was essential for providing the value to customers, Carrefour hired temporary workers in local areas, regions, and central offices to assemble online orders.¹⁶

Walmart, in the same way as Carrefour, innovated its mechanisms for creating value by making the purchase service more efficient, thanks to apps' updates useful for improving in-store experience. Specifically, Walmart scaled the access to a series of digital features already developed, such as Walmart Pay (i.e., system for paying in-store with the smartphone, made completely touch-free with the advent of the pandemic), Store Maps (i.e., system for facilitating shop navigation), and Item Finder (i.e., system for tracking down items in the shop).¹⁷ In addition, for what concerns the collection of groceries, if Carrefour

¹³ Gulfnews.com, 2020. Coronavirus: Carrefour launches ‘click and collect’ service in the UAE. <https://gulfnews.com/uae/coronavirus-carrefour-launches-click-and-collect-service-in-the-uae-1.71708284>, accessed on October 19th 2021. European Supermarket Magazine, 2020. Carrefour Poland Introduces Click & Collect Service For Groceries. <https://www.esmmagazine.com/technology/carrefour-poland-introduces-click-collect-service-for-groceries-107617>, accessed on October 19th 2021. Gulf-insider.com, 2020. Carrefour Bahrain introduces ‘Click and Collect’. <https://www.gulf-insider.com/carrefour-bahrain-introduces-click-and-collect/>, accessed on October 19th 2021.

¹⁴ LSA.fr, 2020. [Exclu LSA] Les détails sur le premier drive piéton robotisé de Carrefour. <https://www.lsa-conso.fr/exclu-lsa-les-detaills-sur-le-premier-drive-pieton-robotise-de-carrefour-356703>, accessed on October 19th 2021. Dubai International Financial Centre, 2020. Carrefour Expands into DIFC and Introduces the Region's First Automated Click & Collect Service. <https://www.difc.ae/newsroom/news/carrefour-expands-difc-and-introduces-regions-first-automated-click-collect-service/>, accessed on October 19th 2021.

¹⁵ Carrefour, 2021. Carrefour and Deliveroo sign a partnership deal for France and Internationally. <https://www.carrefour.com/en/actuality/deliveroo-international>, accessed on October 19th 2021. Carrefour, 2021. One year later, Carrefour and Uber Eats are continuing to bolster their partnership. <https://www.carrefour.com/en/actuality/news/ubereats>, accessed on October 19th 2021.

¹⁶ Carrefour, 2020. Our 5 customer commitments during the lockdown. <https://www.carrefour.com/en/actuality/carrefour-committed-helping-protect-peoples-purchasing-power-well-ensuring-safety-both>, accessed on October 19th 2021.

¹⁷ Walmart, 2020. We've Unified our Walmart Apps to Deliver an Even Better Shopping Experience. <https://corporate.walmart.com/newsroom/2020/05/20/weve-unified-our-walmart-apps-to-deliver-an-even-better-shopping-experience>, accessed on October 19th 2021.

Table 2
Value creation and value capture for Walmart and Carrefour in “The marriage between physical and digital” phase.

Walmart	Carrefour
Value creation mechanism: improved level of service for online and in-store purchases	Renewal and creation of digital platforms more resilient and user-centered
Spread of digital options and physical services:	Spread of digital options and physical services:
<ul style="list-style-type: none"> • App features for navigating the store, finding items, paying without contacts • Contactless checkout • Curbside pickup reorganization • Expansion and speeding up of the delivery service thanks to machine learning algorithms, new personal shoppers, and use of stores to fulfill orders 	<ul style="list-style-type: none"> • Intuitive apps and platforms for easier online and in-store purchasing processes • Contactless checkout • Traditional and fully automatic pickup • Expansion and speeding up of the delivery service thanks to specialized partners, temporary workers, and use of stores to fulfill orders
Value capture mechanism: changes to online shopping platforms	
Integration of the grocery platform with the main platform for the sale of food and basic necessities in a single app	Creation of a specific and separate platform for the sale of food and basic necessities in a new bundle of products

invested in the spread of “click and collect” in fully automatic pickup points, Walmart initially preferred to rearrange the traditional curbside pickup process in contactless mode,¹⁸ reserving specific time slots for the pickup for specific categories of people (e.g., people at high risk, first responders),¹⁹ and partnering with Nextdoor (hyperlocal social networking company) for a neighborhood solidarity shopping program.²⁰ In addition to the traditional pickup system, Walmart extended the geographical areas covered by the express delivery service, guaranteed thanks to the hiring of new personal shoppers for the orders’ assembly²¹ and to internally developed machine learning algorithms.²² Regarding the delivery process, in contrast to Carrefour, Walmart initially preferred to manage the deliveries directly or keep the existing line of partners.²³ In fact, the grocer considered the service with high strategic potential since it can count on a dense network of stores from North to Central America within easy reach of most of the population.

As regards innovation in value capture pathways, Carrefour’s strategic choice in France and Italy was to launch e-commerce platforms

¹⁸ Sam’s Club, 2020. Sam’s Club Launches Curbside Pickup Nationwide. <https://corporate.samsclub.com/newsroom/2020/06/11/sams-club-launches-curbside-pickup-nationwide>, accessed on October 19th2021.

¹⁹ Albertelli, S., 2020. Coronavirus: Walmart expands its curbside pickup service in Florida and nation. <https://eu.jacksonville.com/story/news/local/2020/04/14/coronavirus-walmart-expands-its-curbside-pickup-service-in-florida-and-nation/112272756/>, accessed on October 19th2021.

²⁰ Nextdoor.com, 2020. Walmart and Nextdoor provided solutions to connect neighbors in need during COVID-19. <https://business.nextdoor.com/enterprise/success-stories/walmart-and-nextdoor-partnered-to-provide-solutions-to-connect-members-in-need-during-covid-19>, accessed on October 19th2021.

²¹ Meyersohn, N., 2021. This is one of the fastest growing jobs at Walmart. <https://edition.cnn.com/2021/02/12/business/walmart-jobs-personal-shoppers/index.html>, accessed on October 19th2021.

²² Wiggers, K., 2020. How Walmart uses AI to enable two-hour Express Delivery. <https://venturebeat.com/2020/05/11/how-walmart-uses-ai-to-enable-two-hour-express-delivery/>, accessed on October 19th2021.

²³ Walmart, 2020. Walmart Introduces Express Delivery. <https://corporate.walmart.com/newsroom/2020/04/30/walmart-introduces-express-delivery>, accessed on October 19th2021.

specifically dedicated to the purchase of prepackaged shopping boxes containing a mix of groceries and home and personal care products (i.e., “Les Essentials”) structured to cover basic needs in a specific time interval.²⁴ This strategy of splitting the e-commerce channels and selling a new product bundle, with subscription option to receive packages on a regular basis, provided a complete solution to custom[[parms resize(1), pos(50,50),size(200,200),bgcol(156)]]ith just one short visit to the platform, limited the dysfunctionalities of the platform, which in fact was independent from traditional e-commerce channels and became a lab-platform to pre-test e-commerce concepts before launch at scale, and facilitated the work of the warehouse teams, who were able to prepare packages in advance, delivered by Carrefour’s food startup Potager City and DejBox in France and by partners such as ePrice in Italy.

If Carrefour focused on separating e-commerce platforms, allowing customers to simultaneously purchase a rich box of food and basic necessities, Walmart adopt a strategy with the same final purpose but a different concretization plan. Indeed, the grocer choose to integrate its Walmart Grocery app (for food purchases only) with the main Walmart app, so that consumers were able to buy items in multiple departments from the same application.²⁵

The innovations that Walmart and Carrefour promoted in their value creation and capture mechanisms during the first phase of their digital BMI are summarized in Table 2.

4.2. The power of digital to expand customer portfolio

Following the improvement of online and physical purchasing processes, the innovation path adopted by Walmart and Carrefour progressed to the increase in customer base and loyalty, unlocking new services and activities enabled by digital technologies. In particular, on one hand, new value-adding services were introduced in Walmart and Carrefour B2C businesses, focusing on personalization, emotional involvement, simplification and rewards for loyal behaviors. On the other hand, the grocers proposed new marketplace solution to increase the network of business relationships with other companies in the B2B sector.

As regards value creation mechanisms, Walmart and Carrefour activated new shopping experiences, often personalized.

For example, Carrefour launched in France a voice-based e-commerce grocery shopping experience within the framework of the strategic partnership signed in June 2018 with Google, which led to the birth of new skills in artificial intelligence (AI) and machine learning cultivated in a hub jointly built in Paris.²⁶ Thanks to these new abilities and contaminations and leveraging the connection of Google and Carrefour accounts, the two companies activated both the voice creation of a shopping list via Google Assistant to be automatically converted into a cart on [Carrefour.fr](https://www.carrefour.fr) website and the release of relevant product recommendations based on users’ preferences, purchase histories, and the grocer’s best sellers and best prices. Personalization is also the basis of another high-value service offered by Carrefour to intercept new customers, especially in the healthy food sector. The French division, in partnership with the food startup Innit, launched a custom nutritional score that provided online buyers with tailored alimentary information (e.g., suggestions on products to opt for, alternatives for products to

²⁴ Horizons by Carrefour, 2020. Launching a home delivery service in 6 days. <https://horizons.carrefour.com/e-commerce/launching-a-home-delivery-service-in-6-days>, accessed on October 19th2021.

²⁵ Supermarket News, 2020. Walmart Grocery absorbed into flagship mobile app. <https://www.supermarketnews.com/online-retail/walmart-grocery-absorbed-flagship-mobile-app>, accessed on October 19th2021.

²⁶ Sword, A., 2020. Carrefour adds voice grocery shopping with Google Assistant. <https://internetretailing.net/strategy-and-innovation/strategy-and-innovation/carrefour-adds-voice-grocery-shopping-with-google-assistant-21570>, accessed on October 19th2021.

Table 3

Value creation and value capture for Walmart and Carrefour in “The power of digital to expand customer portfolio” phase.

Walmart	Carrefour
Value creation mechanism: online customer attraction with new digital experiences New experience based on the customization of purchasing processes:	New experiences based on the customization of purchasing processes:
<ul style="list-style-type: none"> Interactive cooking video series with personalization and shopping speedup options to support meal preparation at home New experience based on emotional customer engagement:	<ul style="list-style-type: none"> Voice-based e-commerce grocery service with AI-generated recommendation options Custom nutritional score with individual suggestions New experience based on post sale service:
<ul style="list-style-type: none"> Virtual reconstruction of a film setting to showcase and shopping products Live streaming events 	<ul style="list-style-type: none"> Sale of chef-curated recipe boxes with visual cards and online video tutorial to support meal preparation at home
Value creation mechanism: reinforcement of traditional offer with digital service	Increase in the level of product information and purchase transparency with extension of the blockchain ecosystem in the group
Value capture mechanism: design of loyalty and subscription programs New subscription program with augmented delivery and in-store options	New loyalty program and simplification in collecting loyalty benefits
Value capture mechanism: launch and expansion of marketplace platforms Expansion of the B2C marketplace through partnerships and enlargement of B2B ad-marketplaces	Launch of B2C and B2B marketplaces

avoid), based on standard health criteria and on own food habits, nutritional goals, and allergies.²⁷ For the development of the solution, Carrefour combined the experience of its innovation and e-commerce departments, specialized in managing cross functional teams and leading the technical integration and the UX design, with Innit's competences in nutrition science.²⁸ While Carrefour France devised new value creation mechanisms in collaboration with strategic partners, other divisions expanded innovations already well established within the group. This is the case of Majid Al Futtaim, which become the first retailer in the UAE to offer new levels of foods knowledge and transparency for customers and an open-source platform for optimizing the work of growers, processors, and shippers, thanks to the blockchain-enabled ecosystem IBM Food Trust, to which the Carrefour group had joined since 2018 as a founding member.²⁹ Another project started by Majid Al Futtaim in UAE that took inspiration from an innovation already introduced by the group is Cookit Yourself, a chef-curated recipe box for sale in selected stores and online, designed to deliver ready-to-prepare meals with all the necessary ingredients, a step-by-step recipe imprinted on a visual card, and a dedicated tutorial on Carrefour's YouTube channel.³⁰

Walmart also innovated its value creation mechanisms through new shopping experiences that augmented the food purchasing process. For instance, the grocer developed Walmart Cookshop, an interactive celebrity-hosted cooking video series that featured customizable scenarios in a choose-your-own cooking experience, letting viewers to tailor the recipes they are watching with their specific tastes and dietary

specifications, and to purchase products and ingredients directly through the videos, receiving them at home or prepared in pickup stores.³¹ The new personalized video recipe concept took shape thanks to Eko, a video technology provider, with which Walmart had signed a partnership agreement since 2018 aimed at creating interactive storytelling and shows for entertainment and retail. If the strength of Walmart Cookshop is the personalization of the contents, which make a solution similar, in terms of value creation mechanism, to the experiences of voice shopping and nutritional score powered by Carrefour, there are other shopping experiences developed by Walmart that focused on close emotional contact rather than personalization. An example is the one promoted by Sam's Club to stimulate Christmas shopping. The warehouse club chain, counting on the help and skills of Obsess, a company specialized in virtual store platforms for experiential e-commerce, recreated the home setting of a well-known American Christmas film to suggest trendy gifts and holiday food products, allowing customers to buy what they need directly from the virtual experience.³² In addition to these virtual shopping experiences enjoyable at any time, Walmart also successfully tested live streaming shopping experiences on the social network TikTok, reserving them at the moment for the purchase of clothing and beauty items, but declaring the willingness to expand this phenomenon by partnering with creators to showcase different products via different format,³³ and being one step away from buying the Chinese platform.³⁴ If in USA Walmart did not experience the live streaming shopping of foods, in China, in collaboration with the “online to offline”

²⁷ Bfm Business, 2020. Carrefour lance le “premier nutri-score personnalisé gratuit”. https://www.bfmtv.com/economie/entreprises/carrefour-lance-le-premier-nutri-score-personnalise-gratuit_AV-202010190311.html, accessed on October 19th2021.

²⁸ Horizons by Carrefour, 2020. Offering a custom nutritional score on e-commerce. <https://horizons.carrefour.com/e-commerce/offering-a-custom-nutritional-score-on-e-commerce>, accessed on October 19th2021.

²⁹ Ndichu, D., 2020. Majid Al Futtaim taps IBM blockchain for food traceability at Carrefour stores. <https://gulfbusiness.com/majid-al-futtaim-taps-ibm-blockchain-for-food-traceability-at-carrefour-stores/>, accessed on October 19th2021.

³⁰ Food Business Gulf & Middle East, 2020. Carrefour introduces ‘Cookit Yourself’; cook at home recipe boxes with chef-inspired dishes. <https://www.foodbusinessgulf.com/2021/01/carrefour-introduces-cookit-yourself-cook-at-home-recipe-boxes-with-chef-inspired-dishes/>, accessed on October 19th2021.

³¹ Progressive Grocer, 2021. Walmart Expands Its Cookshop Concept. <https://progressivegrocer.com/walmart-expands-its-cookshop-concept>, accessed on October 19th2021.

³² Ormont Blumberg, P., 2020. Whoa! Sam's Club Launches Virtual Holiday Shopping Experience Inside National Lampoon's -Inspired Home. <https://finance.yahoo.com/finance/news/whoa-sams-club-launches-virtual-195357104.html>, accessed on October 19th2021.

³³ Walmart, 2021. Walmart Doubles Down on TikTok Shopping, Hosts All-New Live Stream Shopping Event. <https://corporate.walmart.com/new-room/2021/03/09/walmart-doubles-down-on-tiktok-shopping-hosts-all-new-live-stream-shopping-event>, accessed on October 19th2021.

³⁴ McKinnon, J.D., Leary, A., 2021. TikTok Sale to Oracle, Walmart Is Shelved as Biden Reviews Security. <https://www.wsj.com/articles/tiktok-sale-to-oracle-walmart-is-shelved-as-biden-reviews-security-11612958401>, accessed on October 19th2021.

e-commerce platform JD Daojia, it has been testing the promotion of food since 2017 within omnichannel shopping festivals.³⁵

Also, with regard to value capture mechanisms, Walmart and Carrefour chose similar strategies, based on loyalty and subscription programs, and on solutions capable of increasing sales in new markets.

Carrefour in France, thanks to the Group's payment fintech company Market Pay, combined its loyalty program with Apple Pay for use with Apple Wallet, allowing customers to use their iPhone or Apple Watch as a contactless means for paying for their shopping and simultaneously taking advantage of all the benefits provided by the Carrefour loyalty program.³⁶ Also the new version of "Meu Carrefour", the super app of Carrefour Brazil, which followed the update of the Brazilian e-commerce platform reported in the previous phase, was centered on a new loyalty program, "My Rewards", which provided benefits such as accumulation of virtual coins for online and in-store purchases convertible in discount coupons useful with program partners, greater offer periods for all product categories, and personalized recommendation for Carrefour private label products with 100 % discounts.³⁷

Walmart also introduced options valuable for loyal customers, with the launch of the Walmart+ service³⁸ replacing the subscription service formerly known as Delivery Unlimited. The new premium subscription option, which had undergone adjustments since its release to encounter customer's preferences,³⁹ provided unlimited free and fast deliveries, discounts on fuels, and access to the well-known "Scan & Go" in all stores, and in future could provide useful data for personalization options.⁴⁰ To secure the new service, Walmart loosened its direct customer relationship management and delivery policy, partnering shortly before the launch of Walmart+ with the grocery delivery platform Instacart, which if it is an unpublished collaborator for Walmart USA, had already been a partner by Walmart Canada and the American Sam's Club stores.⁴¹

³⁵ Pr Newswire, 2021. Dada Group's JDDJ Kick Off New Year Festival Campaign with Chilean Cherry Livestreaming E-Commerce Event. <https://www.prnewswire.com/news-releases/dada-groups-jddj-kick-off-new-year-festival-campaign-with-chilean-cherry-livestreaming-e-commerce-event-301210590.html>, accessed on October 19th2021. LaptrinhX, 2017. Shopping Festival Shines Light on Walmart Customer Engagement in China. https://laptrinhx.com/shopping-festival-shines-light-on-walmart-customer-engagement-in-china-2629695888/?x_tr_sl=auto&x_tr_tl=it&x_tr_hl=it&x_tr_pto=nui, accessed on October 19th2021.

³⁶ Carrefour, 2020. Contactless payment: Carrefour's loyalty card now available in Apple Wallet. <https://www.carrefour.com/en/newsroom/contactless-payment-carrefours-loyalty-card-now-available-apple-wallet>, accessed on October 19th2021.

³⁷ LinkedIn, 2020. Grupo Carrefour Brasil: novo app Meu Carrefour. <https://www.linkedin.com/company/grupocarrefourbrasil/videos/native/urn:li:ugcPost:6742486755141849088/?isInternal=true>, accessed on October 19th2021.

³⁸ Corkery, M., 2020. Walmart Announces Membership Service in Attempt to Compete With Amazon. <https://www.nytimes.com/2020/09/01/business/walmart-plus-membership.html>, accessed on October 19th2021.

³⁹ Walmart, 2020. Transcript of Morgan Stanley Virtual Global Consumer & Retail Conference. https://corporate.walmart.com/media-library/document/2020-morgan-stanley-virtual-global-consumer-retail-conference-transcript/_proxyDocument?id=00000176-28ff-db47-ad76-eaffc8af0000, accessed on October 19th2021.

⁴⁰ Lauchlan, S., 2021. Re-inventing the flywheel - how Walmart plans to transform retail as the COVID e-commerce boom slows down. https://diginomica.com/re-inventing-flywheel-how-walmart-plans-transform-retail-covid-e-commerce-boom-slows-down/?x_tr_sl=en&x_tr_tl=it&x_tr_hl=it&x_tr_pto=nui, accessed on October 19th2021.

⁴¹ Dumont, J., 2020. Walmart teams up with Instacart for same-day delivery. https://www.grocerydive.com/news/walmart-teams-up-with-instacart-for-same-day-delivery/583323/?x_tr_sl=en&x_tr_tl=it&x_tr_hl=it&x_tr_pto=nui, accessed on October 19th2021.

Another new value capture mechanism developed by Walmart and Carrefour was the setting up of new business for new customers.

For example, Carrefour in France and UAE, together with software and logistic partners, launched online B2C marketplaces with the aims of boosting sales on websites by offering complementary products relevant with respect to food trends observed among e-commerce customers (e.g., organic, healthy, gourmet, local, international), and of helping small retailers in digitization with support teams and free limited use of platforms.⁴² Also Atacadão, a Carrefour Brazil company dedicated to wholesale sales, launched for the first time, after having acquired 51 % of CotaBest Informação e Tecnologia, startup active in the online wholesale market, a grocery marketplace addressed to the B2B (i.e., small and medium-sized merchants), to extend across the country thanks to new partnerships with the delivery applications Rappi and Cornershop and to the acquisitions of the Makro chain (30 "cash and carry" stores).⁴³

Walmart, like Carrefour, focused on marketplaces to intercept new customers in its businesses, opening its well established B2C marketplace (i.e., Walmart Marketplace) to Shopify users, through the partnership with the all-in-one platform.⁴⁴ In parallel with the investment in its marketplace service to increase the user network, Walmart, in collaboration with technology partners, redesigned and expanded the vision of its media business, newly baptized Walmart Connect, which gathered sellers, buyers, and suppliers in a single ad-marketplace platform.⁴⁵ To "become one of the top ten advertising platforms in the United States", Walmart leveraged the vast omnichannel presence to offer advertisers complete information on customer behavior.⁴⁶ This great innovation could conceal a big step towards a further large-scale BMI activity for Walmart, which could benefit from recent investments in Connect and e-commerce, in healthcare services with the opening of new health centers next to Walmart stores,⁴⁷ and in the

⁴² Bartnik, M., 2020. Carrefour lance à son tour une place de marché ouverte aux marchands. <https://www.lefigaro.fr/societes/carrefour-lance-a-son-tour-une-place-de-marche-ouverte-aux-marchands-20200622>, accessed on October 19th2021. Harvard Business School, 2020. Majid Al Futtaim – Innovation in the Face of Threat, Leveraging Synergies across Businesses. <https://digital.hbs.edu/platform-digit/submission/majid-al-futtaim-innovation-in-the-face-of-threat-leveraging-synergies-across-businesses/>, accessed on October 19th2021.

⁴³ Mercado & Consumo, 2020. Atacadão lança e-commerce e avança na digitalização das operações. <https://mercadoeconsumo.com.br/2020/10/13/atacao-lanca-e-commerce-e-avanca-na-digitalizacao-das-operacoes/>, accessed on October 19th2021.

⁴⁴ Watrous, M., 2020. Walmart Marketplace launches to sell emerging brands online. <https://www.foodbusinessnews.net/articles/16247-walmart-marketplace-launches-to-sell-emerging-brands-online>, accessed on October 19th2021.

⁴⁵ Walmart, 2021. Transcript of Bank of America Consumer and Retail Technology Conference. https://corporate.walmart.com/media-library/document/corrected-transcript-walmart-inc-wmt-us-bank-of-america-consumer-and-retail-technology-conference-11-march-2021/_proxyDocument?id=00000178-3670-d485-a5f8-bef446630000, accessed on October 19th2021.

⁴⁶ Johnson, T., 2021. What is Walmart Connect?. <https://tinuiti.com/blog/walmart/walmart-connect/>, accessed on October 19th2021.

⁴⁷ Repko, M., Farr, C., 2020. Walmart to open at least six more health clinics in greater Atlanta area by end of 2020 as part of bigger health-care push. <https://www.cnn.com/2020/07/23/walmart-to-open-six-health-clinics-in-atlanta-area-by-end-of-2020.html>, accessed on October 19th2021.

creation of a new fintech startup,⁴⁸ to develop its own super app.⁴⁹ In fact, the grocer's attention to this new digital ecosystem capable of providing multiple services through lightweight apps⁵⁰ was accentuated by the negotiations with the Tata group for an investment of 25 billion dollars in the super app of the Indian conglomerate.⁵¹

Table 3 recaps how Walmart and Carrefour innovated their value creation and capture mechanisms in this second phase of the BMI process.

4.3. The new life of physical stores

The final phase of the BMI process that involved Walmart and Carrefour during the pandemic crisis presents as a leitmotif the relaunch of the role assumed by physical stores to innovate value creation mechanisms, leaving value capture mechanisms unchanged.

Specifically, the two grocers increased the levels of automation and physical services in stores to speed up online order fulfillment and solve e-commerce requests, thus strengthening omnichannel growth strategies.

At this regard, Majid Al Futtaim launched in UAE the first of three micro-fulfillment centers for faster and more efficient processing of online orders from the store, in partnership with the e-grocery innovator Takeoff Technologies.⁵² The logistic center, equipped with artificial intelligence and autonomous mobile robots to process online orders, drastically increased the number of daily orders processed, and, although robotization requires 60 % less manpower, no cuts in staff were registered. Personnel was redeployed, upgraded, and redeveloped, probably in view of the expansion of Carrefour in the UAE – planned to open 100 stores in 2021.⁵³ More generally, the group heavily focused on the role of physical stores, also declaring in France to increase the number of shops and points providing e-commerce services (e.g., drive pick-up points accessible by car or pedestrian users, next-day home delivery, one-hour express delivery) to 2000 before the end of 2021 (+500 additional points of sale).⁵⁴ If the French initiative was mainly focused on promotion of e-commerce capacity in medium-sized cities that have not had access to the retailer's entire offer until now, in Spain the acquisition of new 172 stores was aimed at encouraging “click and

collect” in small shops in large cities,⁵⁵ while similar strategies were also adopted in the eastern market, with the acquisition of 224 proximity stores in Taiwan,⁵⁶ and in the western one, with the acquisition of Brazil's third-biggest food retailer operating a multi-format network of 387 stores.⁵⁷ Finally, Carrefour also combined its investments in stores with those in central fulfillment centers, as happened in Belgium,⁵⁸ where, with the support of partners including the supplier of e-grocery management solutions Food X-Technologies, the retailer created an e-commerce distribution center equipped with machine learning for order planning, just-in-time fulfillment, and dynamic last-mile routing.

Walmart, in the same way as Carrefour, strengthened stores to increase the ability to fulfill online orders and facilitate the e-commerce BMs. In particular, in America the grocer implemented new 12 local and modular fulfillment centers using robotics technology and artificial intelligence for speeding up e-commerce grocery orders assembly within physical stores.⁵⁹ The automation of stores, following a two-year pilot, featured different configurations and collaborations with technology suppliers (i.e., Alert Innovation, Fabric, and Dematic), also providing for the installation of automatic collection points in some stores. Along with the consolidation of the pickup, Walmart also invested in various delivery formats for a safe, contactless, and potentially 24/7 food delivery experience, thanks to pilot projects activated with companies specialized in drones (i.e., Flytrex⁶⁰), self-driving cars (i.e., Cruise⁶¹), and smart boxes controlled by IoT platforms (i.e., HomeValet⁶²). Similar investments were released in Canada,⁶³ with the construction of the first fully automated market fulfillment center, the addition of automated kiosks and pickup points in stores, and the spread of delivery to multiple

⁴⁸ Walmart, 2021. Walmart Announces Creation of New Fintech Startup. <https://corporate.walmart.com/newsroom/2021/01/11/walmart-announces-creation-of-new-fintech-startup>, accessed on October 19th2021.

⁴⁹ Shevlin, R., 2021. Walmart's Fintech Ambition: A Super App, Not The 'Bank Of Walmart'. <https://www.forbes.com/sites/ronshevlin/2021/03/08/walmarts-fintech-aspiration-the-first-super-app-in-the-united-states/>, accessed on October 19th2021.

⁵⁰ Calvo, I., 2021. Why Walmart is creating a lifestyle 'super app'. <https://www.thinkwithgoogle.com/marketing-strategies/app-and-mobile/walmart-super-app-case-study/>, accessed on October 19th2021.

⁵¹ Livemint.com, 2020. Walmart looks to join hand with Tata group in retail push. <https://www.livemint.com/companies/news/walmart-looks-to-join-hands-with-tatas-11601337906091.html>, accessed on October 19th2021.

⁵² Nagraj, A., 2021. Video: Autonomous robots deployed in Carrefour fulfillment center in Dubai. <https://gulfbusiness.com/video-autonomous-robots-deployed-in-carrefour-fulfilment-centre-in-dubai/>, accessed on October 19th2021.

⁵³ Gibbon, G., 2021. Carrefour plans ambitious expansion for 2021. <https://www.arabianbusiness.com/retail/459058-plans-revealed-for-ambitious-carrefour-expansion-in-2021>, accessed on October 19th2021.

⁵⁴ Bartnik, M., 2021. Carrefour rachète l'ex-filiale de Walmart au Brésil pour un milliard d'euros. <https://www.lefigaro.fr/societes/carrefour-rachete-l-ex-filiale-de-walmart-au-bresil-pour-un-milliard-d-euros-20210324>, accessed on October 19th2021.

⁵⁵ Business Wire, 2021. Carrefour Completes the Acquisition of 172 Proximity Stores and Supermarkets in Spain. <https://www.businesswire.com/news/home/20210315005182/en/Carrefour-Completes-the-Acquisition-of-172-Proximity-Stores-and-Supermarkets-in-Spain>, accessed on October 19th2021.

⁵⁶ Oung, A., 2021. Carrefour Taiwan completes acquisition of Wellcome, Jansons Market Place stores. <https://www.taipetimes.com/News/biz/archives/2021/02/04/2003751712>, accessed on October 19th2021.

⁵⁷ Business Wire, 2021. Carrefour Reinforces Its Leading Position in Brazil With the Acquisition of Grupo BIG. <https://www.businesswire.com/news/home/20210323006132/en/Carrefour-Reinforces-Its-Leading-Position-in-Brazil-With-the-Acquisition-of-Grupo-BIG>, accessed on October 19th2021.

⁵⁸ Newswire.ca, 2021. Freshlocal Announces the Successful Implementation of its Grocery E-commerce Solution in Belgium. <https://www.newswire.ca/news-releases/freshlocal-announces-the-successful-implementation-of-its-grocery-e-commerce-solution-in-belgium-832848464.html>, accessed on October 19th2021.

⁵⁹ Supermarket News, 2021. Walmart to build local fulfillment centers at dozens of stores. <https://www.supermarketnews.com/technology/walmart-build-local-fulfillment-centers-dozens-stores>, accessed on October 19th2021.

⁶⁰ Greig, J., 2020. Flytrex pilot program with Walmart focusing on backyard drone deliveries. <https://www.techrepublic.com/article/flytrex-pilot-program-with-walmart-focusing-on-backyard-drone-deliveries/>, accessed on October 19th2021.

⁶¹ Repko, M., 2020. Walmart to test deliveries by self-driving car with General Motors' Cruise. <https://www.cnbc.com/2020/11/10/walmart-self-driving-car-deliveries-gm-cruise.html>, accessed on October 19th2021.

⁶² Talk Business & Politics, 2021. Walmart partners with Home Valet to test smart box for grocery delivery. <https://talkbusiness.net/2021/01/walmart-partners-with-home-valet-to-test-smart-box-for-grocery-delivery/>, accessed on October 19th2021.

⁶³ Walmart, 2021. The future is now: Walmart Canada accelerates e-commerce expansion. https://www.walmartcanada.ca/newsroom/2021/03/03/the-future-is-now-walmart-canada-accelerates-e-commerce-expansion?x_tr_sl=auto&x_tr_tl=it&x_tr_hl=it&x_tr_pto=nui, accessed on October 19th2021.

Table 4
Value creation for Walmart and Carrefour in “The new life of physical stores” phase.

Walmart	Carrefour
Value creation mechanism: strengthening of physical stores in an omnichannel perspective	
Physical and digital solutions to speed up online order fulfillment and solve e-commerce requests:	Physical and digital solutions to speed up online order fulfillment and solve e-commerce requests:
<ul style="list-style-type: none"> • Expansion of local and automated fulfillment centers using AI and intelligent robots • Capillary shop fitting to offer pickup (traditional and automated) and delivery • Central omnichannel fulfillment centers 	<ul style="list-style-type: none"> • Launch of micro-fulfillment centers using AI and autonomous mobile robots • Capillary shop fitting to offer pickup (traditional and automated) and delivery • Specialized distribution center
Value creation mechanism: digital redesign of stores to optimize back end and front end activities	
Digital solution for better daily management of stores:	Digital solution for better daily management of stores:
<ul style="list-style-type: none"> • Development of proprietary IoT platform • Labs to test useful options in the back end 	<ul style="list-style-type: none"> • Expansion of autonomous shelf scanning units for inventory management
Digital solution for new physical shopping experience:	Digital solution for new physical shopping experience:
<ul style="list-style-type: none"> • Launch of new store layout and signage • Labs to test useful options for checkout 	<ul style="list-style-type: none"> • Launch of different autonomous stores concepts

communities, as well as in Mexico,⁶⁴ Chile,⁶⁵ and China,⁶⁶ with the redesign and reinforcement of logistics and stores network to enable omnichannel growth and extend improved in-store and online services (e.g., buy online and pick up in-store or deliver at home) to all territories. Furthermore, Walmart in those regions promoted first and new omnichannel distribution centers, accompanying, like Carrefour, investments in stores to those in specialized centers in order to meet the needs of online users.⁶⁷

Another common strategy for the innovation of value creation mechanisms is related to the digital redesign of stores to optimize back-end and front-end activities.

As regard the enhancement of stores' back-end daily management, Majid Al Futtaim planned investments to optimize inventory management by scaling the autonomous shelf scanning units that in 2019 had been tested in selected stores in collaboration with Simbe Robotics, US startup for autonomous inventory.⁶⁸

In parallel, Walmart optimized store activities not connected with

online order fulfillment and customer experience by leveraging the competencies of the Walmart Global Tech's IoT team to create an IoT proprietary platform capable of monitoring refrigeration units, remotely responding to energy consumption and equipment re-programming needs, detecting anomalous events in real time, and taking proactive maintenance and repair measures even remotely.⁶⁹ Additionally, Walmart transformed four US stores into e-commerce labs where teams of product managers, technologists, business owners, and designers tested new digital tools to optimize both back-end and front-end activities.⁷⁰ In these rapid prototyping environments, Walmart verified solutions such as augmented reality apps to accelerate the organization of merchandise from the backroom to the sales floor, the combination of portable devices and new in-store signage to speed up the order assembly, and new hardware and software solutions to optimize the automatic checkout. Furthermore, Walmart released in selected stores a new store layout and signage inspired by airport terminals to more easily guide customers equipped with Walmart app on phones in search of the necessary items in stores.⁷¹

Also, Carrefour worked on new physical shopping experiences for customers, but in a different way compared to Walmart. In fact, in Brazil, Carrefour opened two small autonomous convenience stores in a residential condominium and in a coworking space addressed to proximity and neighborhood market.⁷² The unmanned solution was based on the previous experience with “Scan and Go” technology in about 40 Express stores, on the “Meu Carrefour” super app, as well as on electronic shelf labels and digital signage, and could be expanded in the future to new stores and a franchise model.⁷³ In addition, the group also launched new different automatic store tests in Europe (Romania⁷⁴) and Asia (Taiwan⁷⁵).

A summary of the new value creation mechanisms that have distinguished this phase of BMI for Walmart and Carrefour is provided in Table 4.

5. Discussion

The elaboration of our results is illustrated in the model proposed in Fig. 3, which indicates how to innovate BMs leveraging digital technologies and crisis times. Specifically, the model is based on three constituent blocks, namely “Enabling factors”, which includes the supporting, triggering, and facilitating factors of digital BMI activities, “Fast-moving value mechanisms modifications”, which indicates the

⁶⁴ Opportimes, 2021. Walmart de México plans 33 % more investments in 2021. <https://www.opportimes.com/walmart-de-mexico-plans-33-more-investments-in-2021/>, accessed on October 19th2021.

⁶⁵ Butterworth, O., 2021. Walmart's omnichannel evolution in Chile. <https://retailanalysis.igd.com/news/news-article/t/walmarts-omnichannel-evolution-in-chile-i/27551>, accessed on October 19th2021.

⁶⁶ Bloomberg, 2020. Walmart to Quadruple Sam's Clubs in China After Virus-Led Boom. <https://www.bnnbloomberg.ca/walmart-to-quadruple-sam-s-clubs-in-china-after-virus-led-boom-1.1438780>, accessed on October 19th2021.

⁶⁷ Berthiaume, D., 2020. Walmart runs global omnichannel commerce with advanced distribution. https://chainstoreage.com/walmart-runs-global-omnichannel-commerce-advanced-distribution?_x_tr_sl=en&_x_tr_tl=it&_x_tr_hl=it&_x_tr_pto=nui, accessed on October 19th2021.

⁶⁸ Berthiaume, D., 2021. Carrefour expands pioneering robotic deployment in Middle East. <https://chainstoreage.com/carrefour-expands-pioneering-robotic-deployment-middle-east>, accessed on October 19th2021.

⁶⁹ Walmart, 2021. How Walmart Leverages IoT to Keep Your Ice Cream Frozen. <https://corporate.walmart.com/newsroom/2021/01/14/how-walmart-leverages-iot-to-keep-your-ice-cream-frozen>, accessed on October 19th2021.

⁷⁰ Wassel, B., 2020. Walmart Turns 4 Stores Into Experimental Shopping/Fulfillment Center Hybrids. <https://retailtouchpoints.com/topics/customer-experience/walmart-turns-4-stores-into-experimental-shopping-fulfillment-center-hybrids>, accessed on October 19th2021.

⁷¹ Today.com, 2020. Walmart looks to airports as inspiration of new store layout. <https://www.today.com/money/walmart-looks-airports-inspiration-new-store-layout-t192975>, accessed on October 19th2021.

⁷² Palmeira, C., 2021. Carrefour inaugura lojas sem atendentes em SP; veja como funciona. https://www.tecmundo.com.br/mercado/214667-carrrefour-inaugura-lojas-atendentes-sp-veja-funciona.htm?_x_tr_sl=auto&_x_tr_tl=it&_x_tr_hl=it&_x_tr_pto=nui, accessed on October 19th2021.

⁷³ Horizons by Carrefour, 2021. Piloting autonomous stores @Carrefour Brazil. <https://horizons.carrefour.com/digital-in-store/piloting-autonomous-stores-carrefour-brazil>, accessed on October 19th2021.

⁷⁴ Newsbeez.com, 2021. The first hypermarket without a cashier was opened. Carrefour opened a 100 % self check-out shop in Sfântu Gheorghe. <https://newsbeez.com/romaniaeng/the-first-hypermarket-without-a-cashier-was-opened-carrefour-opened-a-100-self-check-out-shop-in-sfantu-gheorghe/>, accessed on October 19th2021.

⁷⁵ Yu, J.J., 2021. Carrefour Taiwan opens unmanned store. <https://retailanalysis.igd.com/news/news-article/t/carrefour-taiwan-opens-unmanned-store-i/27545>, accessed on October 19th2021.

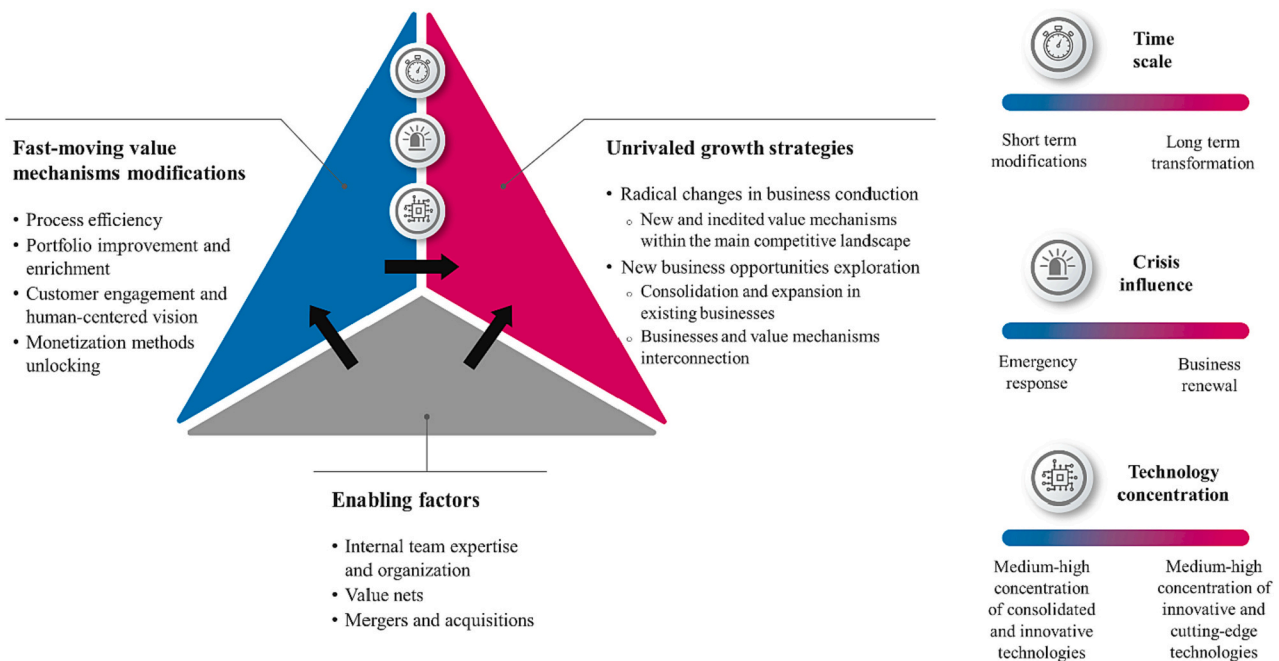


Fig. 3. Model for digital BMI during crisis.

rapid responses to crisis unlocked by the kicking and driving levers, and “Unrivaled growth strategies”, in which levers are used for broader and long-term innovation actions. The model is accompanied by three variables that mark the transition from fast-moving mechanisms modifications to unrivaled growth opportunities, that are time scale, crisis influence, and technology concentration. As a result, fast-moving mechanisms modifications are configured as short-term innovations released as a response to the first phases of the crisis and rely on both innovative and consolidated technologies, while unrivaled growth opportunities occur as long-term transformations in times of business renewal (i.e., return from the worst times of the crisis) leveraging innovative and cutting-edge technologies.

5.1. Enabling factors

The first aspect that deserves attention, being the block at the base of the proposed model and therefore enabling the subsequent considerations, consists of three enabling factors. These are elements both internal and external to the boundaries of the organization which underpin the innovation actions aimed at rapidly modifying value mechanisms during crisis and searching for future opportunities in times of business renewal.

The first enabling factor is the internal team expertise and organization. Indeed, the “people factor”, recognized as relevant element for crisis management (Schmitt et al., 2010) and for the implementation of digital innovation strategies (Correani et al., 2020), was crucial for the digital BMI path of Walmart and Carrefour. Walmart, for example, internally developed machine learning algorithms for speeding up the delivery service and an IoT platform for remotely managing store equipment. Carrefour, instead, made great use of the expertise of its e-commerce technical teams for the optimization of websites and online purchasing platforms, and leveraged the transversal and cross-functional organizational nature of its innovation department to guide the release of the custom nutritional score.

The second enabling factor of the proposed model consists of value nets, namely ecosystems of actors who combine their skills and complementary resources for creating value through collaborations (Kähkönen, 2012; Palo and Tähtinen, 2013; Tavoletti et al., 2021). Indeed, the two grocers implemented almost all of their innovations

during the crisis thanks to a precious network of partners, which plays a significant role to respond to crisis times (Zafari et al., 2020) and to quickly unlock both short-term and long-term value (Fasnacht, 2020). For example, Carrefour introduced the voice shopping service in partnership with Google, leveraging the co-founded AI hub, while Walmart revolutionized deliveries with drones, self-driving cars, and smart boxes by means of pilot projects in partnerships with specialized companies and startups. In addition to technical partnerships, the value net counts diversified collaborations, such as those established by Walmart with the TikTok creators to enable the live shopping experience.

The third enabling factor is represented by mergers and acquisitions (M&A), which are considered effective practices for exploring new value creation and capture mechanisms (Hanelt et al., 2021; Tavoletti et al., 2021), especially in times of crisis, when mergers and acquisitions allow to outperform (Salsberg, 2020). Mergers and acquisitions were mainly employed by Carrefour, who leveraged the acquisition of 51 % in the online wholesale startup CotaBest to create its B2B marketplace in Brazil, and, more generally, acquired several physical store chains to pursue its omnichannel expansion strategy.

5.2. Fast-moving value mechanisms modifications

Enabling factors, combined with the access to consolidated and innovative digital technologies and under the influence of pressure times deriving from the first periods of crisis, rapidly unlock new interesting mechanisms for creating and capturing value in the short term. Our case studies highlighted the existence of four ways in which fast-moving modifications can occur in BMs to ensure, on the one hand, survival at the first impact with the emergency and, on the other, the addition of new valuable solutions amid crisis. Therefore, the value mechanisms modifications spotted are based on the firms' perception of crisis as an opportunity to encourage more risk-taking behaviors and decisions in changing existing BMs (Archibugi et al., 2013; Saebi et al., 2017). In particular, the following value mechanisms concentrate on adjustment of current BMs with minor refinements on the way business is conducted, rather than on the entirely reengineering of processes for developing completely new digital BMs (Verhoeven and Johnson, 2017; Osiyevskyy and Dewald, 2018).

The first fast-moving value mechanism is the improvement of process

efficiency, which is a digital-enabled value creation practice (Parida et al., 2019; Vaska et al., 2021) implemented by Walmart and Carrefour as a first step to cope with the crisis. Indeed, the initial move by the two grocers at the dawn of the crisis to avoid succumbing was the update of digital platforms, releasing more resilient versions and/or new applications that optimized the online purchase process.

The second fast-moving change in value creation mechanisms is represented by portfolio improvement and enrichment. In line with the considerations of Cenamor et al. (2017), Parida et al. (2019), and Vaska et al. (2021) we understand this term as the advancement of the offer portfolio by means of new digital-enabled supports and/or benefits with respect to the core proposals and resources. This is the case, for example, of novel complementary services on digital platforms that increase the value of the main offer thanks to product understanding, process facilitation, and other usefulness. At this regard, Walmart and Carrefour empowered their portfolios in order not only to survive the blow of the crisis but also to provide customers with high-value services. Specifically, they scaled and upgraded features already partially implemented, such as digital options to improve shop navigation, make contactless payments, achieve loyalty benefits, collect shopping in designed points or receive it at home. In this way the two grocers took advantage of an effective synergy between fairly consolidated digital technologies and their core physical resources (i.e., stores) to assure safe business continuity in crisis times.

The third fast-moving modification in the value mechanisms identified by our model is represented by the boost of customer engagement and the emphasis of a human-centered vision within the adoption of digital solutions. Those aspects are expressed in a focal attention to people, both customers and employees, when leveraging digital technologies to modify BMs. Indeed, Walmart and Carrefour improved efficiency and expanded offer portfolios with more intuitive digital services and innovative shopping experiences, following a human-centered shift in business practices triggered by the crisis and enabled by digital technologies (MacDonald et al., 2020; Fazio and Kuehne, 2020). Examples are the voice shopping and custom nutritional score services designed by Carrefour for simpler and personalized shopping moments, as well as the Walmart's augmented purchase processes based on social networks, virtual settings, and interactive cooking videos. These value creation initiatives, aimed at increasing customer loyalty, are based on engagement mechanisms through personalization (Sandulli et al., 2014), individualization (Härting et al., 2018), and process facilitation for customers (Doern and Fey, 2006). In this sense, therefore, our results agree with Sebastian et al. (2017) in highlighting the power of digital technologies in the BMI field to improve customer engagement, especially with a view to create stickiness (Zott et al., 2000). Moreover, the human-centered vision in digital BMI was evident also in back-end actions, as demonstrated by the transformation of Walmart stores into labs where to test augmented reality apps and new in-store signage for optimizing the daily work of the inventory staff.

The fourth modification quickly enabled in the BMI path is represented by the introduction of new monetization methods. Those are unlocked by a platform-based approach (Sorri et al., 2019), which generates fast connections and matchmaking during the crisis (Friederici et al., 2020). Indeed, Walmart and Carrefour took advantage of the growing profitability of digital platforms in the BMI field (Gatautis, 2017; Mancha and Gordon, 2021) to increase revenue during the crisis in two ways. On the one hand, they introduce new subscription programs, such as Walmart's one focused on unlimited and express deliveries and Carrefour' one for the receipt of essential product boxes. On the other hand, the two grocers launched new marketplaces and strengthened existing ones, both in the B2C and in the B2B sphere, thus increasing revenues by means of their networks.

5.3. Unrivaled growth strategies

Relying on enabling factors and on an increasing use of innovative

and cutting-edge technologies, the digital BMI path leads to the exploration of long-term growth strategies in periods of business renewal, i.e., in returning from the more critical phases of the emergency. In this passage, therefore, our research emphasizes, in line with Kraus et al. (2020), the role of crises as events stimulating innovation not only in the short term but also in the long period. Specifically, the proposed model reveals how the digital BMI enables two forms of innovation in long-term business visions, which aims at totally creating new BMs (Kaulio et al., 2017) rather than acting on existing ones. These two forms of innovation are radical changes in businesses conduction and explorations of new opportunities.

First, digital BMI can generate a radical change in business (Linz et al., 2017; Osiyevskyy and Dewald, 2018), aimed at transforming and reconfiguring the mechanisms of value creation and capture with digital technologies (Sjödin et al., 2020) in an unprecedented way within the competitive scenario (D'Ippolito et al., 2019). This state of radical long-term business transformation in the internal methods of conducting the business and/or in the approach to customers considers the crisis as a trigger and accelerator. Indeed, the fast-moving modifications implemented to rapidly counter the emergency unlock a wide-ranging innovation process able to radically reshape businesses. This is exactly what happened to Carrefour. The grocer in Brazil built the radically new concept of fully automatic and unmanned stores on its cutting-edge super app, enhanced in initial crisis phases to quickly increase efficiency and customer engagement.

Furthermore, BMI as a response to crisis can be used to consolidate and exploit current businesses with the aim of exploring future opportunities (Schmitt et al., 2010; Kraus et al., 2020). Specifically, our findings unify and extend to crisis times the study perspectives of Verhoeven and Johnson (2017), Kaulio et al. (2017), and Fasnacht (2020) on the long-term strategic potential of BMI. In fact, during the crisis it is possible to consider and strengthen diversified businesses with respect to the principal business, whose value mechanisms can be integrated thanks to a digital ecosystem, giving birth to new business opportunities. In this matter Walmart was a great example. First, the grocer consolidated and expanded its existing businesses, by investing in e-commerce shopping experiences, redefining its media activities within a new well-focused business, scaling its health clinics across USA, and creating a novel fintech startup as part of the improvement of its financial services. Second, the retailer announced and shown interested in practice towards the interconnections of its diversified businesses within a new powerful super app, leveraging a cutting-edge digital technology to seize new business opportunities for serving its customers in a better, complete, and integrated way.

5.4. Interplay among enabling factors, value mechanism modifications, and growth strategies

The three building blocks of the model are characterized by specific relationships and interplays. In particular, the enabling factors trigger both value mechanisms modifications and growth strategies. Indeed, internal team expertise (i.e., the cultivation of employees' skills) and organization (i.e., the formation of new dedicated teams and business units), value nets (i.e., strategic partnerships), and M&A activities support the establishment of a dynamic organizational environment, the generation and exchange of complementary knowledge, and the acquisition and sharing of resources and capabilities (Svahn et al., 2017; Fasnacht, 2020; Tavoletti et al., 2021; Smith and Beretta, 2021). These activities, which become more critical during times of crisis (Schmitt et al., 2010; Zafari et al., 2020), foster both value mechanisms modifications, which make it possible to change existing BMs, and growth strategies, which make it possible to create entirely new BMs (D'Ippolito et al., 2019; Correani et al., 2020; Hanelt et al., 2021).

Moreover, in accordance with Kraus et al. (2020), we spot that short-term value mechanisms modifications in existing BMs stimulate and facilitate the definition of long-term unrivaled growth strategies in the

form of generation of totally new BMs. In fact, digital changes in existing BMs alter current business routines, processes, and practices (Verhoeven and Johnson, 2017; Osiyevskyy and Dewald, 2018). In this way, digital changes in existing BMs enhance firms' willingness, know-how, and capabilities to trigger the creation of totally new BMs (Saebi et al., 2017; Verhoeven and Johnson, 2017; Osiyevskyy and Dewald, 2018; Rachinger et al., 2019; Fasnacht, 2020).

6. Implications

6.1. Theoretical implications

The present study contributes to the existing literature about BMI and digital innovation in three main ways, assuming a very interesting role in the scenario of great attention that both scholars and industrial firms pay to these issues (Sjödén et al., 2020), especially after the advent of the Covid-19 pandemic (Coskun and Tanrikulu, 2021).

First, our paper broadens the knowledge about the mechanisms of value creation and capture that can be innovated and empowered thanks to digital technologies under the pressure times of crisis. Indeed, conducting digital BMI as a response to crisis enable fast-moving changes to value mechanisms, acting on process efficiency (Parida et al., 2019), portfolio improvement and enrichment (Vaska et al., 2021), and additional monetization methods (Sorri et al., 2019). These mechanisms were studied by researchers, but scant attention was given to the impact of crisis on their usage. In this sense, the present paper highlights how emergencies push firms towards innovative risk-taking behavior (Archibugi et al., 2013; Saebi et al., 2017), triggering new mechanisms to quickly respond to contingent situations. Moreover, our analysis reveals an additional value mechanism rapidly brought out by the crisis and digital technologies, which has so far been little investigated in the BMI literature. This is the digital redefinition of BMs through a human-centered vision. This approach especially emerged with the Covid-19 pandemic (MacDonald et al., 2020; Fazio and Kuehnle, 2020) and applies to modification of both front-end activities and back-end operations.

Second, this research focuses on the positive role of digital BMI in crisis times, during which innovative activities and innovative organizations are subject to changes and re-shaping (Archibugi et al., 2013). In particular, we discover that digital BMI acts not only as a response to the crisis in the short term but also as a sowing moment of long-term business opportunities. In this way, we support findings from Archibugi et al. (2013), Saebi et al. (2017), and Kraus et al. (2020), who spotted that crisis can trigger both short-term changes and long-term innovations in organizations. In fact, during the crisis, on the one hand, digital BMI enables radical change in business (Linz et al., 2017; Osiyevskyy and Dewald, 2018), exploiting the fast-moving value modifications, born as a first response to the crisis, as bricks to revolutionize the competitive scenario (D'Ippolito et al., 2019). On the other hand, digital BMI enables the consolidation and expansion of diversified businesses during the crisis, especially augmenting the positive role of explorative strategies in markets, products, and services domains to cope with the crisis (Archibugi et al., 2013; Osiyevskyy and Dewald, 2018). In particular, we discover that the value mechanisms of diversified businesses, started and/or reinforced during the crisis, can be interconnected thanks to digital technologies with the aim of seizing new business opportunities (Verhoeven and Johnson, 2017; Kaulio et al., 2017; Fasnacht, 2020; Li, 2020).

Third, our paper contributes to the emerging literature on the use of digital technologies for changing existing BMs and for creating totally new BMs (Saebi et al., 2017; D'Ippolito et al., 2019). In particular, in accordance with Rachinger et al. (2019) our paper suggests that digital BMI can be considered as a succession of three steps: initially, optimization of the existing BM, then transformation of the existing BM through reconfiguration and extension of established business, and finally development of a new BM. Moreover, our results indicate that

those three phases, under the effect of pressure times and the always greater concentration of digital technologies, tend to become more blurred and merged, thus accelerating innovation path (Fasnacht, 2020; Gkeredakis et al., 2021).

6.2. Managerial implications

Our research also provides relevant managerial suggestions to successfully emerge from the crisis thanks to a digital BMI. In particular, we address growing and innovative incumbents, i.e., firms who are recognized for maintaining optimal innovative performance in crisis (Archibugi et al., 2013), but also for being ill prepared to identify, select, and implement digital innovations (Parida et al., 2019). We encourage managers of these firms to consider the importance of enabling factors that, especially in times of crisis, facilitate effective innovation paths. In this regard, we advise companies to equip with internal inter-communicating teams specialized in both technical and innovation issues, whose combination can assure prompt response to business perturbations. Moreover, it is very important to forge partnerships, especially but not limited to technical experts, to transform the potential of digital technologies into value, also through, for example, the co-foundation of innovation hubs, where to incubate high value digital solutions in times of crisis. Even partnerships and/or acquisitions of promising startups can prove to be a very profitable practice for investigating, developing, and accelerating the more specialized aspects of digital innovation during crisis. By leveraging these three factors, it becomes much easier to cope with crisis both in the short term, with digital change in existing BMs, and in the long term, with creation of totally new BMs.

7. Conclusions

7.1. Limitations and future research avenues

The paper features some limitations that may however be the trigger for further research avenues.

First, the research counts only two cases, covering mainly European and American contexts. A more detailed analysis of the Asian market to check the consistency and generalizability of findings can be extremely useful. In fact, the eastern Asian territory is very much at the forefront in the grocery and retail, and it was the first place to reinvent during crises such as the 2003 SARS epidemic and the 2020 Covid-19 pandemic.

Second, for the realization of the study it was not possible to exploit all the sources of evidence that the multiple case study methodology suggested (e.g., direct observation, personal interviews). Therefore, it would be interesting to test and detail evidences found with quantitative data and/or statistical studies relating to the design of digital BMI initiatives during crisis and the impact of these innovations on the customer approach and the internal re-organization of work. To this aim, future research can leverage this study for testing hypotheses based on the relationships spotted between the three building blocks of the presented model.

Third, the research examines the cases of two incumbent retail companies operating in the food sector but also active in the commercialization of no-food products. Future research may investigate if and how the results change considering the cases of retailers focused exclusively on the commercialization of food products (e.g., local markets, online food sales platforms) and/or grocers alternative to big incumbents (e.g., convenience stores, "mom-and-pop"). Moreover, even the study of retailers operating in different sectors and domains (e.g., electronics, fashion, furniture, cars) can reveal different scenarios of digital BMI as a response to crisis.

Fourth, our research focuses on the theme of digital BMI amid crisis, concentrating on how digital technologies support the innovation of BMs in tricky times. We acknowledge that the use of digital technologies for innovation is twofold, leading to both modification of existing BMs

and creation of entirely new BMs (Kohli and Melville, 2019; Rachinger et al., 2019; D'Ippolito et al., 2019; Li, 2020; Bosler et al., 2021). In this field, even if we spot how digital technologies can lead to modifications in existing value mechanisms and to definition of totally new opportunities, we encourage scholars in BMs and BMI literature to deepen the comprehension of this phenomenon.

CRedit authorship contribution statement

Iliaria Mancuso: Formal analysis, Investigation, Data curation, Writing – original draft, Visualization. **Antonio Messeni Petruzzelli:** Conceptualization, Methodology, Validation, Formal analysis, Writing – review & editing, Supervision. **Umberto Panniello:** Conceptualization, Methodology, Validation, Formal analysis, Writing – review & editing, Supervision.

Declaration of competing interest

None.

Data availability

No data was used for the research described in the article.

References

- Abbu, H.R., Fleischmann, D., Gopalakrishna, P., 2021. The digital transformation of the grocery business - driven by consumers, powered by technology, and accelerated by the COVID-19 pandemic. In: Rocha, Á., Adeli, H., Dzemyda, G., Moreira, F., Ramalho Correia, A.M. (Eds.), Trends And Applications in Information Systems And Technologies. WorldCIST 2021. Advances in Intelligent Systems And Computing. Springer, Cham, p. 1367.
- Abdelkafi, N., Makhotin, S., Posselt, T., 2013. Business model innovations for electric mobility: what can be learned from existing business model patterns? *Int. J. Innov. Manag.* 17, 1–41.
- Abrell, T., Pihlajamaa, M., Kanto, L., Vom Brocke, J., Uebernickel, F., 2016. The role of users and customers in digital innovation: insights from B2B manufacturing firms. *Inf. Manag.* 53, 324–335.
- Akpan, L.J., Soopramanien, D., Kwak, D.H., 2020. Cutting-edge technologies for small business and innovation in the era of COVID-19 global health pandemic. *J.Small Bus. Entrep.* 1–11.
- Amit, R., Zott, C., 2010. Business Model Innovation: Creating Value in Times of Change. IESE Business School, University of Navarra, Barcelona. Working Paper, No. 870.
- Amit, R., Zott, C., 2012. Creating value through business model innovation. *MIT Sloan Manag. Rev.* 53, 41–49.
- Amit, R., Zott, C., 2015. Crafting business architecture: the antecedents of business model design. *Strateg. Entrep. J.* 9, 331–350.
- Archibugi, D., Filippetti, A., Frenz, M., 2013. Economic crisis and innovation: is destruction prevailing over accumulation? *Res. Policy* 42, 303–314.
- Ardito, L., Coccia, M., Messeni Petruzzelli, A., 2021. Technological exaptation to support innovation for COVID-19 pandemic crisis. *R&D Manag.* 51, 381–392.
- Aull, B., Kuijpers, D., Sawaya, A., Vallöf, R., 2020. What Food Retailers Should Do During the Coronavirus Crisis. McKinsey & Company.
- Belavina, E., Girotra, K., Kabra, A., 2016. Online grocery retail: revenue models and environmental impact. *Manag. Sci.* 63, 1781–1799.
- Berman, S.J., 2012. Digital transformation: opportunities to create new business models. *Strateg. Leadersh.* 40, 16–24.
- Bosler, M., Burr, W., Ihring, L., 2021. Digital innovation in incumbent firms: an exploratory analysis of value creation. *Int. J. Innov. Technol. Manag.* 18, 2040003.
- Böttcher, T., Li, W., Hermes, S., Weking, J., Krömer, H., 2021. Escape from dying retail by combining bricks and clicks: a taxonomy of digital business models in retail. In: PACIS 2021 Proceedings, 10.
- Breier, M., Kallmuenzer, A., Clauss, T., Gast, J., Kraus, S., Tiberius, V., 2021. The role of business model innovation in the hospitality industry during the COVID-19 crisis. *Int. J. Hosp. Manag.* 92, 102723.
- Buck, C., Kreuzer, T., Oberländer, A.M., Röglinger, M., Rosemann, M., 2022. Four patterns of digital innovation in times of crisis. *Commun. Assoc. Inf. Syst.* 557–587.
- Cenamora, J., Sjödin, D.R., Parida, V., 2017. Adopting a platform approach in servitization: leveraging the value of digitalization. *Int. J. Prod. Econ.* 192, 54–65.
- Chakraborty, S., Charanya, T., de Laubier, R., Mahesh, A., 2020. The Evolving State of Digital Transformation. Boston Consulting Group.
- Chenarides, L., Grebitus, C., Lusk, J.L., Printezis, I., 2021. Food consumption behavior during the COVID-19 pandemic. *Agribusiness* 37, 44–81.
- Correani, A., De Massis, A., Frattini, F., Messeni Petruzzelli, A., Natalicchio, A., 2020. Implementing a digital strategy: learning from the experience of three digital transformation projects. *Calif. Manag. Rev.* 62, 37–56.
- Corvello, V., Verteramo, S., Nocella, I., Ammirato, S., 2022. Thrive during a crisis: the role of digital technologies in fostering antifragility in small and medium-sized enterprises. *J. Ambient. Intell. Humaniz. Comput.* 1–13.
- Coskun, A., Tanrikulu, Z., 2021. Digital innovations-driven business model regeneration: a process model. *Technol. Soc.* 64, 101461.
- Cucculelli, M., Peruzzi, V., 2020. Post-crisis firm survival, business model changes and learning. Evidence from the Italian manufacturing industry. *Small Bus. Econ.* 54, 459–474.
- Dannenber, P., Fuchs, M., Riedler, T., Wiedemann, C., 2020. Digital transition by COVID-19 pandemic? The German food online retail. *Tijdschr. Econ. Soc. Geogr.* 111, 543–560.
- Davies, A., Dolega, L., Arribas-Bel, D., 2019. Buy online collect in-store: exploring grocery click&collect using a national case study. *Int. J. Retail Distrib. Manag.* 47, 278–291.
- Demil, B., Lecocq, X., 2010. Business model evolution: in search of dynamic consistency. *Long Range Plan.* 43, 227–246.
- D'Ippolito, B., Messeni Petruzzelli, A., Panniello, U., 2019. Archetypes of incumbents' strategic responses to digital innovation. *J. Intellect. Cap.* 20, 662–679.
- Doern, R.R., Fey, C.F., 2006. E-commerce developments and strategies for value creation: the case of Russia. *J. World Bus.* 41, 315–327.
- Eisenhardt, K.M., 1989. Building theories from case study research. *Acad. Manag. Rev.* 14, 532–550.
- Eisenhardt, K.M., Graebner, M.E., 2007. Theory building from cases: opportunities and challenges. *Acad. Manag. J.* 50, 25–32.
- EIT Food, Lantern, 2020. EIT Food Foresight: Impact of COVID 19 on the Food Sector in Southern Europe. Madrid.
- Fagerström, A., Eriksson, N., Sigurdsson, V., 2017. What's the "Thing" in internet of things in grocery shopping? A customer approach. *Procedia Comput.Sci.* 121, 384–388.
- Fagerström, A., Eriksson, N., Sigurdsson, V., 2020. The use of mobile apps to facilitate customers' choice-making when grocery shopping. In: Zhang, Y.D., Senjyu, T., So-In, C., Joshi, A. (Eds.), Smart Trends in Computing And Communications: Proceedings of SmartCom 2020, Smart Innovation, Systems And Technologies, 182. Springer, Singapore.
- FAO, 2017. *Agribusiness and value chain*. <http://www.fao.org/3/i6811e/i6811e.pdf> accessed on October 19th 2021.
- FAO, 2020. *Migrant Workers And the COVID-19 Pandemic*. Rome.
- Fasnacht, D., 2020. In: The Ecosystem Strategy: Disruptive Business Model Innovation, 89. Zeitschrift Führung und Organisation (zfo), pp. 168–173.
- Fazio, F., Kuehnl, P., 2020. Rethinking Your Business With Human-centered Design. Deloitte Digital.
- Foss, N.J., Saebi, T., 2017. Fifteen years of research on business model innovation: how far have we come, and where should we go? *J. Manag.* 43, 200–227.
- Friederici, N., Meier, P., Gümüşay, A.A., 2020. An Opportunity for Inclusion. Digital Platform Innovation in Times of Crisis. Pioneerspost.
- Gassman, O., Frankenberger, K., Csik, M., 2014. The Business Model Navigator: 55 Models That Will Revolutionise Your Business. Pearson, UK.
- Gatautis, R., 2017. The rise of the platforms: business model innovation perspectives. *Eng. Econ.* 28, 585–591.
- Gavilan, G., Balderas-Cejudo, A., Fernández-Lores, S., Martínez-Navarro, G., 2021. Innovation in online food delivery: learnings from COVID-19. *Int.J.Gastron.Food Sci.* 24, 100330.
- George, G., Bock, A.J., 2011. The business model in practice and its implications for entrepreneurship research. *Entrep.TheoryPract.* 35, 83–111.
- Ghauri, P., Gronhaug, K., 2005. *Research Methods in Business Studies: A Practical Guide*. Prentice Hall, London.
- Ghezzi, A., Cavallo, A., 2020. Agile business model innovation in digital entrepreneurship: lean startup approaches. *J. Bus. Res.* 110, 519–537.
- Gkeredakis, M., Lifshitz-Assaf, H., Barrett, M., 2021. Crisis as opportunity, disruption and exposure: exploring emergent responses to crisis through digital technology. *Inf. Organ.* 31, 100344.
- Gregurec, I., Tomičić Furjan, M., Tomičić-Pupek, K., 2021. The impact of COVID-19 on sustainable business models in SMEs. *Sustainability* 13, 1098.
- Grewal, R., Tansuhaj, P., 2001. Building organizational capabilities for managing economic crisis: the role of market orientation and strategic flexibility. *J. Mark.* 65, 67–80.
- Grewal, D., Noble, S.M., Roggeveen, A.L., Nordfalt, J., 2020. The future of in-store technology. *J. Acad. Mark. Sci.* 48, 96–113.
- Güsken, S.R., 2018. Expanding to online platform business models for grocery retailers? Insights from case studies. In: Proceedings of Business And Management Conferences 6810206. International Institute of Social and Economic Sciences.
- Hanelt, A., Firk, S., Hildebrandt, B., Kolbe, L.M., 2021. Digital M&A, digital innovation, and firm performance: an empirical investigation. *Eur. J. Inf. Syst.* 30, 3–26.
- Härtig, R., Reichstein, C., Schad, M., 2018. Potentials of digital business models - empirical investigation of data driven impacts in industry. *Procedia Comput.Sci.* 126, 1495–1506.
- Hazaa, Y.M.H., Almaqtari, F.A., Al-Swidi, A., 2021. Factors influencing crisis management: a systematic review and synthesis for future research. *Cogent Bus. Manag.* 8, 1878979.
- Herbert, R., Nyssens, J., Vallöf, R., Wachinger, T., 2021. State of the industry. In: *Disruption And Uncertainty – The State of Grocery Retail 2021: Europe*. McKinsey & Company.
- Hobbs, J., 2020. Food supply chains during the COVID-19 pandemic. *Can.J.Agric.Econ.* 68, 171–176.

- Hocquet, M., 2014. From managerial practices to protest practices in the history of the retail sector. The case of Carrefour and Walmart (1960–2012). *Sociol. Prat.* 29, 63–72.
- Holm, A.B., Günzel, F., Ulhøi, J.P., 2013. Openness in innovation and business models: lessons from the newspaper industry. *Int. J. Technol. Manag.* 61, 324–348.
- Hübner, A., Holzapfel, A., Kuhn, H., Obermair, E., 2019. Distribution in omnichannel grocery retailing: an analysis of concepts realized. In: Gallino, S., Moreno, A. (Eds.), *Operations in an Omnichannel World*, Springer Series in Supply Chain Management. Springer, Cham, p. 8.
- Humphrey, J., Memedovic, O., 2006. *Global Value Chains in the Agrifood Sector*. United Nations Industrial Development Organization, Vienna.
- IBM Institute for Business Value, 2020. **COVID-19 and the future of business**. <https://www.ibm.com/downloads/cas/IAPBEJWB> accessed on October 19th 2021.
- Inman, J., Nikolova, H., 2017. Shopper-facing retail technology: an adoption decision calculus. *J. Retail.* 93, 7–28.
- Jacobides, M.G., Reeves, M., 2020. Adapt your business to the new reality. *Harv. Bus. Rev.* 98, 74–81.
- Kähkönen, A., 2012. Value net – a new business model for the food industry? *Br. Food J.* 114, 681–701.
- Kaulio, M., Thorén, K., Rohrbeck, R., 2017. Double ambidexterity: how a telco incumbent used business-model and technology innovations to successfully respond to three major disruptions. *Creat. Innov. Manag.* 26, 339–352.
- Keyes, D., 2020. *The Online Grocery Report*. Business Insider Intelligence.
- Kohli, R., Melville, N., 2019. Digital innovation: a review and synthesis. *Inf. Syst. J.* 29, 200–223.
- Kohtamäki, M., Parida, V., Patel, P.C., Gebauer, H., 2020. The relationship between digitalization and servitization: the role of servitization in capturing the financial potential of digitalization. *Technol. Forecast. Soc. Chang.* 151, 119804.
- Končar, J., Marić, R., Vukmirović, G., Vučenović, S., 2021. Sustainability of food placement in retailing during the COVID-19 pandemic. *Sustainability* 13, 1–19.
- Kraak, V.I., 2020. How digital technology is transforming the food retail landscape. In: *UNSCN Nutrition*, 45, pp. 107–115.
- Kraus, S., Clauss, T., Breier, M., Gast, J., Zardini, A., Tiberius, V., 2020. The economics of COVID-19: initial empirical evidence on how family firms in five European countries cope with the corona crisis. *Int. J. Entrep. Behav. Res.* 26, 1067–1092.
- Kronblad, C., Pregmark, J.E., 2021. Responding to the COVID-19 crisis: the rapid turn toward digital business models. *J. Sci. Technol. Policy Manag.* (Vol. ahead-of-print No. ahead-of-print.).
- Lagorio, A., Pinto, R., 2020. Food and grocery retail logistics issues: a systematic literature review. *Res. Transp. Econ.* 87, 100841.
- Latilla, V.M., Urbinati, A., Cavallo, A., Franzò, S., Ghezzi, A., 2021. Organizational re-design for business model innovation while exploiting digital technologies: a single case study of an energy company. *Int. J. Innov. Technol. Manag.* 18, 2040002.
- Li, F., 2020. The digital transformation of business models in the creative industries: a holistic framework and emerging trends. *Technovation* 92–93, 102012.
- Linde, L., Sjödin, D., Parida, V., Gebauer, H., 2021. Evaluation of digital business model opportunities. *Res. Technol. Manag.* 64, 43–53.
- Lindgart, Z., Reeves, M., Stalk, G., Deimler, M.S., 2009. *Business model innovation*. In: *When the Game Gets Tough, Change the Game*. Boston Consulting Group.
- Linz, C., Müller-Stewens, G., Zimmermann, A., 2017. *Radical Business Model Transformation: Gaining the Competitive Edge in a Disruptive World*. Kogan Page, London.
- Lioutas, E.D., Charatsari, C., 2021. Enhancing the ability of agriculture to cope with major crises or disasters: what the experience of COVID-19 teaches us. *Agric. Syst.* 187, 103023.
- MacDonald, D., Shiever, H.R., Rekhelman, N., Raza, R., Gerrard, P., Heacock, D., 2020. *Human-centered Design Is More Important Than Ever*. Boston Consulting Group.
- Mancha, R., Gordon, S., 2021. Multi-sided platform strategies for organizations: transforming the business model. *J. Bus. Strateg.* 43, 175–183.
- Martinez, G., Renukappa, S., Suresh, S., 2021. Business model innovation in small enterprises from developing countries during COVID-19 outbreak: exploring drivers and BMI outcomes. *Int. J. Bus. Environ.* 12, 364–388.
- Martínez-Velasco, A., Terán-Bustamante, A., 2022. Business model innovation and decision-making for the productive sector in times of crisis. In: *Business Recovery in Emerging Markets (Esd)*. Palgrave Macmillan, Cham.
- Mason, R., 2019. Developing a profitable online grocery logistics business: exploring innovations in ordering, fulfilment, and distribution at ocado. In: Wells, P. (Ed.), *Contemporary Operations And Logistics*. Palgrave Macmillan, Cham.
- Miles, M.B., Huberman, A.M., 1984. *Analyzing Qualitative Data: A Source Book for New Methods*. Sage, Beverly Hills, CA.
- Minadeo, R., 2010. Inovações no varejo alimentar: uma análise das estratégias de entrada e de crescimento do Carrefour e Walmart no mercado brasileiro. *Rev. Bras. Inov.* 9, 119–166.
- Mohamad, A.H., Hamzah, A., Ramli, R., Fathullah, M., 2020. E-commerce beyond the pandemic coronavirus: click and collect food ordering. *IOP Conf. Ser. Mater. Sci. Eng.* 864, 012049.
- Mostaghel, R., Oghazi, P., Parida, V., Sohrabpour, V., 2022. Digitalization driven retail business model innovation: evaluation of past and avenues for future research trends. *J. Bus. Res.* 146, 134–145.
- Myers, M.D., 2009. *Qualitative Research in Business Management*. Sage Publications, Wiltshire.
- Nosratabadi, S., Mosavi, A., Lakner, Z., 2020. Food supply chain and business model innovation. *Food* 9, 132.
- Osiyevskyy, O., Dewald, J., 2018. The pressure cooker: when crisis stimulates explorative business model change intentions. *Long Range Plan.* 51, 540–560.
- Osterwalder, A., Pigneur, Y., 2010. *Business Model Generation. A Handbook for Visionaries, Game Changers, And Challengers*, 1st ed. John Wiley & Sons, Hoboken, NJ.
- Palo, T., Tähtinen, J., 2013. Networked business model development for emerging technology-based services. *Ind. Mark. Manag.* 42, 773–782.
- Parida, V., Sjödin, D., Reim, W., 2019. Reviewing literature on digitalization, business model innovation, and sustainable industry: past achievements and future promises. *Sustainability* 11, 391.
- Presenza, A., Panniello, U., Messeni Petruzzelli, A., 2021. Tourism multi-sided platforms and the social innovation trajectory: the case of airbnb. *Creat. Innov. Manag.* 30, 47–62.
- Priyono, A., Moin, A., Putri, V.N.A.O., 2020. Identifying digital transformation paths in the business model of SMEs during the COVID-19 pandemic. *J. Open Innov. Technol. Mark. Complex.* 6, 104.
- Rachinger, M., Rauter, R., Müller, C., Vorraber, W., Schirgi, E., 2019. Digitalization and its influence on business model innovation. *J. Manuf. Technol. Manag.* 30, 1143–1160.
- Rayna, T., Striukova, L., 2016. 360° business model innovation: toward an integrated view of business model innovation. *Res. Technol. Manag.* 59, 21–28.
- Ritter, T., Pedersen, C.L., 2020. Analyzing the impact of the coronavirus crisis on business models. *Ind. Mark. Manag.* 88, 214–224.
- Saebi, T., Lien, L., Foss, N.J., 2017. What drives business model adaptation? The impact of opportunities, threats and strategic orientation. *Long Range Plan.* 50, 567–581.
- Salsberg, B., 2020. *The case for M&A in a downturn*. *Harv. Bus. Rev.* <https://hbr.org/2020/05/the-case-for-ma-in-a-downturn>.
- Sandulli, F., Duarte, A., Sánchez-Fernández, D., 2014. Value creation and value capture through internet business models. In: Martínez-López, F. (Ed.), *Handbook of Strategic e-Business Management*. Progress in IS. Springer, Berlin, Heidelberg.
- Schmitt, A., Probst, G., Tushman, M.L., 2010. M@n@gement in times of economic crisis: insights into organizational ambidexterity. *M@n@gement* 13, 128–150.
- Sebastian, I.M., Ross, J.W., Beath, C.M., Mockey, M., Moloney, K., Fonstad, N.O., 2017. How big old companies navigate digital transformation. *MIS Q. Exec.* 16, 197–213.
- Seetharaman, P., 2020. Business models shifts: impact of COVID-19. *Int. J. Inf. Manag.* 54, 102173.
- Shafer, S.M., Smith, H.J., Linder, J., 2005. The power of business models. *Bus. Horiz.* 48, 199–207.
- Sirmon, D.G., Hitt, M.A., Ireland, R.D., 2007. Managing firm resources in dynamic environments to create value: looking inside the black box. *Acad. Manag. Rev.* 32, 273–292.
- Sjödin, D., Parida, V., Jovanovic, M., Vismjic, I., 2020. Value creation and value capture alignment in business model innovation: a process view on outcome-based business models. *J. Prod. Innov. Manag.* 37, 158–183.
- Sloot, L.M., 2018. Commentary: the impact of digitization on grocery retailing: why shopping lists might be a valuable tool for brick-and-mortar grocery retailers. *J. Assoc. Consum. Res.* 3, 410–411.
- Smith, P., Beretta, M., 2021. The Gordian knot of practicing digital transformation: coping with emergent paradoxes in ambidextrous organizing structures. *J. Prod. Innov. Manag.* 38, 166–191.
- Sorri, K., Seppänen, M., Still, K., Valkokari, K., 2019. Business model innovation with platform canvas. *J. Bus. Models* 7, 1–13.
- Spanke, M., 2020. *Retail Isn't Dead: Innovative Strategies for Brick And Mortar Retail Success*. Palgrave Macmillan, Cham.
- Strauss, A., Corbin, J., 1998. *Basics of Qualitative Research, Grounded Theory Procedures And Techniques*. Sage, Newbury Park, CA.
- Sturiale, L., Scuderi, A., 2017. The marketplaces and the integration between physic and virtual in the business models of fresh produce and vegetables e-commerce. In: *HAICTA Computer Science Business*, pp. 79–90.
- Svahn, F., Mathiassen, L., Lindgren, R., 2017. Embracing digital innovation in incumbent businesses: how Volvo cars managed competing concerns. *MIS Q.* 41, 239–253.
- Takashima, K., 2020. Brick-and-mortar retailers' survival strategies amid the COVID-19 crisis. In: *Global Strategic Studies Institute Monthly Report*. Mitsui & Co.
- Tavoletti, E., Kazemari, N., Cerruti, C., Grieco, C., Appolloni, A., 2021. Business model innovation and digital transformation in global management consulting firms. *Eur. J. Innov. Manag.* 25, 612–636.
- Teece, D.J., 2010. Business models, business strategy and innovation. *Long Range Plan.* 43, 172–194.
- Teece, D.J., 2018. Business models and dynamic capabilities. *Long Range Plan.* 51, 40–49.
- Vaska, S., Massaro, M., Bagarotto, E., Dal Mas, F., 2021. The digital transformation of business model innovation: a structured literature review. *Front. Psychol.* 11, 539363.
- Vazquez-Nogueur, M., Prado-Prado, C., Liu, S., Poler, R., 2021. How can e-grocers use artificial intelligence based on technology innovation to improve supply chain management? In: *Camarinha-Matos, L.M., Ferreira, P., Brito, G. (Eds.), Technological Innovation for Applied AI Systems*. DoCEIS 2021. IFIP Advances in Information and Communication Technology, 626. Springer, Cham, Rome.
- Verhoeven, B., Johnson, L.W., 2017. Business model innovation portfolio strategy for growth under product-market configurations. *J. Bus. Models* 5, 35–50.
- Vojvodić, K., 2019. Brick-and-mortar retailers: becoming smarter with innovative technologies. *Strateg. Manag.* 24, 3–11.
- Wagner, L., Pinto, C., Amorim, P., 2021. On the value of subscription models for online grocery retail. *Eur. J. Oper. Res.* 294, 874–894.
- Yin, R.K., 2014. *Case Study Research: Design And Methods*, 5th edition. SAGE Publications, Thousand Oaks, CA.
- Yrjölä, M., 2014. Value creation challenges in multichannel retail business models. *J. Bus. Models* 2, 89–104.

- Zafari, K., Biggemann, S., Garry, T., 2020. Mindful management of relationships during periods of crises: a model of trust, doubt and relational adjustments. *Ind. Mark. Manag.* 88, 278–286.
- Zhang, Y., Zhao, S., Xu, X., 2016. Business model innovation: an integrated approach based on elements and functions. *Inf. Technol. Manag.* 17, 303–310.
- Zott, C., Amit, R., Donlevy, J., 2000. Strategies for value creation in e-commerce: best practice in Europe. *Eur. Manag. J.* 18, 463–475.

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