






ARTICLE



<https://doi.org/10.1057/s41599-023-02023-z>

OPEN

# Retail technologies that enhance the customer experience: a practitioner-centred approach

Myriam Quinones <sup>1</sup>, Ana M. Díaz-Martín<sup>1</sup> & Mónica Gómez-Suárez <sup>1</sup>

Technology has helped consumers embrace new ways of shopping. This article aims to explore how retailers capitalise on technology to create a differentiated customer experience (CX). The study provides a list of 15 shopper-facing technologies that retailers assess when aiming to improve CX and develops a framework to classify them. To do so, an exploratory study is conducted based on a qualitative enquiry and a survey of 201 retail experts. Data are analysed using content, descriptive, and correspondence analyses. The results spell out three groups of technological solutions that retailers should consider when aiming to create an enhanced CX: (1) technologies that contribute to improving experiential aspects of the shopping experience, (2) technologies that reduce friction throughout the customer journey and (2) technologies that enhance transparency and brand trust. The findings of this study offer key insights to retail companies who face the challenge of investing in technological advancements that deliver superior value to customers while supporting their firm's long-term economic goals.

<sup>1</sup>Universidad Autónoma de Madrid, Madrid, Spain. ✉email: [myriam.quinones@uam.es](mailto:myriam.quinones@uam.es)

## Introduction

With consumers increasingly demanding a seamless shopping experience, the delivery of a superior customer experience (CX) has become a key objective for retail companies, many of which have incorporated this notion into their business mission statements (Foroudi et al., 2018). Aiming to produce marketing-relevant insights, this study responds to the call to conduct descriptive research as a starting point to identify the CX management strategies currently in use in retail (Verhoef et al., 2009).

Conveniently integrated into the customer journey, technology has the potential to enhance CX (Sebald and Jacob, 2020; Alexander and Kent, 2020), which includes all the touchpoints at which the customer interacts with the business, product, or service (Grewal et al., 2009), and ultimately drives satisfaction, purchase intentions, and store patronage (Puccinelli et al., 2009; Mosquera et al., 2018; Molinillo et al. 2020). In that vein, firms that succeed at using technology to improve the shopping experience are most likely to enjoy a stronger competitive advantage (Savastano et al., 2019; Reinartz et al., 2019; Foroudi et al., 2018; Sethuraman and Parasuraman, 2005).

In today's highly competitive retail environment, retailers require information on how they can strategically incorporate technology to maximise the experience they can provide to customers and the performance of their firms (Grewal et al., 2020; Moore et al., 2022). However, research on the role of technology as an enabler of CX remains scarce (Flavián et al. 2020; Tom Dieck and Han, 2022; Alexander and Kent, 2020). Consequently, the main objective of this research is to explore how retailers leverage technology to create a differentiated CX.

Only a small number of previous studies offer an inventory of retailing technologies into a common framework, with even fewer adopting the retailer perspective (e.g., Hoyer et al., 2020; Linzbach et al., 2019; Reinartz et al. 2019; Pantano and Vannucci, 2019; Sethuraman and Parasuraman, 2005). This practice-informed article contributes to the existing literature by proposing a new framework to classify key retail technologies based on their potential to sustain CX management strategies. Specifically, this study provides a list of 15 customer-facing technologies and classifies them based on three paths that retailers follow to improve CX: (1) improving the hedonic aspects of the shopping experience, (2) reducing pain points from the customer journey, and/or (3) enhancing customers' brand trust. In doing so, the study aims to help retailers evaluate the technology investments that best fit their CX differentiation goals.

The theoretical foundation of this research draws from the conceptualisation of CX developed by Verhoef et al. (2009) and the classification of competitive retail strategies developed by Kahn (2018). Our mixed-method research comprises qualitative and quantitative studies that involve obtaining data from retail executives. Following several in-depth interviews and focus groups with retail managers, we collected survey data from a sample of 201 retail and technology practitioners. Resulting from the analysis of their input, the findings of this exploratory study offer valuable information to academia and practitioners on how retail firms can capitalise on technology to drive brand trust, make shopping a fun experience, or remove friction from the purchasing process. To the authors' knowledge, this study is the first in the field of marketing which associates a comprehensive set of technologies with retail strategies directly addressed to boost CX.

The remainder of this paper is organised as follows. Section 2 reviews the literature on customer experience, the integration of technology in the customer journey and the role of technology on retailers' CX strategy. This section also provides a proposal for a new categorisation of retail technologies. Methods section focuses

on the research methodology, while the Results section presents the results of the empirical analyses. The study's key findings, research limitations and future research paths are discussed in the Discussion section.

## Theoretical framework

**Retail technologies and CX.** As technology reshapes existing relationships between consumers and retailers, the latter strive to integrate and manage channels to offer a connected and personalised experience to their clients (Shankar et al., 2021; Ratchford et al., 2022, Hsia et al., 2020). These customer-retailer interactions, many of which are digital, establish the foundations of CX (Lemon and Verhoef, 2016; Roggeveen and Sethuraman, 2020; Alexander and Kent, 2022).

With an ever-increasing number of contact points adding complexity to the customer journey, CX has received growing attention from marketing academics and managers for the last two decades (Bolton et al., 2018; Lemon and Verhoef, 2016; De Keyser et al., 2015, 2020; McColl-Kennedy et al., 2015). Table S1 of the supplementary information file provides a brief overview of the definitions of CX.

Verhoef et al. (2009 p.32) define CX as "a holistic construct and involves the customer's cognitive, affective, emotional, social, and physical responses to the retailer. This experience is created not only by those elements that the retailer can control (e.g. service interface, retail atmosphere, assortment, price) but also by elements that are outside of the retailer's control (e.g. the influence of others, purpose of shopping)". Based on extant research that identifies macro-factors and firm-controlled factors that influence the cognitive and affective responses that define CX (Grewal et al., 2009; Verhoef et al., 2009), the idea that underpins this study is that customer-facing technological solutions have the potential to shape CX because technology affects how customers sense, think, act, and relate to retailers and their brands.

It is generally accepted that the consumer experience is created through a customer journey, which includes three stages: prepurchase, purchase, and postpurchase (Lemon and Verhoef, 2016). Recent literature describes the proliferation of retail technologies and how they fit into each phase of the customer journey (Roggeveen and Sethuraman, 2020; Hoffman et al., 2022; Shankar et al., 2021).

During the search and consideration phase that defines the prepurchase process, advanced retail technologies linked to the Internet of Things (IoT) provide companies with real-time transactional as well as behavioural data that enable better-informed customer recommendations (Verhoef et al., 2009). The content of personalized messages and alerts may be related to price changes, new products, availability of out-of-stock products, promotions, reminders about the status of the online store basket or wish lists (Willems et al., 2017; Hofacker et al., 2016; Linzbach et al., 2019). Similarly, technologies that provide immersive experiences (augmented, virtual and mixed reality) allow shoppers to know and experience products and services during the awareness and consideration stages of the consumer journey, with a high degree of realism and in a playful way (Farah et al., 2019).

In the purchase stage, electronic tags that provide product, price, and promotional information contribute to generating more confidence and better shopping experiences (Valdés and Franco, 2020). Self-checkout systems and new forms of payment through mobile phones or facial recognition are technological solutions that streamline the purchasing process for consumers, enhancing their CX. Click&collect methods and smart lockers, which allow consumers to conveniently pick up products that

they purchased online, also contribute to the objective of removing pain points from the shopping experience (Reinartz et al., 2019).

In addition, there is a growing number of technologies with high potential to enhance the postpurchase stage of the customer journey. For example, conversational platforms that range from virtual personal assistants to chatbots are used not only to assist shoppers during the early phases of the customer journey through voice or online messaging but also to stay connected after the purchase has been completed (Rzepka et al., 2020). Likewise, prior studies show that customer interactions with VR/AR can facilitate loyalty and advocacy (Kliestik et al., 2022; Farah et al., 2019).

In summary, as Roggeveen and Sethuraman (2020 p. 300) indicate, “understanding the customer journey cannot be complete without taking into account how different retail technologies direct the journey”. However, understanding the role of retail technologies in the provision of superior CX remains underplayed in the extant literature, therefore, warranting further attention.

Companies that identify which technologies best enhance the shopper experience stand a better chance of being successful (Grewal et al., 2021). Since no previous studies have evaluated retail technologies as enabling factors for a superior CX, this article aims to advance previous research by proposing a framework that organises technologies according to the retail CX strategy they mostly support.

Based on Kahn’s (2018) Retail’s Success Matrix and Gauri et al. (2021) customer-centric conceptual framework for the success of retail formats, we propose three groups of front-end retail technologies that firms can leverage to enhance CX:

1. Technology that improves the experiential aspect of shopping and makes the act of shopping a fun and exciting activity. For instance, technologies such as AR/VR/MR have been found to enrich the purchase experience because they offer unique opportunities for consumers to explore new shopping environments. Whether through glasses or mobile applications, users interact with objects and situations, both in the real and digital world, changing the way they engage in shopping (Bonetti et al., 2019; Beck and Crié, 2018) and creating meaningful experiences which lead to higher in-store traffic (Flavián et al., 2020; Hsia et al., 2020; Mosquera et al., 2018; Farah et al., 2019; Pantano and Viassone, 2015).
2. Technology that contributes to a frictionless shopping experience by saving money, time, and effort that customers devote to shopping (Grewal et al., 2020; Reintartz et al., 2019; Inman and Nikolova, 2017), such as price comparison apps or in-store, self-service technology (Moorhouse et al., 2018).
3. Technology that helps increase customer trust. Customer trust has been defined as the “overall belief that the retailer will take actions that result in positive outcomes for the shopper” (Inman and Nikolova, 2017 p. 16). For example, retail solutions powered by blockchain technology allow customers to track a product back to its source, which might increase shoppers’ confidence in the product/brand.

It is important to mention that there are also back-office technological solutions available to retailers that have the potential to improve operational efficiency (Reinartz et al., 2019; Sethuraman and Parasuraman, 2005). However, as previously stated, the emphasis of this study is on the customer-facing technologies that may influence CX. Thus, aiming to explore the range of front-end technologies that retailers evaluate as enablers of an enhanced CX, we develop the following research questions:

RQ1: According to retailers, what technological solutions have the greatest potential to influence CX?

RQ2: According to retailers, what lever of CX does each technology primarily support?

The next section describes the research methods employed to reveal the answers to these questions.

## Methods

The study was structured in two phases: (1) a qualitative stage and (2) a survey to retail managers through personal and online questionnaires. The qualitative stage comprises in-depth interviews, group meetings, and expert opinions while the quantitative stage is based on personal and online surveys.

In the qualitative phase, the authors conducted three in-depth interviews with key informants. The executives consulted held senior management positions and were experts in their respective sectors (mass consumer goods, apparel, and furniture). After the in-depth interviews, three group meetings were held with managers of leading retail companies. Between six and eight informants participated in each meeting. Participants were experts in the fields of digital transformation, information technologies, and/or strategic marketing.

Based on the results of the qualitative study and the bibliographic review, a questionnaire was designed as the basis for the quantitative work. Then, a pre-test with 10 retail experts was run to establish the final list of technologies and assess their validity. The items of the questionnaire that were unclear, not representative of the domain, or open to misinterpretation were eliminated or reworded. In addition, redundant or unnecessary items were eliminated. The resulting questionnaire had a first block of questions related to the classification variables (company role in the distribution channel, industry, company size and practitioner’s job title). A second block included a table with the list of technologies and the request to assign each technology to the CX strategy it had the greatest impact on. The questionnaire may be found in the supplementary information file.

The main survey was conducted using Qualtrics. Participants were presented with a list of retail technologies and were subsequently asked to associate each technology with the CX strategy they believed the technology contributed the most. Participants responded through a personal interview (60%) and a self-administered online questionnaire (40%).

To gather the sample, the authors collaborated with an agency that regularly organises national retail events that bring together important Spanish industry players. It is important to mention that the retail sector plays a crucial role in Spain’s economy, holding a prominent position in terms of its contribution to economic activity, employment generation, and the number of enterprises (Spanish Ministry of Industry, Commerce and Tourism, 2022). This industry has a strong presence throughout the country, acting as a cohesive force within the economy from both social and territorial perspectives (Caixabank Research, 2021).

The sample was composed of three profiles: retail managers (55%), executives of mass consumer goods manufacturers (20%) and retail technology service providers (25%). The respondents worked in the following business areas: marketing (23%), commercial or business development (18%), digital transformation and technology (11%) and logistics (6.5%). 11% of them were CEO or company owners. Regarding the companies’ profiles, their activity sectors were apparel (16%), food (15.5%), furniture (10%) and cosmetics (3%). Most of the sample (80%) were companies with 500+ employees.

After the depuration of the initial 201 responses, we retained 168 valid surveys. To analyse the data, we applied descriptive methods and Multiple Correspondence Factor Analysis (MCA) using SPSS 26.0.

MCA was chosen for its flexibility regarding the conditions required to graphically represent the relationships between CX strategies and technological solutions. In this sense, MCA has some advantages over other mapping techniques such as metric or nonmetric multidimensional analysis (MDS). Its implementation and analysis are much simpler than those of the MDS, based upon a series of cards that must be prepared with the objective that the respondents order or value them by preference. Thus, when applying MDS techniques, only a few objects can be introduced so as not to increase the respondents' cognitive load. On the contrary, in the case of the MCA, researchers only have to introduce the table in the questionnaire with rows and columns and the respondents must mark an answer if they consider there is an association between the two. In addition, the interpretation of the positions of the objects with MCA is not subjective as it is based on the quadrants and the objects' (rows and columns) positions.

**Results**

**Technology-retail strategy spontaneous association.** The qualitative stage served to identify which technological solutions were deployed by key retailers who are looking to offer an excellent customer experience. The analyses based on word clouds and discourse assessments allowed us to nominate a list of 15 retail technologies. In addition, the qualitative study confirmed that retailers who capitalise on technology to excel in CX identified the three strategies that we hypothesised about in the theoretical section: (1) improving the hedonic aspects of the shopping experience by enabling a fun and unique shopping trip, (2) reducing pain points to ensure a convenient and frictionless shopping journey, and (3) enhancing brand trust.

Table 1 shows the contingency table resulting from the survey. It shows participants' spontaneous associations between technologies (rows) and strategies (columns). Some technologies may serve more than one strategic purpose if they encompass the benefits of more than one aspect of CX. For example, voice and image search solutions are strongly associated with both experimental shopping and frictionless shopping because different companies use this technology in ways that vary depending on the source of their competitive advantage.

Our findings show that 80% of the retail experts who participated in the study identified AR/VR/MR as technologies

that add excitement to the shopping customer journey. According to 84% of the participants, 3D printing technology also facilitates the delivery of a differentiated and more pleasant shopping experience. In addition, 52% of the participants made a spontaneous association between voice and image search and experiential shopping, identifying these technologies as enablers of a fun shopping experience, while 43% of them thought that these solutions contributed to reducing customers' pain points.

When presented with the list of technologies, retail experts marked mobile payments (83%), click&collect (73%), facial recognition (67%), geolocation (60%), chatbots (59%) and voice assistants (58%) as technologies that retailers primarily invest in aiming to eliminate pain points and deliver a frictionless shopping experience. Finally, blockchain (52%) and high-tech flagship stores (48%) compose the cluster of technological solutions that support brand trust and transparency strategies.

**Map of technology and CX strategies.** By applying MCA to the absolute frequencies from the crossing of each solution with each strategy, we obtain a two-axis model that proved to be significant (Chi-square = 693.05; df = 28; Sign. = 0.000), accounting for 85% of the inertia (axis 1 = 67.2%; axis 2 = 32.8%). Tables 2 and 3 show the contribution of rows and columns to inertia.

The map that plots the position of the 15 technologies concerning the identified CX strategies is depicted in Fig. 1.

**Discussion**

Responding to calls to conduct research that sheds light on retailing CX management strategies, this study adopts the distributor perspective in identifying key technological solutions that are being deployed to enhance CX in the retail industry and provide a conceptual framework to classify them.

Specifically, the study outlines three paths for retailers to harness technology to deliver a superior CX. The first path is to deploy technology to enhance the hedonic aspect of shopping by making interactions personal and memorable for shoppers. The second route is to leverage technology that eliminates painful touchpoints on the shopping journey, thus offering a frictionless shopping experience. The third axis is to invest in technology that contributes to a transparent and trustworthy shopping experience that helps build brand trust.

Regarding the first path, the study's results show that retail experts identify AR/VR/MR, and 3D printing as technologies that are enabling shoppers to interact with different touch points in innovative ways. AR/VR/MR increase the hedonic and experiential components of a shopping trip because they allow

**Table 1 Contingency table for technologies and CX strategies.**

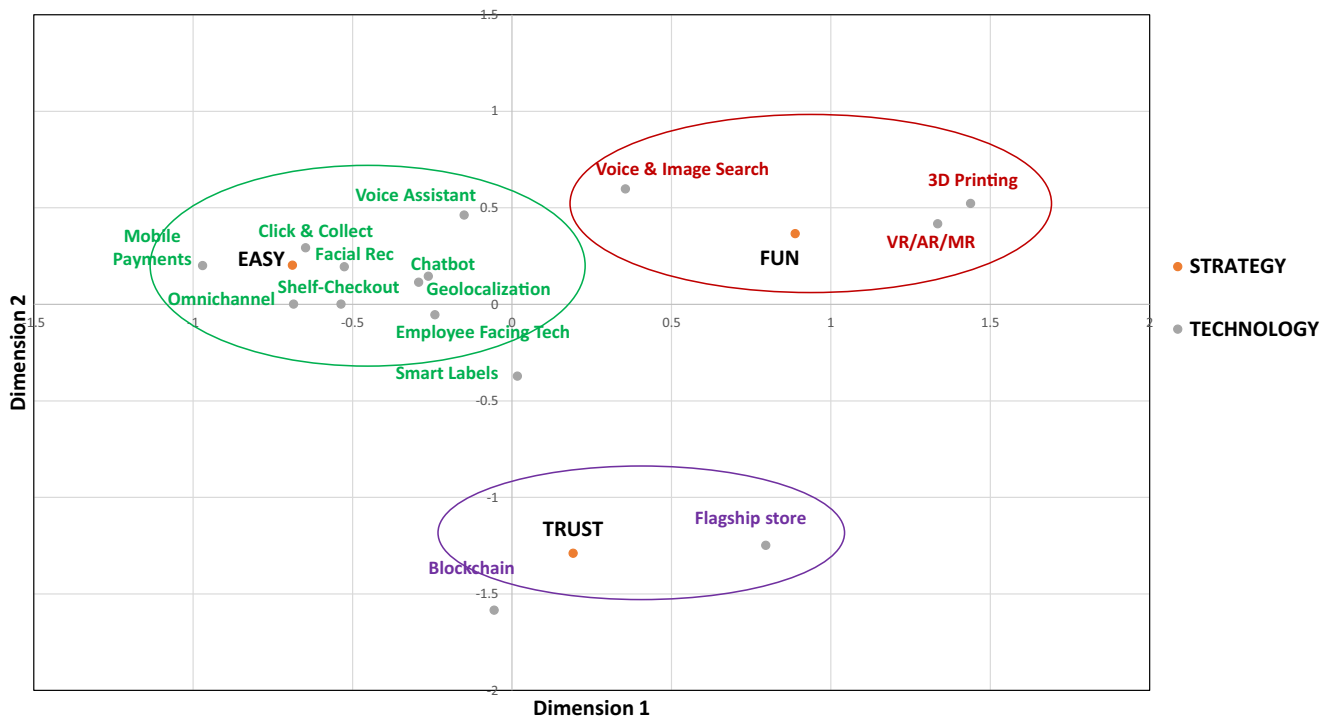
TECHNOLOGY	Brand trust, transparency	Experimental, fun & unique	Easy, frictionless
1. Voice Assistants	6%	35%	58%
2. In-Store 3D Printing	10%	84%	6%
3. Chatbots	13%	28%	59%
4. High-tech Flagship store	48%	43%	10%
5. VR/AR/MR	12%	80%	8%
6. Voice and Image Search	5%	52%	43%
7. Facial Recognition Payments	16%	18%	67%
8. Geolocation	14%	27%	60%
9. Mobile Payments	10%	7%	83%
10. Blockchain	52%	13%	35%
11. Employee-Facing Devices	18%	26%	56%
12. Click&Collect	9%	18%	73%
13. Smart Labels	26%	30%	44%
14. Self-checkout	11%	21%	68%
15. Omnichannel Payments	15%	13%	72%

**Table 2 MCA row results.**

TECHNOLOGY	Mass	Dimension		Inertia	Contribution				
		1	2		Point in inertia		Dimension in inertia		Total
					1	2	1	2	
Voice Assistants	0.076	-0.150	0.463	0.007	0.003	0.046	0.131	0.869	1.000
In-Store 3D Printing	0.069	1.438	0.522	0.078	0.281	0.053	0.916	0.084	1.000
Chatbot	0.071	-0.262	0.145	0.003	0.010	0.004	0.824	0.176	1.000
High-tech Flagship store	0.074	0.796	-1.248	0.064	0.092	0.325	0.368	0.632	1.000
VR/AR/MR	0.075	1.335	0.417	0.072	0.265	0.037	0.936	0.064	1.000
Voice and Image Search	0.075	0.355	0.597	0.014	0.019	0.075	0.337	0.663	1.000
Facial Recognition Pay	0.071	-0.536	0.000	0.010	0.040	0.000	1.000	0.000	1.000
Geolocalization	0.060	-0.293	0.115	0.003	0.010	0.002	0.903	0.097	1.000
Mobile Payments	0.069	-0.970	0.201	0.034	0.128	0.008	0.971	0.029	1.000
Blockchain	0.057	-0.056	-1.584	0.050	0.000	0.402	0.002	0.998	1.000
Employee-Facing Devices	0.053	-0.242	-0.055	0.002	0.006	0.000	0.965	0.035	1.000
Click&Collect	0.064	-0.647	0.293	0.015	0.053	0.015	0.875	0.125	1.000
Smart Labels	0.064	0.017	-0.372	0.003	0.000	0.025	0.003	0.997	1.000
Self-checkout	0.059	-0.526	0.194	0.009	0.032	0.006	0.913	0.087	1.000
Omnichannel Payments	0.066	-0.685	0.001	0.016	0.061	0.000	1.000	0.000	1.000
Total active	1.000			0.380	1.000	1.000			

**Table 3 MCA Column Results.**

STRATEGY	Mass	Dimension		Inertia	Contribution				
		1	2		Point in inertia		Dimension in inertia		Total
					1	2	1	2	
TRUST	0.173	0.191	-1.290	0.105	0.013	0.815	0.031	0.969	1.000
FUN	0.340	0.888	0.366	0.152	0.531	0.129	0.894	0.106	1.000
EASY	0.487	-0.689	0.202	0.124	0.457	0.056	0.943	0.057	1.000
Total active	1.000			0.380	1.000	1.000			



**Fig. 1** Positioning Map.

customers to virtually try on products or view how a product would look in their home before making their purchase. These technologies also help display virtual endless shelves with a curated selection of products based on customer preferences or past purchase history. Similarly, practitioners report that 3D printing technology facilitates the delivery of unique shopping experiences because it allows small-scale, on-demand manufacturing of products designed according to customer needs.

Based on the study's findings, retailers think of voice assistants, chatbots, automated checkouts and mobile and facial recognition payment systems as key technologies that should be leveraged to remove obstacles from the shopping journey. This is the second route to enhance CX identified in this study. Voice assistants and chatbots minimize friction by improving store and web navigation, making finding and purchasing a product easier and faster. Likewise, click&collect services offer additional convenience to omnichannel shoppers. The results also suggest that in-store shopping can be enhanced by empowering front-line employees with mobile devices to access real-time inventory and process transactions anywhere in the store. Similarly, self-checkouts and contactless and/or mobile payment methods offer the ability to eliminate pain points from the shopping journey by significantly reducing queuing times. Finally, the ubiquity of mobile devices supports distributors' decisions to increasingly invest in geo-marketing initiatives. With Bluetooth, GPS systems, or Wi-Fi/ultrasound beacons installed to identify the location of customers connected through their mobile apps, retailers can issue personalized and contextualized push notifications, such as promotional offers and meaningful product recommendations based on the consumer's profile and mobility pattern (Bourg et al., 2021), which aid in completing the purchase as well as enable follow-up services and loyalty programs.

Regarding the third path, participants in our study pointed out that blockchain's immutable distributed ledger technology has the potential to improve collaboration between different supply chain agents, allowing retailers not only to ensure that products are available in the right place at the right time but also to provide shoppers with unprecedentedly transparent product information. With buyers heavily relying on brands and sellers that they trust (Nghiem-Phú, 2022; Nim et al., 2022), high-tech flagship stores may also contribute to signalling that the retailer is competent and helpful, qualities that are associated with higher trust (Inman and Nikolova, 2017; Mosquera et al., 2018).

**Theoretical implications.** This paper aims to expand academic research on the role of technology in retailers' CX management strategies. Consequently, it offers several theoretical contributions.

First, studies that provide an up-to-date overview of retailing technologies are scarce. To address this gap, this article depicts 15 customer-facing technological solutions that are currently deployed in the retail industry according to the literature and input from retail experts in practice. Moreover, the retail executives who participated in the study corroborate the key idea that underpins this research work. That is, the integration of technology into the customer journey has the potential to enhance CX (Sebal and Jacob, 2020; Alexander and Kent, 2022).

Second, this article offers a clear theoretical contribution by proposing a new conceptual framework to categorise front-end retail technologies. We offer a map of existing technological solutions where technologies are placed per their positions relative to three levers of CX: fun and unique shopping experience, easy or frictionless purchase process and brand trust. Researchers considering studying retail technology could use this framework and expand our analysis by incorporating new

technological solutions. Furthermore, concurrent with the existing literature (Hoffman et al., 2022), our findings show that technology can serve multiple purposes at the same time, although maybe to different degrees.

Finally, since the study takes the perspective of retailers, it provides theoretical insights that could have been neglected in studies based on the more broadly adopted customer viewpoint. Moreover, whilst most previous retailer-oriented research uses secondary data sources, by soliciting information from retail practitioners, this study offers a deeper understanding of their perception of technology as a core component of their CX management strategies.

**Managerial implications.** Given that consumers are and will be loyal to retailers that provide exceptional value through great experiences (Moore et al., 2022; Kahn, 2021), this study could help retail firms gain a better understanding of how to integrate technology into the customer journey to serve as a point of differentiation in the competitive retail sector.

With a wide selection of technologies available on the market, it might be difficult for retailers to choose the most appropriate solutions, especially if implementation costs are high. Our map, which plots the position of 15 technologies according to three different paths that might be followed to enhance CX, offers retailers an additional tool to evaluate emerging technologies. Retailers should select the area where their service offer can stand out compared to their competitors and then choose the technological solutions that help them deliver their value proposition in the best fashion. For instance, Nike, Ikea, Gap, and Sephora were pioneers in using augmented reality to improve the way their customers engaged in shopping for their brands. Other retailers decide to prioritise investing in flagship stores to build greater customer trust or to enhance CX by supplementing the efforts of frontline employees through the integration of self-service technologies such as self-checkouts or click&collect services.

**Limitations and future research lines.** Future research could address the limitations of this exploratory study. First, as a non-random sampling method was followed, new studies could replicate our work using a probabilistic sampling method and compare the results. Second, given that the research focus was on customer-facing technologies, several back-end retail technologies were not included in the study. Further research could incorporate technologies aimed at increasing operational efficiency. Third, despite its significance, the retail sector in Spain consists mainly of small and medium-sized enterprises (SMEs) and micro-SMEs, making it a labour-intensive sector where the adoption of key digital capabilities, including Customer Relationship Management, big data, cloud computing, IoT, Artificial Intelligence (AI), and employment of IT specialists are relatively lower than its European counterparts (Spanish Digital Economy Association, 2023). New studies are required to provide conclusive cross-country studies, which could compare not only the role of technology as an enabler of CX in different countries but also test if there are statistically significant differences in parameters pertaining to geographical, economic and/or cultural contexts.

Deepening the understanding of the perceptual gap that might exist between consumers and retail managers could be another fruitful line of research. As Moore et al. (2022) suggest, "what contributes towards a positive retail CX for one consumer might be the very thing that leads to a bad experience for another shopper. Choice rather than imposed technology is the key to success" (p.7). Likewise, an interesting new research avenue would be to explore the barriers that technology poses to certain

customer segments (e.g., ageism or technostress (Kumar et al. 2022)). Finally, adding technologies to the retail experience has been found to alter the way customers interact with frontline employees (Grewal et al. 2020). Therefore, additional studies could explore the impact of retail technology on CX adopting the lens of in-store associates.

In summary, whilst the insights provided by this study contribute to the retail literature by shedding light on how customer-facing technologies enhance retailers' CX, future studies are needed to address the new research paths identified in this article.

### Data availability

The data presented in this study are not publicly available due to confidentiality restrictions. They could be made available on reasonable request from the corresponding author with the prior permission of the companies involved.

Received: 15 March 2023; Accepted: 10 August 2023;

Published online: 12 September 2023

### References

- Alexander B, Kent A (2020) Change in technology-enabled omnichannel CXs in-store. *J Retail Consum Serv* 102338
- Beck M, Crié D (2018) I virtually try it... I want it! Virtual Fitting Room: a tool to increase on-line and off-line exploratory behaviour, patronage and purchase intentions. *J Retail Consum Serv* 40:279–286
- Bonetti F, Pantano E, Warnaby G, Quinn L (2019) Augmenting reality: fusing consumers' experiences and interactions with immersive technologies in physical retail settings. *Int J Technol Market* 13(3-4):260–284
- Bolton RN, McColl-Kennedy JR, Cheung L, Gallan A, Orsingher C, Witell L, Zaki M (2018) CX challenges: bringing together digital, physical, and social realms. *J Serv Manag* 29(5):776–808
- Bourg L, Chatzidimitris T, Chatzigiannakis I, Gavalas D, Giannakopoulou K, Kasapakis V, ... & Zaroliagis C (2021) Enhancing shopping experiences in smart retailing. *J Ambient Intell Humaniz Comput* 1–19
- Caixabank Research (2021). El papel del comercio minorista en la economía española. Retrieved from <https://www.caixabankresearch.com/es/analisis-sectorial/comercio-minorista/papel-del-comercio-minorista-economia-espanola>
- De Keyser A, Lemon KN, Klaus P, Keiningham TL (2015) A framework for understanding and managing the CX. *Market Sci Inst Working Paper Series* 85(1):115–121
- De Keyser A, Verleye K, Lemon KN, Keiningham TL, Klaus P (2020) Moving the CX field forward: introducing the touchpoints, context, qualities (TCQ) nomenclature. *J Serv Res* 23(4):433–455
- Farah MF, Ramadan ZB, Harb DH (2019) The examination of virtual reality at the intersection of consumer experience, shopping journey and physical retailing. *J Retail Consum Serv* 48:136–143
- Flavián C, Gurrea R, Orús C (2020) Combining channels to make smart purchases: the role of webrooming and showrooming. *J Retail Consum Serv* 52:101923
- Foroudi P, Gupta S, Sivarajah U, Broderick A (2018) Investigating the effects of smart technology on customer dynamics and CX. *Comput Hum Behav* 80:271–282
- Gauri DK, Jindal RP, Ratchford B, Fox E, Bhatnagar A, Pandey A, Navallo JR, Fogarty J, Carr S, Howerton E (2021) Evolution of retail formats: past, present, and future. *J Retail* 97(1):42–61
- Grewal D, Gauri DK, Roggeveen AL, Sethuraman R (2021) Strategizing retailing in the new technology era. *J Retail* 97(1):6–12
- Grewal D, Levy M, Kumar V (2009) Customer experience management in retailing: an organizing framework. *J Retail* 85(1):1–14
- Grewal D, Noble SM, Roggeveen AL, Nordfalt J (2020) The future of in-store technology. *J Acad Market Sci* 48(1):96–113
- Hsia TL, Wu JH, Xu X, Li Q, Peng L, Robinson S (2020) Omnichannel retailing: The role of situational involvement in facilitating consumer experiences. *Inf Manag* 57(8):103390
- Hofacker CF, Malthouse EC, Sultan F (2016) Big data and consumer behaviour: imminent opportunities. *J Consum Market* 33(2):89–97
- Hoffman DL, Moreau CP, Stremers S, Wedel M (2022) The rise of new technologies in marketing: a framework and outlook. *J Market* 86(1):1–6
- Hoyer WD, Mirja Kroschke M, Schmitt B, Kraume K, Shankar V (2020) Transforming the CX Through New Technologies. *Journal of Interactive Marketing* 51:57–71
- Inman JJ, Nikolova H (2017) Shopper-facing retail technology: a retailer adoption decision framework incorporating shopper attitudes and privacy concerns. *J Retail* 93(1):7–28
- Kahn BE (2018) *The Shopping Revolution: How Successful Retailers Win Customers in an Era of Endless Disruption*. Wharton Digital Press, Philadelphia
- Kahn BE (2021) *The Shopping Revolution, Updated and Expanded Edition: How Retailers Succeed in an Era of Endless Disruption Accelerated by COVID-19*. University of Pennsylvania Press, Philadelphia
- Kliestik T, Zvarikova K, Lázároiu G (2022) Data-driven machine learning and neural network algorithms in the retailing environment: Consumer engagement, experience, and purchase behaviors. *Econ Manag Financial Markets* 17(1):57–69
- Kumar V, Rajan B, Salunkhe U, Joag SG (2022) Relating the dark side of new-age technologies and customer technostress. *Psychol Market* 39(12):2240–2259
- Lemon KN, Verhoef PC (2016) Understanding CX throughout the customer journey. *J Market* 80(6):69–96
- Linzbach P, Inman JJ, Nikolova H (2019) E-Commerce in a physical store: which retailing technologies add real value? *NIM Market Intell Rev* 11(1):42–47
- McColl-Kennedy JR, Gustafsson A, Jaakkola E, Klaus P, Radnor ZJ, Perks H, Friman M (2015) Fresh perspectives on CX. *J Serv Market* 29(6/7):430–435
- Molinillo S et al. (2020) The impact of affective and cognitive app experiences on loyalty towards retailers. *J Retail Consum Serv* 54:101948
- Moore S, Bulmer S, Elms J (2022) The social significance of AI in retail on customer experience and shopping practices. *J Retail Consum Serv* 64:102755
- Moorhouse N, Tom Dieck MC, Jung T (2018) Technological innovations transforming the consumer retail experience: a review of literature. *Augmented Reality and Virtual Reality: Empowering Human, Place and Business*, 133–143
- Mosquera A, Olarte-Pascual C, Juaneda E (2018) The role of technology in an omnichannel physical store. *Span J Mark* 22(1):63–82
- Nghiêm-Phú B (2022) Customers' perspectives on marketing mix elements in social media-based purchases. *Int J Internet Market Advert* 16(2):91–37
- Nim D, Jaggi S, Singh G (2022) Role of brand experience, brand trust and brand love in assessing brand loyalty: a study of fashion jewellery brands among women. *Int J Internet Market Advert* 17(1-2):200–216
- Pantano E, Vannucci V (2019) Who is innovating? An exploratory research of technologies diffusion in retail industry. *J Retail Consum Serv* 49:297–304
- Pantano E, Viassone M (2015) Engaging consumers on new integrated multi-channel retail settings: challenges for retailers. *J Retail Consum Serv* 25:106–114
- Puccinelli NM, Goodstein RC, Grewal D, Price R, Raghubir P, Stewart D (2009) Customer experience management in retailing: understanding the buying process. *J Retail* 85(1):15–30
- Ratchford B, Soysal G, Zentner A, Gauri DK (2022) Online and offline retailing: What we know and directions for future research. *J Retail* 98(1):152–177
- Reinartz W, Wiegand N, Imschloss M (2019) The impact of digital transformation on the retailing value chain. *Int J Res Market* 36(3):350–366
- Roggeveen AL, Sethuraman R (2020) Customer-interfacing retail technologies in 2020 and beyond an integrative framework and research directions. *J Retail* 96(3):299–309
- Rzepka C, Berger B, Hess T (2020) Why Another Customer Channel? Consumers' Perceived Benefits and Costs of Voice Commerce. *Proc Annu Hawaii Int Conf on Syst Sci* 2020:4079–4088
- Savastano M, Bellini F, D'Ascenzo F, De Marco M (2019) Technology adoption for the integration of online-offline purchasing: Omnichannel strategies in the retail environment. *Int J Retail Distribution Manag* 47(5):474–492
- Sebald AK, Jacob F (2020) What help do you need for your fashion shopping? A typology of curated fashion shoppers based on shopping motivations. *Eur Manag J* 38(2):319–334
- Sethuraman R, Parasuraman A (2005) Succeeding in the Big Middle through technology. *J Retail* 8(2):107–111
- Shankar V, Kalyanam K, Setia P, Golmohammadi A, Tirunillai A, Douglass T, Hennessey T, Bull JS, Waddoups R (2021) How technology is changing retail. *J Retail* 97(1):13–27
- Spanish Digital Economy Association (2023) *Economía Digital en España*. Retrieved from <https://www.adigital.org/economia-digital-en-espana/>
- Spanish Ministry of Industry, Commerce and Tourism (2022). Retrieved from <https://comercio.gob.es/comerciointerior/Paginas/Index.asp>
- Tom Dieck MC, Han DID (2022) The role of immersive technology in CX Management. *J Market Theory Practice* 30(1):108–119
- Valdés Cervantes A, Franco A (2020) Retailing technology: do consumers care? *Span J Market-ESIC* 24(3):355–375
- Verhoef PC, Lemon KN, Parasuraman A, Roggeveen A, Tsiros M, Schlesinger LA (2009) CX creation: determinants, dynamics and management strategies. *J Retail* 85:31–41

Willems K, Smolders A, Brengman M, Luyten K, Schöning J (2017) The path-to-purchase is paved with digital opportunities: an inventory of shopper-oriented retail technologies. *Technol Forecast Soc Change* 24:228–242

### Acknowledgements

This study was conducted under the framework of the research group TECHNOCONS 'Consumer Behaviour and Technology', Universidad Autónoma de Madrid (UAM). This study benefited from the Professorship Excellence Program in accordance with the multi-year agreement signed by the Government of Madrid and the Autonomous University of Madrid (Line #3). This work was supported by the Spanish Ministry of Science and Innovation under Grant PID2020-113561RB-I00. The fieldwork was supported by funding under grant FUAM -135700.

### Author contributions

Conception of the study, conceptualization and data acquisition: MQ and AMD-M. Formal data analysis: MG-S. Writing-original draft preparation: MQ and MG-S. Writing—review and editing: MQ, MG-S and AMD-M. All authors have read and agreed to the published version of the manuscript.

### Competing interests

The authors declare no competing interests.

### Ethical approval

All procedures performed in the study involving human participants were in accordance with the ethical standards of the Declaration of Helsinki and followed the protocol issued by the Ethics Committee of Research (Comité de Ética de la Investigación) approved by Universidad Autónoma de Madrid (Spain).

### Informed consent

Informed consent was obtained from all individual participants involved in the study.

### Additional information

**Supplementary information** The online version contains supplementary material available at <https://doi.org/10.1057/s41599-023-02023-z>.

**Correspondence** and requests for materials should be addressed to Myriam Quinones.

**Reprints and permission information** is available at <http://www.nature.com/reprints>

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

© The Author(s) 2023