Retailing technology: doconsumers care?

Tecnología en el comercio al detalle: ¿les importa a los consumidores?

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Abstract

Purpose – Disruptive retailing technologies improve productivity and cost optimization, but there is a lack of academic literature about their effects on shoppers' perceptions and behaviors. This paper aims to develop and test a conceptual model regarding the effects of retail technology on store image and purchase intentions and to measure how human interaction services (HIS) moderate this relationship. Two relevant retail technologies are explored.

Design/methodology/approach – The results of this study indicate that retailing technology has notable influences on consumer perceptions. Thus, shopping technologies improve store image perceptions and increase purchase intention, moderated by HIS.

Research limitations/implications – Future field experiments in actual stores should attempt to corroborate the results of this study and offer greater internal validity.

Practical implications – The results should help reduce retailers' resistance to technology adoption. In-store technology can help retailers leverage their store image and increase purchase intentions. HIS could offer a bridge between consumers and new technology.

Originality/value – This paper is an original research paper, given that few research papers are experimentally based to measure consumer's reactions to new technology implementation.

Keywords QR codes, Store image, Purchase intentions, RFID technology, Retail technology, Human interaction services

Paper type Research paper

Resumen

Propósito – Las tecnologías disruptivas de ventas al por menor mejoran la productividad y la optimización de costes, pero hay una falta de literatura académica sobre los efectos de estas tecnologías en las percepciones y actitudes de los compradores. Este artículo desarrolla y prueba un modelo conceptual de los efectos de la tecnología minorista en la imagen de la tienda y las intenciones de compra y mide cómo los servicios de interacción humana moderaron las relaciones. Este artículo explora dos tecnologías comerciales relevantes para investigarlo.

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Diseño/metodología/enfoque – Un total de 480 personas participaron en los tres experimentos en un laboratorio y utilizaron las etiquetas electrónicas de estanterías (ESL) y el carro inteligente de la misma manera que podían usarlo en las tiendas.

Hallazgos – Los resultados indican que la tecnología de venta al por menor tiene influencias notables en las percepciones de los consumidores. Por lo tanto, las tecnologías de compra mejoran la percepción de la imagen de la tienda e incrementa la intención de compra moderada por los servicios de interacción humana.

Originalidad/valor – Es una contribución original porque pocos trabajos de investigación se basan en experimentos para medir las reacciones de los consumidores debido a la implementación de la nueva tecnología.

Limitaciones/implicaciones – Los experimentos de campo en tiendas reales deben intentar corroborar estos resultados y ofrecer una mayor validez interna.

Implicaciones prácticas – Los resultados deberían ayudar a reducir la resistencia de los minoristas a su adopción. La tecnología en la tienda puede ayudar a los minoristas a aprovechar su imagen de tienda y aumentar las intenciones de compra. Los servicios de interacción humana podrían ser un puente entre los consumidores y las nuevas tecnologías.

Palabras clave Tecnología en Minoristas, Imagen de tienda, Intenciones de compra, Servicios de interacción humana, Códigos QR, Tecnología RFID

Tipo de artículo Trabajo de investigación

1. Introduction

The retail sector is not only the most dynamic sector but also difficult, complex and demanding – with vast opportunities – for which a clear strategy and positioning can help firms sustain their competitive advantage based on consumer preferences (Renko and Druzijanic, 2014). One efficacious solution is to design and implement store technologies (Verhoef *et al.*, 2009); however, technology implementation could be more effective if retailers understood the overall benefits of technologies (Grewal *et al.*, 2020b).

Retailers have adopted technologies primarily to reduce costs and to operate more efficiently (Grewal *et al.*, 2020a). Retailers assess the return on investment, payback period, net present value, internal rate of return and impact on profits when they evaluate a new technology adoption. These technologies are generally adopted without a comprehensive understanding of how they impact shopper experience and without leveraging the technology to meet shoppers' expectations and provide the most satisfying in-store experience. Moreover, retailers could be more successful when they differentiate between technologies that increase operational efficiency and those that enhance the customer experience (Grewal *et al.*, 2020b).

Despite the widespread use of technologies, little research has been conducted on how they impact consumer perceptions and behaviors (Grewal *et al.*, 2020a; Bertacchini *et al.*, 2017; Inman and Nikolova, 2017). Specifically, Grewal *et al.* (2017) urged further research to determine the efficacy of in-store technologies for influencing consumer's perceptions and behaviors with respect to store image and purchase intention. Store ambience is an important category to measure distribution services contributing to an increase in consumer satisfaction (Cortiñas *et al.*, 2019). Moreover, understanding how the retail sector can manage the consumer experience is pivotal, as poor human interaction services (HIS) could disrupt the consumer–company relationship (Lavin and Maynard, 2001) and diminish loyalty (Parks, 2010).

In our paper, we define retailing technologies as technologies implemented in the store to increase efficiency, reduce costs and enhance the customer shopping experience.

Specifically, we discuss two recently introduced technologies: Electronic Shelf Labels (ESL) equipped with quick response (QR) codes and SmartCart operated through radio frequency identification (RFID) systems. We integrate these technologies with the concepts of store image and purchase intention into an interactive research model. We explore specific aspects of the model such as technology type and HIS. More specifically, we develop three experiments using a retail laboratory where participants use in-store technology. In measuring consumer's perceptions and behaviors owing to new technology implementation, researchers could conduct experiments for future research (Inman and Nikolova, 2017), specifically as Shankar *et al.* (2011) recognized to understand usage and technology effectiveness. Finally, we conclude by identifying the managerial implications of the model and future research opportunities.

2. Literature review

2.1 Technology in retailing

We use Mosquera *et al.*'s (2018) definition of in-store technology as different hardware and software that eases the shopping process at various points in the store. Such a technology allows customers to perform any one of a number of actions such as automatic checkout, automatic product location in the store, automatic customer order and automatic delivery to the customer's home. Terms such as retailing technology and disruptive technology (Inman and Nikolova, 2017), smart technology (Adapa *et al.*, 2020; Balaji *et al.*, 2020) and innovative technology (Renko and Druzijanic, 2014) are also used to describe in-store technology. Each will now be explained.

We define retailing technology as technology implemented in-store to reduce costs, increase store efficiency and enhance the customer shopping experience. Shankar *et al.* (2011) underscore how advances in technology create opportunities for digital shopper marketing activities at different points in the shopping cycle – from the couch (e.g. television remotes, video gadgets and iPhone apps) to the cart (e.g. digital signage and RFID tracking). Furthermore, in stores, technological and mobile advancements have created options for Product Finder, ESL, SmartCart, Mobile Mirror, Mobile Apps, Mobile Shopping Assistant, Augmented Reality Makeup, SmartCart-Game, Self-Checkout, In-store Kiosks, Virtual Reality, Intelligent Shopping List, Digital Signs, Bitcoins, Augmented Reality, Digital Communication Bins, Smart Windows, Facial Detection, Smart Display, Interactive Fitting Room, Customer Identification Cards, Retailer Specific App (which allowed the Internet of Things (Inman and Nikolova, 2017) and Service Robots (Belanche *et al.*, 2020). All these are facilitated through developed hardware and software such as QR codes, RFID technology, iBeacons, Bluetooth and Wi-Fi, among others. For example, iBeacons, which can be made ubiquitous across the store, can track a shopper's movements, then send messages to sensors in his/her mobile device (Kalyanam *et al.*, 2006). When placed on products, they would issue an alert when taken, placed in a cart or returned to the shelf. Because these applications collect valuable information about consumer's in-store behavior, they suggest highly customized and targeted offers (De Sanden *et al.*, 2019).

Tracking technologies allow retailers to monitor customers through their mobile devices (Grewal *et al.*, 2018). Every smartphone has a unique address that becomes visible when the user relies on Wi-Fi or Bluetooth, so retailers can determine the location of each phone in store and thus comprehend which displays attract more customer attention, how much time customers wait in queue and how they move through the store. Orús *et al.* (2019) found that physical retailers could benefit from evolving mobile technologies and implementing applications including, for example, customer recommendations, which may impact the consumer's purchase decisions.

Additionally, Willems *et al.* (2017) categorize in-store technologies in terms of customer value and their impact stage in the customer journey. Grewal *et al.* (2020a, 2020b) classified retail technologies based on their level of convenience and social presence for the consumer.

Combining the two typologies, we develop a classification of the primary in-store technologies (Table 1). We consider their utilitarian value, the hedonic benefits, their convenience and the social levels to develop. We separate between utilitarian value or convenience value (technology that helps in price comparison; to save money, time and effort; and to get in-store information and product information to compare products) and hedonic benefits or social value (technology to offer customized recommendations, personification in the function of optimizing one's choice, social value in terms of connecting people or a lively dimension in the shopping experience). The SmartCart is categorized both as a convenient and as a social in-store technology (Willems *et al.*, 2017), and the ESL is classified as a convenient technology.

Citing the importance of technology, Parasuraman and Grewal (2000) propose extending the traditional retailing triangle model (i.e. company, employees and customers) into a three-dimensional pyramid, wherein technology mediates the interactions among the three elements. Similarly, Shankar *et al.* (2011) underscore four pivotal environmental drivers of shopper behavior and innovations, one of which is technology and how it has enhanced marketers' ability to reach shoppers through new touchpoints. Because of the vast dispersion of technology, people have grown accustomed to it, suggesting that marketers and retailers might influence shopper attitudes and behavior by taking advantage of such trends (Shankar and Balasubramanian, 2009).

Retailers thus require new insights to influence shoppers' in-store decisions using RFID and other technologies (Kalyanam *et al.*, 2006). Verhoef *et al.* (2009) urged further research into passive technologies, such as SmartCarts, and their effects on the customer experience. The numerous technologies in use on sales floors, all purport to drive sales and create better shopping experiences for consumers, and they provide retailers with a wealth of data about buying habits.

In conclusion, it is unclear which technology will be effective, to what extent and under what conditions (Shankar *et al.*, 2011). Grewal *et al.* (2011) also urge research to measure the efficacy of in-store digital signage technology on consumer shopping behavior (e.g. usage rates and brand switching); the long-term impacts of new strategies on reference prices; and the determining factors for the success of these novel price and promotion options.

Our research investigates ESL, which include QR codes, and Smart Carts operated through RFID technology. We selected them because the former creates utilitarian value (ESL/QR) and the latter develops hedonic benefits (SmartCarts/RFID). Moreover, Grewal *et al.* (2020b) recognized that ESL is less of a social technology and a more convenient technology conveying a secondary goal during purchases (e.g. in-store searching for product information or looking for retailer/products' brand stimuli at the store); while SmartCart is

Table 1.
In-store technology typology based on utilitarian value and hedonic benefits

Utilitarian value/convenient value		Hedonic benefits/social (interactive) benefits	
Price comparison and/or money, time and effort saving	Product information and/ or product comparison	Personalization and/or customization	Social and/or play
Product Finder	Electronic shelf labels/QR	SmartCart	Mobile mirror
Mobile Apps	Mobile shopping assistant	Augmented reality makeup	SmartCart-Game
Self-Checkout	In-Store Kiosks	In-Store robots	Virtual reality
Intelligent shopping list	Digital signs	Bitcoins	Augmented reality
		Digital communication bins	Smart windows
		Facial Detection	Smart Display
		Customer identification cards	Interactive fitting room

both a convenient and social technology directing store goals and interacting with the technology (e.g. receiving a shopping assistant list and personalized promotions, adding products to the cart, scanning only once – before the checkout line and paying online). Next, we discuss each technology.

2.2 Electronic shelf labels that include QR codes

ESL support efficient, automatic price changes using infrared (IR) technology. The battery-powered tags are connected by an IR antenna, which connects to software installed on a computer that is programmed to send a signal to each label in the store to change their information as needed. Thus, a single click can adjust product prices and other information on shelf tags. Large-scale changes can even occur on the corporate level, with changes communicated to every store wirelessly. Thus, a retail supermarket chain can change the labels in hundreds of stores, resulting in significant cost savings by replacing the manual work of re-labeling each tag. Inman and Nikolova (2017) noted the numerous hours required by employees to change prices on paper price tags.

The new technology increases operating efficiency and optimizes pricing strategy by eliminating any discrepancy between the price determined at the point of sale (set by management) and the store price observed by the customers. In turn, it should generate more confidence and better shopping experiences (Garaus *et al.*, 2016). The technology requires a transmitter base station and software for wireless communication. The transmitters can send/receive diodes and communicate wirelessly with electronic tags via electronic signals. The connections are simple; the station communicates with the transmitter and the transmitter communicates with the tags.

Electronic tags contain product information, such as the bar code, price and promotions, but they also feature QR codes, which store information within a dot matrix or two-dimensional barcode. Created by the Japanese company Denso-Wave in 1994, QR codes were first used in the automotive industry by Toyota to identify the parts of the cars as they were manufactured. Similar to a bar code, a QR code can store about 350 times more information, and it can be read vertically or horizontally. The point system in the displayed square has three corners that contain all the product information. In addition to text, the code can store images, videos and web links. Consequently, it is an innovative way to provide product information. The codes can be read using smartphones, aiding their widespread usage. The software can read the code when the camera in the device nears the QR code, leading users to company web pages, advertising or product information. This enhanced information facilitates consumers to make better purchasing decisions, which should lead to an increase in perceived value (Viejo-Fernández *et al.*, 2019).

In addition, their use creates information about consumers and products by monitoring how often people scan a particular product or by collecting a person's total scans to detect buying patterns. Finally, QR codes support virtual purchases, allowing the shopping process to occur anywhere. Even if a store is closed, consumers can shop electronically by saving the desired products' QR codes. Virtual shelves feature touchscreens that show consumers what is available, which can appear elsewhere than in an actual supermarket. For example, Tesco developed a virtual store in Seoul that allows users to order products while waiting at the train station, as long as they have a mobile device that can translate QR codes.

2.3 SmartCart operated by radio frequency identification

Radio frequency identification technology identifies products through an implanted chip that records and stores data, such as prices, product features and serial numbers. An RFID system comprises the chip-containing label, which is placed on the physical object to be identified; a reader and antennas enabling the tags to be read without direct contact (unlike a bar code, which requires a line of sight and must be read one at a time); and a computer with a middleware application that manages the equipment, filters information and interacts with applications (Asif and Mandwiwalla, 2005).

In supply chains, RFID improves the efficiency of operations by facilitating planning, monitoring and delivering goods in channels and distribution centers. In stores, because RFID relies on radio waves, the signal chips can be read by an antenna from a distance, supporting the identification and monitoring of each individual product. This technology also has broad implications for retailers wanting to implement dynamic pricing: they can shift prices automatically according to costs, inventory levels or consumer spending habits (Grewal *et al.*, 2011). Finally, for retailing in general, RFID offers significant potential (Ganesan *et al.*, 2009; Hui *et al.*, 2009; Webb, 2008), including simplified payments, dynamic pricing and data collection.

In particular, SmartCarts operating through RFID are equipped with a video screen that supports interactive technology uses, enabling customers to locate products, access shopping lists, check prices, receive promotions and scan purchases. Stores can identify which products enter shopping carts and thus can measure and analyze consumer buying habits. Some retailers (e.g. Safeway, Stop and Shop) have mounted touchscreen tablets onto shopping carts to serve as personal shopping assistants (Kalyanam *et al.*, 2006). Sorescu *et al.* (2011) describe Stop and Shop's introduction of a wireless shopping cart as "buddies" that customers can use to search for required products using a dropdown menu, which then displays the selected products on a store map. The "buddy" can also place orders, notify store associates of out-of-stock items and issue electronic rain checks, thus enhancing and simplifying the shopping experience. Such self-service technologies (SSTs) offer opportunities for product and process innovations, but they also enable retailers to understand the opportunities and challenges for consumers and their behaviors.

Other products that use RFID technologies include smart shelves integrated with RFID readers that can detect and report every item removed or returned to the shelf, so as to automatically notify supply clerks or security. Thus, in addition to improving the shopping experience, smart shelves can prevent merchandise losses and improve marketing planning and shrinkage rates. Moreover, RFID tags specific to each displayed item can inform retailers which type of products are viewed most frequently, what gets purchased, in what color and in what season, etc. Additionally, customer identification cards integrate RFID readers to detect customers' purchasing patterns. Therefore, the RFID technology also can support in-store customer relationship management efforts by generating a deep consumer knowledge, such as entry/exit and purchase history, to support data mining and customer relationship management strategies. These cards also can support a cashless payment system.

Although QR codes and RFID technology have been studied broadly in relation to their operational efficiencies, particularly in supply chains, they also offer vast opportunities to influence and measure consumer shopping patterns in stores, consumer perceptions of store images and purchase intentions; which we will discuss in the next section.

2.4 Store image

To maintain a competitive advantage, stores constantly change their image and positioning (Grewal *et al.*, 1998). This is, at least in part, because they want to portray an appealing image to their customers who know the derived benefits. According to the POPAI's (2014) mass merchant shopper engagement survey, 82% of consumers make decisions at the point of sale, whereas the GMA Sales Committee (2010) reports an engagement rate of 59%, thus suggesting a constant need to work on the store image.

The store image, in turn, is the sum of tangible and intangible attributes of the retailer that has been noticed with a value for consumers through his/her store experience. According to Mazursky and Jacoby (1986, p. 147), store image is

> "a cognition and/or affect (or a set of cognitions and/or affects), which is (are) inferred, either from a set of ongoing perceptions and/or memory inputs attaching to a phenomenon (i.e., either an object or event such as a store, a product, a "sale," etc.), and which represent(s) what that phenomenon signifies to an individual".

As such, store image is a consumer perception that could be modified by in-store technology implementation (Davis, 1986). A retailer could implement retailing technologies for improving physical stores (Pantano and Laria, 2012) and influencing store perceptions (Garaus *et al.*, 2016; Hopkins *et al.*, 2014; Adapa *et al.*, 2020). According to Poncin and Mimoun (2014), the new forms of in-store technologies improve sensory perceptions by making traditional stores more appealing and attractive because of the introduction of advanced technologies (Pantano *et al.*, 2013; Balaji *et al.*, 2020; Baker *et al.*, 1994). It is important because consumers still see the physical store more attractive for completing the purchasing process (Flavián *et al.*, 2020).

Additionally, to make the store more attractive, technologies such as the SmartCart and ESL could modify consumer experience because of increasing consumer's understanding (e.g. recording customer data, using it to forecast future consumer behavior and marketing strategies such as a better merchandise assortment based on consumer patterns). The effects could be a more knowledgeable and involved customer (Grewal *et al.*, 2017) positively impacting store image perceptions. The store enhances the ability to connect with consumers and personalizes the whole service experience.

Technology such as QR codes and RFID helps shoppers to scan, bag and pay for products without cashier interaction, affording customers more control over the purchase process, which ultimately improves their purchase experience (Flavián *et al.*, 2019). Thus, technology influences the in-store customer experience, which, in turn, improves the shopping process (Beck and Crié, 2016). Consequently, shopping technologies and innovations could improve consumer experience and the store image perception because the store could be more appealing, more informative and more interactive with more involvement and could offer a better service. Thus, we propose the following hypothesis:

H1. In-store technology (ESL with QR and SmartCart based on RFID) generates more favorable evaluations of a retailer's store image.

2.5 Purchase intentions

Once retailers understand the impact of in-store technologies on customer perceptions (store image), it is then imperative to realize consumers' feasible responses. Parise *et al.* (2016) found that 72% of consumers encountering in-store technology will increase their purchase intention. Inman and Nikolova (2017) measured consumers' reactions to technology by asking if their willingness to purchase groceries from a retailer would change as a result of the implementation of a new technology. Mosquera *et al.* (2018) found that the implementation of new in-store technologies positively influences purchase intention. Grewal *et al.* (2020b) found that in-store technology enabling convenience and a high social value elicits higher sales. Moreover, companies can benefit from technology implementation through capturing and leveraging consumer insights and to encourage repurchase (Willems *et al.*, 2017).

There are some reasons why technology impacts purchase intentions. One of the main reasons is attraction. Pantano and Viassone (2015) argue that technology attracts more customers to the store because it could increase store appealing. The second reason is store information. Additionally, Suh and Lee (2005) found that information quality provided by in-store technology positively impacts purchase intention. The third reason is personification. Bues *et al.* (2017) found that personalizing marketing strategies through technology can increase the likelihood of purchase. The next reason is time. Lunde and Ahlbom (2019) found that technology incites consumers to spend more time in the store and spend more time examining products and prices on the shelves. More time means more purchases (Bohl, 2012; Spangenberg *et al.*, 2006). The last reason is attention. Nordfält (2011) argues that the likelihood of unplanned purchases increases when consumers pay adequate attention to a specific point of purchases items located in the store. One of these could be technology such as ESL and SmartCarts. Thus, we argue that attraction, information, personification, time and attention contribute to increased purchase intentions because in-store technology implementation. Hence, consumer's reactions to new technology could be measured as an effect on purchase likelihood. We can, therefore, propose that:

H2. In-store technology (ESL with QR and SmartCart based on RFID) increases purchase intentions.

Bagozzi and Burnkrant (1979) define purchase intentions as a personal behavioral tendency to buy a product. Purchase intentions indicate that consumers use their experiences, preferences and the external environment to collect information, evaluate alternatives and make decisions (Zeithaml, 1988; Schiffman and Kanuk, 2000). Dodds *et al.* (1991) measure purchase intentions by incorporating product quality assessments in terms of likelihood, probability and willingness to buy.

2.6 Relationship of technology, store image and purchase intentions

Technology in retailing has been implemented mainly to improve productivity and reduce operating costs, but it also impacts consumer perceptions and behaviors (Shankar *et al.*, 2011). Inman and Nikolova (2017) suggest that retailers need to consider shoppers' perceptions about technology because differences in perceptions determine future purchase likelihood. As previously explained, the appeal of immersive technologies is related to store image and would attract consumers to the stores (Pantano and Laria, 2012).

So, store image is a consumer perception, and it has been found to have a direct relationship with purchase intentions (Grewal *et al.*, 1998; Hildebrandt, 1988). As Inman and Nikolova (2017) argue, shopper perceptions of the retailer are affected by new technologies, and these reactions impact store image and mediate behavioral intention. Additionally, Erdil (2015) proposed that store image positively affects consumer purchase intention, and store image mediates the relationship with purchase intention. Hence, consumer perceptions of the retailer are affected by new in-store technologies, and these reactions mediate purchase intentions. Therefore, we propose the following hypothesis:

H3. The impact of in-store technology (ESL with QR and SmartCart based on RFID) on purchase intentions is mediated by store image.

Figure 1 illustrates our framework, which expands the relationship between technology-induced purchase intentions by adding a mediating effect of store image formed through new in-store technology implementation.

It is necessary to differentiate the effects of the above technologies. For example, Inman and Nikolova (2017) found different consumer perceptions and behavior between technologies. In our paper, we determine which technology (ESL's with QR codes or SmartCart operated by RFID) has the greatest impact. Similar to Inman and Nikolova (2017), we predict that the SmartCart technology has greater impact because consumers find it more interactive, more innovative and more fun. As Table 1 illustrates, a SmartCart is classified as a social technology with hedonic benefits and a convenient technology, whereas ESL is classified as a convenient technology with functional value. The SmartCart offers a more personalized shopping experience. In-store technology inducing high levels of convenience and social presence produce higher desirable consumer sales. We expect that convenient and social in-store technology, such as the SmartCart, will improve consumer perception, and it will, in turn, increase preferences and purchase likelihood. Hence, we posit the following hypotheses:

H4. The positive impact of in-store technology on store image is higher for SmartCart technology (social technology) than for ESL technology (convenience technology).

H5. The positive impact of in-store technology on purchase intentions is higher for SmartCart technology (social technology) than for ESL technology (convenience technology).

H6. The mediation effect of store image in the relationship between in-store technology and purchase intention is higher for SmartCart technology (social technology) than for ESL technology (convenience technology).

In both technologies, consumer services are generated. As proposed, the SSTs should influence the perceived store image. They have many advantages, along with the disadvantage of lacking HIS, which are explained in the following section.

2.7 Human interaction service

Technology might create customer convenience, but it can also create/increase customer dissatisfaction (Makarem *et al.*, 2009), mainly because of the customer's need for human interaction. Kattara and El-Said (2014) define HIS as transactions that occur via direct contact between the customer and an employee in a service encounter, whether face-to-face, by telephone or through other media (Maloney and Asce, 2002).

Studies have investigated the advantages of a direct service contact compared with SSTs, noting that consumers tend to prefer interactions with employees rather than

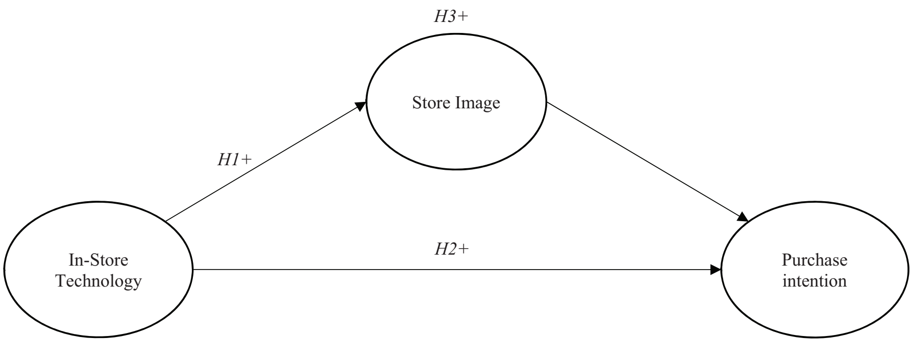

Figure 1.
Basic research model

machines (Zeithaml and Gilly, 1987; Makarem *et al.*, 2009; Kattara and El-Said, 2014). Studies have found that HIS increases trust and interpersonal relationships (Edvardsson *et al.*, 2011; Dagger *et al.*, 2007; Gwinner *et al.*, 1998); increases consumer satisfaction (Grönroos, 1984); and enhances loyalty (Reynolds and Beatty, 1999). However, other studies noted a preference for SST (Dabholkar, 1996), which provides faster service (Meuter *et al.*, 2000), as well as greater independence and freedom (Oliver *et al.*, 2009). Makarem *et al.* (2009) summarize satisfaction levels for HIS and SST service encounters, as illustrated in Table 2.

Companies seek the best combination of SST and HIS that can satisfy customers efficiently. "For customers who are tempted to switch to interpersonal help, firms should make sales assistants available, especially for newly introduced SSTs" (Zhu *et al.*, 2013, p. 27). Our study, therefore, tests the possible effect of HIS on our research model (Figure 2) mainly in the relationship between technologies with store image perception as a moderator. Thus, we propose the following hypothesis:

H7. When HIS is present, the effects of social in-store technology are enhanced, leading to better store image perceptions.

3. Methodology

3.1 General research methodology

The hypotheses were investigated by conducting three experiments – the preponderant and novel contribution of this paper. Inman and Nikolova (2017) urged experiments for future research to measure consumer's reactions and perceptions owing to new technology implementation. Additionally, Kidder *et al.* (1991) argued that a randomized experiment is best for determining causal relationships. Specifically, to understand usage and technology effectiveness, manufacturers and retailers can conduct experiments, e.g. pilot projects or virtual stores (Shankar *et al.*, 2011).

Table 2.
Differences between human interaction service and self-service technology

Human interaction service	Self-service technology
Reliability (Parasuraman *et al.*, 1988) Responsiveness (Parasuraman *et al.*, 1988, Bitner *et al.*, 1990, 2002) Spontaneity (Bitner *et al.*, 1990) Service recovery (Bitner *et al.*, 1990, 2000) Convenience (Berry *et al.*, 2002)	Process convenience, reliability of technology, service outcome (Parasuraman *et al.*, 2005)

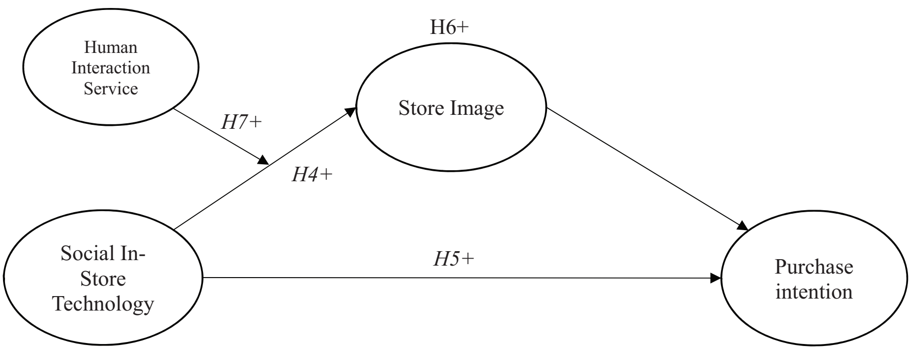

Figure 2.
Complete research model

For this study, the experiments were conducted in a retail laboratory equipped with RFID, QR codes, ELS and a smart fitting room (Franco and Valdez, 2018). The RFID technology also supports a SmartCart in the lab because each product has an identifying chip. Participants placed products in carts, and the antenna identified them and determined the customer's activities without scanning each individual item in the cart at a checkout counter. Thus, the process is faster, which may generate a better shopping experience, because it reduces queues and waiting time.

The lab stocked several types of products (e.g. cereal, cookies, soda and detergent); respondents imagined a purchase simulation for eight products in different categories. First, respondents in the technology group had to download a QR code scan app to scan the ESLs. Second, their names were registered in an RFID card to personalize their purchase. Third, they purchased eight specific products on the list, for which they had to spend a specific amount and read at least three QR codes, each of which directed them to the retail lab's Web page, with information about their scanned products. Fourth, participants were asked to observe a screen that displayed their name, the number of products they purchased (eight), the list of product names, the price of each product and the total amount they should pay. Because it was a simulation, they did not actually pay for the products. Finally, they filled out a questionnaire in a different room.

A total of 480 students participated in the three experiments (mean age: 20.30 years, SD = 1.3; 52% females; 100% students, 63% were undergraduate students in the first or second grade and 37% were undergraduate students in the third or fourth grade). Participants were contacted at the same university and invited to participate. The sample was randomly selected.

The hypotheses were tested using the Student's *t*-test, analysis of variance (ANOVA), Tukey's honestly significant difference (HSD) and PROCESS Model 4 to measure mediation and Model 7 to measure moderation (Hayes, 2012).

After they completed the task in the supermarket, they filled a physical questionnaire.

3.2 Measurements

The questionnaire seeks to measure perceived store image and purchase intentions. The questionnaire was pretested on several groups of undergraduate students, and refinements were made based on the results.

Perceived store image was measured on a seven-point semantic differential scale (adapted from Grewal *et al.* (1998) that inquired about the shopping interactive experience, the store appeal and overall service (excellent/very bad). It also included evaluations of the store's merchandise information (high/low) and whether the store was better/worse than others.

The willingness to buy construct was measured using items from Dodds *et al.* (1991) on a seven-point semantic differential scale: I would (always/never) buy in this store; I (would change/would not change) my regular store for this store; the probability that I would consider buying is (very high/very low); and I will visit this store (more often/less often) than I used to visit others.

For each construct, the item reliability, scale reliability and variance extracted are provided. The reliabilities of the two multiple-item scales used to measure the model constructs were evaluated by calculating the coefficient alphas (store image = 0.805 and purchase intention = 0.879). The results of a principal components factor analysis using Varimax rotation supported a three-factor solution. The two factors had eigenvalues greater than 1.00 and accounted for 69.98% of the variance in the items.

3.3 Study 1

Study 1 investigated the first three hypotheses, i.e. the effect of in-store technology on evaluations of a retailer's store image, purchase intention and the mediation effects of the store image on the relationship between technology and purchase intention.

A total of 140 students participated in the first experiment, separated equally into two groups: Group 1 used a traditional shopping process without any technology, whereas Group 2 relied on the technology in the lab, including ESLs (with QR codes) and smart shopping carts with RFID.

3.3.1 Analysis and results. In manipulation checks, the respondents evaluated the technology factor using an *ad hoc* measurement scale (α = 0.971). Technological group perceived a more technological store (M = 6.59) than no technological group (M = 2.99; t (138) =16.21, $p < 0.001$) indicating a successful manipulation of technology, as indicated in Table 3.

The hypotheses were tested using the Student's *t*-test and PROCESS Model 4 (Hayes, 2012). Table 3 summarizes the *t*-test results. The mean values of the construct's store image and purchase intention served as the dependent variables, and the two formats for two technological scenarios (technological group vs no technological group) represented the independent variable.

Purchase intention is higher in the technological group (M_{notech} = 4.66 vs M_{tech} = 5.82; t (138) = 5.50, $p < 0.001$). Store image also is higher in the technological group (M_{notech} = 5.76 vs M_{tech} = 6.31; t (138) = 3.99, $p < 0.001$).

To test for a direct effect of in-store technology on purchase intention (*H1*) and an indirect effect through store image (*H2*), we used the bootstrapping procedure recommended by Preacher and Hayes (2008). They suggest it to compute a confidence interval (CI) around the indirect effect. A bootstrap CI that does not include zero provides evidence of a significant indirect effect of in-store technology on purchase intention through store image. The mediation analysis was performed by applying Hayes' PROCESS SPSS macro (Model 4), using 5.000 bootstrapped samples to estimate the indirect effect.

Table 4 displays the results. In-store technology has a significant positive effect on store image (b = 0.2714, standard error [SE] = 0.1204, t = 2.2551, p = 0.02), indicating that consumers experiencing in-store technology will generate better store image perceptions. Furthermore, we found a significant effect of store image on purchase intention (b = 0.7111, SE = 0.1095, t = 6.4942, $p < 0.010$). As hypothesized, a significant positive indirect effect of in-store technology on purchase intention via store image was found (point estimate = 0.1930, 95% CI = 0.0241–0.4124). Thus, *H3* was supported. Results indicate that in-store technology positively affects perceived store image and purchase intention.

3.4 Study 2

This study investigated how types of technology (ESL vs SmartCart) produce different store image perceptions and purchase intentions (*H4* and *H5*). How the mediation effect of store

Table 3. Comparison of means (independent samples *T*-test) technological group vs no technological group perceptions

Variables	Mean No technological group	 Technological group	Standard deviation No technological group	 Technological group	*t*
Technology	2.99	6.59	0.77	0.55	16.21**
Purchase intention	4.66	5.82	1.44	1.01	5.50**
Store image	5.76	6.31	0.99	0.60	3.99**

Notes: **Significance level <0.01; *H1* and *H2* accepted image has an impact on the relationship between technology and purchase intention differs between these technologies (*H6*).

Group 2 in Study 1 used both technologies. Yet, one technology might have a stronger impact than the other, so Study 2 comprised two respondent groups: Group 1 uses ESLs with QR codes, and Group 2 accesses smart shopping carts with RFID technology. Each group had 70 students. The procedure was the same as in Study 1, except that Group 2 did not read the QR codes but instead viewed paper labels, not ESL. They followed the same procedure for RFID cards and smart shopping carts.

3.4.1 Analysis and results. Table 5 details the results. The RFID group, compared with the QR group, expressed higher purchase intentions (M_{RFID} = 5.71 vs M_{QR} = 5.08, t (138) = 3.57, $p < 0.001$) and better perceived the store (M_{RFID} = 6.26 vs M_{QR} = 5.99, t (138) = 2.26, p = 0.020), as detailed in Table 5. The difference indicates that the RFID group exhibited better indicators than the QR group.

When comparing no technological group (Study 1) with these two groups and running ANOVA and Tukey's HSD, the difference reveals that RFID group exhibited better purchase intention than the notechnological group intention (M_{RFID} = 5.71 vs M_{NoTech} = 4.66, $p < 0.001$) and better store image (M_{RFID}= 6.26 vs M_{NoTech} = 5.76, $p < 0.001$). But the QR group does not (neither purchase intention (M_{QR} = 5.08 vs M_{NoTech} = 4.66, $p > 0.050$; nor store image M_{QR} = 5.99 vs M_{NoTech} = 5.76, $p > 0.050$).

QR codes could be used more to increase productivity and decrease operating costs, as it has less impact on consumer perceptions. According to the upper and lower CIs (Hayes, 2013) of −0.7473 and −0.1238 for the direct effect and −0.4163 and −0.0240 for the indirect effect, *H6* is supported. Technology increases store image, so when consumers encounter a highly technological retailer that provides RFID capabilities, the increased store image leads them to increase their purchase intentions.

3.5 Study 3

This study seeks to determine which combination of SST and HIS have the most positive impact on store image and purchase intentions (*H7*). To identify the impact of HIS, 200 students were

Variables and R^2	Mediator: store image Coefficient	t	Dependent variable: purchase intention Coefficient	t
In-store technology	−0.2714	2.55*	−0.4356	2.76**
Mediator = store image			0.7111	6.49**
R^2	0.0355		0.2998	

Notes: **Significance level <0.01; *H1* and *H2* accepted

Table 4. Direct and indirect effect of in-store technology on purchase intention

Variables	Mean ESL group	Mean Smart group	Standard deviation ESL group	Standard deviation Smart group	t
Purchase intention	5.08	5.71	1.08	0.99	2.26*
Store image	5.99	6.26	0.64	0.77	3.56*

Notes: *Significance level <0.05; *H4* and *H5* accepted

Table 5. Comparison of means (independent samples *T*-test) SmartCart group perceptions vs ESL group perceptions

invited to participate and assigned to four groups, each with 50 participants, who had to purchase the same product list. One group relied on no technology, i.e. HIS; the second group had no technology but received HIS; the third group used technology but not HIS; and the fourth group had access to both – technology and HIS. In HIS groups, participants could ask three questions to an employee, who wore an official lab uniform, easily distinguishable by participants.

3.5.1 Analysis and results. The indirect effect provided evidence of a mechanism carrying the effect of in-store technology on the purchase intention through store image. This indirect effect depends on HIS (*H7*). To test the moderated mediation model and explain the effects of HIS on the research model, PROCESS Model 7 (Hayes, 2012) provides estimates of the conditional (i.e. absence or presence of HIS) indirect effects of the causal variable (RFID technology) on the dependent variable (purchase intentions) through the proposed mediator (store image), as well as the conditional direct effect of the causal variable on the outcome variable.

In an intermediate step, both in-store technology (b = 0.8360, SE = 0.157, t = 5.31, $p <$ 0.010) and HIS (b = 1.2240, SE = 0.3519, t = 3.47, $p <$ 0.010) were found to have a positive effect on store image. In addition, the interaction between in-store technology and HIS was significant (b = −0.4650, SE = 0.2225, t = 2.07, $p <$ 0.050) (Table 6). The effect of store image was also significant (b = 0.6855, SE = 0.1540, t = 4.4500, $p <$ 0.000).

To examine *H7*, we focused on the conditional indirect effect of the interaction between in-store technology and HIS on the purchase intention through store image. The indirect effect was consistently positive and increased with the presence of HIS, as proposed in *H7*. The effect was significantly different from zero among those with no HIS (95% CI = 0.2405–0.7226) and those with HIS (95% CI = 0.0647–0.3796).

The main impact is in the non-technological group. Figure 3 indicates the pattern of results. In-store technology was significant and positively related to store image in the absence or presence of human interaction ($p <$ 0.010). As hypothesized, there is a significant influence of in-store technology on store image when HIS is present.

4. Theoretical contributions and implications

Disruptive retailing technologies improve productivity and cost optimization, but there is a lack of academic literature about the effects of these technologies on shopper's perceptions and attitudes. The objective of this paper was to close this literature gap. This paper developed and tested a conceptual model of the effects of retail technology on store image and purchase intentions.

Three experiments in a retailing laboratory provided data that were subjected to statistical analysis using the Student's t-test, ANOVA, Tukey's HSD and PROCESS

Table 6.
Moderation of the indirect effect of HIS on the research model

Variables and R^2	Mediator: store image Coefficient	T	Dependent variable: purchase intention Coefficient	t
In-store technology	0.8360	5.31**	0.6855	4.45**
Moderator = HIS	1.2240	3.47**		
Int Tech*HIS	−0.4650	2.07*		
Mediator = store image			−0.5562	6.39**
R^2	0.2252		0.3154	

Notes: Significance level; **< 0.01. *< 0.05; *H7* accepted

Model 4 and Model 7 for mediation and moderation (Hayes, 2012). It is an important contribution, given the clarion call in Inman and Nikolova (2017) for experiments to measure consumer's reactions to new technology. In our three experiments, participants interacted with the technology, so that they could use ESL and a SmartCart similar to their use in stores.

Our results indicate that retailing technology has five notable influences. First, retailing technology impacts consumer perceptions (Inman and Nikolova, 2017). Our contribution is to measure it on terms of store image perceptions. Thus, shopping technologies improve consumer experience and store image perceptions, as the store is more appealing and attractive, more informative, more interactive and offers a better service. Thus, consumers feel that the store is better than others. Second, in-store technology increases the purchase intention in terms of likelihood, probability and willingness to buy. Third, store image mediates the relationship between technology and purchase intentions, such that retailer innovation is an important differentiating factor. We linked these concepts in the model through Grewal *et al.*'s (1998) and Hildebrandt's (1988) proposed significant relationship between store image and purchase intention. Fourth, the type of technology determines customers' perceptions, as the differences among technologies "would help to calibrate each technology vis-à-vis its potential to deliver on its value proposition in the framework" (Inman and Nikolova, 2017, p. 17). We found that SmartCart (social technology) generates a better store image, higher purchase intention and higher mediation effects than ESL technology (convenience technology) as Grewal *et al.* (2020) propose. Fifth, HIS moderates the relationship between technology and store image and between technology and purchase intention. This implies that at least for the SmartCart, consumers need some interactions with employees as Zeithaml and Gilly (1987) and Pfeffer (1994) propose, at least during the phases of its early implementation and/or adoption phase (Zhu *et al.*, 2013).

Specifically, consumers evaluate store image through shopping experience, the overall store image, overall service, store merchandise and how the store relates to with others. Consumer behavior or reaction is measured through purchase intentions.

Our research model also supports the significance of store image as a mediator between retail technology and purchase intentions. Specifically, consumer's perceptions of the store image are affected by new technologies, and these mediate behavioral intentions. Our paper also evaluated the main disadvantage of retailing technology, i.e. the lack of HIS, which

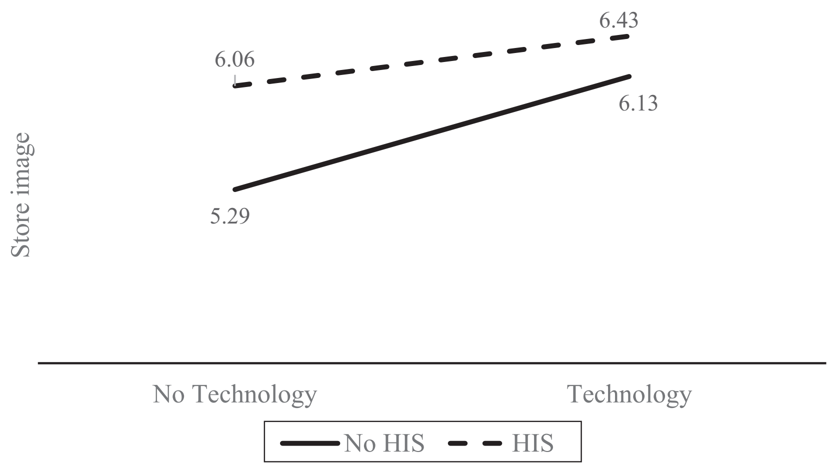

Figure 3.
Effects of HIS and SmartCart technology on store image

could negatively affect the store image. Results indicate that HIS moderates the relationship between the technology and purchase intention.

In summary, our results offer insights to address the research gap on the relationship between in-store technology and its impact on consumer perceptions and behaviors.

5. Managerial implications

Retailing is a most changing and competitive sector, demanding generating value for consumers. One efficacious strategy is to design and implement store technologies. SmartCarts and QR codes likely improve productivity and cost optimization, but these disruptive technologies also enhance consumers' store perceptions and behaviors. Retail firms must understand the overall benefits of technologies; and our results should help reduce retailers' resistance to their adoption (Grewal *et al.*, 2009). In particular, we demonstrate that consumers' intentions to purchase are influenced by the store-implemented technology. Thus, additional value can be derived from the consumer's improved store images. In-store technology can help retailers leverage their store image and capture more consumers, implying that retailers need to think outside the box.

We found that the shopping cart operating through RFID (social technology) was the technology with the greatest impact on store image and purchase intentions. This cart can identify each product that consumers add and calculate the amount due, quickly and automatically, so it enhances and simplifies the shopping experience. As an added benefit, RFID technologies can support automatic billing processes that enable self-service checkouts. The SmartCart's touch screen also provides other functionalities that allow customers to perform innovative activities, such as searching for products and find them in the store, as well as receiving daily promotions.

Practically, we recognize that retailers must rank investments in in-store technologies. In what type of technology should they invest to enhance store image perceptions and to increase purchase intention? According to our results, the answer is to capitalize in technologies with hedonic or social benefits because these enhance a better consumer experience. Thus, our research demonstrates that different technologies available must be considered carefully. The finding that more positive store images increase purchase intentions is not surprising, but we investigated what drives both store image and purchase intentions. The impact of their antecedents varies with the technology. Therefore, when developing and implementing store technology, retailers should measure consumer perceptions and behaviors related to their perceived store image and purchase intentions, for each technology (convenience technology vs social technology). Specifically, we found that SmartCarts using RFID (social technology) evoke higher evaluations than ESLs using QR codes (convenience technology).

Yet to encourage technology adoption by consumers, companies also need to develop a formal program to educate how to use the technology. HIS might serve as a bridge between the consumer and new technology, as they positively impact the relationship between technology and store image and purchase intentions. Service personnel should be trained in the use of technology, so that they can communicate its ease of use and trustworthiness. Then stores can convince the consumer to enjoy the benefits of using SmartCarts and any new technology.

6. Limitations and suggestions for further research

Although the scope of our research was limited to supermarkets, the effects should generalize to other retailing formats. In-store technology applies to retailers in all formats, so further research should extend this work and investigate whether the effects of in-store technology on store image and purchase intention apply to other type of retailers, such as department stores and specialty stores, to name just a few. It would also be advisable to use other products such as clothes, shoes and personal items to refute or corroborate the proposed model.

Finally, the current research focuses on substantive impacts of specific technologies on shopping behavior, using experiments conducted in a retailing lab. Field experiments in actual stores should attempt to corroborate these results and offer greater internal validity.

An agenda for continued research is needed, because retailers who understand how technology can influence consumer experiences and in-store decisions are likely to develop a competitive advantage. For example, although diagnostic variables concerning age, gender and academic level had no effect on the relations of the model proposed in this research, it is worth analyzing the impact in future research that may reflect other variables such as socioeconomic level and previous experiences with in-store technology in the model variables. We hope the empirical findings act as catalysts for further research in this area.

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