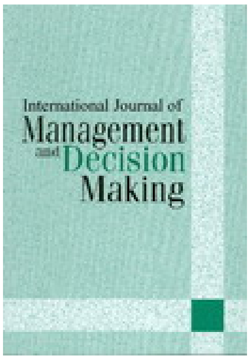

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Riham Adel

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Value-based smart retail measurement model

Riham Adel

College of Management and Technology,
Arab Academy for Science,
Technology and Maritime Transport,
Miami Campus, P.O. Box 1029, Alexandria, Egypt
Email: rehamadel@aast.edu

Abstract: In response to literature calls to expand the body of knowledge about smart retail, this study aims to develop a value-based smart retail measurement model. The model explicitly aligns with the cognitive-affective-behaviour paradigm that is extensively used to define the concept of perceived value. The model is developed upon the grounded theory of technology acceptance that is integrated with hedonic value, technology readiness, perceived risks, perceived trust, and smart experience as perceived value factors. The model was tested in Egypt within a retailer specialising in selling furnishing solutions to expand the literature with new insights from a developing country. The goodness of fit, reliability, and validity of the model was confirmed. The direct, indirect, and total effects of these factors are examined using AMOS structural equation modelling (SEM). The findings indicate that Egyptian customers' acceptance to adopt smart retail technologies will be influenced by the chain of factorial model's effects.

Keywords: smart retail; technology readiness and acceptance; hedonic value; perceived risks; perceived trust; smart experience.

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Biographical notes: Riham Adel is an Associate Professor at the College of Management and Technology, Arab Academy for Sciences, Technology and Maritime, Transport, Egypt. She is a Certified EFQM Assessor and Six Sigma Green Belt. She received her PhD degree in Automation of Technological Processes from VSB-Technical University of Ostrava, Czech Republic. Her research interest is multidisciplinary related to quality management and organisation excellence, business processes management, operation management and the increasingly important areas of service science within profit as well as no-profit organisations.

1 Introduction

In light of the emergent technologies' development, as well as the accelerated pace of digitalisation triggered by COVID-19 pandemic crisis, retailing has changed dramatically. We are moving towards smart technologies' solutions that mediate all interactions between retailers and customers. Everything is becoming digitised; from searching information, selecting, and comparing products to shopping, payment, and customers' relationships. An increasing number of retailers are moving towards smarter formats that integrate both physical and digital worlds to create new customer experiences (McLean and Wilson, 2019).

In such a digital connected network, customers expect connecting with retailers in real-time anywhere, anyplace, anytime to access information, products and services. The internet of things (IoT) is a game changer for retailers, giving rise to 'SMART' retail concept. Smart retail has many innovative solutions developed with IoT such as smart shelfs, smart stock information system, smart customer tracking, that resulted in smart retail analytics enabling retailers to have their customers' digital footprints and better understand their shopping journey. Consequently, customise offers and promotions in real-time, have more dynamic pricing schemes, enhance store layouts and cost savings, and create smarter shopping experiences.

Fagerstrøm et al. (2020) anticipate that effective deployment of IoT in retail sector will have an economic effect of $410 to $1.2 trillion in 2025, with expectations that IoT applications will be of widespread usage with an estimated economic impact of $3.9 to $11.1 trillion by 2025. Furthermore, estimate that there will be between 25 to 50 billion connected devices by 2025. On the other hand, cisco claims in its report, that by 2030 there will be almost 500 billion devices connected IoT. While, Telefonica expects that in average every person will have 15 connected devices by then Zikria et al. (2021). IoT market is expected to grow from $381.30 billion in 2021 to $1.85 trillion in 2028, which denotes 25.4% annual growth rate. Thus, it is estimated that by 2025, productivity benefits to businesses using IoT will reach $3.7 trillion representing more than half of total revenue opportunitiy for all industry sectors (UNCTAD, 2021).

Pantano and Timmermans (2014) emphasise that the emerging idea of smart retailing indicates that firms and consumers use technology to strengthen their role in the new service economy in order to improve their customer experiences. In fact the concept 'SMART' evolves around the idea that both retailers and consumers are interactive actors in a digital ecosystem, whereas each has an active role in value co-creation. As a result, smart retailing's main attribute is the presence of smart objects/devices connected with each other and with customers through wireless technology. Thus, revolutionising the way consumers shop and the way retailers do business (Roy et al., 2017).

It is confirmed that the customers' decision to use or reject a new technology is mostly affected by their value-related perceptions. Zauner et al. (2015) state that the customer's overall cognitive and affective assessment of risks and the utility of a product/service to weight the trade-off between sacrifices and benefits is conceptualised as 'perceived value' – an outcome as defined by customer. Drawing upon the findings of previous research conducted in last three decades, it is concluded that proposed dimensions to measure perceived value differs in diverse contexts. Thus, it is crucial to further develop specific measurement instruments that conceptualise customers' perception of value along cognitive and affective dimensions in different settings in the form of structural model. Perceived value has an individualistic conceptualisation defined by the customer's personal perception on value produced from their interactions with the service or product (Zeithaml et al., 2020).

Therefore, to measure IoT value within smart contexts, it is proposed to measure the role of cognitive factors such as ease of use, usefulness, emerging risks and digital trust; as well as hedonic, motivators and inhibitors' factors affecting customers' emotions to recognise their role in forming consumers' perceptions of resistance or acceptance to adopt smart technologies. It becomes very challenging to trust the physical surrounding, especially that consumers will be connected all the time to objects or devices. Hence, they cannot control the amount of information gathered about them, how it is stored, processed and used. Therefore, it is emphasised that privacy and security are major concerns for consumers, which will consequently slow down the widespread adoption of smart technologies (Bok, 2016; Hazée et al., 2017; Mani and Chouk, 2018; Chouk and Mani, 2019).

Previous studies have confirmed the suitability of using technology acceptance model (TAM) as starting point to examine smart technologies adoption in retail settings. It is also confirmed that security and privacy are perceived risks that reduce probabilities of customers' readiness to adopt smart technology. Accordingly, building and maintaining trust will play a significant role in developing positive smart technology adoption behaviour among customers. Moreover, several studies indicate that IoT adoption will enhance customers' experiences within retail settings and confirm the role of customers' experiences in encouraging the adoption of smart technologies and eliminating their perceived risks. Thus, this study contribution is twofold aiming to offer theoretical and practical insights of smart technologies adoption within retail context. First from a theoretical perspective, it offers a comprehensive measurement model for smart retail. Second, from a practical perspective, the results derived from this research will help practitioners in their shift towards smart retail context, thus can develop smart services that are acceptable and adoptable by their customers.

The paper is structured as follows. The next section elaborates the relevant literature on 'technology readiness and acceptance', 'perceived risks', 'trust', 'and 'smart experiences' to conceptualise the research model. Then, the research methodology is explained and findings are presented. Finally, conclusions are discussed, and recommendations for future research are suggested with highlights on practical and theoretical implications.

2 Literature and research theoretical background

Smart technologies' influence in the retail sector represents a fertile area for further investigation, particularly in light of the limited number of research related to customers' perceptions towards smart technology adoption in retail. There is a clear need to expand research into smart retail technology-mediated services' from customers' perspectives (Chiu and Hofer, 2015; Garaus et al., 2016; Roy et al., 2017; Inman and Nikolova, 2016).

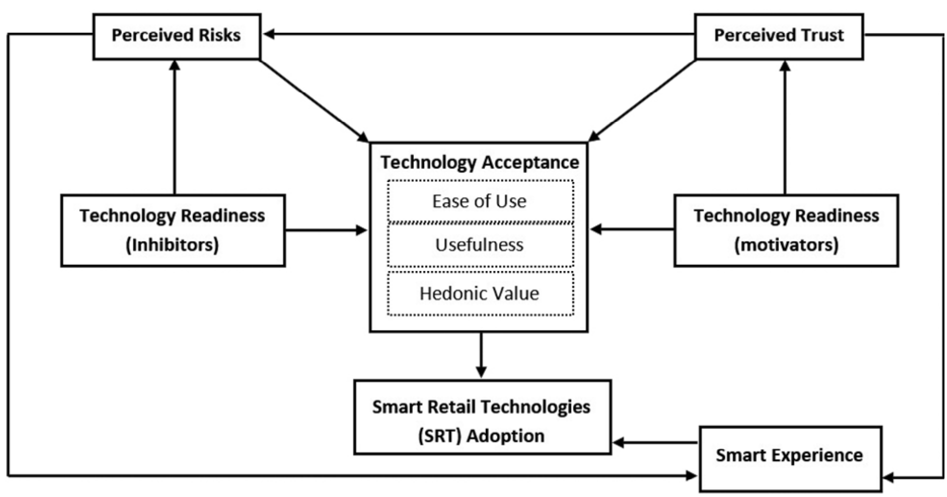
The retail industry is at the forefront of embracing IoT smart technologies.

Roy et al. (2017) affirm that many retailers struggle to understand the ability of smart technologies to add value to consumers. Moreover, Roy et al. (2018) call for future research to assess how technology readiness impacts customers' acceptance of smart retail. Additionally, Adapa et al. (2020) pinpoint that SRT ' potential risks must be taken into consideration. While, AlHogail (2018) note that consumers' trust is believed to play a pivotal role in smart technologies' adoption. On the other hand, Roy et al. (2017) have clearly emphasised the need for further research how customer experience is leveraged by smart technologies and its influence on consumers' adoption behaviour in the context of retail. Also, Foroudi et al. (2018) state that the value of new experiences triggered by smart technologies and its impact on customer behaviour is still limited in the literature.

Moreover, it is noted that future research on smart retail technology adoption should be extended to developing countries; which indicates that to date there is still a lack of research related to customers' perceptions towards smart retail in developing countries. Little is known regarding the predictors of smart technologies adoption in retail context (Gao and Bai, 2014; Dacko, 2017; Kim et al., 2017; Vrontis et al., 2017; Roy et al., 2018). Finally, there are increased calls in the literature to fulfil the academia need and develop new models that explain the dynamic nature of smart retail and identify the factors that affect users' decision to adopt smart technologies (Wells et al., 2010; Hamza, 2014; LAI, 2016; Zhitomirsky-Geffet and Blau, 2016). In light of the identified research shortage and the limited studies from developing countries; it is essential to fill the literature gap with further studies examining SRT adoption from consumers' perspectives.

Accordingly, this study responds to these calls and integrates the variables agreed upon across literature into a comprehensive measurement model. The researcher focuses specifically within this research on integrating all identified factors from the stream of literature into one comprehensive conceptual framework (Figure 1) to explore the most significant factors affecting consumers' decision to use smart retail. The proposed framework identifies the core dimensions extracted from literature including: technology readiness, technology acceptance, perceived hedonic value, perceived risks, trust, and smart experience. Furthermore, the researcher emphasises that by exploring these factors, the research can develop an in-depth understanding of its effects as predictors to consumers' decision to adopt SRT.

Figure 1 Proposed conceptual research framework



2.1 *Technology acceptance, perceived hedonic value, and technology readiness*

TAM theory has been used over the years by various scholars to explain users' acceptance of new technologies (Lai, 2017; Shuhaiber and Mashal, 2019). TAM has been the widely used model in the literature and proved its success in explaining the reasons behind the acceptance of new technologies in different contexts. TAM can serve as a useful foundation for examining the utilitarian aspects of IoT technology in retail industry. Yet, it is acknowledged across literature that TAM is primarily focusing on extrinsic motivations. Thus it is recommended that future research should focus on integrating hedonic attributes that are considered intrinsic motivations to gain a better understanding of customers' acceptance and readiness to use new technological innovations. Hence, pave the way to extend TAM and develop successive models capable of conceptualising the dynamic nature of smart technologies and explore additional factors that predict smart technologies adoption (Gao and Bai, 2014; Lekjaroen et al., 2016; Park et al., 2017; Patil, 2017; Karahoca et al., 2018; Lee and Lee, 2018; Mital et al., 2018; Chiu and Cho, 2020).

Many scholars assert that hedonic values are amid the factors that impact the customers' behavioural intentions. The hedonic value is concerned with evaluating smart technologies with regard to the emotional side of the experience including pleasure, enjoyment, entertainment and aesthetics (Akel and Armağan, 2021). The hedonic value is high emotional-arousal stimuli that complement utilitarian value, whereas customers can experience both simultaneously. The perceived experiential/functional value stimulate the customers' evaluation of pleasure and benefits respectively. Thus, produce affective and cognitive responses. It is recognised that the customers' motivation focusing on perceived hedonic values has stronger impact because decisions are based on emotional gratifications that refer to enjoyment outcomes and pleasant experiences (Vieira et al., 2018). The researcher affirms that the perceived hedonic value will reflect the customers' enjoyment when they interact with smart technologies and it denotes the intrinsic motivation related to finding the new technology interesting, pleasurable and enjoyable.

Moreover, it was found that hedonic value explains 75% of the variance in attitudes and support the argument that perceived hedonic value motivates customers to use new technology (Allam et al., 2019). Recent research has emphasised the positive relationship between perceived ease of use, perceived hedonic value and perceived usefulness. It is proven that the three constructs combined have direct impact on behavioural intentions of technology acceptance (Chang and Chen, 2021). Either the customers will perceive smart technologies easy to use and the shopping task is enjoyable; or they will perceive it difficult and in that case they will be most likely frustrated and will reject using smart technologies. Hence, previous literature supports the important role of perceived hedonic value as one of the main factors influencing customers' willingness to accept the adoption of smart technologies (Al-Azawei and Alowayr, 2020).

In 2000, Parassuraman and Colby propose the technology readiness index (TRI) a two dimensional construct that include the positive drivers of new technology acceptance called 'motivators' consisting of optimism and innovativeness; while on the other hand discomfort and insecurity called 'inhibitors' are considered negative drivers that delay new technology acceptance (Lubis and Mirzanti, 2016). Technology readiness is a measure that is individual-specific related to people belief about new technologies. While technology acceptance is a system-specific measure of particular technology mediated tasks. Hence, it is argued that the relationship between technology readiness and technology perceived usefulness and ease of use is intuitive (Lin, Shih and Sher, 2007).

Ferreira et al. (2014) confirm that technology readiness has a direct effect on perceived ease of use (PEoU) and perceived usefulness (PU). It was reported the inconsistencies of studies with respect to the significant or insignificant relationship between technology readiness and technology adoption behaviour. It was confirmed that the direct effect of both motivators and inhibitors on technology adoption behaviour is weak or non-significant. Thus, it is affirmed that the two-dimensional construct of technology readiness can't be used as direct predictor for the adoption of smart technologies mediated services. In contrary, it demonstrates strong indirect effects on technology adoption behaviour through different mediators (Blut and Wang, 2020). Customers can display both positive attitude and negative attitudes towards smart technologies mediated services. Whereas, both positive and negative beliefs about new technologies can coexist (Lin et al., 2007).

Therefore, Laukkanen et al. (2008) affirm that technology readiness conceptualises the psychological barriers for adoption of new technologies. It is argued that customers with high level of motivators are highly expected to accept and adopt smart technologies. Most likely, they will have a favourable view of new technologies and can easily adapt with the challenges and discomfort associated with smart technologies. In contrast to the positive view of new technology, customers can also have a negative view with respect to new technology adoption; that is triggered from their perceptions of new technologies' complexity as well as the lack of confidence in its ability to work properly and the perception of distrust due to lack of control and fears arising from its risky consequences while using new technologies (Chiu and Cho, 2020).

Based on the theoretical and practical findings in various studies, it is determined that both TRI and TAM concepts are directly correlated, whereas technology users retrieve cognitive information related to new technology readiness which have consequently a positive influence on their perception about its usefulness and ease of use. Several researchers have integrated TRI and TAM into technology readiness and acceptance model (TRAM) to evaluate users perceptions with respect to their capabilities to use new technology (Shin and Lee, 2014). Yet, it is noted that future research is still needed on how technology readiness and acceptance can affect the customers' intentions to adopt smart technologies in the retail sector (Roy et al., 2018). Furthermore, Liljander et al. (2006) have recommended testing technology readiness in different contexts to compare consumers' mental readiness to accept new technologies in different countries.

2.2 Perceived risks and trust

Although the deployment of SRT yields several benefits, but at the same time it generates potential risks, uncertainties and negative consequences (Adapa et al., 2020). The interconnection of smart things over the internet infrastructure requires establishing confidence between individuals, objects, devices and organisations that utilise smart and interactive solutions (Ziegeldorf et al., 2014; Whitmore et al., 2015). Existing research implies that perceived risks regarding smart technologies can limit users acceptance to use a given technology and its perceived value (Alalwan et al., 2017; Verkijika, 2018). It is acknowledged that perceived risks are associated with the extent and nature of insecurities perceived by consumers. Several types of risks been extensively discussed in the literature such as: physiological, product performance, financial and time loss, security and privacy risks (Mohd Suki and Mohd Suki, 2017).

From a customer point of view, the product performance concerns denote the fear of loss if the purchased product did not perform as predicted. Similarly, the amount of time involved in searching for products information and completing the purchase transaction activate the fear of losing time due to the complexity and difficulty of new technology-based systems. Moreover, the customers directly relate the financial loss to errors in online transactions or misuse of information which triggers their fear of monetary loss due to lack of financial privacy and security (Mohd Suki and Mohd Suki, 2017). The security risks are concerned with the belief that the online transactions are safely conducted with control over unwanted intrusions. It is acknowledged that the higher the customers' anxiety about personal security, the higher the probabilities they will not adopt smart technologies (Cannizzaro et al., 2020). While privacy risks are concerned with customers' information disclosure and secondary use of their information without authorisation or consent. This brings awareness to the fact that retailers should carefully consider the impact of perceived risks when adopting smart technologies (Jones, 2015; Weinberg et al., 2015; Bok, 2016; Shuhaiber, 2016).

Several scholars have pinpointed that perceived risks concerns can reduce the customers' perceptions of smart technologies usefulness and adoption intentions (Roy et al., 2017). As it will influence the consumers' perception of value. Consequently, affect their purchase decisions and start to compare with other alternatives based on what they will receive and what they will give up. Thus, perceived risks can hinder the diffusion of innovative technologies. Yet, previous findings from literature have confirmed that the retailer's brand and smart technology related aspects can play a significant role in overcoming customers' perceived risks. Further findings have highlighted the link between the level of trust held by customers' and their behavioural intentions towards technology adoption (Foroudi et al., 2018; Ameen et al., 2020). Hence, it is crucial to have an in-depth understanding of customers' perceived trust within smart contexts due to its pivotal role in reducing customers' uncertainties about using smart technologies (Wiedmann et al., 2010; Shuhaiber and Mashal, 2019; Adapa et al., 2020).

Smart retail is recognised as an adaptive socio-technical system, embedding interactions and inter-relationships between digital network actors. Thus, trust within smart settings can be defined with the extent of customers' confidence that their vulnerabilities will not be exploited when using smart technologies. It is worth noting that research findings point out that trustworthiness of retailers due to their solid reputation will not necessarily be transformed into feelings that one's security and privacy are well managed which means they should carefully manage perceived risks emerging from new technologies to increase their trust level and technology acceptance (Pizzi and Scarpi, 2020). Thus, Trust is viewed as a fundamental aspect of smart technologies acceptability and adoption. Trust in smart retail context can be observed across three basic components including competence which relates to the customers' belief that smart technology is capable to complete a particular task, thus trust is affected by the perceived ability and functionality technology. Data management integrity, and benevolence which is the belief that the customers' best interests will be always respected within a smart context. It can be concluded that the customers' positive perception of the retailers' reputation and their belief that they have protective mechanisms that assure safe and secure transactions will accordingly affect the customers' belief of smart retailers' credibility, honesty and promises fulfilment. Accordingly, smart retailers can be perceived to fully act in the best interest of customers and offer necessary advice when necessary (Park et al., 2017; Wright, 2017; Garry and Harwood, 2019; Cannizzaro et al., 2020).

It must be emphasised that the growing number of internet-enabled devices and IoT connected devices will speed up the collection and consumption of data by various actors and in different ways. Thus, will lead to increasing cross-border data flows without human interference which can largely affect users' trust and their fear from abuse and misuse of sensitive data. Consequently, to minimise the inherent risks related to privacy and security in the global digital ecosystems, there is an urgent need to review and discuss the appropriate data-related policies and proper governance systems to regulate cross-borders data exchange and its implications on national security and human rights (UNCTAD, 2021).

2.3 Smart experience

It is emphasised that the increased use of smart technologies will have $62 trillion effect on the world economy by 2025 with specific impact in the retail industry. The rapid technology advancements facilitated the emergence of smart ecosystem leading into networked customers' experiences. The smart technologies adoption has led to changes in consumers' dynamics. The interactivity and continuity principles distinguish technology-mediated experiences from conventional experiences. On the other hand, the concept of real experience that has a start, an end and a goal to be accomplished is reinforced within smart context. It is depicted that smart technologies' individual and system specific features have an effect on the experiential consequences. This aligns with the user experience definition pertaining to the consequences of system performance, functional and interactive capabilities that incorporate both utilitarian and hedonic values (Dieck et al., 2016).

In line with this thinking, it is important to understand the cognitive and affective perceptual responses that are evoked from interactions between customers and smart technologies. The shift from traditional experience into smarter experiences can be observed from the lens of technical, social and engaging interactive aspects that provide affective and cognitive values to the customers. Moreover, new smart experience characteristics include visibility, controllability, self-configuration, and autonomy (Foroudi et al., 2018; Gonçalves et al., 2020; Lee et al., 2020; Hoyer et al., 2020).

Smart experiences are grounded on the amount of technology intensity, actors' interactions in digital network to co-create value, intelligent data processing and levels of autonomous decision making. Thus, it is crucial to differentiate between both technologies enhanced experiences and technologies empowered experiences. Whereas technology enhanced experience makes customers highly involved in creating their own experiences with the supporting role of technology. In contrast to technology empowered experiences which require the existence of technology as an integral part of experiences' co-creation; Therefore, it is determined that smart technologies develop new experiences that share same human-technology interactions and engagement characteristics (Neuhofer et al., 2014; Flavián et al., 2019).

Due to the growing use of smart technologies, the customer journey is transformed into completely new seamless experiences. Such experiences are not only associated with using digital technology, but also charcterised by being intelligent and interconnected experiences. Smart experience creates convenience, informational, emotional, identity, and social values for customers who strive to co-create value in their interactions with retailers (Kabadayi et al., 2019).

Smart retailing experiences can be defined with five key dimensions including perceived real-time human-technology interactivity, relative advantage, perceived enjoyment, control and personalisation (Roy et al., 2017). It is argued that user experience with new technologies is viewed as distinct experience characterised by number of interactions and emotions (Lee et al., 2018). Furthermore, it is emphasised that the higher the quality of smart experience, the higher the levels of customers' behavioural intentions (Fan et al., 2020). Yet, to date, empirical studies that examine new consumers' experience triggered by smart technologies are still limited (Foroudi et al., 2018; Fan et al., 2020; Hoyer et al., 2020).

3 Research method

The researcher adopts the abduction approach underpinned by pragmatism. Thus, explores the phenomenon under study in order to identify the factors affecting Egyptian consumers' decision to adopt SRT. Then, proposed a conceptual framework (See Figure 1) that will be empirically tested within a retailer specialising in selling furnishing solutions in Egypt to generate testable conclusions and modifications to existing theory. A survey research strategy is normally conducted in quantitative research, where findings can be predictive, explanatory, confirming and can be applied on a wider population. (Saunders et al., 2019).

3.1 Data collection and sample characteristics

The total population in Egypt is estimated with 102,334,404. In the context of this study, the age groups under 18 years and above 74 are excluded from the study. Thus, the total population is recalculated to be approximately 65,992,341 (Worldometers.info, 2020). Only the four generational cohorts including: baby boomers, gen X, gen Y, and gen Z are included in this study which represents respectively 15.79%, 22.98%, 35.30%, 25.94% from the overall population.

The acceptable sample size is determined to be 384. The sample size was computed using an online sample size calculator with confidence level (95%) and confidence interval (5%). It is also recommended that to determine the suitable sample size a ratio of 1:5 can be used to perform appropriate multivariate analysis. Yet, it is suggested to include in the sample size 20% more participants to avoid any problems that may occur in data collection such as missing data (Hair et al., 2019). Using this rule-of-thumb, the adequate sample size for this study should not be less than 260 participants by calculated the sample size based on having 5 respondents per each scale item (i.e., sample grater 5 times the total number of scale items). Based on these arguments, the researcher asserts that the total number (n = 483) of responses received in this study is considered appropriate sample size and meeting the condions of good sample size for factor analysis (Costello and Osborne, 2005).

The survey isnstrument used in this study was divided into three sections. Section A comprised the respondents' demographic characteristics. Section B contained questions about the respondents' orientation towards using smart technologies. Section C included 52 items corresponding to the seven constructs in the conceptual framework as follows: technology acceptance (9 items) consisting of perceived ease of use, perceived usefulness, and perceived hedonic value; technology readiness that involve motivators (8 items) and inhibitors (7 items); perceived risks (8 items); perceived trust (7 items); smart experience (7 items); and SRT adoption (6 items). Items were designed to be measured using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The scale items were adapted from literature. Statements were slightly modified to fit the study context (See Table 2).

A simple random sample was colledted utilising electronic survey' sent by the retailer via e-mails to its customers' database asking them about their perception towards the smart retail applications in his stores. Two questions were used to screen the survey participants as follows:

1 are familarity with SRT

2 how frequently do you use SRT.

Only customers who were aware and frequent users of SRT are included in the final sample (n = 483). The highest percentage of responses were from females with 67.7%. It was noticed that the two generational cohorts Gen Y and Gen Z represent 76.4% of survey participants. Whereas, 61.7% of responses are from age group 25–39, followed by 14.7% from age group 18–24 which highly corresponds with the reported median age in Egypt 26.5 years (Worldometers.info, 2020). All respondents have declared that they have smart devices. 85.7% of the respondents use their smart devices for searching information, browsing virtual catalogues, using digital services like, in-store apps, scanning bar codes, electronic price tags, and self-service payments...etc. Finally, 93.5% of participants agreed that they would like to use smart solutions that might be available at retail stores (i.e., self-service kiosks; face recognition; scan and go; augmented reality applications…etc.) to facilitate their shopping experience. Although, 94.8% of respondents think that smart retail is easy to use and useful. Yet, 55.7% indicated that they have concerns regarding privacy and personal data protection.

3.2 Measurement model validity and reliability

The measurement model is initially evaluated before examining the SEM. The preliminary tests conducted, using SPSS 24.0 were to ensure the measurement model constructs/items validity and reliability. A principal axis factoring (PAF) analysis with an oblique rotation promax based on eigenvalues > 1.0 (Worthington and Whittaker, 2006; Kahn, 2006) was conducted. The results showed that the Kaiser-Meyer-Olkin (KMO) is 0.951 > 0.50 and the Bartlett's test of sphericity is significant ($\chi 2$ (951) = 29,519.735, $p < 0.0001$) which reflects the sample adequacy (Hair, 2011). It was observed high communalities' value above 0.3 ranging from 0.636 to 0.851. Further there are 30 (2.0%) non-redundant residuals with absolute values greater than 0.05 (Costello and Osborne, 2005; Tabachnick and Fidel, 2012). Finally, it was noted that the seven factors model accounts for 75,432% of total variance explained (See Table 1) Thus, indicating satisfactory measurement model constructs as it accounts > 60% (Hair et al., 2014).

There is a clear evidence of the measurement scale convergent and discriminate validity. The average variance extracted (AVE) examined exceeds the recommended threshold 0.5. The factors' pattern matrix results indicate strong loadings of items in the constructs, all factor loadings are ≥ 0.6 (Bagozzi and Yi, 1988; Gefen et al., 2000) which fulfils the validity tests conditions. Similarly, data was checked for internal consistency reliability using Cronbach's Alpha (α), where all values ranged from 0.93 to 0.96, and the composite reliability (CR) value determined was ≥ 0.70 (Fornell and Larcker, 1981). It is essential for model evaluation to assess the discriminant validity in order to avoid multicollinearity issues. To assess discriminant validity in SEM ling, heterotrait-monotrait (HTMT) ratio is also used along Fornell and Larcker criterion. Different recommendations from the literature agreed upon HTMT preferable thresholds to be below 0.850 for strict criterion and below 0.900 for liberal HTMT criterion indicating that only values above and close to 1 indicate lack of discriminate validity. In our study, the discriminate validly has been established as all HTMT values established are < 0.85 (Henseler et al., 2015). Thus after conducting all required statistical tests, it can be concluded that the research measurement model is considered reliable and valid (See Tables 2 and 3).

Table 1 Measurement model factors' total variance explained (N=483)

Factors	*Initial Eigenvalues*			*Extraction sums of squared loadingns*			*Rotation sums of squared loadings a*
	Total	*% of Variance*	*Cumulative %*	*Total*	*% of variance*	*Cumulative %*	*Total*
1	22,024	42,355	42,355	21,795	41,913	41,913	14,483
2	5,155	9,914	52,269	4,858	9,342	51,254	11,807
3	4,220	8,115	60,384	3,976	7,646	58,900	16,125
4	3,817	7,341	67,725	3,583	6,890	65,790	15,508
5	2,450	4,712	72,437	2,228	4,285	70,075	12,910
6	1,741	3,347	75,784	1,499	2,883	72,959	4,870
7	1,501	2,887	78,671	1,286	2,473	75,432	16,459

Notes: Extraction method: principal axis factoring.
a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

It was necessary to use a confirmatory factor analysis (CFA) to initially confirm the constructs scale items that resulted from PAF, then evaluate the proposed research model goodness-for-fit (Hooper et al., 2008). CFA is a hypothesis-driven-approach (Brown, 2015) that is conducted to identify the model fit prior to testing the hypothesised relations and effects between the model constructs. CFA is key element of SEM. Barrett (2007) argue that chi-square (x2) is the only essential exact fit test for SEM, but, its discrepancies sensitivity to large sample size. Therefore, claims that the indices proposed in the literature are not 'tests' for model-fit, rather provide researchers with predictive precision of the model relevant criteria to consider acceptance of the model. Kline (2016) recommends using combination of fit indices to assess the model in addition to the chi-square test. Hence, the researcher uses the absolute fit-index chi-square to assess the fit between the hypothesised model and the set of measurement items observed, in addition to other fit-indices including The comparative fit index (CFI), root mean square error of approximation (RMSEA) and standardised root mean square residual (SRMEA).

Table 2 Measurement model validity and reliability (N = 483)

Constructs/scale items	*Factors loading*	*CR*	*AVE*	*α*
Factor 1: Technology acceptance (Davis, 1989; Venkatesh and Davis, 2000; Childers et al., 2001)		*0.965*	*0.754*	*0.965*
Smart retail technologies would save me time and effort during shopping	0.940			
In general, smart retail technologies are convenient and useful for shopping	0.903			
Smart retail technologies would be useful for obtaining necessary information during shopping	0.903			
I find smart technologies easy to use	0.880			
It would be easy for me to become skillful in using smart retail technologies	0.867			
I find interaction with smart technologies clear and understandable	0.865			
Shopping using smart retail would be enjoyable	0.833			
Shopping using smart retail would be exciting	0.808			
Smart retail would make the shopping experience more entertaining	0.792			
Factor 2: Perceived risks (Xu, 2007; Mohd Suki and Mohd Suki, 2017)	*Factors loading*	*CR*	*AVE*	*α*
		0.956	*0.730*	*0.956*
I feel unsafe providing my personal information to use smart retail technologies	0.920			
I feel insecure that my personal information might not be adequately protected and can be disclosed without my knowledge	0.883			
I am concerned that smart retail technologies are collecting too much information about me	0.864			
I feel I don't have control over who can access my personal information and how it can be used	0.863			
I am concerned that smart retail technologies would be complex and difficult to use	0.852			
I am afraid that smart retail technologies would fail to perform the required task right from the first time	0.845			
I worry that using smart retail technologies would be time consuming than traditional retail and might lead to time loss	0.803			
I worry that using smart retail technologies could involve potential financial loss	0.740			
Factor 3: Technology readiness – motivators – (Parasuraman and Colby, 2015)	*Factors loading*	*CR*	*AVE*	*α*
		0.965	*0.774*	*0.964*
Smart retail technologies will make me more efficient and productive in my daily life	0.997			
I like new technologies that allow me to tailor things to fit my own needs	0.961			
Products and services that use the newest technologies are much more convenient to use	0.926			
Technological functions and services provided by smart retail contribute to a better quality of life	0.875			
I keep up with the latest technological developments in my areas of interest	0.866			
In general, I am among the first in my circle of friends to acquire new technology when it appears	0.691			
I can usually figure out new high-tech products and services without help from others	0.672			
I find I have fewer problems than other people in making technology work for me	0.631			

Table 2 Measurement model validity and reliability (N = 483) (continued)

Constructs/scale items	*Factors loading*	*CR*	*AVE*	*α*
Factor 4: Perceived trust (Marimon et al., 2019; Chohan and Hu, 2020)		*0.953*	*0.742*	*0.951*
Information provided through smart retail technologies about products and services is credible, accurate and up-to-date	0.916			
In case of any queries, I would receive a satisfactory and timely response from virtual service assistant or support service staff	0.893			
Smart retail technologies are always available and I can successfully use every time to complete my transactions	0.866			
Transparent privacy and security policies that are clearly communicated to customers would improve my confidence and trust in smart retailers' technologies	0.833			
I am confident that smart retail technologies have adequate safeguards features to protect my security and privacy when conducting transactions	0.812			
Smart retailers' are trustworthy and have good reputation	0.798			
The retailers using smart retail technologies are well known for their quality products and services	0.741			
Factor 5: SRT adoption (Roy et al., 2017)	*Factors loading*	*CR*	*AVE*	*α*
		0.959	*0.794*	*0.959*
Given the chance, I intend to use smart retail technologies	0.906			
I am willing to use smart retail technologies in the near future	0.898			
I will frequently use smart retail technologies	0.880			
I am willing to do shopping from smart retail stores in the near future	0.863			
I will frequently do shopping from smart retail stores	0.818			
I would recommend my family and friends to use smart retail technologies	0.762			

Table 2 Measurement model validity and reliability (N = 483) (continued)

Constructs/scale items	*Factors loading*	*CR*	*AVE*	*α*
Factor 6: Smart experience (Zhang, 2017; Roy et al., 2019; Fan et al., 2020)		*0.938*	*0.684*	*0.937*
Smart retail technologies would offer me superior and interactive shopping features than traditional stores	0.885			
Smart retail technologies would offer me real-time information (i.e. products, services)	0.856			
Smart retail technologies are stable and reliable	0.856			
Smart retail technologies would allow me to compare between different options to choose the best offer.	0.847			
Smart retail technologies enable me to tailor things that fit my specific needs and interests.	0.825			
Smart retail technologies would have the ability to respond to my preferences and customise extra offerings suitable for me	0.797			
Smart retail technologies give me control over the decisions involved in my shopping experience	0.718			
Factor 7: Technology readiness – inhibitors – (Parasuraman and Colby, 2015)	*Factors loading*	*CR*	*AVE*	*α*
		0.953	*0.745*	*0.953*
I do not feel confident doing business with a place that can only be reached online	0.892			
I prefer talking to a person rather than interacting with an automated system	0.861			
Whenever something gets automated, you need to check carefully that the system is not making mistakes	0.853			
Technology always seems to fail at the worst possible time	0.844			
It is embarrassing when I have trouble with a high-tech device while people are watching	0.814			
Technical support lines are not helpful because they don’t explain things in terms I understand	0.772			
Many new technologies have health or safety risks that are not discovered until after people have used them	0.734			

Table 3 Discriminate validity results using heterotrait-monotrait (HTMT) ratio

	Technology acceptance	*Perceived risks*	*Motivators*	*Perceived trust*	*SRT adoption*	*Smart experience*	*Inhibitors*
Technology acceptance							
Perceived risks	0.440						
Motivators	0.517	0.450					
Perceived trust	0.515	0.497	0.741				
SRT adoption	0.556	0.346	0.683	0.541			
Smart experience	0.023	0.053	0.036	0.038	0.000		
Inhibitors	0.626	0.574	0.693	0.710	0.584	0.018	

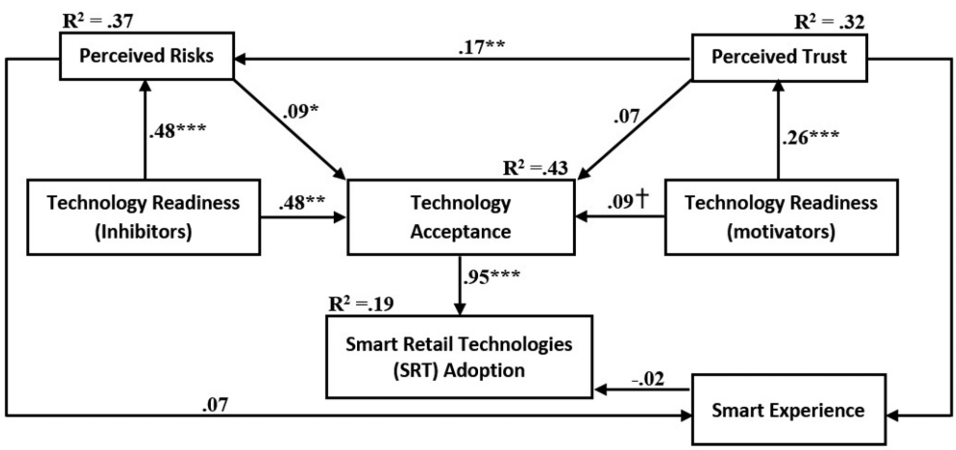
The results observed indicate (χ^2 = 3704.781, *df* = 1,244, $p < 0.001$), the measurement CMIN/DF is 2,798 which is considered excellent fit based on the cut-off criteria < 3. The CFI index was found above ≥ 0.90 indicating an acceptable fit of 0.916. Similarly, SRMR value of 0.040 showing excellent cut-off criteria < 0.08. Finally, RMSEA was established indicating 0.075 above the acceptable model fit threshold set < 0.08. As, a result the researcher affirms with evidence the research model goodness for fit and proceeds accordingly to use SME.

3.3 Research structural model path analysis

To test the research model, AMOS-SEM technique was used to overcome the limitations of traditional multivariate analysis. Moreover, both latent and observed variables can be measured in the model. SEM technique is both CFA and regression analysis. Multiple structural relationships can be examined, the direct, indirect and total effects can be tested simultaneously (Hair et al., 2010).

The research model was tested using path analysis coefficients to examine relationships between factor and analyse direct, indirect and total effects across factors. To evaluate the path coefficients' significance, a bootstrapping with 2,000 sub-samples (Turnes and Ernst, 2015) was executed. To obtain estimates of direct, indirect and total effects, a bootstrap approximation obtained by constructing two-sided bias corrected confidence intervals was used.

Figure 2 Structural equation mode



Notes: Significance Thresholds *** p < 0.001; ** p < 0.010; * p < 0.050; † p < 0.100 (Gaskin and Lim, 2018).

Table 4 Standardised special indirect effects

Indirect path	*Standardised estimate (β)*	*Lower*	*Upper*	*P value*
Motivators --> trust --> risks	0.046*	0.011	0.148	0.036
Motivators --> trust --> risks --> technology acceptance	0.046 †	0.000	0.019	0.051
Motivators --> trust --> risks --> technology acceptance --> SRT adoption	0.046*	0.000	0.019	0.048
Motivators --> trust --> risks --> smart experience	0.046 †	0.000	0.015	0.089
Motivators --> trust --> risks --> smart experience --> SRT Adoption	0.046	–0.001	0.000	0.221
Motivators --> trust --> smart experience	0.001	–0.024	0.031	0.904
Motivators --> trust --> smart experience --> SRT adoption	0.001	–0.001	0.001	0.797
Motivators --> trust --> technology acceptance	0.018 †	0.001	0.056	0.081
Motivators --> trust --> technology acceptance --> SRT adoption	0.018 †	0.002	0.050	0.073
Motivators --> technology acceptance --> SRT adoption	0.088	–0.010	0.198	0.145
Inhibitors --> risks --> technology acceptance	0.042 †	0.000	0.091	0.095
Inhibitors --> risks --> technology acceptance --> SRT adoption	0.042 †	0.000	0.088	0.094
Inhibitors --> risks --> smart experience	0.032	–0.009	0.070	0.216
Inhibitors --> risks --> smart experience --> SRT adoption	0.032	–0.004	0.000	0.329
Inhibitors --> technology acceptance --> SRT adoption	0.457***	0.346	0.507	0.000
Trust --> risks --> technology acceptance	0.015 †	0.002	0.039	0.054
Trust --> risks --> technology acceptance --> SRT adoption	0.015*	0.002	0.038	0.049
Trust --> risks --> smart experience	0.012	–0.001	0.032	0.126
Trust --> risks --> smart experience --> SRT adoption	0.012	–0.002	0.000	0.290
Trust --> smart experience --> SRT adoption	0.000	–0.004	0.002	0.833
Trust --> technology acceptance --> SRT adoption	0.065	–0.023	0.131	0.235
Risks --> technology acceptance --> SRT adoption	0.085 †	0.001	0.157	0.095
Risks --> smart experience --> SRT adoption	–0.001	–0.008	0.001	0.338

Notes: Significance thresholds*** $p < 0.001$; ** $p < 0.010$; * $p < 0.050$; † $p < 0.100$.

Source: *Gaskin and Lim (2018)*

By observing the results, it was noted that motivators have significant direct effect on perceived trust (β = 0.263, $p < 0.050$) and technology acceptance (β = 0.093, $p < 0.100$). Similarly, inhibitors have significant direct effect on both perceived risks (β = 0.472, $p < 0.001$) and technology acceptance (β = 0.479, $p < 0.001$). Also, it was indicated that perceived risks have significant direct effect on technology acceptance (β = 0.89, $p < 0.050$), while perceived trust has significant direct effect on perceived risks (β = 0.174, $p < 0.001$. Finally, Technology acceptance has a value of (β = 0.953, $p < 0.001$) representing a significant direct effect on SRT adoption. The squared multiple correlation coefficient (R^2) was used to understand the total variance these predictors have in outcome predicted. (R^2) values range from to 19% to 43% (See Figure 2). Furthermore, the model goodness of fit was tested (χ^2 = 7,292, df = 5) with a probability level = 0.200 and all indices meet excellent cut-off criteria (CMIN/DF = 1,458 < 3; CFI = 0.998 >0.95; SRMR = 0.013 < 0.08; RMSEA = 0.031 < 0.06; PClose = 0.708 > 0.05).

Additionally, the path coefficient analysis of indirect (mediated) effects is examined (Gaskin and Lim, 2018). Every chain of significant special indirect effects in the SEM estimation is highlighted in (Table 4).

As a result, the standardised total effect (direct and indirect) estimates indicate that motivators is significant on perceived trust, perceived risks, technology acceptance and SRT adoption respectively as follows (β = 0.263, β = 0.46, β = 0.109, with $p < 0.010$). Moreover, inhibitors have total effects on perceived risk, technology acceptance and SRT adoption in that order (β = 0.472, β = 0.521, β = 0.496, with $p < 0.001$). While both perceived trust (β = 0.083, $p < 0.01$) and perceived risks (β = 0.089, $p < 0.01$) have only significant total effect on technology acceptance (See Table 5).

Table 5 Standardised total effects

Model predictor total effect	*Predicted outcome*	*Standardised estimate (β)*
Motivators	Perceived trust	0.263*
Inhibitors	Perceived risks	0.472***
Perceived trust	Perceived risks	0.174**
Motivators	Technology acceptance	0.093 †
Inhibitors	Technology acceptance	0.479***
Perceived trust	Smart experience	0.002
Perceived risks	Technology acceptance	0.089*

Notes: Significance Thresholds *** $p < 0.001$; ** $p < 0.010$; * $p < 0.050$; † $p < 0.100$.

Source: Gaskin and Lim (2018)

It is clear from the results of Table 5 displayed above, that perceived trust an inhibitors are determinant predictors with significant effect on the perceived risks variable.Thus, by increasing the customers perceived trust through the motivators in the smart retail solutions, and decreasing the inhibitors will reduce their perceptions of perceived risks inherented in smart retail. Consequently, will have an impact on customers' decision to accept SRT. Finally, it was concluded that there is no dignificant relationship between perceived trust and smart experience.

4 Discussion and conclusions

This research main objective is to theorise a value-based smart retail measurement model. The proposed model is developed from the stand point of customers' perceived value. It is confirmed that the customers' decision to accept or resist new technologies is mostly affected by their value-related perceptions. This aligns with the notion that users' experiences with new smart technologies can be observed from the affective and cognitive values (Gonçalves et al., 2020; Lee et al., 2020; Hoyer et al., 2020). The proposed measurement model fulfils literature calls for research to extend TAM model and develop successive models that explore additional factors that can affect customers' intentions to adopt smart technologies in the retail sector (Roy et al., 2018). This study uses a holistic approach that integrates the technology adoption theories, with the consumers' perceptions of experiential values as well as perceived risks and trust as suggested factors that will influence customers' decision to adopt SRT.

The study affirms Ferreira et al. (2014) previous findings which highlight the direct effect of technology readiness on technology acceptance. Furthermore, supports proven direct impact of combined perceived ease of use, PU and perceived hedonic value on intentions to adopt smart technologies (Chang and Chen, 2021). The findings align with (Blut and Wang, 2020) claims that motivators and inhibitors, the two-dimensional measures of technology readiness have strong indirect effects on technology adoption Additionally, the study confirmed literature related to concerns about perceived risks attributed to smart technologies and its influence on users decision to accept or adopt smart technologies (Chiu and Cho, 2020; Chouk and Mani, 2019). This study also supports literature confirming the link between perceived trust related aspects and its impact on overcoming customers' perceived risks to reduce their uncertainties about using smart technologies (Shuhaiber and Mashal, 2019; Adapa et al., 2020).

The research findings shed light on the mediated effects within the model, creating a chain of perceived value paths that can affect the customers' decision to accept or reject the use of smart technologies. It is acknowledged that the examination of these interlinked relations would provide a better understanding of the most significant factors affecting customers' perceptions to accept and adopt innovative smart technologies for both practitioners and academics. The present study fulfills the academia need and develop new model to measure the factors that affect users' decision to adopt smart technologies (Wells et al., 2010; Hamza, 2014; LAI, 2016; Zhitomirsky-Geffet and Blau, 2016). Still to date few studies have examined customers' perceptions towards SRT and its impact on customer acceptance and adoption. Yet, the findings of this research contributes to the existing body of knowledge with insights about smart retail adoption from Egypt in response to the literature calls to extend smart retail research into developing countries (Roy et al., 2018). The value-based measurement model was imperially investigated in Egypt and gives a better understanding about the interdependent relations among the model factors and its special effects on technology acceptance and adoption.

4.1 Academic implications and future recommendations

With the rise of digitalisation, it is essential to develop study the perceived value of the new smart retail applications and its effect on customers' decisions. The study developed a model that identifies the most significant predictors of technology acceptance and adoption within the Egyptian context. It was found that the technology acceptance is partially mediating the relationship between all variables.

Yet, it is important to understand that the perceived risks from fast evolving technologies such as artificial intelligence, cloud computing, data analytics, and internet of things are significantly affecting the consumers' decision towards smart retail. Therefore, an enhanced understanding of the inherent risks attached to each type of technology is a must, to be able to rethink and design their data value chain.To date there is no universal agreement on the appropriate policies and governance systems to protect the privacy and security of customers in new digital ecosytems. Smart retail environment involves an array of connected stakeholders that require retailers to build users' trust and assure protection of their digital footprint while using smart solutions, Given that motivators mediates the relationship between perceived trust and technology acceptance of smart technologies.

Future research should consider re-testing the measurement model and examining its applicability within different contextual and cultural environment. In line with this thinking, investigating perceived value variations in the model factors due to different retail sectors types (i.e., clothing, grocery, auto, electronics…etc.) can be a new contribution worthy to explore. Further research testing the model with respect to specific innovative smart technologies designed for specific types of retail sectors and its different levels of human-machine interactions characteristics can yield interesting findings and might extend the model into an interactional communication model. Finally, it is suggested to investigate the characteristics of smart experiences generated from smart retail applications and conceptualise a framework to help retailers effectively integrate smart solutions, design and sustain their digital networks.

4.2 Practical imiplications for future retail developments

The present study has practical implications for retailers who are advised to focus on increasing the motivation of customers to accept and adopt SRT , and minimise the inhibitors and perceived risks. The findings indicate the positive direct effect of individual-specific technology readiness (motivators and inhibitors) and pinpoint its strong mediating effect across the model. Retailers can segment customers based on their levels of trust or uncertainties to adopt smart retail.

Moreover, retailers should develop value-based strategies to co-design smart services' and operations. It is acknowledged that by sharing relevant knowledge and experience, retailers will approach problems quickly with new set of customers' relevant data and from the lens of customers' decision making during their shopping journey. The co-design strategies can help retailers to discover appropriate value configurations for target customers, to invest in SRT that create value to their customers', design better smart experiences and to improve smart services operations quality.

Digital connected ecosystems, represent an innovative tool to interact with customers and digitalise customer journey. Thus, retailers can generate greater value with smart retail solutions that provide customers with convenient, time saving, and real-time offerings. Therefore, an important layer in implementing smart retail solutions is data analytics. Retailers should strive to develop advanced data analysis tools and enhance their digital capabilities to deal with real-time data. Thus, develop appropriate pricing strategies, adjust promotion campaigns, improve marketing strategies, create personalised experiences and increase customers' engagement. Yet, the significant importance of privacy and security risks on the customers' perception of smart retail value, require an increasing efforts from retailers to establish regulating mechanisms to control the inhernet risks in the digital ecosystem. Such regulations need to be flexible, putting into consideration variety of conditions and different levels of digital readiness of retailers.

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