Analysis of the adoption of customer facing in-store technologies in retail SMEs

ABSTRACT

Brick and mortar stores are suffering the dramatic revolution of the retail sector. Customer facing in-store technologies (CFIST) are a key component of the inevitable transformation of retail stores; yet the reasons to adopt such technologies by business owners may be little known. Based on a TOE and TAM inspired framework, this study analyses the drivers of such decision by small and medium size enterprises using a survey methodology. The results show that the attitude towards technology is the strongest predictor of the intention to adopt CFIST, highlighting the role of the top management in technology decisions. This conclusion has important implications for practitioners. This research is the first to address the adoption of CFIST by SMEs and therefore set the path for further studies about the impact and adoption of in-store technology in SMEs.

KEYWORDS

Retail; SME; in-store technologies; digitalisation; brick and mortar; TOE; TAM, CFIST

1 Introduction

Small and Medium Enterprises (SMEs)[1] are the most common form of enterprise in the European Union, accounting for 66% of all jobs and 99% of all companies (Eurostat, 2018). In the retail sector alone there are 3.6 million businesses, employing 8.3% of the whole European labour force (Euro Commerce, 2017). SMEs make the economy more resilient and diversified (OECD, 2017), bring flexibility to it and are a source of innovation (Awa et al., 2015). Several studies have addressed the adoption of different technologies in SMEs (Dincer & Dincer, 2016), as Information and Communication Technologies (ICT) in general contribute greatly to productivity growth and competitiveness (European Commission, 2016; Gërguri-Rashiti et al., 2017; Loonam et al., 2018). But none of them has addressed the specific technologies that are emerging for the transformation of brick and mortar retail, at a time when the sector is undergoing a major disruption (Hagberg et al., 2017; Mende & Noble, 2019).

Retail is shifting to online at a dramatic rate. eCommerce is growing over 20% Year over Year (YoY) (Clement, 2019a; Lal & Chavan, 2019), with global retailers like Amazon seizing a large part of this opportunity (Stanton, 2019). Although some scholars believe that eCommerce is the only future for retail SMEs (Khaskheli et al., 2017; Lal & Chavan, 2019), retail SMEs are mostly local and must leverage the proximity to their customers, as the physical space will still play an important role in the future of shopping (Vojvodić, 2019). Technologies that interact with customers in brick and mortar stores can help to fulfil the needs of new buyers and become a hub for cross-channel strategies (Härtfelder & Winkelmann, 2016; Vojvodić, 2019). Hence, studying how SMEs adopt

[1] The EU Official Journal defines SMEs as "enterprises which employ fewer than 250 persons and which have an annual turnover of under 50 million EUR, and/or an annual balance sheet total of under 43 million EUR." (European Commission, 2003).

such technologies is critical for the future of local retail. We group these technologies under the name of customer facing in-store technologies (CFIST), although this term is not fully established in the literature and researchers employ different denominations (Betzing et al., 2018; Bonetti et al., 2018; Grewal et al., 2020; Inman & Nikolova, 2017; Roy et al., 2017). Furthermore, some of these emerging technologies have been studied from a customer adoption perspective (Adapa et al., 2020; Chiu, Fang, & Tseng, 2010; Pantano & Di Pietro, 2012; Roy et al., 2017).

The objective of this work is to answer the following research question: Which are the drivers that predict the adoption of CFIST technologies by SMEs? For this purpose, we build an adoption model that considers previous works based on the Technology, Organization and Environment model (TOE) and the Technology Acceptance Model (TAM), adapting them to the specificities of the target technologies. Some works have addressed the managerial process of decision for CFIST (Bonetti et al., 2018); but to the best of our knowledge, there are no studies of the adoption from an organisational perspective, making this a new avenue of research. The results will bring new relevant insights and determine the key elements that hinder or boost the digital transformation of retail SMEs.

The rest of this paper is structured as follows. In the next section we include the theoretical foundations of our research. First, we explain the technologies behind the CFIST concept. We then overview the main SMEs technology adoption models and show why a model based in TOE and TAM is suitable for our study. We close this section with a brief literature review of the adoption of CFIST. In the third section we develop our research model based on TOE and TAM. The development of the research and the analysis of data are presented in sections four and five. We finally discuss and explain our findings, the contributions of our work and set up the basis for future research.

2 Theoretical framework

2.1 An overview of customer facing in-store technologies (CFIST)

Since the start of the internet, changes in business have been drastic for traditional retail shops. The impact of the internet is growing over time and the most recent data show a major increase in online shopping (Clement, 2019b; European Union Commission, 2016), concentrated around massive companies like Amazon or Alibaba (Blazyte, 2019; Stanton, 2019), and a decrease in the number of brick and mortar shops and shopping centres in most countries (Corkery, 2017; Mitrofanoff, 2019).

Despite this situation, which has been dramatically defined as the retail apocalypse (Helm et al., 2018), customers do not want the physical stores to disappear, but to transform (Balaji et al. 2018; Grewal et al., 2020). Physical retail must focus on experience over convenience (Balaji et al., 2018; Pantano et al., 2018) and must provide an integrated omnichannel experience (Arora & Sahney, 2017; Rashid et al., 2015). Furthermore, brick and mortar retailers can benefit from the digitisation of the physical space by installing devices that are part of Internet of Things (IoT) (Nowodzinski et al. 2016) to gather data of all digitised interactions to improve customer knowledge and take actions accordingly (Celik, 2016). Before these technologies were available some of these data were too costly to obtain and others were just no available at all (Kambies et al., 2016).

We group all the technologies that digitise and enhance the customer experience in the physical store under the term *Customer Facing In-Store Technologies* (CFIST), similar to the definition of Betzing et al. (2018) and Bonetti et al. (2018). These

technologies perform different functions to improve the customer experience, increase efficiency and gather data to enhance the purchasing processes (Grewal et al., 2020; Jayaram, 2017; Pantano & Timmermans, 2014; Reinartz et al., 2011; Sturari et al., 2016). The level of adoption of these technologies is still very low for all firms (Kambies et al., 2016; Kim et al., 2017) and they have not been sufficiently studied (Pantano et al., 2018).

For the purpose of our work, we have chosen three technologies that are making their way into the stores of big retail companies: Digital signage, social Wi-Fi and people counters. Digital Signage is a network of screens that can present information and videos based on a scheduled loop or specific real time data (Dennis et al., 2010; Kim, 2012). Social Wi-Fi is made available for customers to access the internet for free in the Stores, but at the same time it is used to deliver marketing campaigns and retrieve footfall data (Chung et al., 2017; Ojala et al., 2012). People counters allow us to measure the traffic in different areas of the store to take business decisions (Karaman, 2015).

2.2 Technology adoption models in Small and Medium Enterprises

Academics have made many attempts to determine why individuals and organisations take a decision or course of action. Technology adoption models were created many decades ago (Doob, 1947; Hill et al., 1977; Rosenberg & Hovland, 1960). Adoption models can be applied to individuals (Kim et al., 2017; Müller-Seitz et al., 2009) and to firms (Giotopoulos et al., 2017; Susanty et al., 2017), or address both together (Gangwar et al., 2015; Venkatesh et al., 2003). The main theories used for individuals are Diffusion of Innovation (DOI) (Rogers, 1983), Task Technology Fit (TTF) (Goodhue & Thompson, 1995), Theory of Reasonable Action (TRA) (Hill et al., 1977), Theory of Planned Behaviour (TPB) (Ajzen, 1991), the Value-Attitude-Behaviour

framework (V-A-B) (Homer & Kahle, 1988), the Stimulus-Organism-Response (S-O-R) paradigm (Mehrabian & Russell, 1974) and the Technology Acceptance Model (TAM) (Davis, 1989). Most of these theories have been unified in a single model by Venkatesh et al. (2003), creating the Unified Theory of Acceptance and Use of Technology (UTAUT). As regards firms, the main theories are Diffusion of Innovation (Bhattacharya and Wamba, 2015; Rogers, 1983) and the Technology, Organization and Environment (TOE) framework (DePietro et al., 1990), and most of studies are derived from them (Chong et al., 2009; Tan et al., 2009).

None of the models applies without limitations to all technologies, and several studies have shown their limitations for specific innovations (Alzougool & Kurnia, 2008; Ukoha et al., 2011). We have chosen TOE for our research as it is the most extended framework used in predicting technology adoption for SMEs (Bollweg et al., 2016; Kevin et al., 2003; Lee & Cheung, 2004). Following the existing literature, we have chosen TAM constructs for the Technology Context (Awa et al., 2015). Although TAM is an individual level theory, this decision is appropriate in the environment of SMEs, as their decisions are frequently taken by a single person (Oliveira & Martins, 2010; Riemenschneider et al., 2018) and we expected most of the respondents in the survey to be decision-makers in their firms.

2.3 Brief literature review of CFIST adoption in SMEs

A growing corpus of literature has been analysing the SME technology adoption from multiple perspectives, as reflected in extensive reviews and meta-analysis (Bollweg et al., 2016; Consoli, 2012; Dincer & Dincer, 2016; Haddara & Zach, 2012; Oliveira & Martins, 2010). Most articles include new constructs associated with research topics

inside or outside the three contexts of TOE, depending on the technology they are studying (for example, security for cloud services (Kim et al.,2017), trading partner pressure for eCommerce (Abed, 2020) or customer pressure for generic ICT adoption (Nguyen et al., 2015)). Although the references that justify our constructs are described in the research model, we can highlight the role that some scholars believe CEO characteristics have in decisions (Riemenschneider et al., 2003; Yadav & Mahara, 2018), which can lead to combined individual – organisational models (Awa et al., 2015; Ikumoro & Jawad, 2019).

In order to base our research model on similar works, we have conducted a brief literature review of CFIST technology adoption based on TOE and TAM. The organisation literature on CFIST related topics is scarce (Pantano et al., 2018) and we could not find papers simultaneously addressing SMEs and CFIST, or even CFIST for larger organisations[2]. In any case, Table 1 presents a list of relevant CFIST adoption papers published in the past years, highlighting the added value of our investigation. As it can be seen, they are all related with individual adoption and not organisational adoption.

[2] . To conduct our review, we have used Web of Science and Google Scholar: We have searched for different combinations of the following keywords: "TAM", "TOE", "SME", "Technology adoption", "Brick and mortar", "Retail", "Physical store", "In-store technology" and "Customer-facing technology". Out of the first 100 results of each keyword search, papers were selected based on title relevance, then a second review was carried out reading the abstract and the whole paper when needed. A final addition of papers was made based on the references of the most relevant ones.

Table 1: Review of selected literature on CFIST adoption in chronological order.

Author	Kind of technology	Research Model	Differences with our study
Wang (2012)	Self Service Technology	TAM inspired model	Individual theory.
Lee (2015)	Self Service Technology	Original	Individual theory.
Rashid et al. (2015)	Augmented Reality and RFID	N/A	No adoption model.
Hagberg et al. (2016)	Digitalization of Retail	N/A	No adoption model. Only some use cases are CFIST
Lee & Lyu (2016)	Self Service Technology in grocery	V-A-B framework	Individual theory
Margulis & Boeck (2016)	RFID	TRA/TAM/UTAUT	No empirical findings. Use cases not CFIST.
Nysveen & Pedersen (2016)	RFID enabled skiing service	Extended UTAUT	Individual theory Use cases not CFIST.
Thamm et al. (2016)	Beacons based services	N/A	No adoption model.
Inman & Nikolova (2017)	Shopper-facing retail technologies	Original	Individual theory.
Kim et al. (2017)	Smart In-Store Technologies (SIST)	TAM	Individual theory.
Jayaram (2017)	Generic CFIST technologies	N/A	No empirical findings.
Roy et al. (2017)	Smart Retail Technologies (SRT)	Original	Individual theory.
Balaji et al. (2018)	Customer-facing IoT technologies	TAM	Individual theory.
Bonetti et al. (2018)	Generic CFIST technologies	N/A	Organization perspective, but no adoption model.
Foroudi et al. (2018)	Smart technology, proximity marketing	TAM inspired model	Focus on shoppers, not on shop owners. No specified use cases.
Lecointre-Erickson et al. (2018)	Digital Signage	S-O-R paradigm	Individual theory.
Roy et al. (2018)	Smart Retail Technologies (SRT)	Expanded TAM	Individual theory.
Vojvodic (2019)	Self Service Technology in grocery	N/A	No adoption model.
Adapa et al. (2020)	Smart Retail Technologies (SRT)	Original	Individual theory.
Grewal et al. (2020)	Generic CFIST technologies	Original	No empirical findings.

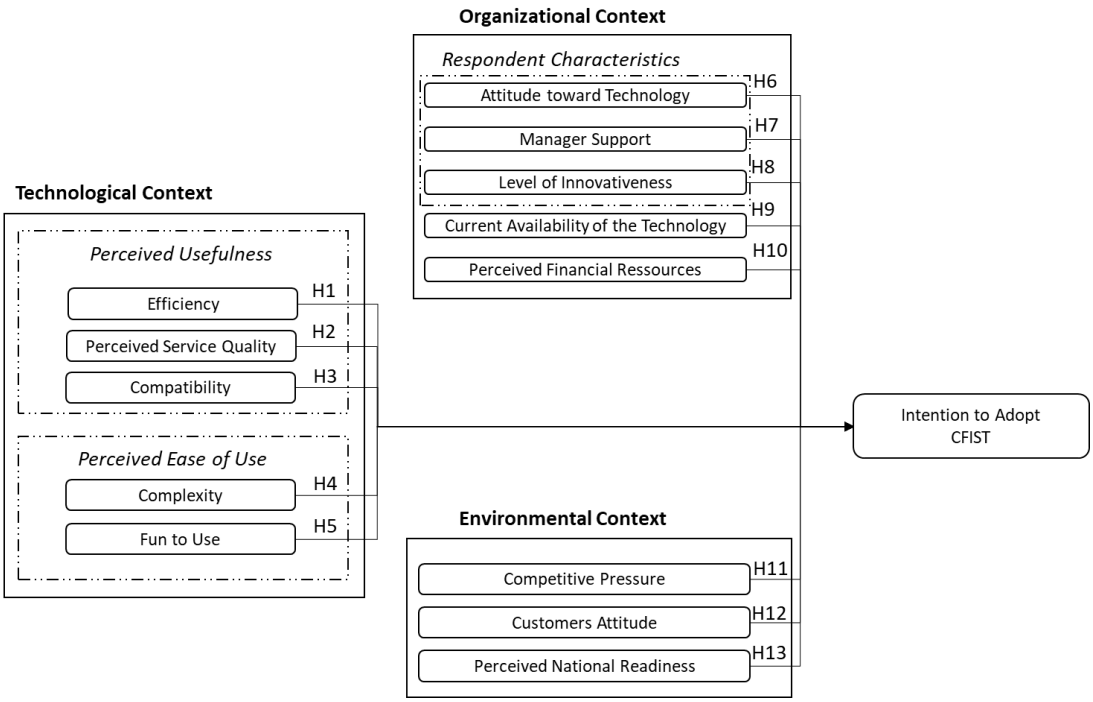
RFID – Radio Frequency Identification; N/A: Not applicable

3 Empirical analysis

3.1 Research Model

Due to the lack of previous CFIST works based on TOE, we have built our model on variables that are widely used in the SME literature for adoption of other technologies. The proposed model, shown in Figure 1, highlights the constructs that refer to the CEO as both a respondent and a user (technology context).

Figure 1: Theoretical Model



3.1.1 Technological context

The role of personal perception in technology adoption in organisations has motivated the integration of the TAM model in TOE as part of the technological context (Awa et al. 2017; Gangwar et al., 2015). Three constructs related to perceived usefulness

and two related to perceived ease of use have been selected. We define *efficiency* as the respondent's perception that adopting technology will make them more efficient, which is a key parameter for SME retailers due to their reduced margins. *Efficiency* has been broadly used in previous works and more specifically in the context of retail innovation (Cazier et al., 2008; Chiu et al., 2010). *Perceived service quality* is how the respondent perceives the improvement in service with the adoption of technology, and it has been included in previous studies about technology adoption (Awa et al., 2017; Çelik & Yilmaz, 2011) and more specifically in CFIST technologies (Kallweit et al., 2014; Lee, 2015; Lee & Yang, 2013). Quality is understudied in SMEs and only few studies address it (Rubio-Andrada et al., 2011). *Compatibility* refers to the extent to which the new technology is compatible with the company's values, information base, experience and technological infrastructure (Grover, 1993), and has been widely studied in the individual context by Karahanna et al. (2006); Awa et al. (Awa et al., 2017) include *Compatibility* in their integrated TAM-TOE model to study RFID. *Complexity* is broadly used in the literature and is related to the perception of how complex it is to implement, learn and use new technology (Adapa et al., 2020; Alismaili et al., 2016; Gangwar et al., 2015; Limthongchai & Speece, 2018). Finally, *fun to use* is similar to the construct of perceived enjoyment from some previous works (Ha & Im, 2014; Lee & Lyu, 2016) and is recognised as a natural extension of TAM (Pantano et al., 2018) with an important impact on shopping as other studies suggest (Babin et al., 1994; Kim & Forsythe, 2008).

3.1.2 Organisational context

We include five constructs within the organisational context. Three of them are related to the characteristics of the respondent, to delve into the individual influence of the CEO, as one of the most important factors for technology adoption in SMEs (Connon,

2007; Thong, 1999; Thong & Yap, 1995; Yadav & Mahara, 2018). *Attitude towards technology* measures the respondent's interest in technology innovation (Jeon et al., 2006). *Manager support* refers to the level of involvement of top management in the discussions that lead up to technology adoption decisions (Wang et al., 2010; Yap et al., 1994). Several studies have shown a positive impact of *manager support* in technology adoption decisions (Abed, 2020; Low et al., 2011). *Level of innovativeness* measures the respondent's inclination towards innovation (Ghobakhloo et al., 2011) and appears as a relevant factor for other technologies (Al-Qirim, 2007; Thong & Yap, 1995). As a fourth construct, *current availability of technology* measures the perception of the current technology (Connon, 2007; Guo & Xu, 2006; Thong & Yap, 1995; Yap et al., 1992). Finally, *perceived financial resources* refers to the way the decision-makers in the firm perceive their financial capability, which is not necessarily related to the actual return of investment in the technology (Guo & Xu, 2006; Nguyen, 2009; Yap et al., 1992).

3.1.3 Environmental Context

Environmental context relates to facilitating and inhibiting factors that influence the development of the firm's business (Awa et al., 2015). Three constructs were selected to delve into this context. *Competitive pressure* relates to what is being done by the competitors and how customers can easily switch to them (Alzougool & Kurnia, 2008; Awa et al., 2015; Bollweg et al., 2016; S. Chong, 2008). *Customer's attitude* measures the respondent's perception of customers' expectations regarding the technology (Connon, 2007; Reinartz et al., 2011), as customers are a major driver in technology adoption (Nguyen et al., 2015). *Perceived national readiness* is relevant in SMEs as their growth is often supported by government programmes (Alzougool & Kurnia, 2008).

3.2 Methodology and data

We decided to base our study on a survey as this is the most common approach in the literature for Technology Adoption research (Choudrie & Dwivedi, 2005). An online questionnaire with 48 questions was created with the Qualtrics tool according to the research model. Standard instruments were used as much as possible and most of the items were taken from previous research, adapted to CFIST and translated to Spanish. Nine questions were related to company and respondent demographics. For the other 39 a five-point Likert scale was used. Questions were presented in a different order to each respondent to avoid bias. An Exploratory Factor Analysis (EFA) was performed using the FACTOR software (Lorenzo-Seva & Ferrando, 2006) (Lorenzo-Seva & Ferrando, 2006), version: 10.10.03. Thirteen dimensions were extracted using the polychoric correlations matrix, Parallel Analysis (PA) method, Robust Unweighted Least Squares (RULS) with the oblique Promin rotation (Lorenzo-Seva, 2013) (Lorenzo-Seva 2013), instead of the fourteen factors expected. The Kaiser-Meyer-Olkin test value was .86, which indicated the matrix was well suited to factor analysis. The Bartlett test of sphericity, $\chi 2$ (780) = 1679.0, $p < .001$, confirmed that the model was significant. Theoretical saturation was reached for all indicators, except for some within the Technological context. However, we kept them as separate dimensions due to theoretical concerns.

A two-phase approach was taken. First the survey was sent to ten SMEs that were asked to complete the survey and provide extra feedback. Modifications were made regarding the number of questions, the ordering, wording, and format.

Subsequently, the survey was distributed to potential SME participants. A research agreement was signed between a Spanish university and a company based in Spain delivering technology services to retailers. A Spanish SME trading association with more than 50,000 members also agreed to participate. The survey was sent by email to retailers from the company and the association. A small raffle was held among the respondents as an incentive to participate. A total of 387 answers were received, although 223 of them were not valid since the questionnaire was not fully completed. This is probably because SME CEOs are usually very busy and there was no personal interaction to encourage them to finish. The final number of useable responses was 164. This number of responses is similar in size to other adoption studies involving business owners (Francioni et al., 2015; Karami et al., 2006; Thong & Yap, 1995).

Therefore, the sample of this study consisted of 164 participants (79.3% male, 20.7% female) with an average age of 48.3 years (*SD* = 8.1, 30–65). Most of the respondents were owners or managing directors (67.7%); the rest of the sample included managers and middle managers (23.8%) and employees (8.5%). A total of 45.1% of the respondents were solely responsible for deciding taking decisions regarding the acquisition of technologies in their company, while 45.7% shared this responsibility with others. Most participants held a university degree (56.1%) or had finished secondary studies (27.4%); 10.4% reported other studies and 6.1% primary studies. Descriptive, correlational, and regression data were calculated with the aid of the statistics software SPSS.

3.3 Results

3.3.1 Descriptive analysis

First, Cronbach's alphas and composite reliability coefficients were calculated for all the scales to assess the internal consistency (Table 2). All coefficients exceeded the recommended cut-off value of .70. Second, we calculated the Average Variance Extracted (AVE) values, which were above the critical threshold of 0.50, indicating good convergent validity. Furthermore, to assess the constructs' discriminant validity we applied the Fornell and Larcker (1981) criterion, that is, the square root of AVE value for each variable is greater than the correlations with the other variables, and we concluded that the measures in the model exhibit discriminant validity. Third, we calculated the descriptive statistics (means and standard deviations) and correlations of the study variables (Table 2). Interestingly, the dimensions of *complexity* (technological context), *competitive pressure* and *perceived national readiness* (environmental context) did not significantly correlate with the intention to adopt CFIST. However, they were positively correlated with other study variables. We compared the answers of early respondents (15% of the sample) with late respondents (15% of the sample) using non-parametric Mann-Whitney tests, and we found no statistical differences regarding the study variables, suggesting that there is no nonresponse bias in this study.

Table 2: Pearson Correlations between study variables.

Variables	*Items*	*M*	*SD*	α	ρ_c	$\sqrt{AVE}$	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Intention to adopt CFIST	3	3.70	1.02	.89	.93	.90	1												
2. TC_Efficiency	3	4.46	0.78	.86	.91	.88	.17*	1											
3. TC_Perceived Service Quality	3	4.35	0.68	.79	.87	.84	.26**	.60***	1										
4. TC_Compatibility	2	4.09	0.91	.77	.90	.90	.23**	.49***	.65***	1									
5. TC_Complexity	3	3.34	0.88	.86	.91	.88	.14	.25**	.28***	.39***	1								
6. TC_Fun to Use	3	3.64	0.84	.85	.91	.88	.35***	.43***	.46***	.55***	.46***	1							
7. OC_Attitude towards Technology	4	4.16	0.92	.95	.96	.93	.59***	.20**	.29***	.45***	.22**	.45***	1						
8. OC_Manager Support	2	3.83	1.09	.74	.89	.90	.36***	.38***	.27***	.44***	.30***	.32***	.29***	1					
9. OC_Level of Innovativeness	3	3.74	0.80	.77	.87	.83	.21**	.33***	.22**	.14	.08	.30***	.18*	.26**	1				
10. OC_Current Availability of Technology	3	4.26	0.83	.75	.81	.77	.21**	.46***	.49***	.64***	.31***	.39***	.32***	.50***	.18*	1			
11. OC_Perceived Financial Resources	3	3.56	0.91	.74	.85	.81	.26**	.37***	.32***	.49***	.46***	.39***	.31***	.47***	.17*	.65***	1		
12. EC_Competitive Pressure	3	4.09	0.93	.82	.89	.85	.08	.28***	.26**	.15	-.01	.12	.07	.18*	.14	.19*	.08	1	
13. EC_Customer Attitude	2	3.84	0.91	.75	.88	.89	.27***	.47***	.47***	.51***	.24**	.35***	.32***	.42***	.23**	.44***	.29***	.31***	1
14. EC_Perceived National Readiness	3	2.55	0.98	.82	.88	.84	.14	.10	.03	.20**	.28***	.18*	.13	.22**	.06	.28***	.41***	.01	.20**

TC:technological context; OC:organizational context; EC:environmental context. α: Cronbach's alpha. AVE: average mean extracted. ρ_c: composite reliability.

*** $p < .001$, ** $p < .01$, * $p < .05$. Scores could range from 1 to 5.

Regarding the demographic profile and control variables (Table 3), we found no differences in *intention to adopt CFIST* between male (n = 130, M = 3.72, SD = 0.98) and female participants (n = 34, M = 3.61, SD = 1.17, $t(162) = .586$, $p = .56$), across ages (n = 141, r = -.06, $p = .51$), province of residence ($F(34,163) = 0.777$, $p = .80$), role in the company ($F(3,163) = 1.255$, $p = .29$), role in decision-making ($F(3,163) = 1.628$, $p = .19$), nor education level ($F(3,163) = 0.180$, $p = .91$). No differences were found for *intention to adopt CFIST* with respect to organisational characteristics, such as business sector ($F(13,163) = 0.805$, $p = .65$), number of PoSs ($F(4,163) = 1.970$, $p = .10$), or number of employees ($F(4,163) = 2.200$, $p = .07$).

Table 3: Demographic profile and control variables.

Variables		*Percentage*
Gender	Male	79.3
	Female	20.7
Age	30–65 (M = 48.3 years, SD = 8.1)	
Role in the company	Owner or managing director	67.7
	Manager	12.2
	Middle manager	11.6
	Employee	8.5
Role in decision making for the acquisition of technologies in their company	Sole responsible	45.1
	Shared responsibility with others	45.7
Education level	University degree	56.1
	Secondary studies	27.4
	Primary studies	6.1
	Other studies	10.4
Location	Madrid	13.4
	Barcelona	12.2
	Valencia	11.0
	Other cities in Spain	63.0
Sector	Retail trade	31.7
	Restaurant	25.0
	Other sectors	43.3
Number of points of sale (PoS) per business	A single PoS	69.5
	Two to five PoSs	18.9
	Six to 20 PoSs	3.6
	More than 20 PoSs	7.9
Business size	Microenterprises (less than five employees)	47.5
	Microenterprises (six to 10 employees)	22.0
	Small enterprises (11 to 49 employees)	16.5
	Medium enterprises (50 to 250 employees)	9.1
	Large enterprises (more than 250 employees)	4.9

3.3.2 Regression analyses

To test our hypotheses, we conducted successive regression analyses with *intention to adopt CFIST* as a dependent variable (Table 4). In addition to the main and complete research model (M4), we decided to do isolated regression analyses for each context to search for additional exploratory findings. First, only technological context variables were entered in Model 1. The most relevant variable was *fun to use* (β = .33, p < .01). Second, organisational context variables were entered (Model 2). Neither *company demographics* (e.g., business size) nor *respondent demographics* (e.g., gender, age) were significant. *Attitude toward technology* presented a high significant beta coefficient (β = .54, p < .001), as well as *manager support* (β = .22, p = .004). Third, as regards environmental context (Model 3), *customers attitude* was the unique significant variable (β = .26, p = .002). Finally, all variables were entered in Model 4. *Attitude toward technology* (β = .54, p < .001) presented the higher beta coefficient, followed by *compatibility* (negative, β = -.29, p = .007), *manager support* (β = .25, p = .001) and *perceived service quality* (β = .22, p = .018). Multicollinearity was not an issue as the maximum values of Variance Inflation Factors (VIF) remained under the recommended value of 5.

Table 4: Regression analyses. Dependent variable: intention to adopt CFIST.

	M1	M2	M3	M4
TECHNOLOGICAL CONTEXT				
Efficiency	-.05			-.09
Perceived Service Quality	.15			.22*
Compatibility	-.01			-.29**
Complexity	-.04			-.08
Fun to Use	.33**			.13
ORGANIZATIONAL CONTEXT				
Respondent characteristics				
Attitude towards technology		.54***		.54***
Manager Support		.22**		.25**
Level of Innovativeness		.07		.02
Other organizational context variables				
Current Availability of Technology		-.12		-.09
Perceived Financial Resources		.05		.08
ENVIRONMENTAL CONTEXT				
Competitive Pressure			.01	-.02
Customers Attitude			.26**	.06
Perceived National Readiness			.08	.05
F	5.09***	20.89***	4.73**	9.26***
R^2	.11	.38	.06	.40

Note. Standardized beta coefficients. *** $p < .001$, ** $p < .01$, * $p < .05$.

3.4 Discussion

Our results show that the respondent's *attitude towards technology* is the strongest predictor of the intention to adopt CFIST in SMEs ($\beta = .54$, $p < .001$). This factor, together with respondent *manager support* ($\beta = .25$, $p = .001$), shape the individual characteristics of our sample, where 90.8% of respondents stated that they make the technology decisions in the firm. Previous studies have highlighted the role of managers as individual factors in technology adoption (Consoli, 2012). They are in charge of taking most of the decisions, frequently by themselves. CEO characteristics influence any other argument as they are the final decision-maker for any strategy (Francioni et al., 2015). If the CEO's attitude is not shaped by the right information, an inappropriate decision can be made. Moreover, computer illiteracy can inhibit technology adoption (Chatzoglou & Chatzoudes, 2016). Since CEOs may not be technology experts and do not have time to conduct an in-depth analysis, simplified information about the technology options and the business impact is required. Our results are consistent with extant literature analysing the CEO role. Thong and Yap (1995) focused their work on CEO characteristics and found that one of the major predictors to adopt new technologies is the attitude towards technology innovation. In subsequent research, Thong (1999) came to the conclusion that innovativeness and the CEO's level of Information Systems (IS) knowledge are determining factors in the decision making process. The aforementioned studies focused on the CEO role, while our study includes other sources of constructs, increasing the consistency of our results. Our results encourage further research on the role of CEOs and how to educate them in technology to eliminate illiteracy bias and improve the quality of their decisions regarding the introduction of CFIST technologies.

The second significant predictor is *compatibility*. Contrary to expectations, *compatibility* has a negative influence in *intention to adopt CFIST* (β = -.29, p = .007). Although some studies find no relevance of compatibility for adoption (Hossain & Quaddus, 2011; Ramdani et al., 2009), we have not found evidence of negative influence in other studies. Compatibility includes not only technological infrastructure but also values, experience and needs (Rogers, 1983). In the context of the urgent transformation that the retail SMEs are experiencing (Bollweg et al., 2016; Helm et al., 2018), one possibility is that they feel the need for a sharp change in their current operations, and CFIST technologies can help them to accelerate such change, where technology is just one the elements (Pantano et al., 2018). The positive although small impact in the adoption of *perceived service quality* (β = .22, p = .018) strengthens our argument, as it highlights the perception of how CFIST technologies lead to improved service for customers at a time of disruption (Pantano & Timmermans, 2014). Interestingly, there is no significance beyond the constructs already mentioned. This finding supports and strengthens the role of the CEO in SMEs when it comes to digital transformation. The CEO's attitude towards technology can override other aspects that a different kind of organisation would not omit (Thong & Yap, 1995) and reinforces the need to focus and invest in the attitude, knowledge and experience of the CEO to make the right decisions for the company.

The partial models M1-M3, isolating each context of the TOE Model, provide some exploratory findings that may encourage further research. Regression model M3, which isolates the environmental context, shows a certain level of significance in *Customers attitude* (β = .26, p = .002), in line with previous work (Bollweg et al., 2016). Retailers have to react to the evolution of customers' attitude, as they become more technologically knowledgeable and demanding over time. Adapa et al. (2020) confirms the impact of

consumer innovativeness in the perceived shopping value of smart retail technologies and proposes actions to be taken by retailers. Roy et al. (2018) also stress the need for retailers to adopt CFIST technologies that are easy to use. Retailers have to focus on the benefits of CFIST for customers: "Wider offer, reduction of queues and waiting time, access to customised services, more efficient delivery, rewards for loyal consumers, reinforcement of trust with sellers, and more satisfying shopping experiences." (Pantano et al., 2018. p.5).

Finally, *fun to use* (β = .33, p < .01) appears as relevant in the partial technology regression model (M1). CFIST technologies are oriented towards customers and therefore they must also impact emotions (Dennis et al., 2010; Poncin & Ben Mimoun, 2014). This finding is consistent with previous works (Kim et al., 2007; Kim et al., 2017; Wang, 2012) but due to the partial level of relevance confirmatory studies will be required.

4 Conclusions

The objective of this study was to shed light on the reasons why retail SMEs can be inclined to adopt technologies to interact in the physical space with their customers. To the best of our knowledge, our study is the first that looks at CFIST technologies in SMEs. The literature on SME technology adoption focus mainly on computer solutions or eCommerce. We can expect an organisation to decide on the adoption of its information systems based on similar factors; however, CFIST characteristics may stress other factors, as the customer experience component makes this category of technologies very different. Our study helps to fill this research gap and opens a new avenue of research that complements the extant literature.

Our findings have important managerial implications as CEO characteristics are more relevant than technological or environmental contexts, and as integrated TAM constructs inside the TOE model do not seem relevant enough to prevail over the former. Decisions are CEO-centric in SMEs. If CEOs do not have the knowledge or skills to correctly assess the potential of the technology, they can make the wrong decision (Pantano et al., 2018). The approach to solutions design must consider the CEOs' view even before customer experience. On the one hand, CFIST vendors must simplify business messages and technology functionalities to allow CEOs to understand all of the benefits without the need to devote too much time. Solutions cannot be the same as those adopted by larger organisations where a devoted team will probably analyse the decision and present it to the management. On the other hand, CEOs of SMEs must acknowledge the bias that they may introduce when taking decisions. They must move quickly to gather information about CFIST, as the disruption of the physical retail is accelerating.

Our paper also contributes to establish CFIST category as a field of study. Although these technologies appear more and more frequently in literature, the category is not fully established and has variations among researchers (Betzing et al., 2018; Bonetti et al., 2018; Grewal et al., 2017; Roy et al., 2017). Regardless of the name given, we forecast that the category will stay. Our findings should encourage researchers to delve into it, as one of the main drivers of the transformation and survival of brick and mortar retailers (Helm et al., 2018). Although the effort of governments and institutions for the digitalisation of retail SMEs is mainly devoted to eCommerce (Konstantinou, 2016), and internet presence is the more common way to measure their level of digitalisation, the reality is that physical commerce still accounts for the majority of sales and CFIST plays a prominent role in the evolution.

CFIST a s a category may overlap with other categories, like the Internet of Things (IoT) or ICT in general, but it has a specific effect on the customer experience, it is visible and it modifies the atmosphere of the store (Dennis et al., 2012; Grewal et al., 2020). Due to their visual impact, CFIST technologies also overlap with architectural elements. Although technology adoption studies focus exclusively on the technology, other elements do have an impact on the experience, like brand image, furniture or lighting. We agree with Pantano et al. (2018) considering that technology need to be integrated in a framework of the many elements of smart retail. An interesting line of future research is to analyse the relationship between all of the different elements of the experience, including the non-technical ones, with the adoption of CFIST technologies.

Despite the uniqueness of the scope and the relevant findings, this study is not free of limitations. First, our research studies a set of technologies (CFIST) rather than a single technology; this can blur the findings and confuse respondents. Although this approach is common in CFIST literature with scholars mixing up to twenty-two different use cases (Adapa et al., 2020; Grewal et al., 2020; Roy et al., 2018), further work should be undertaken selecting and isolating specific use cases. Second, the number of hypotheses of our model is high for the level of responses received. We have been able to confirm two hypotheses and explore a potential relationship in two others in the limited models M1-M3. Third, as our study was sent by email to addresses in a commercial database, the response ratio is low, although inside the average for email campaigns. A greater number of responses would have increased the validity of our study, but the profiles of respondents make it difficult to obtain relevant responses rates.

As the study of CFIST technologies is in the early stages, some scholars have proposed broad emerging research agendas (Grewal et al., 2020; Pantano et al., 2018), although none of them address the size of the organisations. Based on this work, we

foresee five major lines of research. First, the profile of respondents and companies should be modified to search for variations in the different retail subsectors, as different businesses have different customer journeys. Second, the specific CFIST technologies must be analysed individually, as the category is heterogeneous both in technologies and use cases. Third, the adoption model should be modified to include new constructs to delve into the more significant drivers of adoption. Fourth, the simultaneous study of customers and managers of the same business would allow to compare the adoption model from users perspective and firms perspective. Finally, non-technical elements must be included such as architecture, marketing, or brand values to study how the mix impacts adoption decisions.

5 Acknowledgments

Included in the Title Page.

6 Appendix

This work has no appendix.

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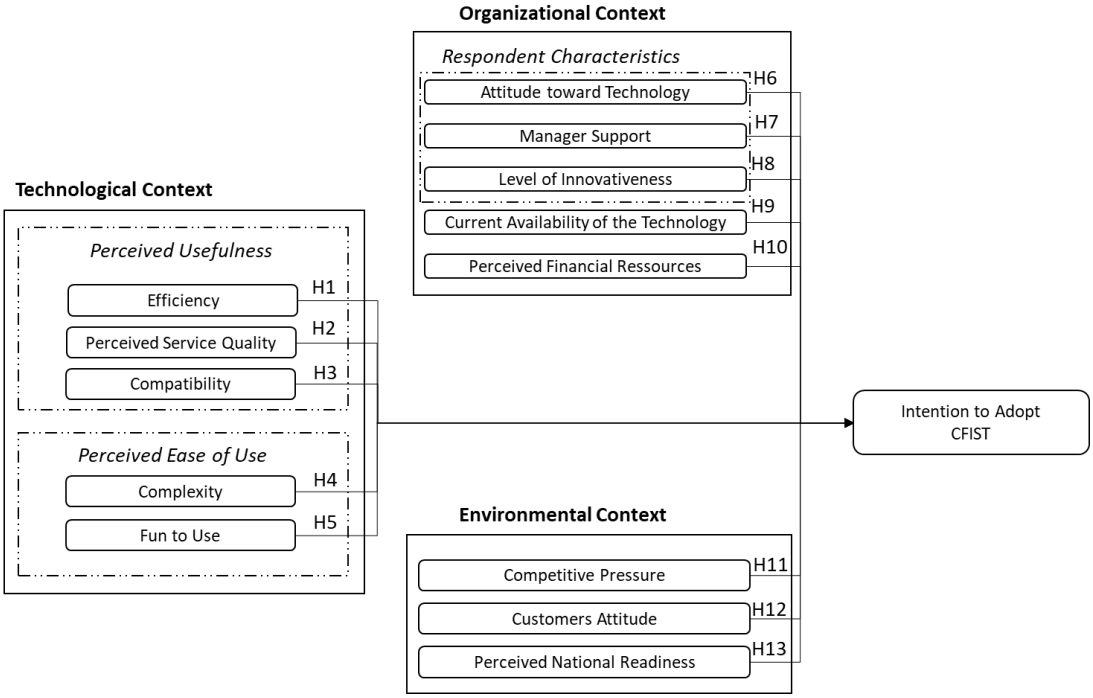
8 Figures Captions

Figure 1: Theoretical Model



9 Tables

Table 1: Review of selected literature on CFIST adoption in chronological order.

Author	Kind of technology	Research Model	Differences with our study
Wang (2012)	Self Service Technology	TAM inspired model	Individual theory.
Lee (2015)	Self Service Technology	Original	Individual theory.
Rashid et al. (2015)	Augmented Reality and RFID	N/A	No adoption model.
Hagberg et al. (2016)	Digitalization of Retail	N/A	No adoption model. Only some use cases are CFIST
Lee & Lyu (2016)	Self Service Technology in grocery	V-A-B framework	Individual theory
Margulis & Boeck (2016)	RFID	TRA/TAM/UTAUT	No empirical findings. Use cases not CFIST.
Nysveen & Pedersen (2016)	RFID enabled skiing service	Extended UTAUT	Individual theory Use cases not CFIST.
Thamm et al. (2016)	Beacons based services	N/A	No adoption model.
Inman & Nikolova (2017)	Shopper-facing retail technologies	Original	Individual theory.
Kim et al. (2017)	Smart In-Store Technologies (SIST)	TAM	Individual theory.
Jayaram (2017)	Generic CFIST technologies	N/A	No empirical findings.
Roy et al. (2017)	Smart Retail Technologies (SRT)	Original	Individual theory.
Balaji et al. (2018)	Customer-facing IoT technologies	TAM	Individual theory.
Bonetti et al. (2018)	Generic CFIST technologies	N/A	Organization perspective, but no adoption model.
Foroudi et al. (2018)	Smart technology, proximity marketing	TAM inspired model	Focus on shoppers, not on shop owners. No specified use cases.
Lecointre-Erickson et al. (2018)	Digital Signage	S-O-R paradigm	Individual theory.
Roy et al. (2018)	Smart Retail Technologies (SRT)	Expanded TAM	Individual theory.
Vojvodic (2019)	Self Service Technology in grocery	N/A	No adoption model.
Adapa et al. (2020)	Smart Retail Technologies (SRT)	Original	Individual theory.
Grewal et al. (2020)	Generic CFIST technologies	Original	No empirical findings.

RFID – Radio Frequency Identification; N/A: Not applicable

Table 2: Pearson Correlations between study variables.

Variables	*Items*	*M*	*SD*	α	ρ_c	$\sqrt{AVE}$	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Intention to adopt CFIST	3	3.70	1.02	.89	.93	.90	1												
2. TC_Efficiency	3	4.46	0.78	.86	.91	.88	.17*	1											
3. TC_Perceived Service Quality	3	4.35	0.68	.79	.87	.84	.26**	.60***	1										
4. TC_Compatibility	2	4.09	0.91	.77	.90	.90	.23**	.49***	.65***	1									
5. TC_Complexity	3	3.34	0.88	.86	.91	.88	.14	.25**	.28***	.39***	1								
6. TC_Fun to Use	3	3.64	0.84	.85	.91	.88	.35***	.43***	.46***	.55***	.46***	1							
7. OC_Attitude towards Technology	4	4.16	0.92	.95	.96	.93	.59***	.20**	.29***	.45***	.22**	.45***	1						
8. OC_Manager Support	2	3.83	1.09	.74	.89	.90	.36***	.38***	.27***	.44***	.30***	.32***	.29***	1					
9. OC_Level of Innovativeness	3	3.74	0.80	.77	.87	.83	.21**	.33***	.22**	.14	.08	.30***	.18*	.26**	1				
10. OC_Current Availability of Technology	3	4.26	0.83	.75	.81	.77	.21**	.46***	.49***	.64***	.31***	.39***	.32***	.50***	.18*	1			
11. OC_Perceived Financial Resources	3	3.56	0.91	.74	.85	.81	.26**	.37***	.32***	.49***	.46***	.39***	.31***	.47***	.17*	.65***	1		
12. EC_Competitive Pressure	3	4.09	0.93	.82	.89	.85	.08	.28***	.26**	.15	-.01	.12	.07	.18*	.14	.19*	.08	1	
13. EC_Customer Attitude	2	3.84	0.91	.75	.88	.89	.27***	.47***	.47***	.51***	.24**	.35***	.32***	.42***	.23**	.44***	.29***	.31***	1
14. EC_Perceived National Readiness	3	2.55	0.98	.82	.88	.84	.14	.10	.03	.20**	.28***	.18*	.13	.22**	.06	.28***	.41***	.01	.20**

TC: technological context; OC: organizational context; EC: environment context. α: Cronbach's alpha. AVE: average mean extracted. ρ_c: composite reliability.

*** $p < .001$, ** $p < .01$, * $p < .05$. Scores could range from 1 to 5.

Table 3: Demographic profile and control variables.

Variables		*Percentage*
Gender	Male	79.3
	Female	20.7
Age	30–65 (M = 48.3 years, SD = 8.1)	
Role in the company	Owner or managing director	67.7
	Manager	12.2
	Middle manager	11.6
	Employee	8.5
Role in decision making for the acquisition of technologies in their company	Sole responsible	45.1
	Shared responsibility with others	45.7
Education level	University degree	56.1
	Secondary studies	27.4
	Primary studies	6.1
	Other studies	10.4
Location	Madrid	13.4
	Barcelona	12.2
	Valencia	11.0
	Other cities in Spain	63.0
Sector	Retail trade	31.7
	Restaurant	25.0
	Other sectors	43.3
Number of points of sale (PoS) per business	A single PoS	69.5
	Two to five PoSs	18.9
	Six to 20 PoSs	3.6
	More than 20 PoSs	7.9
Business size	Microenterprises (less than five employees)	47.5
	Microenterprises (six to 10 employees)	22.0
	Small enterprises (11 to 49 employees)	16.5
	Medium enterprises (50 to 250 employees)	9.1
	Large enterprises (more than 250 employees)	4.9

Table 4: Regression analyses. Dependent variable: intention to adopt CFIST.

	M1	M2	M3	M4
TECHNOLOGICAL CONTEXT				
Efficiency	-.05			-.09
Perceived Service Quality	.15			.22*
Compatibility	-.01			-.29**
Complexity	-.04			-.08
Fun to Use	.33**			.13
ORGANIZATIONAL CONTEXT				
Respondent characteristics				
Attitude towards technology		.54***		.54***
Manager Support		.22**		.25**
Level of Innovativeness		.07		.02
Other organizational context variables				
Current Availability of Technology		-.12		-.09
Perceived Financial Resources		.05		.08
ENVIRONMENT CONTEXT				
Competitive Pressure			.01	-.02
Customers Attitude			.26**	.06
Perceived National Readiness			.08	.05
F	5.09***	20.89***	4.73**	9.26***
R^2	.11	.38	.06	.40

Note. Standardized beta coefficients. *** $p < .001$, ** $p < .01$, * $p < .05$.