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Intention to use new mobile payment systems: a comparative analysis of SMS and NFC payments

Francisco Liébana-Cabanillas[a], Iviane Ramos de Luna[a,b] and Francisco Montoro-Ríos[a]

[a]Department of Marketing and Market Research, UGR, Granada, Spain; [b]Capes Foundation, Ministry of Education of Brazil, Brasília, Brazil

ABSTRACT

The rapid growth of mobile technology among the world's population has led many companies to attempt to exploit mobile devices as an additional tool in the business of sales. In this sense, the main objective of our study resides in comparing the factors that determine the acceptance by consumers of the SMS (Short Message Service) and NFC (Near Field Communication) mobile payment systems as examples of means of future payment. The model used in our research applies the classic variables of the Technology Acceptance Model, as well as that of Perceived Security, a model deriving from the review of the major relevant recent literature. The results achieved in this study demonstrate that there are differences in the factors that determine the acceptance in each of the systems, as well as the level of the Intention to Use. Finally, we highlight the main implications for management and cite some strategies to reinforce this new business in the context of new technical developments.

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1. Introduction

In recent years, mobile devices such as smartphones, personal digital assistants (PDAs), wireless tablets, and laptop computers transmit all kinds of data. These devices now also serve to pay for goods and services by means of the transmission of data, a system known as mobile payments (m-payments). Any wireless means to initiate, activate or confirm a payment is considered an m-payment (Geva, 2012). Liébana-Cabanillas (2012) goes on to propose that any personal or commercial activity involving an electronic device connected to a mobile network to complete an economic transaction can also be considered an m-payment.

This study focuses on the two largest current mobile systems of payment. The first, Short Message Service (SMS) is remote, whereas the second, Near Field Communication (NFC) requires close proximity. The use of SMS for mobile payment requires a communication protocol that allows the exchange of short text messages between two mobile devices (Valcourt, Robert, & Beaulieu, 2005). The SMS system, however, faces the following four drawbacks

CONTACT Francisco Liébana-Cabanillas franlieb@ugr.es

related to security (Ivarsson, 2008): (1) the problem of storage in the terminal receptor after completion of the message, (2) the absence of coding, (3) the lack of a delivery confirmation, and (4) the reduced capacity of transmission due to a limit of 160 characters. According to recent studies, the SMS has been the more conventional means of payment and obtains the greatest profit among m-payment applications (Kadhiwal & Zulfiquar, 2007). The SMS employs the following technologies: GSM (Global System for Mobile Communications), GPRS (General Packet Radio Services) and UMTS (Universal Mobile Telecommunications System) (Sebola & Penzhorn, 2010). However, in light of the rapid growth of smart phones and their new features, NFC use is on the rise.

Near Field Communication (NFC) payments, on the other hand, are made in person in a store or at a compatible terminal by simply approaching the mobile device to the terminal. The major advantages NFC technology (Grassie, 2007) are the following: 1) its scope and availability; it can be implemented in all existing mobile terminals (on the condition of the installation of a chip) generating a wide range of new services for users and the terminal itself, 2) its wide range of applications (paying bills, car payments, leisure, etc.), 3) its ease of use because it only requires that the parties involved be within a specific proximity, 4) its security, since it requires the user to manually activate or approach the receiver for payment, demanding proactive behaviour from the user, 5) the generation of added value services, 6) its use on devices equipped with contactless features, and its use as a platform to receive cash, make payments and pay for transport worldwide, and finally, 7) its economic attractiveness because it is based on open standards and users are not obliged to pay licencing fees.

Although there have been many attempts in the last decade to use mobile devices for business-to-consumer payments (B2C), none have gained particular success (Pousttchi, Schiessler, & Dietmar, 2009). The following drawbacks have been detected: (1) the high costs of the implementation the technology and ensuing financial fees (Islam, Ahmad, Khan, & Ali, 2010), (2) the complexity of the systems (Balan, Ramasubbu, Prakobphol, Christin, & Hong, 2009), (3) the diversity of the types of services and the lack of unified systems of payment (Liébana-Cabanillas, 2012), (4) the large spectrum of types of terminals hindering the implementation of uniform measures of security, control and monitoring (Islam et al., 2010), (5) the mistrust of these types of transactions (Wu, Li, Dai, & Zhao, 2010), (6) the immaturity of some markets, especially emerging economies, that reject new technology (Wu et al., 2010), and (7) the limited rate of penetration in Third World countries and emerging economies (Saidi, 2010).

In spite of this initial lack of success, and due to the advances in mobile technology and the reduction of technical barriers for m-payments, we believe that this means of payment will eventually become more commonplace and simple to use in the coming years. According to a recent study from Accenture (Accenture Consulting, 2015), consumers see, in the next years, a decrease in the use of traditional payment instruments in favour of an increase of digital payments. By the end of the decade, the study expects a significant boost in the use of retail apps (8%), Apple Pay™/Samsung Pay™ (7%) and PayPal (6%). In 2016, total mobile payment transactions will attain $27.05 billion, with users spending an average of $721.47 annually (eMarket, 2015). One of the reasons that the total mobile payment sales will rise faster than average spending per user in 2016 is due to the growth of use of this technology.

In other hand, this growth is due to the fact that consumers in more developed countries frequently make small payments from their mobile phones for purchases of digital content

(games, wallpapers, etc.) or applications (mainly iPhones or Androids). In developing countries, the poor quality of existing means of payment opens a great window of opportunity for the future use of m-payments (Bourreau & Verdier, 2010).

For this reason, in light of this new potential market, and owing to the limited amount of relevant published scientific research, our work aims to analyse the determining factors associated with to the adoption of new mobile payment technology by focusing on the two previously cited payment systems (SMS and NFC). To achieve this, we have applied a revised model of theoretical behaviour deriving from classic theory. In this manner, we offer a review of the different variables that have been analysed over the last years in the study of mobile commerce and in the study of mobile payment models by means of the Technology Acceptance Model (TAM) with the aim to compare and justify the suitability of the proposed model. From the results obtained after evaluating the process of acceptance of the mobile payment technologies, we will offer recommendations from the business standpoint to improve the *intention of use* of potential consumers by means of specific strategies.

2. Theoretical background

Among the classic theories that explain human behaviour related to adopting new technologies is the Theory of Reasoned Action (TRA), developed by Ajzen and Fishbein (1980), and the Theory of Planned Behaviour (TPB) by Ajzen (1991). Both have been widely applied as the principal theoretical framework for understanding and explaining the adoption and usage behaviour of various information systems. According to Yang, Lu, Gupta, Cao, and Zhang (2012), the TRA and the TPB spell out that 'an individual's intention to adopt an innovation is determined by attitude and subjective norms, which are formed by behavioural and normative beliefs of an individual.'

Davis (1989) developed the Technology Acceptance Model (TAM) on the basis of these theories. TAM suggests that the *perceived usefulness* and *ease of use* by an individual are the factors that determine the *attitude* towards the adoption of a specific technology, and consequently determine his *intention to use* resulting in the adoption of the technology (Davis, Bagozzi, & Warshaw, 1989). This model has been applied in many fields such as online services (Liao, Chen, & Yen, 2007), mobile phones (Ervasti & Helaakoski, 2010), mobile ticketing (Mallat, Rossi, Tuunainen, & Öörni, 2009), social networking (Lorenzo, Alarcón, & Gómez, 2011), healthcare information systems (Pai & Huang, 2011) and mobile payments (Liébana-Cabanillas, 2012; Luna, 2012).

Although the TAM has undergone several revisions (Lee, Hu, & Yeh, 2003; Liébana-Cabanillas, 2012), it is still considered the most solid, rigorous and influential model related to the behaviour of technology acceptance (Davis, 1989; Davis et al., 1989). Precisely for this reason it has been adopted in many mobile payment studies (Table 1).

Furthermore, the adoption of different payment tools has been analysed in previous research. This is the case of smart cards (Plouffe, Hulland, & Vandenbosch, 2001) and credit cards (Qi & Yang, 2003). The study of mobile payments in different countries has also been undertaken. Cheong, Park, and Hwang (2004) analysed the transition from credit cards to mobile payments in Korea while Dewan and Chen (2005) explored the factors that determine the adoption of m-payment by consumers in the United States. Teo, Fraunholz, and Unnithan (2005) explored inhibitors and facilitators in the adoption of mobile phones as payment devices in Australia. The adoption of mobile payment systems was also the object,

Table 1. Overview of TAM research used in studies explaining mobile payment.

Author	Concepts from original Tam used	Additional concepts	Background characteristics
Nysveen, Pedersen, and Tohorb-jornsen (2005)	BI, AT, PU, PEOU	Perceived Behavioural Control, Normative pressure, Perceived Enjoyment and Perceived Expressiveness	Gender, Age, Education
Mao, Srite, Thatcher, and Yaprak (2005)	BI, PU, PEOU	Price, Accessibility, Mobile, Phone efficacy and Perceived innovativeness	Gender, Age, Nationality, Education
Chen (2008)	PU, PEOU, BI	Perceived transaction convenience, Perceived transaction speed, Security concerns, Privacy concerns, Perceived Risk and Compatibility	
Schierz et al. (2010)	PU, PEOU, AT, BI	Perceived compatibility, Perceived security, Individual mobility and Subjective norms	
Shin (2009)	PU, PEOU, AT, BI	Perceived security, Trust, Perceived Self-efficacy and Social Influence	Gender, Age, Income
Chandra, Srivastava, and Theng (2010)	PU, PEOU, BI	Perceived reputation, Perceived opportunism, Perceived Risk, Perceived structural assurance and Consumer trust	Gender, Age, Mobile internet, Internet banking
Mehra (2010)	U, BI, PU,PEOU	Usage process, Individual characteristics, Technology characteristics, Context, Communication/task characteristics and Modality of mobility	Gender, Age, Marital status, Employment status, Education, Annual income, Occupation, Residency status, Ethnicity, Use mobile phone, Mobile provider, Pre-paid or on-account
Kim, Mirusmonov, and Lee (2010)	PU, PEOU, BI	Innovativeness, M-payment Knowledge, Mobility, Reachability, Compatibility and Convenience	Early Adopter and Late Adopter
Zhang, Yue and Kong (2011)	PU, PEOU, BI	Perceived Risk and Subjective norms	Uncertainty Avoidance, Individualism
Lu et al. (2011)	BI	Perceived Cost, Perceived Risk, Relative advantage, Compatibility and Image	Internet Payment Trust, Initial Mobile Payment Trust
Yang et al. (2012)	BI	Perceived Risk, Perceived fee, Compatibility, Relative advantage, PIIT and Subjective norms	Potential adopters, Current users
Liébana-Cabanillas (2012)	PU, PEOU, AT, BI	Subjective norms, Social Influence, Trust, Quality and Risk	Gender, Age, experience
Liébana-Cabanillas et al. (2012)	PU, PEOU, BI	Trust and Risk	
Liébana-Cabanillas et al. (2014)	PU, PEOU, AT, BI	Subjective norms, Trust and Risk	Experience
Luna, Montoro-Ríos, and Liébana Cabanillas (2016)	PU, PEOU, AT, BI	Perceived compatibility, Perceived security, Individual mobility, Subjective norms and PIIT.	
Liébana-Cabanillas, Luna, and Montoro-Ríos (2015)	PU, PEOU, AT, BI	Perceived compatibility, Perceived security, Individual mobility, Subjective norms and PIIT.	

Note: PU – Perceived Usefulness; PEOU – Perceived Ease of Use, AT – Attitude toward use, BI – Behaviour Intention to use, U – Use.
Source: Authors and the references included in these table.

among others, of studies by Yang et al. (2012) in China, Balachandran and Tan (2015) in Malaysia, Gao and Waechter (2015) in Australia and Slade, Dwivedi, Williams, and Piercy (2016) in the United Kingdom. Despite this earlier research, no empirical comparative studies regarding current mobile payment systems have been undertaken. Hence the relevance of the present work.

3. Conceptual model and research hypothesis

Most research on the adoption of mobile payment technologies and mobile services is based on existing technologies and their use. The goal of this study is to compare the SMS and NFC systems of payment in accordance with previously established relationships and draw up a model based on the behaviour towards mobile payment systems. This model is entitled Mobile Payment Acceptance Model in New Electronic Environments (MPTAM). The present study specifically proposes the following ideas: (1) that subjective norms may have a direct or indirect impact on the intention to use, ease of use and perceived usefulness, (2) that the ease of use determines the usefulness of the payment devices and the consumer's attitude, (3) that the potential consumer's perceived usefulness of the good is related to his attitude and intention to use mobile payment methods, (4) that the attitude determines directly the intent, and (5) that the perception of security positively affects the behaviour of the consumer. We have selected precisely this last variable of security since it, along with the question of risk, is the most common variable cited in the existing research.

3.1. Subjective norms

Social influences in the form of subjective norms are used as factors both in models of technology acceptance and in their subsequent adaptations (Venkatesh & Bala, 2008). This factor is defined as the degree of an individual's perception of what people important to him consider on whether he should adopt a system or perform a certain action (Venkatesh & Bala, 2008). This social construct is composed of two basic underlying sets of factors. First are the beliefs that the consumer has of the people considered as a reference, and second is the motivation of the person to behave according to the desires of the people of reference (Herrero, García, & Rodríguez Del Bosque, 2005). From this point of view, many authors have identified a direct and positive link between *subjective norms* and *ease of use* (López-Nicolás, Molina-Castillo, & Bouwman, 2008), *usefulness* (Zhang, Yue & Kong, 2011) and, of course, the *intention to use* (Shin, 2009). Therefore, we propose the following hypotheses:

Hypothesis 1: The subjective norms of individuals positively determine the ease of use of mobile payment systems.

Hypothesis 2: The subjective norms of individuals positively determine the usefulness of mobile payment systems.

Hypothesis 3: The subjective norms of individuals positively determine the intention to use mobile payment systems.

3.2. Perceived usefulness

The importance of perceived usefulness has been widely recognised in numerous studies (Guriting & Ndubisi, 2006). Perceived usefulness is the subjective probability that technology can improve the way a consumer completes his goal. In the context of our study, perceived usefulness will improve the consumer's attitude and intention to use mobile payment systems.

According to TAM, the perceived usefulness is the degree to which a person believes that adopting a particular system will increase his effectiveness and job performance (Davis, 1993). Different studies have demonstrated that perceived usefulness has a direct relationship with attitude (Muñoz, Hernández-Méndez, & Sánchez-Fernández, 2012; Shin, 2012), as well as the intention to use (Liébana-Cabanillas, Sánchez-Fernández, & Muñoz-Leiva, 2014; Pai & Huang, 2011). In the context of our research, we consider that the perceived usefulness of the payment system will influence the intention to use through user's attitude toward the payment system. The perceived usefulness of the system of payment will also be directly influence the intention to use based on the principles of TAM. Based on the preceding thoughts, we propose the following hypotheses:

Hypothesis 4: Perceived usefulness positively influences the attitude towards the intention to use mobile payment systems.

Hypothesis 5: Perceived usefulness positively influences the intention to use mobile payment systems.

3.3. Ease of use

The ease of use refers to the individual's perception that using a particular system will be effortless or, simply, easy to handle (Davis, 1989). It is therefore considered one of the most influential aspects regarding the decision to adopt new technology. For Davis et al. (1989) the question of ease of use has a double impact. It has, on the one hand, an impact on the attitude, because self-efficacy and instrumentality, and secondly by its utility as shown by the TAM (Muñoz, 2008).

The effect of the perceived ease of use of a product on the perceived usefulness has been demonstrated in numerous researches from different contexts (Liébana-Cabanillas, Muñoz-Leiva, Ibáñez-Zapata, & Rey-Pino, 2012; Muñoz et al., 2012). The relationship between the ease of use, attitude and intention to use has also often been examined (Hernández, 2010). Under such circumstances we advance the following hypotheses:

Hypothesis 6: The perceived ease of use positively influences the usefulness in the adoption of mobile payment systems.

Hypothesis 7: The perceived ease of use positively influences the attitude towards the intention of mobile payment systems.

3.4. Attitude

Empirical studies of the dissemination of technological innovations have expanded the use of the TAM model to include the factor of attitudes, as proposed by the Theory of Reasoned Action (TRA) of Davis et al. (1989). According to Polatoglu and Ekin (2001), a consumer's

decision to adopt a product depends on his attitude toward the product, that is, his beliefs of its purpose and perceived importance. Consequently, in the online environment, it is expected that attitude facilitate transactions and reduce the barriers to the adoption of the terms of trade (Pavlou, 2002a,b), and more specifically, in our case, favour the intention to use mobile payment systems (Schierz, Schilke, & Wirtz, 2010). In line with previous research (Tsai, Zhu, Ho, & Wu, 2010; Yoon & Kim, 2013), we propose a similar relationship in the case of the new systems of payment. This results in the following hypothesis:

Hypothesis 8: The attitude toward the intention to use is an antecedent of intention to use mobile payment systems.

3.5. Perceived security

From the classic studies of Bauer (1960) that highlighted that risk is a factor in consumer behaviour since the consequences of the use of a product cannot be anticipated with certainty, to the latest research related to payment systems, the perception of security has always been associated with negative consequences that the consumer might suffer if he modifies his intention to use.

Some research suggests that the risk perceived among consumers of online shopping is one of the main factors that hinder its development (Gefen, Karahanna, & Straub, 2003a,b). For this reason, companies are attempting to curtail this perception in order to minimise its impact and enhance the perception of security.

Security and the perception of risk are major concerns in the field of electronic payment systems (Ashrafi & Ng, 2008). It is therefore necessary to establish new security mechanisms for new electronic payment systems so as to protect customer transactions and generate confidence, hence improving attitude. It is precisely this risk that is a major inhibitor of the implementation of new payment systems (Lee, 2009; Pavlou, 2002b). Consequently, we consider that the perception of security in accepting new payment systems must be controlled (Schierz et al., 2010) for this type of technology to be successful (Grassie, 2007). We propose the following research hypothesis:

Hypothesis 9: Perceived security positively influences the intention to use mobile payment systems.

Figure 1 summarises the relationships collected by previous research hypothesis.

4. Methodology: scope of study, measurement scales and data collection

To evaluate the proposed behavioural model, two self-administered questionnaires were created to be filled out by the consumer after watching an explanatory video describing the new SMS and NFC payment systems. However, prior to distribution, the questionnaire was subjected to several preliminary tests to ensure its reliability.

4.1. Development of the measurement scales

The questionnaire consisted of closed questions for the constructs, seven-point Likert scales, and socio-demographic data. Specifically, we adapted the scales of Venkatesh and Davis (2000) and Schierz et al. (2010) to measure *subjective norms* about SMS/NFC mobile

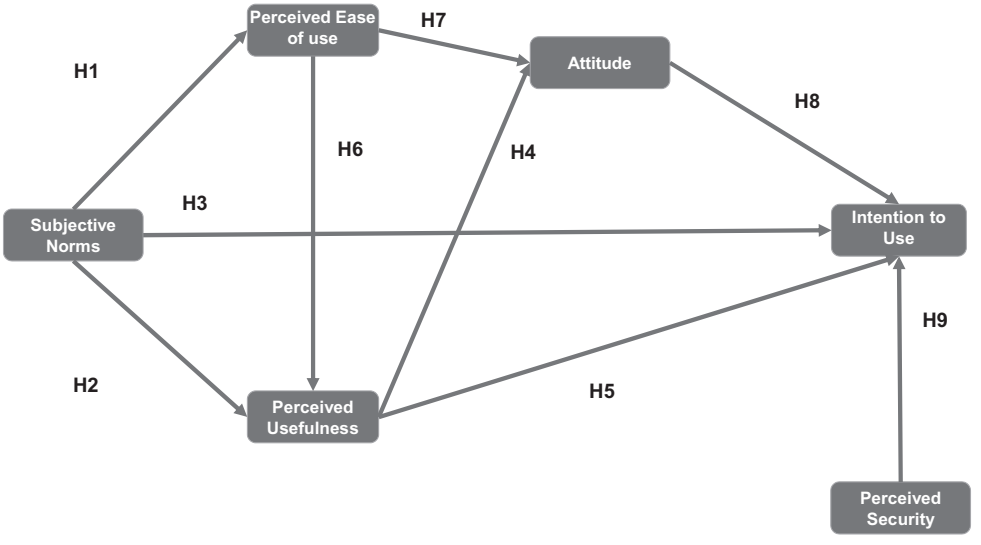

Figure 1. Summarises the relationships collected by previous research hypothesis. Source: Authors.

payment systems. The *attitude to use sc*ale was adapted from research conducted by van der Heijden (2003), Yang and Yoo (2004) and Schierz et al. (2010). The *usefulness scale* was adapted from the work of Bhattacherjee (2001), van der Heijden (2003) and Schierz et al. (2010). The *perceived ease of use scale* was adapted from Bhattacherjee (2001), Davis et al. (1989), Venkatesh and Davis (2000) and Schierz et al. (2010). The *perceived security scale* (three items) was adapted from the scales of Parasuraman, Zeithaml, and Malhotra (2005) and Schierz et al. (2010). Finally, *the intention to use scale* was adapted from Davis (1989), Gefen et al. (2003a and) Gefen et al. (2003b), Venkatesh and Davis (2000) and Schierz et al. (2010).

To verify the *suitability of the measurement scales*, their reliability and validity were analysed by both exploratory (SPSS 18.0) and confirmatory (AMOS 18) methods (see Data analysis section).

4.2. Data collection

Our research applied a standardised, self-administered, online questionnaire based on a prior viewing of a video describing each of the proposed payment systems. Before the survey took place, to ensure its reliability, the questionnaire was subject to several preliminary tests.

We employed a quota sampling method based on the characteristics of consumers reflected in the Survey on Equipment and Use of Information Technologies and Communication in Homes INE, a project that took into account a national panel of Internet users. For SMS payment system, the survey was conducted between January and February 2012 and attained a valid sampling size of 584. For the NFC payment system, the survey was conducted between July and August 2012 and attained a valid sampling size of 287.

Finally, it must be noted that a random selection was carried out among the first experiment (SMS) in order to attain a statistically similar sampling number for both payment system studies.

5. Data analysis and results

5.1. Reliability and validity

Cronbach's α indicator was first used to measure the reliability of the scales, with 0.7 as the reference value (Hair, Anderson, Tatham, & William, 1995). All the variables obtained very good values in the two groups or subsamples (α > 0.8). To test the convergent and divergent validity of the scales, a confirmatory factor analysis was performed. In this analysis the items that contributed least to the explanatory power of the model was eliminated ($R^2 > 0.5$). Convergent validity was evaluated by means of the factor loadings of the indicators. The coefficients were significantly different from zero, and the loadings between latent and observed variables were high in all cases (β > 0.7). Consequently, we can deduce that the latent variables adequately explain the observed variables (Bollen, 1989; Hair et al., 1995).

With regard to discriminant validity, the variances were found to be significantly different from zero. Moreover, the correlation between each pair of scales did not exceed 0.8. Given the weak relationship among the constructs, we can therefore confirm that there are five constructs in each of the two models.

The reliability of the scales can again be evaluated from a series of indicators drawn from the confirmatory analysis. The composite reliability and the average variance exceeded the threshold used as a reference at 0.7 and 0.5, respectively, as well as other indicators of overall fit for the measurement model (Hair et al., 1995) (Table 2).

5.2. Structural equation model

After evaluating the reliability and validity of the measurement scales, the research hypotheses based on the review of the literature were tested. For this a structural equation model was developed for each group. Considering the absence of normality of the variables, we opted for the maximum likelihood estimation method and bootstrapping technique (or bootstrap learning samples) for 500 consecutive steps or samples, and a significance level of 95 percent. The maximum likelihood is preferable in the case of small samples, as opposed to generalised or weighted least squares (West, Finch, & Curran, 1995). For the bootstrapping technique we used the Bollen-Stine's corrected p-value, testing the null hypothesis that the model is correct. Through re-sampling, this technique permits the standard error of the constructs to be corrected.

Before evaluating each of the two models in further depth and examining the differences among them, the overall goodness of fit was verified and seen to be satisfactory as the values of the goodness of fit indicators were within the levels recommended in the literature (Bollen, 1989; Muñoz, 2008) RMSEA < 0, 08 GFI and AGFI > 0, 80, CFI and NFI > 0, 90 (see Table 3).

5.3. Hypothesis testing

To assess the structural model for statistical significance, the model structural loads were analysed. Both the SEM analysis results and the results of the hypotheses are shown in Figure 2 and Table 3.

In the first place, hypotheses 1, 2 and 3, deriving from the effect of subjective norms over the *ease of use*, *perceived usefulness* and *intention to use,* cannot be rejected ($p < 0,1$).

Table 2. Convergent validity and internal composite reliability.

Relationships between constructs			SMS				NFC			
			Standard coefficient	Cronbach's α	Composite reliability	Variance explained	Standard coefficient	Cronbach's α	Composite reliability	Variance explained
Subjective norms	→	SN1	0,879	0,92	0,92	0,79	0,887	0,93	0,93	0,82
	→	SN2	0,874				0,951			
	→	SN3	0,908				0,879			
Perceived ease of use	→	PEOU1	0,782	0,80	0,83	0,81	0,741	0,91	0,92	0,74
	→	PEOU2	0,942				0,810			
	→	PEOU3	0,899				0,938			
	→	PEOU4	0,789				0,936			
Perceived Usefulness	→	PU1	0,816	0,92	0,93	0,76	0,769	0,87	0,88	0,65
	→	PU2	0,957				0,819			
	→	PU3	0,827				0,858			
	→	PU4	0,880				0,859			
Attitude to use	→	AT1	0,761	0,93	0,93	0,78	0,855	0,92	0,92	0,74
	→	AT2	0,935				0,866			
	→	AT3	0,918				0,894			
	→	AT4	0,911				0,832			
Perceived Security	→	PS1	0,730	0,88	0,88	0,71	0,911	0,92	0,93	0,81
	→	PS2	0,855				0,940			
	→	PS3	0,934				0,847			
Intention to use	→	IU1	0,892	0,94	0,94	0,83	0,880	0,93	0,93	0,82
	→	IU2	0,904				0,893			
	→	IU3	0,944				0,948			

Source: Authors.

Table 3. Non-standardised coefficients (β) of the models, Goodness-of-fit indicators in the structural model and Comparison of models SMS versus NFC.

	SMS			NFC			Comparision SMS versus NFC	
Hypothesis	β_{sms}	S.E.	Sig.	β_{nfc}	S.E.	Sig.	*t*-Student	*p*-valour
H1. Subjective Norms →Perceived Ease of Use	0,336	0,067	***	0,407	0,053	***	−0,83	0,4,063
H2. Subjective Norms → Perceived Usefulness	0,474	0,056	***	0,390	0,054	***	1,08	0,2,807
H3. Subjective Norms → Intention to use	0,119	0,055	**	0,353	0,072	***	**−2,58**	**0,0,101**
H4. Perceived Usefulness →Attitude	0,475	0,054	***	0,955	0,110	***	**−3,92**	**0,0,001**
H5. Perceived Usefulness → Intention to Use	0,162	0,065	**	0,336	0,109	***	−1,37	0,1,709
H6. Perceived Ease of Use → Perceived Usefulness	0,272	0,052	***	0,500	0,067	***	**−2,69**	**0,0,074**
H7. Perceived Ease of Use → Attitude	0,213	0,045	***	−0,078	0,088	n.s.	**2,87**	**0,0,042**
H8. Attitude → Intention to Use	0,273	0,072	***	0,375	0,081	***	−0,94	0,3,470
H9. Perceived Security → Intention to Use	0,065	0,035	**	0,078	0,047	**	−0,22	0,82
Coefficients								
RMSEA	0,060			0,062				
X^2	364,820			378,041				
df	179			179				
Bollen-Stine's p	0,002			0,001				
NCP	185,820			199,041				
RFI	0,918			0,922				
GFI	0,892			0,886				
AGFI	0,860			0,853				
NFI	0,930			0,933				
CFI	0,963			0,964				

Notes: The results in bold represent significant differences (significance < 0.05) in the relationships between certain variables of the two structural models.
**0, 1 of significance; ***0, 001 of significance.
Source: Authors.

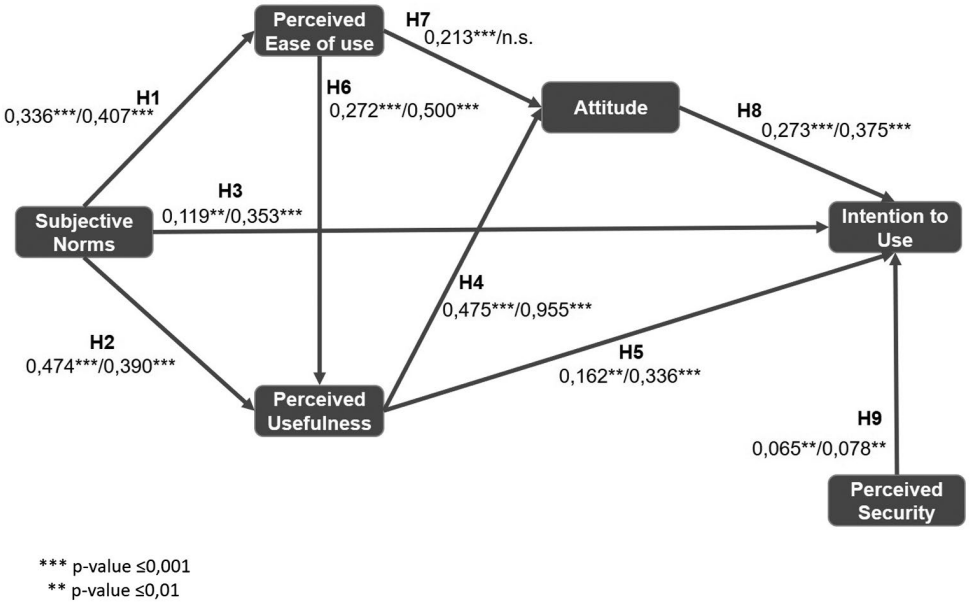

Figure 2. Behavioral models MPTAM: SMS payment/NFC payment (n.s. = non significant). Source: Authors' calculations.

In this case the subjective norms have a direct and positive relation over the *ease of use* (βsms = 0,336 $p < 0,001$; βnfc = 0,407 $p < 0,001$), over the *usefulness* (βsms = 0,474 $p < 0,001$; βnfc = 0,390 $p < 0,001$) and over the *intention to use* (βsms = 0,119 $p < 0,10$; βnfc = 0,353 $p < 0,001$). These results reinforce the conclusions of previous research (Zhang et al., 2011).

Secondly, the relationship between the *usefulness* and the *attitude* and *intention* in hypotheses 4 and 5 also cannot be dismissed. In this situation, the *usefulness* that the consumer perceives toward the payment device will have a direct effect both on his *attitude* toward it (βsms = 0,475 $p < 0,001$; βnfc = 0,955 $p < 0,001$) and on his intention to use it in the future (βsms = 0,162 $p < 0,10$; βnfc = 0,336 $p < 0,001$). These relationships involve a direct and positive relationship between the value of the means of payment and the user's attitude and intention toward it (Lorenzo et al., 2011).

Furthermore, the hypothesis derived from the effect of *ease of use* (hypotheses 6 and 7) also cannot be put into question in the case of the SMS payment system and can only partly be rebuffed in the case of NFC. In this sense, the perceived *ease of use* reveals a direct and positive relationship with the perceived *usefulness* (βsms = 0,272 p < 0.001; βnfc = 0,500 p < 0.001) revealing that for both systems the perceived ease of use affects the perceived usefulness of the system for the user. However, the *ease of use* reveals a direct and positive relationship with the *attitude* of the consumer for the SMS payment system (βsms = 0,213 p < 0,001) but not for the NFC system (βnfc = −0,078 p = 0,421) probably due to the relative lack of effort that he must invest, compared the large effort inherent to starting from scratch with a new device (Muñoz et al., 2012).

Moreover, hypothesis 8, which places in relation a favourable *attitude* towards the payment system and its *intention to use*, cannot be completely rejected (βsms = 0,273, $p < 0,001$; βnfc = 0,375, $p < 0,001$). Following the thought of Ajzen and Fishbein (1980) and other later works, the favourable *attitude* of a consumer toward a mobile payment tool proposal will

improve his intention to adopt it. Even though it is difficult to define the attitude of a potential user due to the multidimensionality of the construct, this relationship has been proven in research related, among others, to mobile payment systems (Schierz et al., 2010; Shin, 2009).

Finally, hypothesis 9 reveals a positive relationship between the *perceived security* and the *intention to use* (βsms = 0,065 βnfc = 0,708 p < 0,10). In this case, when the system of payment is considered secure, the intent of the consumer will increase**.** This is a result that coincides with the conclusions obtained in other research (Lee, 2009).

5.4. Comparison of models

To demonstrate the existence of a common model for the two payment systems (SMS and NFC) after their evaluation, we compared the regression coefficients or weights in pairs between the structural models using a modified version of Student's t-test for independent samples (Chin, 2000). The evaluation was performed using the procedure suggested by Chin (2000) to develop a multi-group analysis based on Student's t-test according to the following formula:

$$\text{Ho: B1} = \text{B2} \qquad t = \frac{B_1 - B_1}{\sqrt{SE_1^2 + SE_2^2}} \tag{1}$$

Where *Bi* denotes path weights and *SEi* is the standard error of the path in the structural model.

The results reveal significant differences (significance < 0.05) in the relationships between certain variables of the two structural models (see Table 3). These differences are especially pronounced in the relationships between *subjective norms* and *intention to use* (difference = −2,58; p = 0,01), perceived *usefulness* and *attitude* (difference = −3,92; p = 0,00), perceived *ease of use* and perceived *usefulness* (difference = −2,69; p = 0,00), and finally, perceived *ease of use* and *attitude* (difference = 2,87; p = 0,00).

The largest differences are between perceived *usefulness* and *attitude* and perceived *ease of use* and *attitude*.

Precisely the *ease of use* will become more important in the SMS payment system due to its relationship with *attitude,* while *subjective norms* and perceived *usefulness* show a greater relevance with the NFC payment system due to its impact on *attitude* and *intention*.

The results indicate that the model of mobile payment behaviour cannot be applied in a global manner and the relationships proposed in the model are expressed with different intensity depending on the system of payment under study.

6. Discussion

The goal of our research is to analyse the acceptance by consumers of the NFC and SMS mobile payment systems from a behavioural model standpoint and determine its constitutive factors. In this sense**,** the models explain the variation in the intention of use of the values of 0,557 and 0,654, higher than those advanced by analogous models of technology acceptance (Lu, Yang, Chau, & Cao, 2011).

On the question of the academic contribution of this research, it is noteworthy that although other work has been carried out on the subject of the acceptance of mobile

technologies, as well as on the different forms of mobile payments using as a basis the TAM, this is a first comparative empirical analysis of consumer acceptance of SMS and NFC payments.

Regarding the adoption of the mobile payment system by SMS, in order of importance the most important variables in the intention to use are: the attitude, followed by perceived usefulness, subjective norms, and perceived security. On the other hand, regarding the adoption of the NFC mobile payment system, in order of importance the most important variables in the intention to use are: the attitude, followed by subjective norms, perceived usefulness and perceived security.

The major variable regarding the *intention to use* in both payment systems is the *attitude*. *Attitude* also becomes an essential determinant factor related to the question of the *intention to use* the new payment system. It expresses, in fact, a significant, positive and direct effect on the *intention to us*e. Precisely the feelings or attitudes of the consumer to some extent also determine his predisposition to use the new technology. Secondly, in the adoption of the SMS mobile payment system, the perceived usefulness is a more important factor than in the NFC mobile payment system adoption, which has the subjective norms as its second most important variable. This implies that the future NFC mobile payment system user retains in higher consideration the opinions of those that are really important to them more than the future SMS mobile payment system users. But on the other hand, the future SMS mobile payment system users better valuate the system usefulness than the future NFC mobile payment system users.

Finally, perceived *security* also bears a significant influence on the *intention to use*. Although this variable is rarely contemplated in research on the question of the acceptance of mobile technologies, in our work it is relevant due to the fact that consumers with a higher level of perceived *security* will show a higher propensity to accept new mobile payment systems.

On the other hand, it is worth noting that the differences detected between the two mobile payment systems reinforce the idea that the behaviour of the consumer will differ depending on the type of mobile payment system, as seen through the difference of intensity of the different *constructs*. In our case, we have observed differences in the levels between s*ubjective norms* and *intention to use*, perceived *usefulness* and *attitude*, perceived *ease of use* and perceived *usefulness*, and finally, perceived *ease of use* and *attitude*.

7. Limitations, conclusion and managerial implications

While our work focuses on a sampling of Spanish consumers, the goals of our research reside in analysing precisely the *intention to use* and factors of use in developing markets with an incipient use of this technology. Nonetheless, the study can be applied to other countries in a situation similar to that of Spain with, possibly, differences of culture and even different levels of technology acceptance.

To confer greater external validity to our results, we could conduct a comparative study between different systems of payment, establishing a classification and a user profile for each type of technology, including other mobile technologies that are substituting payment by card. Finally, we could include in our study potential determining or modifying factors such as gender, age and even the grade of experience with similar payment devices.

Moreover, this study can impart a number of recommendations to companies interested in adopting mobile payment systems. It is evident to us, however, that the key to the diffusion of these new payment systems lies in the change of perspective of the general public regarding mobile payments and, more specifically, in convincing consumers to adjust their habit of paying with card and cash to paying by mobile phone. It is therefore essential that companies focus marketing strategies on informing consumers of the benefits of this service. It is also vital that companies interested in promoting these technologies take into account other factors that, despite playing a lesser role, are still important to the process of adoption of payment systems through mobile phones. These secondary factors are related to individual mobility, the quality of the specific payment system and even the elements of today's technological environment.

Once these first implications are overcome, we believe that it is vital for companies to sway subjective norms in the consumer's current technological environment chiefly by means of the virtual social media (Liébana-Cabanillas, 2012). This is currently a market that is beginning to be explored by many companies in order to secure an advantageous position and to exploit future synergies. In spite of this, it appears that NFC users will be more receptive to the influences of this type of payment since it is considered it to be a 'cooler' system. Marketing strategies that aim to influence and draw the attention of a large number of people should merchandize their products in films, television and other public events. These are starting points for the masses to recognise the benefits of these systems of payment.

Furthermore, the effect on the consumer's *attitude* toward the new payment systems involves, first, highlighting the need for an effort to ensure that they improve their perception and general opinion of new systems. For this reason, it is essential that companies publicise the benefits of these devices. It is, however, true that there are factors that favour companies that work with this new technology, such as the high rate of acceptance of mobile phones, as well as the increase of access to social networks through mobile internet. These trends provide access to shopping portals from any location at any time, exceeding the significant benefits of e-commerce itself. In our case we can observe a greater attitude or inclination on the part of consumers towards the NFC payment system.

On the other hand, usefulness is also a determining factor in the acceptance of these payment systems, as it reinforces the *intention to use*. Here, again, the usefulness of the NFC system exceeds that of the SMS. We encourage developers of mobile payments, especially those applying NFC, to focus their efforts on implementing user experience (UX) techniques and go beyond consumer expectations. They should seek not only to highlight their utility, but add value to their use. They must take into account that the UX represents an emerging change in the very concept of usability where the goal is not just to improve the performance of user interaction (effectiveness, efficiency and learning ease), but solve the strategic problem of the utility of the product and the psychological question of the gratification and pleasure of its use (D'Hertefelt, 2000).

Finally, perceived *security* is another fundamental factor in the acceptance by consumers of the new payment systems. Due to this perception, all the actors cited above must implement relevant security measures so as to reduce the consumer's perceived risk and focus the consumer's *attitude* towards the importance of the *usefulness* and, consequently, encourage a future *intention to use*. To carry this out companies must accentuate the notion

of security of these payment systems through publicity, through seals of security quality and even making use of associated brands (VISA or PayPal, for example).

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