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Analysis and modeling of the determinants of mobile banking acceptance

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Table of Contents

- 1 **ANALYSIS AND MODELING OF THE DETERMINANTS OF MOBILE BANKING ACCEPTANCE**
SAMUEL HENRIQUE SILVA BIDARRA, University of Granada, Spain
FRANCISCO MUÑOZ-LEIVA , University of Granada , Spain
FRANCISCO LIÉBANA-CABANILLAS , University of Granada, Spain
- 28 **DEVELOPING CAREER SELF-MANAGEMENT SKILLS: A STUDY IN HIGHER EDUCATION**
JOANA CARNEIRO PINTO, Portuguese Catholic University of Lisbon, Portugal
MARIA DO CÉU TAVEIRA, University of Minho, Portugal
- 54 **THE EFFECT OF CORPORATE GOVERNANCE ON THE FINANCIAL STRUCTURE OF LISTED FIRMS**
J. AUGUSTO FELÍCIO, Technical University of Lisbon, Portugal
RICARDO RODRIGUES, CEGE – Centre for Management Studies, Portugal
- 78 **A NEW FUNNEL FRAMEWORK TO SUPPORT INNOVATION MANAGEMENT IN SMES**
STEFANO BIAZZO, University of Padua , Italy
PATRIZIA GARENGO, University of Padua , Italy
GIOVANNI BERNARDI, University of Padua , Italy

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The determinants of mobile banking acceptance: conceptual development and empirical analysis

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Abstract

Mobile banking represents a great breakthrough in electronic banking. However due to several factors, costumers are not still completely confident in its use. In this study we contribute to the research on electronic banking adoption, in particular mobile banking acceptance, and we improve our understanding of consumers' attitudes towards new technology usage. With this aim, we proposed a new model using the principles of the theoretical model TAM (Technology Acceptance Model) as the backbone, to which new variables such as trust and risk were added, since they are likely to be influenced by security and privacy concerns. We applied an online survey, and using structural equation modeling (SEM) obtained important results regarding consumers' perceptions of mobile banking applications. In particular, we were able to better understand the relationships between trust, risk, intention to use, as well as the other relationships present in the original TAM model, in the mobile banking context, which also raised issues relating to the perceived ease of use and usefulness of mobile banking and users' attitudes toward it.

Keywords: Internet, Electronic commerce, Mobile Banking, Online Banking, Electronic Banking, Trust, Intention to use.

1. Introduction: electronic banking and mobile banking

The rapid growth of the Internet has led to its usage to facilitate electronic commerce, known as Internet-based electronic commerce (IBEC). IBEC is defined as a set of business information exchange processes, maintaining business relationships and conducting business transactions over the Internet (Auger et al., 2003).

Nowadays, anyone with access to the Internet is a potential buyer in the online environment. This has been enhanced by the fact that e-commerce has virtually eliminated the physical distance which normally exists between buyers and sellers. As a result, the enormous potential of electronic commerce has increased. Consumers can now buy directly from distributors, independently of their location. All this has led to far-reaching implications in socio-economic aspects. New relationships are closer and forged between businesses and consumers, traditional intermediaries are replaced, and new products and markets are developed with these new terms of trade in mind.

The rapid growth in information technology (IT) in commerce has propelled the economic developmental officials to constantly improve their competitive communities in order to anticipate the future. Advances in IT also have a huge effect and impact on the banking sector, with the creation of new payment methods, which increase flexibility and are easy to use. Since the early 1980s, the major banks have been improving their technology products and services traditionally offered through automated teller machines (ATM), offering them through online banking available anywhere, twenty four hours a day, seven days a week (Liao and Cheung, 2002). In just over ten years, it was clearly recognized that the Internet had revolutionized retail banking. BusinessWeek magazine stated categorically that "banking is essential for a modern economy, banks are not" (Tan and Teo, 2000).

In this context, mobile devices (such as smartphones, tablets, etc.) and their applications not only become a point of contact for most people but are also setting up a new sales channel for banks. Considered a channel for the consumption of services, the mobile phone offers enormous potential in banking (Laukkanen and Lauronen, 2005). This is the well-known mobile banking, defined as "a channel through which the consumer interacts with a bank via a mobile device such as a phone or a personal digital assistant." In that sense it can be seen as "a subset of banking electronics and an extension of Internet banking with its own characteristics" (Laukkanen and Passanen, 2008).

For some other authors, it is a central element in the growing strategies of banking and mobile industries (Goswami and Raghavendran, 2009). This development is also ensured by the banks, through their custom applications, offering a combination of payments, banking in real time, bidirectional data transmission and ubiquitous access to information and financial services (Jacob, 2007).

This service convenience, the easy access to the service regardless of time and place, the privacy and the time and effort saving are some of the factors that contribute to the adoption of this type of banking (Laukkanen, 2007). Therefore, consumers assume (and it is expected to be so) that through a phone they can easily access to a fast and comfortable service capable of support their demands.

However, despite of these advantages, the use of mobile banking has not spread as predicted by some authors (Kim et al, 2009 and Laukkanen, 2007) and the Internet is still the leader in electronic banking channels. However, we recognize the potential of Mobile banking as an alternative channel in certain situations (outside the office, passenger stations, during the trips, and so on).

Therefore, the aim of this paper is to study Mobile banking acceptance, in particular, to analyze customer perceptions of electronic banking vis a vis mobile banking. As such, we present the state of art with regard to this topic, justifying the assumptions contained in the proposed behavioral model of acceptance of mobile banking applications. Then, we describe the methodological aspects and the results of our online survey analyzed using a structural equation. Finally, we draw the conclusions, implications for management and future research (section 7).

2. Theoretical background

2.1. Factors leading to the acceptance of mobile banking

The literature describes a behavioral pattern that can help explain and predict acceptance behavior with regard to new technology and information systems. This is summarized in the Technology Acceptance Model (TAM), originally proposed by Fred D. Davis in 1986 (Davis et al., 1989) and still widely used by many authors today. The TAM has corroborated a theoretical model to help explain and predict user behavior towards information technology (Legris et al. 2003), and is considered an extension of the Theory of Reasoned Action (TRA) proposed by Ajzen and Fishbein (1980). In fact, TAM was as adaptation of the TRA, proposed as an explanatory model for why a user accepts or rejects the information technology (Davis, 1989 and Davis et al., 1989). The TAM provides a study basis that scrutinizes how certain external variables influence beliefs, attitudes and intention to use. Briefly, two cognitive beliefs are at the basis of TAM: perceived usefulness and perceived ease of use. According to TAM, the actual use of a technological system is influenced directly or indirectly by users' intentions, attitudes, the system usefulness, and its perceived ease. TAM also proposes external factors which affect the intention and actual use through mediated effects on perceived usefulness and perceived ease of use. Figure 1 shows the original TAM.

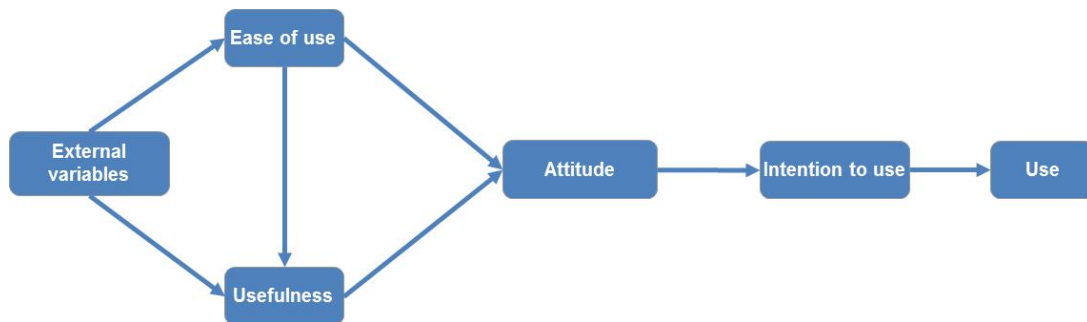


Figure 1: Original TAM Model [Source: Davis et al., 1989]

Usefulness and perceived ease of use are the original constructs proposed by Davis (1989) in their TAM model. Perceived usefulness is defined as "the degree to which a person believes that using a particular system will improve the performance of their work" (Davis, 1989). The importance of perceived usefulness in the adoption of information systems (IS) and the Internet has been previously shown to positively affect online purchase intention (Chiu et al., 2005).

The perceived usefulness of the Mobile Internet (M – Internet) also plays a key role in developing a positive attitude towards the Internet, as well as in the intention of use. In fact, Pikkarainen et al. (2004) found that perceived usefulness is positively correlated with the use of online banking. This only happens if consumers become more interested in the benefits offered by online banking than in the ones provided by regular banking channels.

"Ease of use" is described by Davis (1989) as the level to which a person believe that the use of a particular system will be stress free. Recently, Amin et al. (2008) found that ease of use is significantly related to intention to use in the context of mobile banking. Pikkarainen et al. (2004), on the other hand, found that perceived ease of use did not correlate positively with the use of online banking. This indicates that the perceived ease of use does not significantly affect the use of online banking.

Consequently perceived ease of use has less impact on the acceptance of the technology than perceived usefulness.

In this context, trust is also considered a key factor in the world of electronic commerce and therefore in the acceptance of new technologies (Chircu et al. 2000). Trust is one of the determinants of perceived usefulness, especially in an online environment. This is particularly due to the guarantee that consumers will get their expected utility out of the web interface, which depends on the people behind the website. In electronic commerce context, trust may reduce consumers' need to monitor the online retailer actions and check all the details, making online transactions easier. On the other hand, when trust is low, consumers will have to pay special attention to all aspects of the transaction process, increasing the time and effort required.

Mobile banking has been highlighted in recent studies. Laukkanen and Kiviniemi (2010) analyzed the effects of information and guidance offered by a bank in five adoption ways. The authors found that guidance information has the most significant effect on the perception of a new innovation functional usability and plays an important role in increasing the positive-image of the innovation. Koenig-Lewis et al. (2010) found that compatibility, perceived usefulness, and "risk associated to mobile banking" are important indicators for the adoption of these services. Compatibility is an important background element to ease of use, perceived usefulness and credibility. Moreover, trust and credibility are crucial to reduce the overall perceptions of risk of mobile banking. Cruz et al. (2010) investigated the barriers to the adoption of mobile banking and found that most of the people inquired did not use any type of banking service, and that the reasons for this were, among others: the costs, risks, low perception about the service and complexity. Riquelme and Ríos (2010) looked into the factors that affect adoption of mobile banking among current users of Internet banking. Their results showed that perception of risk, social norms, ease of use and usefulness of the device for banking purposes are the most prominent factors in choosing a service and where users look for a comparative advantage. Kim et al. (2009) investigated the mechanisms associated with the initial formation of people's trust in mobile banking and intention to use the service. Their study focused on four types of forces that generate trust: institutional services (structural guarantees), cognition (perceived benefits), personality (behavior of the staff staff) and business characteristics (business reputation). Their results show that three of these variables (relative benefits, the propensity to trust and structural guarantees) have a significant effect on initial trust toward mobile banking. However, the impact of reputation as a business feature in the

adoption of mobile banking did not appear to be an important factor. Laforet and Li (2005) investigated, in an online environment, consumers' attitudes and the use of mobile banking in China. They concluded that security is the most important factor for the adoption of these online banking services, while the main obstacles to their adoption and use were perception of risk, low technological skills and the traditional banking culture in China.

The following defines and supports the research hypotheses that will shape the proposed acceptance model. The high focus of work in this area has justified the effect of constructs such as trust, privacy concerns and security based on fundamentals or results from the area of electronic commerce.

3. Research hypothesis and conceptual model

3.1. Security purposes on the type of transaction and service provider

Safety has been widely recognized as one of the main obstacles to the adoption of electronic banking (Aladwani, 2001). Many authors have found that those who feel safer in Internet are more likely to trust a specific website, such that this is a way to enhance trust among consumers (Gefen et al., 2003). As shown in literature, web seals or guarantees, such as Third-Party Certifications (TPC) can also encourage customers, helping reduce security and trust issues (Wakefield and Whitten, 2006). This effect is due to the significant relationship between perception of structural security and trust (Jarvenpaa et al, 2000; Yousafzai et al, 2005). In particular, it is believed that the feeling of security has a significant effect on perceived trust (Kimery and McCord, 2006).

Consumers are generally concerned about how banking transactions are made. By eliminating the risks of an unauthorized transaction, customers develop feelings of trust in the service provider. The description of Koller (1988) customers as risk averse (and even more uncertainty as is the online environment) reinforces this approach. Likewise, according to Sánchez and Villarejo (2004), there is a relationship between users with relevant and similar qualities and their relationship with the Internet. According with these authors, the users with experience in Internet has less risk averse.

Concerning the above-described studies and adapting these arguments to the mobile banking scenario, we propose the following research hypothesis:

H1: Security concerns have a significant negative effect on trust in the adoption of mobile banking

3.2. Effects of concern for the privacy of sensitive information

Privacy concerns have been identified as a major, if not the most critical obstacle to e-commerce. This is a barrier to the rapid growth of electronic commerce since the lack of consumer trust and privacy laws create this problem in the online environment. One of the problems associated with the lack of privacy on the Internet is spam. This implies usage tracking and data collection that may allow sharing information with others. These areas of interest correspond to the taxonomy described by Wang et al. (1998). For consumers need, it is very important that the information shared is subject to the limits outlined in person, which is the essence of privacy on the Internet.

Consumers in the online environment, contrary to traditional retail environments, have low perceived control over information privacy and this has a significant influence on their willingness to participate in exchange relationships with web merchants or retailers.

Empirical studies have found that consumers of financial services are often reluctant to share personal information because of the fear that their financial life becomes an open book to the Internet world (Bestavros, 2000). So there is a risk of confidentiality loss, which is a significant factor in building trust (Culnan and Armstrong, 1999).

According to Stone and Stone (1990), customers can have positive perceptions about privacy when: 1) the information is collected in the context of an existing relationship, 2) there is perceived ability to control the use of information in the future, 3) information collected or used is relevant to the transaction, and 4) they believe that the information will be used to draw valid and reliable conclusions about them.

A business model with guaranteed privacy of information, more consumer-oriented, leads to exchanges of commercially valuable relationships, very important and beneficial for customers and for the companies doing business on the Internet (Wang et al., 1998). In a large consumer sample, Korgaonkar et al. (1999) found that non-transactional privacy concerns were significantly and negatively related to the percentage of business use on the Web. They also reported that security and privacy based on the transaction (for example, concern about giving the credit card number and security of financial transactions on the web) were negatively related to Internet shopping.

According to the purpose of our study and based on this review of the literature, we intended to demonstrate the influence of privacy concerns on consumer trust when using mobile banking. We thus propose the following research hypothesis:

H2: Privacy concerns negatively influence trust in the adoption of mobile banking

3.3. Effects of perceived usefulness

The importance of perceived usefulness has been widely recognized in the field of electronic banking (Guriting and Ndubisi, 2006; Jaruwachirathanaku and Fink, 2005). According to these studies, the usefulness is the subjective probability that a new technology will improve the way a user achieves his/her goal. According to TAM, usefulness refers to the degree to which a person believes that using a particular system will increase their effectiveness and job performance. According to Davis et al. (1992), perceived usefulness refers to consumer perceptions regarding the results of the experience. Davis (1993) defines it as the consumer perception that the use of the new technology will improve their performance.

In his studies Pavlou (2002a, 2002b) independently analyzed three current behaviors. The findings highlighted that the direct relationship between usefulness and trust is only in the case of the behavioural analysis of intention to receive information.

Pikkarainen et al. (2004) applied the TAM model in Finland and found that the construct is a determinant of actual behavior that encourages the user to the XXI century banking self-service. The consumer is propelled to use the most innovative technologies that give them greater autonomy in conducting banking transactions, obtaining information on financial advice, and the purchasing of other financial products. However, Gerrard and Cunningham (2003) noted that usefulness depends on the offered banking services such as checking bank balances, loan application, payment options, overseas money transfers, and obtaining information on investment funds. Also, Tan and Teo (2000) and Hernández et al. (2011) suggest that usefulness is an important factor in the determination of the adaptation to innovations. As a result, the bigger this perception with regard to e-banking services, the more likely it will be the adoption of electronic banking (Jaruwachirathanakul and Fink, 2005).

The relationship between usefulness and attitude toward the use is proven in several studies, among which we highlight Karahanna et al. (1999), Pavlou (2002b), Sanchez and Roland (2005), Taylor and Todd (1995).

Derived from the above, the following hypothesis is proposed for the case of Mobile banking and for the usefulness construct:

H3: Perceived usefulness positively influences trust in the adoption of mobile banking

H4: Perceived usefulness has a positive influence on attitudes towards the use of mobile banking

H5: Perceived usefulness positively influences intentions to use mobile banking

3.4. Effects of usability

Ease of use refers to the individual's perception that using a particular system is free of effort or simply easy to do (Davis, 1989). It is considered one of the most influential attributes in the adoption of a new technology. For Davis et al. (1989), ease of use has a double impact on attitudes, both through self-efficacy and instrumentality, and through utility, as shown by the TAM (Muñoz, 2008). The effect of perceived usability on perceived usefulness has been shown in multiple studies applied to different contexts (Aldás et al., 2011; Muñoz et al., 2012; Liébana et al., 2012), while other work has focused on the relationship between the ease of use, attitude and intention (Chau and Lai, 2003; Hernandez, 2010). Furthermore, the existence of a positive correlation between usability and trust has been shown in a variety of fields (Koufaris and Sousa, 2002; Gefen et al., 2003), including electronic banking (Aldás et al., 2009).

The following hypotheses are thus proposed:

H6: Perceived ease of use positively affects utility in the adoption of mobile banking

H7: Perceived ease of use positively influences attitudes towards intention to use mobile banking

3.5. Effects of Trust

People make important purchasing decisions based in part on their level of trust in the product, seller and / or company (Hosmer, 1995). Trust has been viewed as a catalyst in many transactions between

buyers and sellers, which can provide consumers with high expectations of satisfying exchange relationships (Hawes et al., 1989). Many researchers have argued that trust is essential to understanding interpersonal behavior and economic exchanges (McKnight, et al., 2002). Trust is a very complex and multidimensional construct, in particular in the field of social change, and it has been analyzed from three main dimensions: capacity or competence, benevolence, and integrity (Mayer et al., 1995).

Moorman et al. (1992) describes trust as the willingness to rely on an exchange partner in which you have trust. This definition was further characterized by Ganesan (1994) as a willingness to rely on the other side, on the basis of beliefs or expectations of the partner experience, reliability and benevolence. Mayer et al. (1995) incorporate vulnerability in the definition of trust, based on the fact that when consumers are no longer vulnerable, they are taking a risk.

Similarly, the decision of Internet shopping involves not only the trust between the merchant and the consumer Internet, but also between the consumer and the computer system through which transactions are executed (Lee and Turban, 2001). The open nature of the Internet as a transaction infrastructure and its global constitution has made trust a crucial element of electronic commerce (Hoffman et al., 1999). Also Hoffman et al, (1999) focus on security and privacy as the main drivers of online trust, arguing that environmental control or consumers' ability to control the actions of a web provider directly affect consumer perception of the online security and privacy. They also discuss the effectiveness of a trusted TPC (e.g. seals TRUSTe or Verisign) and a public key infrastructure to ensure transaction security (including privacy protection), as central success factors for Building consumer trust online.

McKnight et al. (2002a) suggest that consumers seriously consider the circumstances in which virtual operations with vendors (e-vendors) occur, due to the uncertainty and perceived of the virtual environment. Moreover, according to Jarvis (2000), 92% of Internet marketers believe that consumers would conduct far more transactions if they had additional trust in the privacy regulations governing websites. Fear and distrust of losing personal information is one of the most important factors for online consumers (Wang et al, 1998; Hoffman et al., 1999). Privacy, trust and integrity of the transaction are other factors determining consumers' willingness to be involved in the terms of trade (Wang et al., 1998).

Customer trust in electronic banking transactions has unique dimensions when compared to “face to face “ transactions; for example, the extensive use of technology for transactions, distance and the associated impersonal nature of the online environment, and the implicit uncertainty of using open technology infrastructures. The spatial and temporal separation of the banking field and the client and the financial advisor raises fears of opportunism arising from the uncertainty of the product and identity. Customer trust in an Internet environment is, therefore, very important since there are few guarantees that the e-seller will maintain an ethical behavior, lack opportunism, practice fair price, present accurate information, and that the distribution of personal data and purchasing information will not be leaked without prior permission (Gefen, 2000).

According to previous research, those who have the most online experience also have a higher level of trust in online applications (Flavián et al., 2006, Ruiz et al. 2007). In turn, trusting online settings reduces risk beliefs about online transactions set out with it. Pavlou (2003) found that the relationship between trust and risk is direct and negative. Trust has also been proposed as an antecedent of attitude toward use in Pavlou’s studies (2002a and 2002b).

Thus, trust in the e-vendor and in the retailer's website significantly influences internet purchase intentions (Koufaris and Sousa, 2004; Gefen et al. 2003; Pavlou, 2003), directly or indirectly by above mentioned constructs.

Therefore we argue that:

H8: Trust positively influences perceived ease of use of mobile banking

H9: Trust positively influences attitude towards the use of mobile banking adoption

H10: Trust risk negatively influences the adoption of mobile banking

3.6. Effects of perceived risk

The notion of perceived risk is defined as the consumer's subjective belief of suffering a loss in pursuit of a desired outcome. Risk perception refers to the "party who transfers beliefs about probabilities income outside considerations involving the debtor relations in particular." Thus, consumers have personal beliefs about the risks inherent in each transaction based on limited information available to them.

Trust is intertwined with risk, and both are based on perceptions. Trust has also been defined as the expectation that an exchange partner will not engage in opportunistic behavior. Therefore, one of the consequences of trust is that it reduces the consumer's perception of the risks associated with opportunistic behavior by the seller.

High levels of buyer trust were found to stimulate favorable attitudes and behaviors. Macintosh and Lockshin (1997) found that consumer trust in an online store has an impact on consumer attitudes toward that same store. It is argued that this is due to trust reducing perceived risk of being abused by the store, and low risk perception in turn influencing the orientation of consumer attitudes towards the store. In this sense, Pavlou (2002) proves the existence of a relationship between risk and attitude toward use.

Featherman and Pavlou (2003) also show that the relationship between risk and intended use is direct, but negative, eg. the risk that adversely affects the intended use of new electronic services, such as online banking. With regard to the intention to use Mobile banking this raises the following propositions:

H11: Risk has a negative influence on attitude towards the use of mobile banking

H12: Risk negatively influences intention to use mobile banking

3.7. Attitude towards the use of mobile banking

The adoption of electronic banking is important not only in terms of reducing costs and improving competitiveness, but also in terms of banks' ability to maintaining existing customer base and attract new customers (Akinci et al., 2004; Guriting and Ndubisi, 2006).

Empirical studies related to the dissemination of technological innovations have expanded the use of the TAM model to include attitudes, as proposed by the Theory of Reasoned Action, TRA (Davis et al., 1989; Karjaluoto et al., 2002). According to Polatoglu and Ekin (2001) consumer attitudes consist of beliefs about the purpose and the perceived importance (weight) of an attribute in the decision to adopt. In the context of electronic banking, consumer attitude is very diverse in terms of perceptions about information products, payment method, delivery time, services offered, risks, privacy, security, personalization, visual appeal, navigation, entertainment and fun. The relationship between the

attitudes and beliefs was found to be direct and positive, as shown in studies by Sánchez and Roldán (2005), Taylor and Todd (1995), Pavlou (2002a, 2002b) and Zimmer et al. (2010) among others.

The following hypotheses for research in the area of mobile banking are thus proposed:

H13: Attitude toward intended use is an antecedent of intention to use mobile banking

In Figure 2 we summarize the relationships delineated in the research hypotheses above:

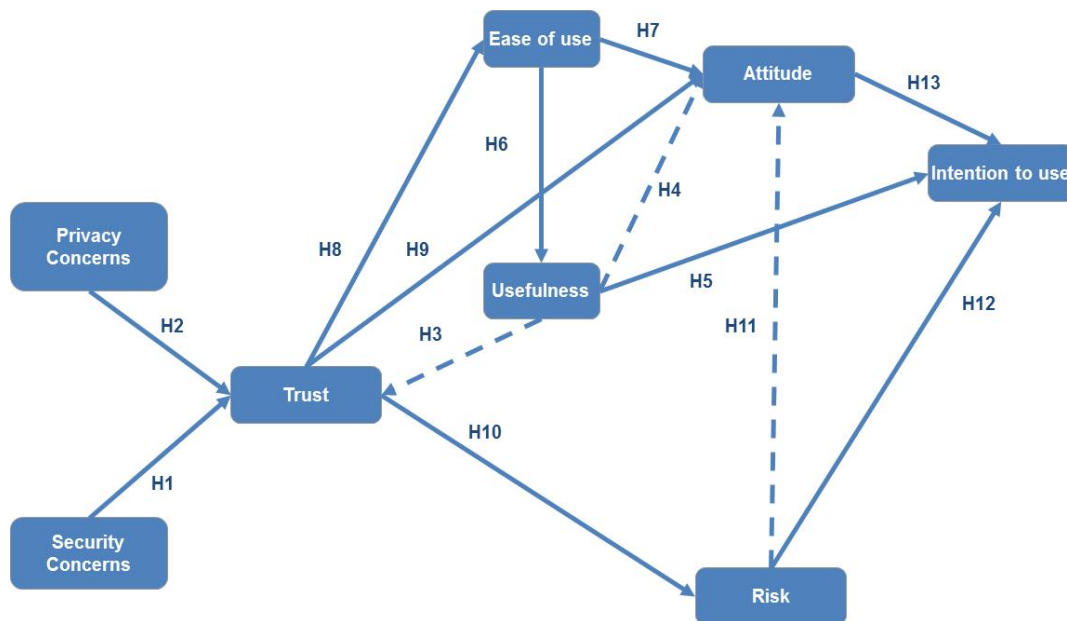


Figure 2: Research model proposed.

4. Research methodology and assessment of the measurement scales

4.1. Research scope and data collection method

The data obtained for this study proceeded from an online survey method. Participation was voluntary, and the data were collected from August 8th to August 21th, 2012. Data collection consisted of mass mailing on the Facebook social network. The reason for concentrating on this population was that these individuals had initial contact with this type of electronic service and therefore represented a defined

basis for comparison when evaluating the characteristics of the service. The total number of valid responses was 154 (see Table 1).

Table 1: Technical specifications and sample characteristics

Population	Population of Spanish potential and actual users of mobile banking; habitual Internet users
Method of sampling	Non-probabilistic sampling, via self-selection by the respondent through massive mailing
Method of data collection	Online survey
Sample size	154 valid cases
Sample error*	7.90%
Date of fieldwork	August 1 st -28 th , 2012

4.2. Development of the measurement scales

The questionnaire used for the survey (see appendix) consisted of closed questions for the constructs, with 5-point Likert scales, and socio-demographic data. This questionnaire included a number of multi-item scales previously developed in the scientific literature. Specifically, we adapted the scales previously used by Korgaonkar et al. (1999) to measure the perceived security concern scale. The privacy concern measure was adapted from the work of de Culnan (1993) and McKnight et al. (2002b). The trust scale came from the scales of Pavlou (2002a - study 1) and the risk scale from Jarvenpaa et al. (2000), McKnight et al. (2002b) and Wakefield and Whitten (2006). The measure of perceived usefulness and ease of use was adapted from the study by Mukherjee et al. (2003) and Venkatesh and Davis (2000). The attitude to use construct was adapted from Shih and Fang (2004) and Herrero et al. (2005). And finally, the intention to use scale was adapted from the Lane's (2003) study.

5. Data analysis and results

5.1. Reliability and validity

To verify the suitability of the measurement scales, the reliability and validity of the scales were analysed by means of both exploratory (SPSS 18.0) and confirmatory (AMOS 20) methods.

A Cronbach’s alpha indicator was first used to measure the reliability of the scales, with 0.7 as the reference value (Nunnally, 1978; Hair et al., 1995). All the variables obtained very good values in the three groups or subsamples ($\beta > 0.7$). The reliability of the scales was also evaluated from a series of indicators drawn from the confirmatory analysis. The standard compound reliability (SCR) and the average variance explained (AVE) exceed 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 (Bollen, 1989; Hair, 1995; Del Barrio and Luque, 2012) (see Table 2).

To successfully achieve satisfaction, it is necessary to analyse its determinants. More exactly, the determinants used in this research and which will be discussed below in relation to electronic banking are: accessibility (Ganguly & Roy, 2011), trust (Chiou, 2004), ease of use and usefulness (Bhattacharjee & Premkumar, 2004, Al-Somali et al., 2009; Jalal et al., 2011).

Table 2: Convergent validity and internal consistency reliability

Scale	Final number of items	Cronbach’s alpha	SCR	AVE
Security concern	3	0.91	0.91	0.63
Privacy concern	3	0.90	0.79	0.62
Usefulness	2	0.73	0.75	0.60
Ease of use	2	0.75	0.74	0.59
Trust	4	0.91	0.87	0.63
Risk	4	0.87	0.88	0.64
Attitude to use	4	0.93	0.93	0.77
Intention to use	2	0.83	0.83	0.72

To test the convergent and divergent validity of the scales, a confirmatory factor analysis (CFA) was performed. In this analysis, the items that contributed least to the explanatory power of the model were eliminated ($R^2 < 0.5$). Convergent validity was evaluated by means of the factor loadings of the indicators.

In our work we demonstrate that the coefficients are significantly different from zero, and that the loadings between latent and observed variables are high in all cases ($\beta > 0.7$). Consequently, we can say that the latent variables adequately explain the observed variables (Bollen, 1989; Hair, 1995).

Regarding 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 (Flavián et al. 2004). Given the weak relationship among the constructs, we can therefore confirm that there are eight constructs in the model proposed.

6. Structural equation model

After evaluating of the measurement scales' reliability and validity, we tested the research hypotheses. For this purpose, a structural equation model (SEM) was developed. Considering the absence of normality in the variables, we decided to use the maximum likelihood (ML) estimation method and the bootstrapping technique (or bootstrap learning samples) for 1,000 consecutive steps or samples, and a significance level of 95%.

In the case of small samples, the ML analysis method is the best suitable option, by opposition to the generalized or weighted least squares methods (West et al., 1995). In the bootstrapping technique, we used the Bollen-Stine's corrected p-value, testing our null hypothesis that states the model is correct. Through re-sampling, this technique allows the correction of the standard error of the constructs. Before evaluating in detail each of the three models, and examining the differences among them, the overall Goodness-of-fit proved to be satisfactory, since the values of the Goodness-of-fit indicators were within the levels recommended in the literature (Bollen, 1986; Bollen, 1989; Muñoz-Leiva, 2008): RMSEA < 0.08, GFI > 0.8, and CFI and IFI > 0.9 (see table 3).

Table 3: Goodness-of-fit indicators in the structural model

Coefficients	RMSA	GFI	CFI	IFI	Bollen-Stine's p-value
Value	0.06	0.83	0.93	0.93	0.008

Table 4: Non- standardized coefficients (β) of the model.

Relationship	β	Error Est.	Critical ratio (t-Student)
H1: Perceived Security \rightarrow Trust	-0.48**	0.07	-5.49
H2: Privacy concerns \rightarrow Trust	-0.11*	0.14	-1.71
H3: Perceived Usefulness \rightarrow Trust	N.S	N.S	N.S
H4: Perceived Usefulness Attitude \rightarrow Intention to Use	N.S	N.S	N.S
H5: Perceived Usefulness \rightarrow Intention to Use	0.12*	0.09	1.61
H6: Ease of Use \rightarrow Perceived Usefulness	0.76**	0.10	6.66
H7: Ease of Use \rightarrow Attitude to the Intended Use	0.27**	0.12	2.27
H8: Trust \rightarrow Ease of Use	0.67**	0.09	7.37
H9: Trust Attitude \rightarrow Intention to Use	0.38**	0.11	3.26
H10: Trust \rightarrow Risk	-0.44**	0.09	-4.78
H11: Risk Attitude \rightarrow Intention to Use	N.S	N.S	N.S
H12: Risk \rightarrow Intention to Use	-0.18**	0.08	-2.63
H13: Attitude toward Intention to Use \rightarrow Intention to Use	0.69**	0.11	7.13

*C.R. extracted from AMOS; * 0.1 of significance; ** 0.05 of significance; N.S.: not significant*

The results obtained (Table 4) are consistent. First, hypothesis H1 (t-Student = -5.49, p-value = 0.00 <0.05), analyze the concern for security in transactions and in the service provider itself, and how it influences the perception of trust in the other party and / or transaction. This relationship is negative, indicating that less concern about the security system enhances trust in the use of banking through mobile devices.

Concerning the second hypothesis, H2, we observed deteriorating trust results from a greater concern for user privacy in transactions (Student's t = -1.71, p-value = 0.08 <0.10). Although this relationship did not show a significant relationship we consider its approximation to significance very relevant given prior discussion.

The results obtained for hypothesis H3 and H4 did not show statistical significance, so we decide to eliminate them from the intermediate steps of final model extraction. In our particular case (mobile banking), perceived usefulness was not a significant influence on either trust or attitude, however this

influence was observed in intention to use (H5), with an almost significant relationship (Student's $t = 1.61$; $p\text{-value} = 0.09 < 0.10$).

Hypotheses H6 and H7 were accepted, thus we can say that the ease of use significantly influences the perceived ease of use of mobile banking (Student's $t = 6.66$, $p\text{-value} = 0.00 < 0.05$) and attitudes toward the mobile system (Student's $t = 2.27$, $p\text{-value} = 0.02 < 0.05$). Thus, higher perceived ease of use of mobile banking improves ease of use perceptions and attitude, and therefore also intentions to use.

Hypotheses H8, H9 and H10 related to trust were all verified. Trust has a strong positive effect on ease of use (Student's $t = 7.37$, $p\text{-value} = 0.00 < 0.05$) and in attitude towards the use of the electronic system ($t\text{-Student} = 3, 26$, $p\text{-value} = 0.00 < 0.05$); as well as negative effect on risk perceptions ($t\text{-Student} = -4.78$, $p\text{-value} = 0.000 < 0.05$).

Hypothesis H11 was removed from the final model in the study, since our first data showed no significant relationship. The results confirmed hypothesis H12 (Student's $t = -2.63$, $p\text{-value} = 0.00 < 0.05$), therefore, we may conclude that risk directly and negatively influences intention to use. In this case we can assume that the higher the perceived risk, the lower the acceptance of mobile banking will be.

Finally, the last hypothesis of this study assesses attitudes toward and intention to use (H13) mobile banking. Here we observed a very strong and positive relationship (Student $t = 7.13$, $p\text{-value} = 0.000 < 0.05$).

The results from the SEM analysis and the data outcome from the different scenarios are shown in Figure 3 and Table 4.

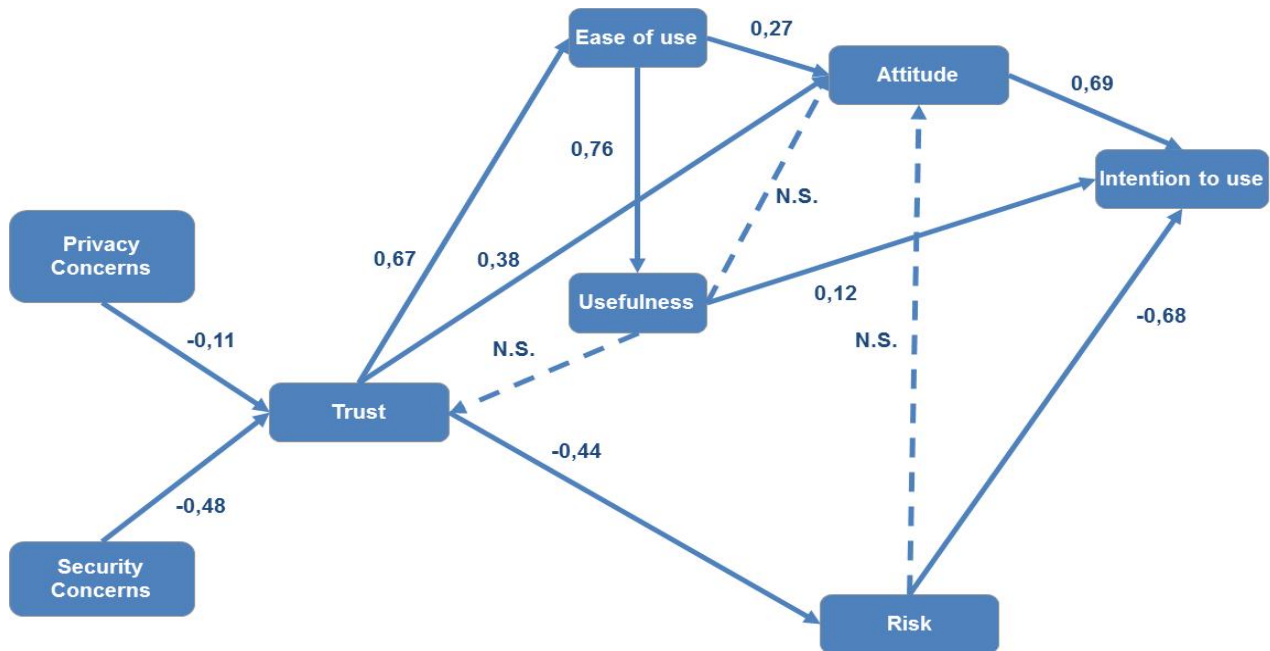


Figure 3: Behavioural models (standardized beta)

Summarizing, here we highlight a high and powerful explanatory model ($R^2 = 66.10\%$) that correlates the adoption of mobile banking, and the way intention of use is determined in the proposed model by attitude ($\beta = 0.69$), perceived risk ($\beta = -0.18$) and the actual usefulness of the service ($\beta = 0.12$). Moreover user trust will be reduced by the lack of perceived security ($\beta = -0.48$) and increased privacy concerns ($\beta = -0.11$). Finally, user desire will be strengthened by user trust ($\beta = 0.67$), which manifests a direct and positive effect on usefulness ($\beta = 0.76$) and attitude ($\beta = 0.27$).

7. Conclusions, Managerial implications and future research

7.1. Final conclusions

The main objective of this study was to analyze financial institutions customers' acceptance of mobile banking. In this work, we used the principles of TAM (Technology Acceptance Model), a theoretical model, to which we added the variables of trust and risk that in theory will be influenced by security and privacy concerns.

First we can conclude that TAM appears as an underlying model in the case of mobile banking, with the existence of strong relationships between constructs. However in our case, when dealing with a group of users relatively accustomed to electronic applications, perceived usefulness loses power in explaining the adoption of the system (compared with previous studies focusing on banking or electronic commerce). Moreover, we conclude that ease of use was an important bearing on the perceived usefulness of mobile banking and in the user's attitude toward using.

As originally thought, concerns about security and privacy are negatively related to trust. According to this, we may affirm that there is an obvious customer concern for privacy and information security systems that decrease the adoption speed of mobile banking systems.

Concerning risk, as expected the results showed that consumers present lower intentions to use mobile banking applications when they associate it to a great risk. Therefore, as with trust, banks need to work on mitigating these beliefs and perceptions, by improving safety and reducing the risk associated to these services.

Finally, attitude toward the use directly influences positive and strongly, the intention to use. This led us to the conclusion that if a customer has a favorable attitude toward mobile banking applications, there will be a high probability of him to make a coherent and consistent behavior toward the acceptance and use of this application. Within this behavior the customer analyzes the privacy, security, reliability, usefulness, ease of use and risk involved in the use of mobile banking application.

7.2. Managerial implications and future research

Presently, virtually all banks have or use online banking as a channel of communication and customer acquisition. The results obtained in this study are very important and interesting to financial institutions that intend to increase their income and customers through the implementation of mobile banking

applications. In this context, entities will have to devote effort and resources to ease concerns about the security of their services in mobile banking application. Furthermore, these entities need to improve the usability perceptions and, mainly, to convey trust in these services, since those major determinants of perceived risk and a favorable attitude toward the system, in turn explain the system adoption.

Finally, we believe that it would be interesting to do a similar research and comparative study applied to a wider population and segmented by age, sex, level of experience with the system, etc. With this we would be able to better understand which candidates should be the direct target of financial institutions to implement the banking applications. Also of great interest, we think that some latent variables could be added to this model, such as risk aversion, download time of application and time management of mobile banking application. Concluding, this study provides a new vision about the consumers' feelings regarding the mobile banking, highlighting fears and acceptance issues, contributing to a future development in this field of exploratory marketing.

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Appendix

Scale	Items	Author
Perceived security	I'm worry about the security of financial transactions made through mobile applications	Korgaonkar et al. (1999)
	I'm worry that my financial information can be shared without my consent by mobile applications	
	I'm uncomfortable giving my credit card data through mobile applications	
	I'm worry about the security of personal information provided by mobile applications	
	When I do any kind of movement in mobile banking, I'm worry that someone else can access without my consent	
	I feel uncomfortable to perform banking transactions through mobile applications	
	For me the use of mobile banking applications would be more attractive if offered guarantees to protect consumers (secure transactions, refund, consumer advocacy, ...)	
Privacy concern	When I transmit personal data by mobile banking applications, I'm not sure of who can catch it	McKnight et al. (2002b)
	When I use mobile banking applications I cannot control the data capture applications from me	
	My data is not safe in mobile banking applications, can be captured by unauthorized persons or organizations	
Trust	I believe that banking applications for e-Mobile keep the promises and commitments made	Pavlou (2002a - study 1)
	The mobile banking applications are legit	
	I rate the applications for mobile banking as honest	
	I think the mobile banking applications are responsible	
Ease of Use	I think mobile banking applications are: Hard to use/ Ease to use	Mukherjee et al. (2003) and Venkatesh and Davis (2000)
	I think mobile banking applications are: High complexity/ Low complexity	
Usefulness	I think mobile banking applications require: Much knowledge for effective use/ Little knowledge to effective use	Mukherjee et al. (2003) and Venkatesh and Davis (2000)
	I think mobile banking applications require: Many new procedures must be mastered for effective use / Few of the new procedures must be mastered for effective use	
Risk	I think other people can find information about my bank online transactions if I make it through mobile applications;	Jarvenpaa et al. (2002), McKnight et al. (2002b) and Wakefield and Whitten (2006)
	There is a high potential for loss of information if I contract Internet banking services through mobile applications;	
	There is a significant risk when engaging the services of Internet banking if I use mobile applications;	
	I consider the hiring of Internet banking service through mobile applications is a risky choice;	
Attitude	Absurd / Intelligent	Shih and Fang (2004) and Herrero et al. (2005)
	I dislike / I Like	
	Boring / Interesting	
	Unpleasant / Pleasant	
Intention to use	The probability of using mobile banking applications in the near future is;	Lane (2003)
	Likelihood to recommend mobile banking applications to a friend is;	