LISBON SCHOOL OF ECONOMICS & MANAGEMENT
UNIVERSIDADE DE LISBOA

MASTER

MARKETING

MASTER´S FINAL WORK

DISSERTATION

INFLUENCING FACTORS OF MOBILE BANKING APPLICATIONS ADOPTION

EDGAR IVÁN GUTIÉRREZ JIMÉNEZ

NOVEMBER - 2020

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ABSTRACT

Mobile services are a new reality that are changing the way companies approach their clients, using technological innovations. The banking sector is not the exception; mobile banking services are changing the bank-client relationship in a way that benefits both the client and the bank.

Some of the advantages that mobile banking provides to the users are a cost reduction for the transactions and the possibility to access the banking account from anywhere at any time from a mobile device. However, despite the advantages that this mobile service brings to the customers, the adoption and usage of mobile banking have not been as popular as expected. For this reason, it is important to understand which factors influence the decision of adopting this banking service.

This dissertation provides new insights into the factors that influence the decision to adopt mobile banking, specifically banking applications. A research model was designed based on the Diffusion of Innovation Theory, where ten factors are being studied (relative advantage, complexity, trialability, compatibility, risk, image, age, education, income, and gender).

A questionnaire was applied to obtain data from two different cultural contexts (Mexico and Portugal). The questionnaire was available online between May and June 2020. The hypotheses were tested using the quantitative data obtained with the questionnaire. It was concluded that different factors of adoption are relevant depending on the country´s context.

In Mexico, relative advantage positively influences the adoption decision of banking applications; complexity and a negative image influence the adoption decision negatively. Also, age, education, and income are relevant variables in the Mexican sample.

In the Portuguese sample is observed that compatibility positively influences the adoption decision of banking applications, while risk influences the decision negatively. Age is also a relevant factor for this sample.

KEYWORDS: Mobile banking; banking applications; innovation adoption; adoption factors.

RESUMO

Os serviços móveis são uma nova realidade que está mudando a forma com que as empresas se aproximam dos seus clientes através da utilização de inovações tecnológicas. O setor bancário não é exceção; os serviços de *mobile banking* estão mudando o relacionamento entre os bancos e seus clientes de uma forma que beneficia às duas partes.

Algumas das vantagens que o *mobile banking* fornece aos usuários são as reduções de custos e a possibilidade de aceder às contas bancárias de qualquer lugar e em qualquer momento a partir de um dispositivo móvel. Apesar de todas as vantagens que este serviço traz para os clientes, a adoção e o uso do *mobile banking* não tem sido tão popular como era de esperar. Por esse motivo, é importante entender quais são os fatores que influenciam a decisão de adoptar este tipo de serviço bancário.

Este estudo contém informação sobre os fatores que influenciam a adoção de aplicações bancárias. Foi desenvolvido um modelo conceitual baseado na Teoria da Difusão de Inovações, onde dez fatores foram estudados (vantagem relativa, complexidade, experimentação, compatibilidade, risco, imagem, idade, educação, renda e sexo).

Foi aplicado um questionário para obter dados de dois contextos diferentes (México e Portugal), este foi disponibilizado online entre os meses de Maio e Junho de 2020. As hipóteses foram testadas usando os dados quantitativos obtidos e foi concluído que diferentes fatores são relevantes dependendo do contexto de cada país.

No México, a vantagem relativa influencia positivamente a decisão de adoptar aplicações bancárias; Já a complexidade e a imagem negativa influenciam negativamente a decisão de adopção. Idade, educação e renda são variáveis relevantes na amostra mexicana.

Em Portugal, a compatibilidade influencia positivamente a decisão de adoptar aplicações bancárias, enquanto o risco influencia a decisão negativamente. A idade também é um fator relevante para esta amostra.

Palavras-Chave: Mobile banking; aplicações bancárias; adopção de inovações; fatores de adoção.

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1. INTRODUCTION

1.1 Contextualization

Electronic banking is integrated by mobile banking and internet banking; the difference between those components is that internet banking is accessed through a computer and mobile banking through a wireless device (Yu, 2012).

The recent advances in wireless technology and the evident insertion of smartphones in the people's daily routine motivated the banking industry to invest big budget on the development of mobile banking systems (Yu, 2012) to provide their customers with innovative options to interact with their accounts.

Internet and mobile technology provide beneficial services to customers. However, these innovations currently face resistance from the customers, which delays or even prevent adoption (Laukkanen, 2016). Especially, the adoption of mobile banking is lower than expected (Yu, 2012). Thus, this research focuses on mobile banking services, specifically on mobile banking applications' adoption.

1.2 Relevance

A study about the factors that influence banking applications adoption is relevant because innovations made on technology usually create high discontinuity (Ram & Sheth, 1989). Identifying causes of product failure is an important challenge because firms currently face high innovation resistance rates that endanger overall competitiveness (Joachim, Spieth, & Heidenreich, 2018). Regarding mobile applications, more research is needed to find the causes of its adoption and usage (Karjaluoto, Aijaz A. Shaikh, Saarijärvi, & Saraniemi, 2019).

Finding the factors that influence the adoption of banking applications bring great value to the marketing theory, it allows to foresight the reaction of consumers towards new products or services (Rogers, 1983) especially on technological innovations.

This need for information leads to the following question: Which factors influence the adoption of mobile banking applications?

This study aspires to discover the most relevant factors that influence the adoption and usage of banking services via mobile applications. Also, to discuss how those factors can be used to prevent mobile banking services failure and increase its rate of adoption.

Academic literature about the factors of innovation adoption already exists. However, most of the studies were performed in developed countries such as Finland (Karjaluoto et al., 2019; Laukkanen, 2016), Ireland (Claudy, Garcia, & O'Driscoll, 2015), and Germany (Joachim et al., 2018). According to Ferreira, Da Rocha and Da Silva (2014), analysing the factors of adoption in developing countries can lead to different results due to cultural and economic differences. For this reason, it is of great importance to collect data from a developing country context and compare the results with a developed country.

This project is going to collect information about two different markets. First, a developed country (Portugal). And second, a developing country (Mexico). The results of both contexts are going to be analysed and discussed to find similarities and differences.

According to the study about internet usage in Mexico, developed by Asociación de Internet MX (2019), from the 82.7 million internet users of the country, only 58% access online banking; therefore, less than 50% of those online banking users accessed through a mobile device (Comscore, 2016). This evidence demonstrates the current underuse of this innovative service in the country, but also it demonstrates its potential.

In Portugal according to Instituto Nacional de Estatística (2018), 52% of the Portuguese population between 16 and 74 years old are managing their bank accounts through internet platforms; the country had a big step forward in comparison to 2017 when it had 42% of the population using internet banking. Nevertheless, according to the same institution, Portugal has a much lower rate of use of the electronic banking services in comparison with the European Union that has an average of more than 60% of the population using the service.

1.3 Paper Structure

The first chapter contextualizes the research. It also shows the relevancy of the topic. In this chapter can be found the research question and main objectives that are going to be studied through this work.

The second chapter defines the most important constructs and variables related to the topic according to relevant literature. Also, the hypotheses to be tested are in this chapter.

In the third chapter is shown the conceptual model of the research; it has a general sum-up of the variables that are going to be analysed through this research.

The fourth chapter establishes a detailed description of the processes and methods used in this study, including the nature of the investigation, the sampling methods, and the process for the data collection. This chapter also explains how the data was prepared for analysis and tested to ensure its reliability and consistency.

The fifth chapter of this study explains how the quantitative data was tested. In this chapter is established which statistical tests were performed on the data to test the variables and obtain the results.

Finally on the sixth chapter are shown the results of the research. These results are compared to the inputs suggested by the relevant literature in the second chapter. In this chapter are also placed the conclusions of the study, the theoretical implications, practical implications, study´s limitations, and the recommendations for future researchers.

2. LITERATURE REVIEW

2.1 Marketing in the Digital Era

During the last few years, technological advances have impacted the way firms and other organizations operate. These innovations have shaped the way business is done around the world. Ungerman and Dˇedková (2019) refer to this new era as Industry 4.0, which is characterized mainly by the automation of some of the processes that were originally performed by humans. This automation leads to higher efficiency in the production processes.

Augmented reality, artificial intelligence, system integration, robotics, communication infrastructure, data storage, and Big Data Analysis are some of the tools that were developed in the industry 4.0 to support the new era of technology (Ungerman & Dˇedková, 2019). Nowadays, companies are constantly dealing with a tremendous flow of information concerning the market; this flow has unknown speed and volume (Hassani, Huang, & Silva, 2018). The tools that were mentioned before help to increase the efficiency while obtaining, processing, and communicating large volumes of information (Rad, Rasoulian, Mirzaei, & Sharifipour, 2017).

Marketing practices are also impacted by the innovations of the digital era. Hassani et al. (2018) state that the development of digital services has increased exponentially the real-time information obtained by the companies. They explain that this information can be used by marketers to improve customer satisfaction, create strategic management, build better customer profiles according to their digital behaviour, and make a more accurate segmentation of the market. By developing these actions, organizations can increase the satisfaction and loyalty of their customers, which is the most important capital of every company (Rad et al., 2017).

Some of the marketing innovations during the digital age include not only the development of the digital marketing but also the use of artificial intelligence, Search Engine Optimization (SEO), conversational marketing, omnipresence, and mobile marketing (Ungerman & Dˇedková, 2019). These modern marketing tools bring numerous benefits to the companies, but also lead to some obstacles, for example, they demand highly specialized employees, costly technology and time-consuming processes (Hassani et al., 2018).

2.2 Electronic Banking

The digital era demands changes and innovations from organizations to remain relevant. The banking sector is not an exception. According to Nazaritehrani and Mashali (2020), Information Technology (IT) is the principal cause of change in the banking sector. To avoid technological obsolescence, banks need to adapt to these changes rapidly by presenting banking services through electronic channels. The banking industry is changing fast pulled by the technological environment (Rad et al.,

2017). For this reason, the banking industry had to adapt and create innovative products and services to offer their customers.

Electronic banking is an innovative way to provide banking services through electronic environments. These digital channels allow customers to perform actions such as opening bank accounts, request credit or debit cards, review account balances, pay bills, transfer money, among other transactions (Rad et al., 2017). The electronic banking channels include innovations such as the Automated Teller Machine (ATM), which allows customers to perform several banking services through an automated telecommunication device that can be found in every location (Sharma, Sharma, & Khan, 2019); Another example is the Point of Sales (POS) terminals, which is an electronic device used for debit and credit card payments at any commercial establishment (Kajuju, 2016); Another electronic channel is the internet banking, where customers can perform transactions through the bank´s website; also, mobile banking is an electronic channel that allows users to access their accounts through a mobile device such as smartphone or tablet via message service (SMS), wireless application protocol (WAP) or mobile applications (Nazaritehrani & Mashali, 2020).

Rad et al. (2017) establish that all electronic banking channels should provide a service that is confidential, untraceable, anonymous, and also ensuring authentication and integrity. They also suggest that without electronic banking services, it would not be possible to perform online commerce.

2.3 Mobile Banking

Mobile banking is an innovation in electronic banking channels. It offers unlimited remote access wherever the user might be (Laukkanen, 2016) with the particularity that the transaction can be executed with a mobile device such as a smartphone or a tablet, which provides high usability, usefulness and personalized experience. Users can access mobile banking through several platforms, such as SMS, mobile internet and mobile applications (Karjaluoto et al., 2019). The mobile banking service is reliable, easy to use, and it allows for fast, accurate and well-formatted information; these characteristics positively influence customer satisfaction which directly impacts the loyalty they have towards their bank (Ghobakhloo & Fathi, 2019).

Ghobakhloo and Fathi (2019) state in their article that the mobile banking services exist since the 1990's when it was first offered via SMS banking. They show that performing a mobile banking transaction can cost fifty times less than a transaction at the bank's branch office and ten times less than an ATM transaction. Mobile banking also benefits the user with the advantage of being able to access their accounts whenever they want (Schierholz & Laukkanen, 2007).

One of the most revolutionary mobile banking channels are the banking applications, which are provided by the banks to install in the clients´ mobile phone or tablet (Ghobakhloo & Fathi, 2019) therefore they can be able to perform several banking transactions (Tam & Oliveira, 2016). In their article Karjaluoto et al. (2019) show that banking applications have revolutionized the banking service by facilitating customers´ access to transactions such as fund transfers, balance inquiries, insurance acquisition, bill payments, alert reception, personal banking advisor communication, information storage, among others. For those benefits, banking applications have achieved big market potential, specifically in developed countries.

2.4 Innovation Adoption and Rejection

The innovations can be defined as the process of creating a new idea which is expected to meet the needs of the potential adopters (Rogers, 1983). The purpose of innovations is to create, adapt and evolve the ways of providing services to customers (Martin, Gustafsson, & Choi, 2016). When a new or an improved product or service is created, an innovation emerges. Constant innovation is an important activity to maintain and increase competitiveness in the market (Hassani et al., 2018).

Ma, Yang and Mourali (2014) write that innovation can be a "really new product" or an "incrementally new product". The degree of alteration in the product or service and the technological innovativeness is known as product newness. Many innovation items can be incremental (Martin et al., 2016); innovation does not always have to be something entirely new.

Rogers (1983) defines the innovation adoption, not as an automatic action, but rather as a process of five phases that takes potential customers from the knowledge of an innovation to the decision to acquire it or not. The first phase is knowledge, where potential adopters are exposed to the existence of the innovation. The second phase is

persuasion; in this stage individuals generate a positive or negative attitude or image regarding the innovation. The third stage is the decision, here is where potential adopters decide if they want to adopt or reject the innovation. The fourth step is the implementation stage, where the individuals utilise the new product or service. The fifth and final stage is confirmation, where potential adopters reinforce or reject the decision to adopt.

Adopters are individuals who accepted the new product or service, contrary to rejecters who do not intend to adopt the innovation (Laukkanen, 2016). Consumers adopt an innovation when they perceive the degree of distinctiveness of the product as useful for them (Ma et al., 2014). Rejecters or non-adopters of the innovation are the potential users that do not consider using the new product or service, or they consider adopting it but finally decide not to (Rogers, 1983).

In the context of mobile banking those considered adopters are individuals who regularly use the service, while rejecters are considered those who have never used the service or have used it in a trial basis and decided not to continue utilizing it.

2.5 Predictors for Adoption and Rejection of an Innovation

This research is based on the Diffusion of Innovation Theory (DOI) written by Rogers (1983), which has the objective to find the factors of innovations that mostly affect the rate of adoption of the new product or service. The theory establishes five attributes for understanding the new product and service rate of adoption: Relative advantage, compatibility, complexity, trialability, and observability. DOI theory emphasizes that it is the potential adopter´s perception of these five attributes that affect the rate of adoption.

DOI theory focuses on the evaluation and decision stages, understanding how the perception of the innovations affects the tendency to adopt (Claudy et al., 2015).

Observability factor will not be studied as it is not relevant for the investigation. Rogers (1983) states that innovations that are based on software, are not usually affected by observation; innovations that have mainly software aspects possess less observability relevance. This work studies a software service innovation (banking applications), thus the decision of leaving this factor out of the model was taken.

Two additional factors were highly mentioned as influential for the adoption of new products and services by the authors in the relevant literature. First, “risk” (Ghobakhloo & Fathi, 2019; Inkinen, Merisalo, & Makkonen, 2018; Karjaluoto et al., 2019; Martin et al., 2016; Rad et al., 2017). And second, “image” (Claudy et al., 2015; Joachim et al., 2018; Laukkanen, 2016; Ram & Sheth, 1989). Thus, these two factors are also being studied in this research as factors for the adoption of banking applications.

Some authors (Anbar & Eker, 2019; Ferreira et al., 2014; Laukkanen, 2016; Mann & Sahni, 2012) suggest that sociodemographic factors of potential customers are important predictors for the adoption of new products and services. For this reason, four sociodemographic factors (gender, age, income, and education) were included for the analysis.

All the factors mentioned before were classified as functional factors, psychological factors or sociodemographic factors.

2.6 Functional Factors

Functional factors are related to the functionality of the product or service. They appeal to the logic of the consumers. These factors are influenced by consumer`s perception of the product or service attributes for their personal needs and operational expectations (Inkinen et al., 2018). Complexity, trialability, and value (or relative advantage) are listed as functional factors (Joachim et al., 2018).

The relative advantage of a new product or service is related to the degree of perception by potential customers as being superior to the previous idea it replaces; it indicates the visible reward or punishment produced by the adoption of the innovation (Rogers, 1983). Relative advantage is related to the consumers' perceived value of the innovation, led by the comparison of the new product with the precursor (Joachim et al., 2018). According to Rogers (1983), the relative advantage might involve aspects like economic profitability, lower cost, increased comfort, savings in time and effort and the immediacy of the reward offered by the innovation.

There are significant effects of the perceived value in the context of internet and mobile banking (Joachim et al., 2018). Laukkanen (2016) states that a better-perceived advantage of mobile banking over other banking options can lead to a higher possibility for consumers to adopt this service. The following hypothesis is proposed:

H1: Perception of relative advantage positively influences banking applications adoption.

Complexity is the perception of difficulty to understand and use certain new products or services (Rogers, 1983). Complexity parallels the concept of ease-of-use (Laukkanen, 2016). Innovations might have incongruences with existing practices or habits in the life of consumers, requiring changes in their routine, thus leading to a long development process (Ram & Sheth, 1989).

In the mobile banking context, the perception of complexity negatively affects its adoption (Rogers, 1983). Laukkanen (2016) states that the complexity of electronic banking services prevents some consumers from adopting them. The following hypothesis is proposed:

H2: Perception of complexity negatively influences to banking applications adoption.

Trialability is the capacity of experimenting with a new product or service before its´ adoption. Rogers (1983) affirms that innovations that can be tried on the instalment plan might be adopted by the potential consumers more rapidly. Also, trialability has more influence on early adopters than on later adopters. Adoption barriers can be broken by offering a trial basis on innovation to potential users (Ram & Sheth, 1989).

The ability to try and get acquainted with mobile banking services might affect positively the adoption of banking applications. The trialability factor is positively related to the rates of adoption (Rogers, 1983). The following hypothesis is proposed:

H3: Trialability of banking applications positive influences its adoption.

2.7 Psychological Factors

Psychological factors arise from the consumers' mental evaluation according to their existing beliefs, appealing to their emotions. Risk (Inkinen et al., 2018), image and compatibility (or tradition) represent psychological factors (Laukkanen, 2016) that influence consumer adoption.

“Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters” (Rogers, 1983, p.223). The compatibility factor is related to the concept of self-congruence which

refers to the fit between the self-concept of the potential consumers and the image of the product or service they are evaluating (Karjaluoto et al., 2019).

Adoption of a new product or service might be affected negatively if it promotes features that are counter to the consumers' values (Rogers, 1983), social norms or traditions (Joachim et al., 2018). Adoption can also be affected by the compatibility factor if the innovation is conflicted with past experiences (Laukkanen, 2016) or previously adopted ideas. Another dimension of compatibility is the perception that the innovation meets the needs of the consumers (Rogers, 1983).

The relevancy of self-congruence has been demonstrated in the adoption of mobile services (Karjaluoto et al., 2019). The compatibility factor is relevant in this context because consumers may perceive mobile banking usage as being different from the way they are used to accessing their banking services. For example, by conflicting the needs of the customers to have personal contact with another human during banking transactions (Laukkanen, 2016). Incompatibility of innovation might block the adoption (Rogers, 1983). The following hypothesis is proposed:

H4: Perception of compatibility positively influences banking applications adoption.

Risk factor appears when potential consumers have the perception that the adoption of a new product or service might have negative consequences. Thus, it affects their confidence and increases uncertainty (Karjaluoto et al., 2019).

The risk factor can be divided into economic risk, functional risk, personal risk, and social risk (Joachim et al., 2018). Ram and Sheth (1989) define these four types of risk as follows: Economic risk is associated to the price of adoption; the perception of economic risk increases when the price of the innovation is higher. The functional risk appears when the potential adopter worries that the innovation might not be fully tested, and therefore the possibility that it will not function correctly exists. Personal (or physical risk) develops when the consumer fears that their person or their property could be damaged. Finally, social risk occurs when adopters feel they could experience social rejection or peer ridicule if they adopt the innovation.

Perceived risk has been the subject of major researches related to technology adoption (Karjaluoto et al., 2019). Risk is an important factor that influences the usage of mobile banking. Some consumers are afraid they might lose internet connection

during a banking transaction, others fear they could make a mistake in their banking process (Laukkanen, 2016), or they are afraid of identity theft or fraud (Joachim et al., 2018). The following hypothesis is proposed:

H5: Perception of risk negatively influences banking applications adoption.

Image factor arises from a negative (or positive) impression of a new product or service associated with a brand, country of origin (Joachim et al., 2018), product category (Laukkanen, 2016) or industry to which it is manufactured (Ram & Sheth, 1989). This associated image can result, for example, from negative (or positive) media coverage. "Image barrier is a perceptual problem that arises out of stereotyped thinking" (Ram & Sheth, 1989, p.9).

Laukkanen (2016) shows that the image factor relates to technology adoption. It refers to the mental state of the potential adopters regarding technology in general. In online banking, consumers can have, for example, the negative image that gadgets and the internet are difficult to use. If they perceive technology as difficult to use, this can create a negative image that will affect the rate of adoption of all technological innovations. The following hypothesis is proposed:

H6: Perception of a bad image negatively influences banking applications adoption.

2.8 Sociodemographic Factors

Skills required to manage the internet vary according to demographic factors (Taipale, 2013). Cultural and socioeconomic differences result in different patterns during the adoption of electronic services, including demographic variables such as age, education, income level and gender (Inkinen et al., 2018).

Ferreira et al. (2014) emphasize the relevance of investigating the moderating effects of demographic factors in the technology context. Studying demographic characteristics can help to understand the adoption behaviour of electronic banking services (Mann & Sahni, 2012). Anbar and Eker (2019) show variables such as gender, age, education, income (among others) as very influential on financial services.

Age is a relevant factor that influences innovation adoption. In the context of technology adoption, younger people are more likely to adopt it than older people

(Taipale, 2013). Younger generations are quicker to adopt electronic services, while the elderly are more reluctant to adopt these changes (Inkinen et al., 2018).

In the adoption of technologic services, younger people are more likely to adopt (Mann & Sahni, 2012). Laukkanen (2016) also shows in his study, that older consumers tend to resist internet and mobile banking services more than young ones. He shows that the odds that younger segments adopt mobile banking are almost twice as much as the odds of older segments. The following hypothesis is proposed:

H7a: Age influences banking applications adoption.

According to Taipale (2013), education is the most powerful predictor for the use of the electronic government; adoption rates become higher with higher levels of education. Education increases peoples' capability to interact with a more technological society. Mann and Sahni (2012) show in their article that post-graduates are the quickest to adopt internet banking and these customers constitute the majority among the adopters. Highly educated segments of the population are more likely to prioritize electronic services (Inkinen et al., 2018). Therefore, education level might influence electronic and mobile banking adopters. The following hypothesis is proposed:

H7b: Education influences banking applications adoption.

According to Inkinen et al. (2018), high-income people are more likely to prioritize the usage of electronic services. Early adopters commonly have higher socioeconomic status than the later adopters (Rogers, 1983).

Laukkanen (2016) reveals that lower incomes negatively correlate with the perceived usefulness of new technological products or services. He also explains that higher incomes can influence the adoption of electronic banking channels. The following hypothesis is proposed:

H7c: Income influences banking applications adoption.

Gender factor affects the usage of electronic services (Inkinen et al., 2018). Mann and Sahni (2012) state that the acceptance level of technology between men and women varies. They show that men make up the majority of users of electronic banking services. Laukkanen (2016) notes that in the electronic service context, gender is one of the most studied demographic factors. He infers that men show predominance among

users of mobile banking and women seem to be more inclined to reject it. The following hypothesis is proposed:

H7d: Gender influences banking applications adoption.

3. RESEARCH MODEL

The proposed model for this research is based on the conceptual model presented in the DOI theory (Rogers, 1983) which establishes five influencing attributes related to the innovation adoption (relative advantage, compatibility, complexity, trialability, and observability). For the model of this research, only four of the original factors are going to be studied. Additionally, risk and image were added to the model. Age, education, income and gender are being analysed to understand the sociodemographic characteristics of the adopters and rejecters.

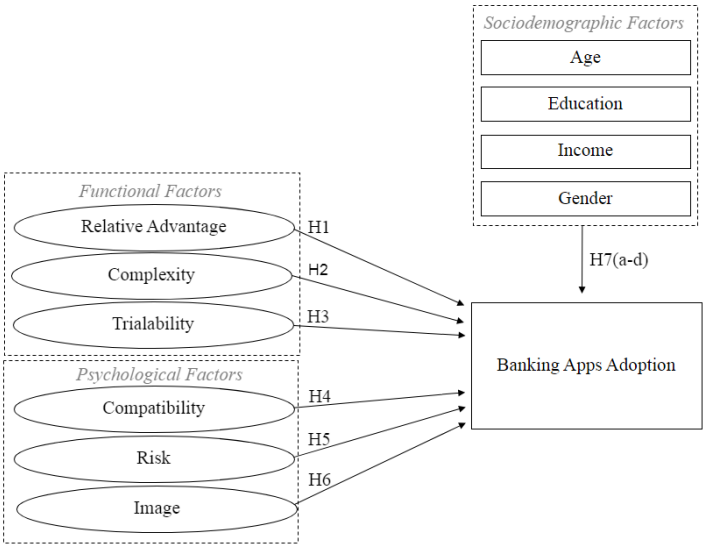

FIGURE 1 – Conceptual model.

The conceptual model (Figure 1) contains as independent variables three functional factors (relative advantage, complexity, and trialability) and three psychological factors (compatibility, risk, and image). Four sociodemographic factors (age, education, income, and gender) are included to know the profile of the customers. These factors are going to be tested in order to analyse the strength of their influence on banking applications adoption, which is the dependent variable.

4. METHODOLOGY

4.1 Nature of the Study

To solve the research problem, a quantitative analysis was developed as it was the best option to collect quantifiable data from a sample of the population of both markets (Mexico and Portugal). Rahman (2017), states that quantitative researches target the studies that can quantify and pattern-specific aspects of social conduct using statistical techniques, and the findings of these studies are commonly generalized to a bigger population. This project followed a deductive approach as the research model was developed after the revision of academic literature followed by the validation of the theory and identification of a causal relationship between the variables (Saunders, Lewis, & Thornhill, 2016). The study´s temporal horizon was cross-sectional.

4.2 Sampling Method and Sample

The sample from the population of both markets (Mexico and Portugal) was selected with a non-probabilistic and convenience method. This method was chosen, as it allows reaching a large number of respondents in a short period; another reason for this selection was the low cost associated with this sample process; and finally, the possibility to distribute the survey in different regions of each country to achieve a miscellaneous group of respondents. The samples are composed of men and women sixteen years and older, who are clients of a banking institution in either Mexico or Portugal.

The questionnaire was distributed online through social media and email platforms, which broke the geographical distance barrier as the research was being developed in Mexico, while the survey was also distributed to a Portuguese sample. However, this sort of sample does not have a number of participants that match with the proportions of the population; thus, cannot be used as a base for any assumption of probability for the elements of the population (Etikan & Bala, 2017).

The sample obtained in Mexico (table I) has a total of 285 respondents composed mainly by people between 26 and 35 years old (41.4%), with a bachelor's degree (63.2%), net monthly income of less than (€400 approximately) 9,000 Mexican pesos (38.6%), and majority women (67%). The members of the sample were divided by users (89.1%) and non-users (10.9%) of banking applications.

TABLE I - Sociodemographic Profile of the Mexican Sample

	Users		Non users		Total	
	N	**%**	**N**	**%**	**N**	**%**
Gender						
Male	87	34.3	7	22.6	94	33.0
Female	167	65.7	24	77.4	191	67.0
Total	**254**	**100.0**	**31**	**100.0**	**285**	**100.0**
Age						
16 to 25	81	31.9	9	29.0	90	31.6
26 to 35	113	44.5	5	16.1	118	41.4
36 to 45	33	13.0	8	25.8	41	14.4
46 or more	27	10.6	9	29.0	36	12.6
Total	**254**	**100.0**	**31**	**100.0**	**285**	**100.0**
Earnings (Mexican pesos)						
$9,000 or less	87	34.3	23	74.2	110	38.6
$9,001 to $18,000	79	31.1	4	12.9	83	29.1
$18,001 to $27,000	62	24.4	2	6.5	64	22.5
$27,001 to $36,000	13	5.1	0	0.0	13	4.6
$36,001 or more	13	5.1	2	6.5	15	5.3
Total	**254**	**100.0**	**31**	**100.0**	**285**	**100.0**
Education						
High school or less	54	21.3	16	51.6	70	24.6
Undergraduate	168	66.1	12	38.7	180	63.2
Masters or PHD	32	12.6	3	9.7	35	12.3
Total	**254**	**100.0**	**31**	**100.0**	**285**	**100.0**

On the other hand, the sample collected in Portugal (table II) has 188 valid responses mainly composed by respondents between 26 and 35 years old (31.9%), with an undergraduate level (47.3%), monthly revenue between €501 and €1,000 (30.9%) and a majority of women (63.8%). The grand majority of respondents are users of banking applications (78.7%) and a smaller number of non-users (21.3%).

TABLE II - Sociodemographic Profile of the Portuguese Sample

	Users		Non users		Total	
	N	**%**	**N**	**%**	**N**	**%**
Gender						
Male	56	37.8	12	30.0	68	36.2
Female	92	62.2	28	70.0	120	63.8
Total	**148**	**100.0**	**40**	**100.0**	**188**	**100.0**
Age						
16 to 25	48	32.4	6	15.0	54	28.7
26 to 35	53	35.8	7	17.5	60	31.9
36 to 45	25	16.9	16	40.0	41	21.8
46 or more	22	14.9	11	27.5	33	17.6
Total	**148**	**100.0**	**40**	**100.0**	**188**	**100.0**
Earnings (euros)						
€500 or less	30	20.3	7	17.5	37	19.7
€501 to €1,000	48	32.4	10	25.0	58	30.9
€1,001 to €1,500	35	23.6	15	37.5	50	26.6
€1,501 to 2,000	19	12.8	2	5.0	21	11.2
€2,001 or more	16	10.8	6	15.0	22	11.7
Total	**148**	**100.0**	**40**	**100.0**	**188**	**100.0**
Education						
High school or less	17	11.5	9	22.5	26	13.8
Undergraduate	72	48.6	17	42.5	89	47.3
Masters or PHD	59	39.9	14	35.0	73	38.8
Total	**148**	**100.0**	**40**	**100.0**	**188**	**100.0**

4.3 Data Collection

The tool used for the collection of quantitative data was the questionnaire (Appendix A). The survey was translated to Portuguese and Spanish so it could be distributed to the samples of Portugal and Mexico. The questionnaire was created on the Qualtrics platform and distributed by social media (mainly Facebook and Instagram), and by

e-mail. These platforms were selected as they provide a fast way of distribution and also a great scope and at low cost.

The survey was selected as the method to analyse the proposed model as it provides the opportunity to collect large amount of data and statistically analyse sub-groups of the respondents and compare their responses and achieve conclusions (Bartram, 2019). The questionnaire included a total of fifteen questions divided into three blocks: The first block had four general questions about the usage of banking services and banking applications. The second block measured the scales of the functional and psychological factors with six questions. Finally, the third block measured the socio-demographic variables with five questions.

Before launching the questionnaire online, there were applied (to the Portuguese version) five pre-tests to native Portuguese speakers; these pre-tests provided few adjudgments for the questionaries' improved clarity. Also, the Spanish version of the survey was submitted to five pre-tests with the help of five different native Spanish speakers, who provided some improvements to the understanding of the questionnaire.

The survey was available online for one month, from May 25th to June 25th of 2020. A total of 446 answers were obtained in Mexico. However, incomplete answers were not included in the analysis, which left 285 valid responses. In Portugal, 273 responses were originally obtained, but after the elimination of the incomplete surveys, 188 responses were analysed.

4.4 Construct Operationalization

In line with prior studies about technology adoption and usage (Inkinen et al., 2018; Claudy et al., 2015), functional and psychological factors of adoption were measured with a five-point Likert scale, from strongly disagree (1), to strongly agree (5).

The constructs of relative advantage and complexity were measured with the adaptation of the scale developed by Venkatesh, Morris, Davis, and Davis (2003). Trialability and complexity were measured with the scale developed by Van Ittersum and Feinberg (2010). Finally, risk and image were measured with the adaptation of the scale designed by Laukkanen and Kiviniemi (2010).

Sociodemographic factors were characterized by questions about age, gender, income, occupation, and education using nominal and ordinal scales.

4.5 Preparation and data Analysis

This subchapter will explain all the previous analysis as well as results obtained by those analyses.

Each item of the constructs was assigned with a particular code to facilitate the analysis (Appendix B). To better evaluate the impact of sociodemographic factors, the variables age, income, and education were re-coded. Also, the scale measuring the complexity construct was inverted to make it match with the concept of the variable.

4.5.1 Principal Components Analysis

The first step was to obtain the results of the Principal Component Analysis (PCA) to identify the latent principal components that are going to forge each of the six functional and psychological variables (constructs). The results of the PCA are shown in Appendix C.

First, the variability of the data and the lack of extreme outliers in the Mexican sample were observed with the analysis of boxplots. The Kaiser-Meyer-Olkin statistic was performed, which results ($p= 0.000$; $KMO= 0.885$) indicated meritorious adequacy among the correlations between the factors (Mooi & Sarstedt, 2011). Bartlett's test results (χ^2 (171) =2 939.365; $p<0.001$) confirmed the PCA´s overall good adequacy. There were six components extracted, each one corresponding to each construct. These components explained 75.16% of the variance. The relative advantage was the factor that explained the largest percentage of the variance. Also, all indicators showed communalities >= 0.5; therefore, all of them were kept for future analysis.

In the Portuguese sample there were no outliers observed. The results for Bartlette´s test (χ^2 (171) = 2818.623; $p<0.001$) confirmed the PCA´s overall good adequacy. And Kaiser-Meyer-Olkin Statistic ($p= .000$; $KMO= .900$) showed marvelous adequacy among the correlations between the factors of the PCA (Mooi & Sarstedt, 2011). Here were extracted six factors (each one corresponding to each construct) that explained 81.01% of the total variance. Also, all the indicators showed communalities >= 0.5.

However, it was realized that the loadings presented by item CX4 were lower than 0.5. For this reason, the PCA was performed again without the CX4 item. In this second execution, the results obtained on the Bartlette´s test (χ^2 (153) = 2563.020; p<0.001) also confirmed the PCA´s overall good adequacy. Kaiser-Meyer-Olkin Statistic (p= 0.000; KMO= 0.890) showed meritorious adequacy among the correlations between the factors of the PCA (Mooi & Sarstedt, 2011). Also, six components were extracted, each one corresponding to each construct. They explained 81.39% of the total variance. The relative advantage explained a higher percentage of the variance compared to the other factors.

4.5.2 Reliability and Internal Consistency

Based on the components identified in the PCA, six indices were built calculating the mean of the items of each factor. To ensure the internal consistency and reliability of each index, Cronbach´s Alpha coefficient was calculated (Appendix D). All the indices reached high values of consistency ($\alpha >= 0.7$) (Field, 2013; Mooi & Sarstedt, 2011). It was not necessary to exclude any of the items of the indices to obtain the highest Cronbach´s Alpha possible. The correlation between the items of each scale showed satisfactory values (>=0.5), reinforcing the internal consistency of each component.

4.5.3 Bivariate Data Analysis

To observe the differences in the mean between users and non-users of banking applications, frequency, and descriptive statistics were used. After the application of the test Kolmogorov-Smirnov test (Appendix E), it was realized that none of the variables followed a normal distribution (p<0.05) in neither the Mexican sample nor the Portuguese sample (including the sociodemographic variables). For this reason the non-parametric test Mann-Whitney was selected in order to analyse the significance of the differences of the means between the users and non-users of banking applications.

The association degree between the constructs was evaluated using the correlation test Rho of Spearman that determined the level of linear association between the quantitative variables. Additionally, the correlation test R of Pearson was applied to the variables to compare the results of both tests and prove that both results were similar.

The non-parametric test of Kruskal-Wallis was applied to measure the relation between the adoption of banking applications and the sociodemographic variables.

Logistic regression was used to test the impact of the functional and psychological variables on the usage of banking applications. Using as independent variables the six multi-item scales (relative advantage, complexity, trialability, compatibility, image, and risk) and as dependent variable the usage/ adoption of banking applications. Logistic regression was selected as it is a robust analysis of the constructs in a context where the normality of the variables is not reached, allowing to analyse the significance of each of the independent variables in the research model.

5. Data Analysis

This chapter shows the results of the statistical analysis of the data. This analysis is going to determine if the proposed research model is successful in answering the research question.

5.1 Mean Differences

Some observations can be made based on the difference of the descriptive statistics between users and non-users of banking applications of the Mexican sample (table III). Users of the mobile service perceive a higher relative advantage, higher compatibility, and more capability to try the service (trialability). On the other hand, users perceive less complexity, less negative image of the banking applications, and slightly less perception of risk.

Table III- Descriptive Statistics for Mexican Sample

	Users of banking apps		**Nonusers of banking apps**	
	Mean (N=254)	**Standard deviation**	**Mean (N=31)**	**Standard deviation**
Relative Advantage	4.4	0.55	3.6	0.94
Complexity	1.8	0.61	2.7	0.96
Trialability	3.5	1.02	3.2	0.97
Compatibility	4.2	0.68	3.5	0.89
Image	2.1	0.88	2.8	0.96
Risk	3.9	0.84	4.1	0.73

Scale: 1= totally disagree; 5= totally agree

Descriptive statistics on the Portuguese sample also show differences between users and non-users of banking applications (table IV). Users of the financial applications

show a higher perception of relative advantage, compatibility, and trialability. Also, they show a lower perception of complexity, negative image, and risk related to banking application usage.

TABLE IV - DESCRIPTIVE STATISTICS FOR PORTUGUESE SAMPLE

	Users of banking apps		Nonusers of banking apps	
	Mean (N=148)	**Standard deviation**	**Mean (N=40)**	**Standard deviation**
Relative Advantage	4.3	0.65	3.3	1.15
Complexity	1.9	0.61	2.8	0.98
Trialability	3.3	0.86	2.9	0.93
Compatibility	4.2	0.66	3.0	1.02
Image	1.9	0.75	2.6	1.03
Risk	3.1	0.84	3.7	0.97

Scale: 1= totally disagree; 5= totally agree

According to the Kolmogorov-Smirnov test, neither the Mexican sample, nor the Portuguese sample showed a normal distribution in any of the variables (Appendix E). For this reason, Mann-Withney (M-U) test was applied to determine the differences between the means of users and non-users of each variable.

In the Mexican sample (table V), was observed that in the variables trialability ($p= 0.111$) and risk ($p= 0.588$), the means differences between users and non-users of banking applications were not statistically significant. However, significance value of $p<0.05$ was observed in the relative advantage, complexity, compatibility, and image factors. Then, the means differences of these factors were statistically significant. It can be noted that non-users of banking applications perceive a higher complexity and also a higher negative image of the banking applications. On the other hand, non-users perceive a lower relative advantage and lower compatibility with this banking service.

TABLE V - MANN-WITHNEY TEST FOR THE MEXICAN SAMPLE

		Mean Rank	
	Mann-Whitney U	**Users of banking apps (N=254)**	**Nonusers of banking apps (N=31)**
Relative Advantage	1524.5*	152.50	65.18
Complexity	1486.5*	133.35	222.05
Trialability	3259.50	145.67	121.15
Compatibility	1984*	150.69	80.00
Image	2349.5*	139.75	194.21
Risk	3705.00	142.09	150.48

* p<0, 05

In the Portuguese sample (table VI), it can be noted that all the variables had a significance value of p<0.05. Then, it can be assumed that the differences in the means of the six factors were statistically significant. Non-users of banking applications perceive a lower relative advantage, lower compatibility, and lower trialability of the service. However, they have a higher perception of a negative image, risk, and complexity about banking applications.

TABLE VI - MANN-WITHNEY TEST FOR THE PORTUGUESE SAMPLE

		Mean Rank	
	Mann-Whitney U	**Users of banking apps (N=148)**	**Nonusers of banking apps (N=40)**
Relative Advantage	1321.00*	105.57	53.53
Complexity	1299.50*	83.28	136.01
Trialability	2318.00*	98.84	78.45
Compatibility	956.50*	108.02	44.49
Image	1731.50*	86.2	125.21
Risk	1940.00*	87.61	120

* p<0, 05

5.2 Correlation

To know the level of correlation between the variables, the simple non-linear correlation Spearman's Rho test was applied (Appendix F), as it can be a non-parametric

alternative to Pearson's r correlation test that can be used with variables that are not following a normal distribution.

According to Field (2013), absolute values of correlation between 0.1 and 0.29 indicate a weak correlation, absolute values between 0.3 and 0.49 suggest a moderate effect of the correlation, and absolute values between 0.5 and 1 imply a strong correlation.

In Mexico, statistically significant correlations ($p<0.05$) were found between most of the variables. First, the results showed a strong negative correlation between relative advantage and complexity. Also, complexity and compatibility showed a strong negative correlation. A strong positive correlation was obtained between compatibility and relative advantage. A moderate negative correlation was observed between complexity and trialability, and also between image and compatibility variables. On the other hand, a moderate positive correlation was reached between complexity and image, and also among trialability and compatibility. A weak negative correlation was found between relative advantage and image. Finally, a weak positive correlation was obtained between relative advantage and trialability, and also between image and risk.

The correlation between the variable risk together with relative advantage, complexity, trialability, and compatibility was almost null. Thus, those correlations were not significant ($p>0.05$). The correlation between trialability and image was also so close to zero therefore it was not considered significant ($p>0.05$).

In Portugal, significant correlations ($p<0.05$) were found between the majority of the variables. Results showed a strong negative correlation between relative advantage and complexity, and also among complexity and compatibility variables. A strong positive correlation was observed between relative advantage and compatibility. A moderate negative correlation was found between three pairs of variables. First, between complexity and trialability. Second, between complexity and image. And third, between compatibility and image. Then, a moderate positive correlation was reached between trialability and compatibility. A weak negative correlation was obtained within relative advantage and image variables. And finally, a weak positive correlation was observed between relative advantage and trialability, and also between image and risk.

In the pairs of variables trialability and image, and also risk together with relative advantage, complexity, trialability, and compatibility, the level of correlation of the variables were so close to zero that it was not considered significant ($p>0.05$).

Pearson's r correlation test was applied to the variables only to confirm that the correlation values were similar with a level of significance of $p<0.05$.

5.3 Logistic Regression

5.3.1 Functional and Psychological Factors

One logistic regression was performed for the sample in Mexico and another was performed to the sample in Portugal.

In Mexico (table VII), it was observed that relative advantage, complexity, trialability, compatibility, image, and risk explained 34.6% of the variation of the adoption of banking applications (Nagelkerke R Square test). However, trialability, compatibility, and risk were not significant (p>0, 05). Hosmer and Lemeshow test (p=0.972) showed that the model is suitable, and classify correctly 89.8% of the individuals by their banking application adoption decision. Specifically, it classified 19.4% of non-users and 98.4 of banking applications users.

TABLE VII - LOGISTIC REGRESSION FOR THE MEXICAN SAMPLE

	B	**Wald**	**Significance**
Constant	3.883	1.590	0.207
Relative Advantage	1.230	8.520	0.004
Complexity	-0.975	5.433	0.020
Trialability	-0.150	0.301	0.583
Compatibility	-0.210	0.245	0.620
Image	-0.574	4.980	0.026
Risk	-0.462	1.707	0.191

Dependent variable: Usage of banking applications (Yes, no)
Nagelkerke R Square = 0.346
Hosmer and Lemeshow = 0.972

According to Wald statistic, the relative advantage is the variable with the positive highest impact on the adoption decision. Complexity also shows a considerable influence on the adoption decision of the customers, but it has a negative influence. A

negative image around the banking applications also is shown as an influential factor for their adoption, with a negative impact.

In the Mexican sample, the hypothesis H1 is accepted as the relative advantage is a positive influencer for the banking application adoption (B=1.230; p=0.004). H2 is also accepted as complexity negatively influences the adoption of banking applications (B=-0.975; p=0.020). H6 is accepted as the perception of a negative image around banking applications negatively impacts their adoption (B=-0.574; p=0.026). On the other hand, hypotheses H3, H4, and H5 are rejected as trialability (B=-0.150; p=0.583), compatibility (B=-0.210; p=0.620), and risk (B=-0.462; p=0.191) are not significant constructs on this sample. Thus, they are not influencers for the adoption of banking applications.

In Portugal (table VIII), it was observed that relative advantage, complexity, trialability, compatibility, image, and risk explained 51.2% of the variation of the adoption of banking applications (Nagelkerke R Square test). However, relative advantage, complexity, trialability, and image were not significant (p>0, 05). Hosmer and Lemeshow test (p= 0.358) showed good suitability of the model, which correctly classifies 84% of the individuals by their decision to adopt banking applications. Specifically, 42.5% of non-users and 95.3% of users of banking applications.

TABLE VIII - LOGISTIC REGRESSION FOR THE PORTUGUESE SAMPLE

	B	**Wald**	**Significance**
Constant	-0.209	0.005	0.944
Relative Advantage	-0.318	0.534	0.465
Complexity	0.406	0.681	0.409
Trialability	0.119	0.125	0.724
Compatibility	1.182	10.461	0.001
Image	0.289	0.982	0.322
Risk	-1.615	12.461	0.000

Dependent variable: Usage of banking applications (Yes, no)
Nagelkerke R Square = 0.512
Hosmer and Lemeshow = 0.358

Wald statistic showed the variable risk as being the most influential variable of the model, which had a negative influence on the adoption of banking applications.

Followed by the compatibility variable, which influences positively the adoption decision of the mobile service.

In the Portuguese sample, is accepted the hypothesis H4, which states that the compatibility factor influences positively the adoption of banking applications (B=1.182; p=0.001). H5 is also accepted as risk is shown to negatively influence the banking applications adoption (B=-1.615; p=0.000). Hypothesis H1, H2, H3, and H6 are rejected as relative advantage (B=-0.318; p=0.465), complexity (B=0.406; p=0.409), trialability (B=0.119; p=0.724), and image (B=0.289; p=0.322) factors do not show statistical significance. Thus, they are not influencers for the adoption of banking applications in this sample.

5.4 Sociodemographic Factors

Kolmogorov-Smirnof test was applied to the sociodemographic variables (age, gender, education, and income), and it was found that neither in Mexico nor in Portugal followed a normal distribution (Appendix E). For this reason, the non-parametric Kruskal-Wallis test was applied to these variables on both samples.

In Mexico (table IX), it can be observed that the differences between users and non-users of banking applications are statistically significant ($p<0.05$) for the variables: Age, education, and income. Then, the users of banking applications in Mexico are mainly people between 26 and 35 years old, with undergraduate education and income between $27,001 and $36,000 Mexican pesos (approximately €1,200 and €1,600). Gender did not show significance in the difference between users and non-users (p=0.193). For this reason, the mean rank difference is not relevant to the adoption of banking applications.

In the Mexican sample, are accepted hypotheses H7a, H7b, and H7c, as age, education, and income are shown as influential factors for the decision of banking application adoption. However, hypothesis H7d is rejected as gender is not an influential factor for the banking application adoption.

TABLE IX - KRUSKALL WALLIS TEST FOR THE MEXICAN SAMPLE

	Users and Non users of banking applications		
	Significance	**N**	**Mean Rank**
Age	**0.001**		
16-25		90	144.25
26-35		118	**152.46**
36-45		41	130.70
46 or more		36	122.88
Gender	**0.193**		
Male		94	147.89
Female		191	140.59
Education	**0.001**		
High shcool or less		70	125.93
Undergraduate		180	**149.00**
Masters or PHD		35	146.29
Income (Mexican Pesos)	**0.000**		
Until $9,000		110	128.70
$9,001 to $18,000		83	151.63
$18,001 to $ $27,000		64	154.05
$27,001 to $36,000		13	**158.50**
$36,001 or more		15	139.50

In Portugal (table X), the mean rank difference of only one sociodemographic factor was found significant ($p<0.05$). This factor is age. For this reason, it can be implied that banking application users in Portugal are mainly people between 36 and 45 years old. However, Gender, education, and income did not show a statistically significant mean rank differences ($p>0.05$). Thus, those variables are not relevant to the adoption of banking applications in the Portuguese sample.

In the Portuguese sample, hypothesis H7a is accepted as age is shown as an influential factor for the banking application adoption. However, hypotheses H7b, H7c, and H7d are rejected as education, income, and gender are not influencers for banking application adoption.

TABLE X - KRUSKALL WALLIS TEST FOR THE PORTUGUESE SAMPLE

	Users and Non users of banking applications		
	Significance	**N**	**Mean Rank**
Age	**0.001**		
16-25		54	84.94
26-35		60	85.47
36-45		41	**111.18**
46 or more		33	105.83
Gender	**0.361**		
Male		68	91.09
Female		120	96.43
Education	**0.203**		
High shcool or less		26	107.04
Undergraduate		89	92.46
Masters or PHD		73	92.53
Income (euros)	**0.274**		
€500 or less		37	92.28
€501 to €1,000		58	90.71
€1,001 to €1,500		50	102.70
€1,5001 to 2,000		21	83.45
€2,001 or more		22	100.14

6. DISCUSSION AND CONCLUSIONS

Banking applications are one of the most recent banking services; they have become an important tool for users of the banking sector. However, the adoption and usage of this particular service shows a slower rate of adoption compared to other banking services such as internet banking. Rates of adoption also vary depending on the country that is being targeted.

The objective of this research was to find the main factors that influence the adoption of banking applications. For this purpose, two countries were selected for analysis; first, a developed country: Portugal; and second, a developing country: Mexico. Samples of both countries were evaluated to find the main factors that

influence each market to adopt banking applications. The results were compared to discover any differences between both counties.

There were developed hypotheses about the functional and psychological factors, as well as the sociodemographic variables. These hypotheses were established based on the information found on the literature review about the influence of the relative advantage, complexity, trialability, compatibility, risk, image, age, education, income, and gender on the adoption and usage of banking applications.

6.1 Relative Advantage and Banking Application Usage

In Mexico, the relative advantage is shown as a highly influential factor for the adoption of banking applications. It can be observed that users of banking applications perceive a higher relative advantage than non-users of the mobile service. This result was expected, as Laukkanen (2016) suggested that a higher perception of the advantages of mobile banking services could drive to a better chance of adoption.

In Portugal, the relative advantage does not show a significant influence on the adoption decision of banking applications. This means that the Portuguese sample does not find the perception of mobile banking being better than other banking services as an important factor for deciding to adopt the banking applications. This result is the opposite of what it was expected, as the relevant literature suggested that there could be significant effects on the perception of advantages or value of mobile banking (Joachim et al., 2018; Laukkanen, 2016).

It can be observed that this factor (relative advantage) has a positive influence on the adoption of banking applications in the Mexican sample. However, it does not show relevance to the adoption of mobile banking in the Portuguese sample. This could be because Portugal is a developed country that is more accustomed to using technological products and services daily than a developing country such as Mexico. Therefore, the perception of the advantages that bring a technological service like banking applications to people´s lives in Portugal is not as relevant as the perception that exists in a developing country like Mexico, where the technological products and services are used less.

6.2 Complexity and Banking Application Usage

In line with the theoretical framework (Rogers, 1983; Laukkanen, 2016), the variable complexity showed a negative influence on the banking application adoption in the Mexican sample. This means that if potential customers perceive the mobile service as being difficult to use, it can negatively affect the decision of adopting banking applications.

On the other hand, complexity does not show relevance to the adoption of banking applications in the Portuguese sample. As Ram and Sheth (1989) explain, the innovative product can lead to obstacles with the lifestyle habits of potential customers; this situation could affect its adoption. However, the Portuguese sample does not present these obstacles. Thus, they do not find the complexity factor as a relevant factor for adopting banking applications. In other words, Portuguese respondents do not find banking application usage as difficult. For this reason, they do not perceive the complexity as an adoption barrier.

As mentioned before, the Portuguese population might be more used to the usage of technological products than the Mexican population. This could explain the different results in both samples. For the Portuguese sample, the usage complexity of mobile banking is not relevant for the adoption decision because they do not perceive the service as being difficult to use. On the other hand, the Mexican sample needs to understand how to use the service before adopting it because they might not be as familiar with these sorts of technological products and services as the Portuguese sample.

6.3 Trialability and Banking Application Usage

Neither the Mexican sample nor the Portuguese sample presented relevance on the trialability factor. This means that none of the samples perceived the ability to try the benefits of the banking applications before definitely adopting them as an important factor for the decision to adopt it. This result differs from the statement of Rogers (1983) that suggests that the ability to try the banking applications can positively affect the intention of adopting them.

The reason for the irrelevance of the trialability factor on both Mexican and Portuguese samples could be because users and non-users of banking applications have

a similar perception of trialability. The differences obtained in the perceived trialability between users and non-users of banking applications were almost null. Then, it can be assumed that this factor does not have a big impact on the positive perception of the banking sector's customers.

6.4 Compatibility and Banking Application Usage

In the Mexican sample, the compatibility factor does not show relevance. This means that for the respondents in Mexico, the perception of compatibility between the usage of the banking applications and their lifestyle is not an influential factor. This result differs from the theoretical framework where it was established that the fit of the self-concept with the image of the new product (banking applications) could influence the adoption decision of the innovation (Karjaluoto et al., 2019).

In the Portuguese sample, it is observed a positive influence of the perception of compatibility between the banking applications and the respondents' lives. This means that if the Portuguese respondents have a positive perception of compatibility, they are more likely to adopt banking applications. This result agrees with Laukkanen (2016) that establishes that a lack of compatibility between banking applications and the lifestyle of the customers would harm the adoption of the mobile service.

6.5 Risk and Banking Application Usage

For the Mexican sample, the risk is not a relevant factor for the adoption decision of banking applications. This outcome differs from what it was expected based on Karjaluoto et al. (2019) who state that the perception that a negative consequence might happen after the adoption of a new product or service increases uncertainty and negatively affects the confidence of potential adopters around the innovation.

In the Portuguese sample, the risk was the most influential factor for banking application adoption. It is noted that in the Portuguese sample, the perception of risk around the adoption of mobile banking negatively affects the decision of usage of this service. This outcome matches with Laukkanen (2016), who suggests that the perception of risk might negatively influence mobile banking adoption.

As was mentioned before, the risk was an influential factor in the Portuguese sample, and it was a non-influential factor in the Mexican sample. A possible reason for

this difference is that in Mexico, the respondents are younger than in Portugal. This could influence the perception of risk when using technological products or services, as the younger generations have a higher interaction with technology products and services in their daily life than the older generations; therefore, younger people might not have the idea that the usage of banking applications is risky.

6.6 Image and Banking Application Usage

Laukkanen (2016) suggests that a negative image affects the adoption of technological innovations. The outcome of the Mexican sample agrees with the previous statement, as it shows that a negative image around the banking applications negatively affects its adoption decision. This means that in the Mexican sample, customers that have a negative impression of an innovation (Joachim et al., 2018) have fewer chances of adopting it.

In the Portuguese sample, the image did not show relevance for the adoption decision of banking applications. This means that Portuguese respondents do not find it important if the image around the banking applications is not great; because it would not be a factor for them not to use them.

6.7 Age and Banking Application Usage

Age is an influential factor in both Mexican and Portuguese sample. This means that there is a particular age group that has a better adoption rate than the others. According to the relevant literature, younger people are more likely to adopt technological products and services than the older ones (Mann & Sahni, 2012; Taipale, 2013; Inkinen et al., 2018).

In the Mexican sample, the age group that has a higher rate of adoption of banking applications is the respondents between 26 and 35 years old, which is one of the youngest age groups of the sample. However, there is one youngest group (between 16 and 25 years old) on the sample that was the second-highest group of adopters. This means that in the Mexican sample, the younger respondents are the ones with a higher rate of adoption of banking applications, which agrees with the authors mentioned before.

On the other hand, in the Portuguese sample, the most relevant age group is the one between 36 and 45 years old, followed by the respondents older than 46 years old. This means that in this sample, older customers are more likely to adopt banking applications. These results differ from Laukkanen (2016), who establishes that older segments of the population are more likely to resist the adoption of internet banking services.

This difference in the results between the Mexican and the Portuguese sample can be related to the age differences of the respondents of the questionnaire of both countries. As in Portugal, almost 40% of the respondents are older than 36 years old. And the Mexican sample has less than 27% of respondents with this same age group.

6.8 Education and Banking Application Usage

The Mexican sample shows that the respondents with one of the highest education levels: Undergraduates are more likely to adopt banking applications. This agrees with the relevant literature that establishes that the most educated segments of the population prefer the usage of electronic services (Inkinen et al., 2018).

In the Portuguese sample, education did not show relevance for the adoption of banking applications. This might be because, in this developed country, the usage of electronic services is more present in all levels of education.

6.9 Income and Banking Application Usage

The income variable had a big relevance on the Mexican sample, showing that the respondents that have net monthly earnings between 27,001 and 36,000 Mexican pesos (approximately €1,200 and €1,600) are the ones who have a higher rate of adoption of banking applications. This group of respondents is one of the highest-earning groups in the sample. Therefore it correlates with Inkinen et al. (2018), who suggest that electronic services are more likely to be adopted by people with a high income. The result also agrees with Laukkanen (2016), who establishes that higher incomes can influence the adoption of digital banking channels.

In the Portuguese sample, neither the low-income groups nor the high-income groups showed a bigger preference for adopting banking applications. This means that for this sample, the income of the customers is not a relevant factor for the adoption of

the banking service; therefore, respondents of all income levels are equally likely to adopt banking applications.

6.10 Gender and Banking Application Usage

According to Inkinen et al. (2018), gender is an influential factor for electronic services adoption. According to Mann and Sahni (2012), the adoption of electronic services is primarily composed of men. These contributions do not agree with the results of this research. Gender was not a relevant factor for the adoption of banking applications of neither the Mexican nor the Portuguese samples. This means that for these samples, both men and women can be equally likely to adopt this electronic service.

6.11 Theoretical and Practical Implications

The findings of this study reduce the risk of failure of technological innovations on products and services by establishing several factors that are relevant for the potential customers when they are deciding whether or not adopting the innovations.

The results of this study show some of the causes of adoption and usage of banking applications in two different cultural contexts: Mexico and Portugal. Therefore the findings could be applied to future marketing strategies in both developing countries and developed countries, depending on the needs of each particular marketing campaign.

For the results obtained in Mexico, it can be concluded that adopters of banking applications find the relative advantage of the service very important; this means that customers value when the innovation has a noticeable benefit compared to other available options. They also value the usage simplicity of the product or service; therefore, the complexity of usage can be an adoption barrier. A positive image around the new product or service is also highly valued by the adopters; for this reason is important to focus on the perception that people have about aspects such as brand, country of origin, industry, product category, among others.

According to the results of the Mexican sample, most of the adopters of banking applications are people between 26 and 35 years old, with an undergraduate degree and monthly earnings between 27,001 and 36,000 Mexican pesos (approximately €1,200

and €1,600). This information can be used by the managers of the organization to decide on future marketing campaigns.

The results obtained in Portugal suggest that the adopters of banking applications value the perception of compatibility of the product or service with their way of living. Low-risk perception is also highly valued by the adopters; this means that the higher the risk perception, the less likely they are to adopt the innovation. Finally, it can be noted that the users of this technological service are mainly people between 36 and 45 years old. This information might help decision making for future marketing campaigns.

6.12 Limitations of the Study

This study presented some limitations. First, it adopted a convenience sample; therefore, it was not representative of the population, which made it impossible to make generalized conclusions. Second, the questionnaire was distributed by internet platforms. Therefore, all the respondents have knowledge about the internet and its services, leaving the segment of the population that does not ordinarily use the internet out of the samples. The inclusion of this segment of the population on the final sample would have given a different magnitude to the results. Third, the research was performed with a quantitative analysis. However, a complementary qualitative analysis could have brought new insights into the results. Finally, only ten factors (or variables) were included in the research model; the addition of more factors would have brought a bigger understanding of the customers' decision to adopt or reject the banking applications.

6.13 Recommendations for Future Studies

Taking into consideration the results and the limitations of this study, some recommendations are made for future researchers on this topic. First, it is recommended to create a stratified sample using other channels to apply the questionnaire to have a representative sample of the population, which also would provide the possibility of making generalized conclusions. The second recommendation is to approach the study with qualitative methods to obtain more detailed insights about the opinions of the users and non-users of banking applications. Finally, it is recommended to amplify the number of studied factors; this could bring to futures researchers a more specific outlook about the reasons that customers have for adopting or rejecting banking applications.

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APPENDIX A - QUESTIONNAIRE

This survey questionnaire aims to collect data on the usage of banking applications by customers of banking institutions. This, with the purpose collecting data for a Marketing Master thesis at ISEG School, Lisbon University. Your participation is very important to complete this project.

Responses are going to be anonymous and confidential.

We appreciate your collaboration.

1. Are you a customer of a banking institution in Mexico/Portugal?

   ○ Yes ○ No (go to the end of the survey)

2. Do you access your bank account through your computer?

○ Never ○ Almost never ○ Occasionally ○ Almost every day ○ Every day

3. Do you access your bank account through your mobile device?

○ Never ○ Almost never ○ Occasionally ○ Almost every day ○ Every day

4. Do you access your bank account through banking applications?

   ○ Yes ○ No

Banking applications are a service provided by banking institutions, which allows their clients to manage multiple financial transactions remotely using a mobile device (cell phone or tablet).

Please rate the following statements according to your perception of the usage of mobile banking applications.

5. Select the most appropriate option for each statement using the following scale 1= Totally disagree; 2= Disagree; 3= Neither agree nor disagree; 4= Agree; 5= Totally agree.

	1	2	3	4	5
Using banking applications enables me to accomplish tasks faster.					
Using a banking application improves the quality of the banking service.					
Using banking applications enhances the effectiveness of the banking service.					
Using banking applications increases the productivity.					

Using banking applications makes banking services easier.					

6. Select the most appropriate option for each statement using the following scale: 1= Totally disagree; 2= Disagree; 3= Neither agree nor disagree; 4= Agree; 5= Totally agree.

	1	2	3	4	5
My interaction with banking applications is clear and understandable.					
I believe that it is easy to get banking applications to do what I want it to do.					
Overall, I believe that banking applications are easy to use.					
Learning to operate banking applications is easy for me.					

7. Select the most appropriate option for each statement using the following scale 1= Totally disagree; 2= Disagree; 3= Neither agree nor disagree; 4= Agree; 5= Totally agree.

	1	2	3	4	5
I can use banking applications on a trial basis to see what they can do.					
It is easy to try out banking applications without a big commitment.					

8. Select the most appropriate option for each statement using the following scale 1= Totally disagree; 2= Disagree; 3= Neither agree nor disagree; 4= Agree; 5= Totally agree.

	1	2	3	4	5
Using banking applications is compatible with all aspects of my life/work.					
I think that using banking applications fits well with the way I like to live/work.					
Using banking applications fits into my life/work style.					

9. Select the most appropriate option for each statement using the following scale 1= Totally disagree; 2= Disagree; 3= Neither agree nor disagree; 4= Agree; 5= Totally agree.

	1	2	3	4	5
I fear that while I am using banking applications, the connection will be lost.					
I fear that while I am using a banking application, I might tap out the information of the bill wrongly.					
I fear that the list of PIN codes may be lost and end up in the wrong hands.					

10. Select the most appropriate option for each statement using the following scale 1= Totally disagree; 2= Disagree; 3= Neither agree nor disagree; 4= Agree; 5= Totally agree.

	1	2	3	4	5
In my opinion, new technology is often too complicated to be useful.					
I have an image that banking applications are difficult to use.					

11. How old are you? _____
12. What is your gender?
    - Male
    - Female
13. What is your level of completed schooling?
    - Primary school
    - Secondary school
    - High school
    - Undergraduate
    - Master´s
    - Doctoral degree
14. What is your occupation?
    - Student
    - Student and worker
    - Self-employed worker
    - Employee
    - Retired
    - Stay home
    - Other
15. What is your net monthly income?
    - Up to € 500
    - € 501 - €100
    - €1 001 - €1 500
    - €1 501 - €2 000
    - €2 001 or more

Thank you for your cooperation.

APPENDIX B - ITEM CODIFICATION

Variable	Code	Item
Relative Advantage	RA1	Using banking applications enables me to accomplish tasks faster.
	RA2	Using banking applications improves the quality of the banking service.
	RA3	Using banking applications enhances the effectiveness of the banking service.
	RA4	Using banking applications increases the productivity.
	RA5	Using banking applications makes banking services easier.
Complexity	CX1	My interaction with banking applications is clear and understandable.
	CX2	I believe that it is easy to get banking applications to do what I want it to do.
	CX3	Overall, I believe that banking applications are easy to use.
	CX4	Learning to operate banking applications is easy for me.
Trialability	TR1	I can use banking applications on a trial basis to see what they can do.
	TR2	It is easy to try out banking applications without a big commitment.
Compatibility	CP1	Using banking applications is compatible with all aspects of my life/work.
	CP2	I think that using banking applications fits well with the way I like to live/work.
	CP3	Using banking applications fits into my life/work style.
Image	IM1	In my opinion, new technology is often too complicated to be useful.
	IM2	I have an image that banking applications are difficult to use.
Risk	RK1	I fear that while I am using banking applications, the connection will be lost.
	RK2	I fear that while I am using a banking application, I might tap out the information of the bill wrongly.
	RK3	I fear that the list of PIN codes may be lost and end up in the wrong hands.

APPENDIX C - PRINCIPAL COMPONENTS ANALYSIS

Mexican Sample

	Principal Components						
Indicators	**RA**	**CX**	**CP**	**RK**	**TR**	**IM**	**Communalities**
RA3	0.837						0.757
RA2	0.815						0.764
RA5	0.695						0.702
RA4	0.694						0.651
RA1	0.652						0.618
CX3		0.824					0.834
CX1		0.781					0.781
CX2		0.742					0.716
CX4		0.719					0.733
CP2			0.825				0.864
CP3			0.812				0.849
CP1			0.738				0.802
RK1				0.801			0.665
RK3				0.794			0.629
RK2				0.768			0.669
TR2					0.862		0.812
TR1					0.859		0.802
IM1						0.878	0.820
IM2						0.876	0.815
% of variance explained	17.55%	16.48%	13.00%	10.16%	9.06%	8.93%	

Extraction Method: Principal Components Analysis

Rotation Method: Varimax

Portuguese Sample

Principal Components - Portuguese Sample							
Indicators	**RA**	**CP**	**RK**	**IM**	**TR**	**CX**	**Communalities**
RA3	0.877						0.841
RA4	0.838						0.756
RA5	0.835						0.827
RA1	0.826						0.791
RA2	0.825						0.810
CP3		0.756					0.919
CP1		0.749					0.879
CP2		0.722					0.904
RK2			0.825				0.762
RK1			0.805				0.749
RK3			0.767				0.791
IM1				0.888			0.864
IM2				0.867			0.856
TR1					0.880		0.848
TR2					0.876		0.824
CX1						0.575	0.781
CX2						0.527	0.708
CX3						0.504	0.739
% of variance explained	29.19%	13.45%	11.15%	10.16%	10.14%	7.31%	

Extraction Method: Principal Components Analysis

Rotation Method: Varimax

APPENDIX D - SYNTHETIC INDEX (CRONBACH'S ALPHA)

Mexican Sample

Dimension	Item	Mean	Standard Deviation	Correlation	Cronbach´s Alpha
Relative Advantage	RA1	4.41	0.811	0.789	0.872
	RA2	4.16	0.873	0.835	
	RA3	4.25	0.799	0.830	
	RA4	4.28	0.804	0.798	
	RA5	4.39	0.736	0.819	
Complexity	CX1	1.95	0.818	0.888	0.896
	CX2	1.98	0.816	0.849	
	CX3	1.90	0.839	0.909	
	CX4	1.78	0.816	0.846	
Trialability	TR1	3.41	1.112	0.899	0.770
	TR2	3.43	1.147	0.905	
Compatibility	CP1	4.05	0.825	0.897	0.899
	CP2	4.14	0.813	0.926	
	CP3	4.18	0.775	0.914	
Image	IM1	2.16	0.962	0.897	0.781
	IM2	2.22	1.058	0.915	
Risk	RK1	3.74	1.114	0.816	0.704
	RK2	4.06	0.948	0.759	
	RK3	4.08	1.058	0.803	

Scale: 1= totally disagree; 5= totally agree.

Portuguese Sample

Dimention	Item	Mean	Standard Deviation	Correlation	Cronbach´s Alpha
Relative Advantage	RA1	4.22	0.987	0.812	0.934
	RA2	3.99	0.976	0.820	
	RA3	4.01	0.978	0.854	
	RA4	3.93	1.042	0.785	
	RA5	4.19	0.944	0.853	
Complexity	CX1	2.06	0.857	0.748	0.853
	CX2	2.16	0.875	0.711	
	CX3	2.11	0.950	0.720	
Trialability	TR1	3.31	0.976	0.669	0.802
	TR2	3.18	0.973	0.669	
Compatibility	CP1	3.84	0.942	0.881	0.954
	CP2	3.94	0.899	0.905	
	CP3	3.96	0.916	0.926	
Image	IM1	1.90	0.908	0.707	0.827
	IM2	2.10	0.973	0.707	
Risk	RK1	2.85	1.089	0.590	0.742
	RK2	3.39	1.091	0.580	
	RK3	3.45	1.115	0.697	

Scale: 1= totally disagree; 5= totally agree

APPENDIX E - KOLMOGOROV-SMIRNOV TEST

Mexican Sample

Kolmogorov-Smirnov Test	
Factor	**Significance**
Relative Advantage	0.000
Complexity	0.000
Trialability	0.000
Compatibility	0.000
Image	0.000
Risk	0.000
Age	0.000
Gender	0.000
Education	0.000
Income	0.000

Portuguese Sample

Kolmogorov-Smirnov Test	
Factor	**Significance**
Relative Advantage	0.000
Complexity	0.000
Trialability	0.000
Compatibility	0.000
Image	0.000
Risk	0.001
Age	0.000
Gender	0.000
Education	0.000
Income	0.000

APPENDIX F - CORRELATION

Mexican Sample

	Spearman´s Rho (N=285)					
	Relative Advantage	**Complexity**	**Trialability**	**Compatibility**	**Image**	**Risk**
Relative Advantage						
Complexity	-0.556*					
Trialability	0.227*	-0.337*				
Compatibility	0.591*	-0.613*	0.342*			
Image	-0.254*	0.370*	-0.053	-0.339*		
Risk	-0.03	0.045	0.017	-0.066	0.222*	

*p<0.05; N=285

Portuguese Sample

	Spearman´s Rho (N=188)					
	Relative advantage	**Complexity**	**Trialability**	**Compatibility**	**Image**	**Risk**
Relative Advantage						
Complexity	-0.628*					
Trialability	0.258*	-0.345*				
Compatibility	0.670*	-0.705*	0.312*			
Image	-0.285*	-0.421*	-0.181	-0.404*		
Risk	-0.130	0.155	-0.022	-0.089	0.289*	

*p<0.05; N=188