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How digital payment apps may contribute to the adoption of e-commerce among Brazilians: A study on the barriers and motivations for adoption.

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Abstract

With the growth of the e-commerce industry in Brazil, companies have started to invest in new technologies in order to create more user-friendly interfaces. The COVID-19 pandemic has boosted the digital payment industry, and more and more, new consumers are attracted by the e-wallet conveniences every day. This study tests the concept of e-wallets applications contributing to the adoption of e-commerce among Brazilians. In this sense, the barriers and motivations of the present business were studied. Data was collected and 275 valid responses obtained. The Spearman's Correlation and Logit Regression was performed. The first one to measure correlations between variables and the second one to study the causality effects between the dependent and independent variables. Thus, being able to validate hypothesis. Findings suggest that the intention to transact has a significant correlation with perceived usefulness, perceived ease of use and trust, meanwhile, trust has significant correlation with perceived risk of e-wallets. However, regression tests reveal perceived ease of use and usefulness as the only significant motivations that influence the effects on users´ future intentions. Moreover the study support the potential contribution of e wallet to the adoption of e-commerce among Brazilians pointing out usefulness and easiness as the key elements to be worked out by managers.

Keywords: e-commerce; Brazil; e-wallets; payment methods; intention to transact; perceived ease of use; perceived usefulness; trust; perceived risk of e-wallets.

Sumário Executivo

Com o crescimento da indústria de e-commerce no Brasil, empresas começaram a investir em novas tecnologias com o objetivo de criar interfaces mais simples de serem usadas. A pandemia do COVID-19 impulsionou a indústria do pagamento digital e mais consumidores foram atraídos pela conveniência das carteiras digitais. Este estudo testa o conceito de carteiras digitais contribuírem para adoção do e-commerce entre brasileiros. Assim, percebe-se que há barreiras e motivações presentes nesse negócio que está sendo estudado. A base de dados foi coletada e 275 respostas válidas foram obtidas. Os resultados foram analisados usando o teste de Correlação de Spearman para identificar a relação entre duas variáveis, seguido do teste de Regressão Logística para validar as hipóteses. Os resultados sugerem que a intenção de transacionar tem correlação significativa como percepção de utilidade, percepção de facilidade de uso, e confiança. E a percepção de risco das carteiras digitais tem uma correlação positiva com a confiança. Entretanto, a regressão mostra que percepção de utilidade e percepção de facilidade de uso são os únicos motores motivacionais que influenciam o uso futuro do aplicativo. Além disso, esse estudo acredita que as carteiras digitais apresentam uma potencial contribuição para a adoção do e-commerce dentre os brasileiros, devido a percepção de facilidade e utilidade do aplicativo.

Palavras chave: e-commerce; Brasil; carteiras digitais; intenção de transacionar; percepção de utilidade; percepção de facilidade de uso; confiança; percepção de risco das carteiras digitais.

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1 INTRODUCTION

Brazil is known as a developing country, and has reached a population of 211 million habitants in 2020 (Agência IBGE Notícias), with 130 million having internet access and using it every day (Jet, 2019). Despite the political and economic crisis Brazilians are known as consumerists people. Thus the country may be considered to have a great potential in the industry.

According to different studies, the internet has become almost a necessity for individuals (Corbitt, Thanasankit, & Yi, 2003). Online channels have been growing in the world over time. With the pandemic in 2020, online services increased drastically around the globe. The COVID-19 pandemic has completely changed the consumers' usual routine and consumptions habits around the world (Deloitte,2020). In addition to that, the pandemic has had an impact in B2B and B2C businesses. Talking more specifically about Brazil, e-commerce increased more than 100% with the pandemic (Desidério, 2020)

With the increase of e-commerce in the country, some companies realized an existing gap in this sector in Brazil, which was the payment methods offered by this industry. Nowadays, the main online payment method is credit card, but the biggest online stores also offer "boleto" as an option. In English, "boleto" can be translated as an invoice issued by online stores. This payment method, however, is not always seen as a good option for online shoppers, since many people do not actually pay the "boletos", they start generating debts with the stores. Which means, people receive the product and do not pay the invoices. In fact, this type of payment is not convenient for the final customers in terms of convenience either, since it requires people to go to the bank in order to pay the "boleto" in cash. Normally, when people want to buy online, they are looking for simplicity and time saving alternatives. In this sense, this option goes against the fundamentals of e-commerce: simplicity.

In many countries (mostly lower development countries), credit cards are not common and the main reason is related to infrastructure (e.g.: no internet access) and trust issues (Aljifri, Pons, & Collins, 2003). According to a study made by Epoca Negócios in 2019, approximately 45 million people in Brazil do not have any bank account, and consequently, no credit card. These people can only purchase in online stores which offer "boleto" as a payment method. In addition to that, there are contextual impediments that prevent this part of the population from buying online, among them are: lack of online access, lack of knowledge (education), no access to banking services (Molla & Licker, 2005).

Thus, this is considered a significant barrier for the online businesses in Brazil, since most of the stores ask for a credit card number to proceed with a purchase. The main reason why so many people do not have any bank account is either because they do not have a fixed address to provide to the bank, or do not want to pay the fees charged by the banks, or sometimes people have their name in Serasa (which means they have a bad credit) and are not able to open a bank account.

Some companies are trying to overcome this gap by creating solutions that can enable people to have easier access to online shopping. The goal is to give consumers more options when buying online.

In order to promote online shopping, different payment apps were created. Companies such as Ame Digital and PicPay are growing with time and are gaining an important space in the market. Both companies are known as e-wallets. 61% of Brazilians use e-wallets nowadays (Furlan, 2019). It consists in an application that allows customers to make online transactions and is used as a payment method in online and physical stores. The objective of e-wallets is to facilitate the experience of the online shoppers. Therefore, the aim of the present study is to understand how digital payment apps may contribute to the adoption of e-commerce among Brazilians. To understand this correlation, the barriers and motivations of online purchase will be studied.

The research questions below were thought to understand the correlation between the barriers and motivations of purchasing online and consequently how it may affect the e-commerce in Brazil:

RQ 1) What are the motivations and barriers for the adoption of digital payment methods in Brazil?
RQ 2) What is the effect of perceived ease of use, usefulness, trust and perceived risk of using e-wallets?

The present study is divided in five parts, which are: introduction, literature review, methodology, results and analysis, and conclusion, limitations, and future research. In the literature review the e-wallets are explained, the motivations towards the usage of the application and an adapted version of the Technology Acceptance Model was applied to the e-wallets in the e-commerce. In the methodology a quantitative study is proposed with an online questionnaire targeted at Brazilians familiar with e-commerce. In the results, the data is first

validated for its measures, then the hypothesis are inspected. In the conclusion the main findings are that customers perceive the applications as easy to use and as a facilitator.

2 LITERATURE REVIEW

2.1 E-commerce in Brazil

Online commerce emerged in the USA in the 90's. Since then, several businesses have started to enter electronic commerce. Some years later, around the year of 2000, online commerce arrived in Brazil (Torenzani, 2008). From then on, the e-commerce has exponentially grown in the country.

The e-commerce revenue achieved R$ 0,5 billion in 2001 (74 million euros. After six years, the revenue increased 43% achieving R$ 6,3 billion (around 940 million euros) (Torenzani, 2008), from then on, electronic commerce has experienced a growth of more than 1000% in a small period of time. The revenue generated from this business kept growing in the country, increasing 7,6% from 2017 to 2018, achieving R$ 61,2 billion (around 9 billion Euros) and in the following year profits expanded 22,7%, reaching R$ 75,1 billion (around 11 billion Euros ("e-commerce brasileiro", n.d.).

Around 134 million Brazilians have internet access nowadays and use it daily (Brigatto, 2020). In February 2020, 52,1% of the consumers who bought online were ("e-commerce brasileiro", n.d.). However, an interesting aspect is that, even though women tend to buy more than men, they spend less. The explanation is that the amount spent per purchase by women was of R$ 371,70 (55 Euros) and by men R$ 473,60 (70 Euros). In addition to that, around 80% of the consumers that use the internet to purchase products/services are between 16 to 50 years old ("e-commerce brasileiro", n.d.) Most of the e-commerce users (66,2%) are from the Southern region of Brazil, which can be easily explained, since it is where Rio de Janeiro and São Paulo are located, the two most important metropolises in the country ("e-commerce brasileiro", n.d.).

E-commerce has a huge potential in the country. With the COVID-19 pandemic in 2020, people were obliged to stay at home and all the physical stores closed in almost all cities. This episode made e-commerce increase exponentially. In addition to that, with this drastic scenario, several online stores emerged in the country. E-commerce has experienced an increase of 400% per month of new stores selling online during the pandemic (Isto é, 2021), and pre-existing online stores started to focus all their attention on this niche of business.

2.2 Digital wallets Background

The electronic wallet (e-wallets) is considered an electronic money payment instrument (Sahut, 2008). Sahut stated that a digital wallet *"is a smart card with a microprocessor whose memory is credited with purchasing power stored in a float account that has previously been deposited in a specialized company (Bank or e-money issuing company)"* (Sahut, 2008, p. 720). The objective of e-wallets is the simple usage. Users need to scan a QR code provided by the e-commerce or physical store by simply using their smartphones. Additionally, they are not obliged to have a bank account when creating an account in this type of application.

There are many advantages in this type of payment, such as safe transactions, intuitive design, extensive way of use, and fast services (Sahut, 2008). Despite the positive aspects, e-wallets have not experienced a rapid growth around the globe. As stated by Sahut (2008), this can be explained since *"both the general public and retailers are reluctant to adopt e-wallets in two-sided markets where the cards are in direct competition with cash which they are supposed to be replacing*" (Sahut, 2008, p.720). In addition to that, this application is still unknown to a large part of the population, and people are still unsure about how reliable this payment method really is.

2.2.1 Digital wallets in Brazil

There are around 600 digital wallets in Brazil. (Brigatto, 2020). However, there are four main players in the market which are the following: Ame Digital, MercadoPago, PayPal and PicPay. It is known that almost 61% of the population use e-wallets in Brazil nowadays in the online and offline market. (Furlan, 2019).

Digital wallets allow Brazilians to make not only online but also offline purchases. The application users are not obliged to register a credit card to create an account, enabling this business to reach a larger range of customers. While navigating in the application, users may find different functionalities that enable them to put funds in the APP, make bank transfers, make medical appointments, purchase in online partners, and more. These applications aim to become a "Super App", considering their ability to concentrate different functionalities. Moreover, digital wallets applications provide a user-friendly interface. There are also different ways to put money in the account such as: bank transfer, going to a point of sale (such as Lojas

Americanas for the Ame Digital users), through credit card or via “boleto”. Therefore, this type of application can be considered a type of “bank account”, since people can add money and pay for products or services using their smartphone in different places. During the pandemic, it became quite common going to a supermarket and paying the bill with the application.

E-wallets are useful and convenient for their users. More importantly, it allows users that do not have a bank account to create an account in the application and transfer money to it, allowing those people to have access to different services, which they were not able to reach previously, such as online shopping. It is important to mention that these companies focus on customers that know how to use the internet and have access to it.

During the pandemic in 2020, the Brazilian government decided to help unemployed citizens with an amount of R$600 per month (88 Euros). Through negotiation with the government, Ame Digital and PicPay made it possible for users to add this emergency help fund directly to their e-wallet. Thus, these applications attracted a large number of users from different social classes.

As mentioned before there are four main players in the digital payment industry. However, the focus of the present study will be Ame Digital and PicPay, both e-wallets are competitors, and neither of them require a credit card in order to create and account in the APP, which attracts more customers.

2.2.2 Ame Digital

Ame Digital is a well-known digital wallet in Brazil. It emerged from B2W, the biggest e-commerce company in the country. Established in 2018, the company is growing fast. This platform offers several advantages to its customers. As a marketing strategy, Ame Digital, offers “cashback” deals, which means that people will receive a refund in their e-wallets, a pre-determined amount for specific purchases if they pay with the application. For instance, users are able to receive 5% off a television price if they use the Ame Digital App to purchase it. This is a partnership made between the company and e-commerce with the goal to attract more buyers.

It is simple to become a member in Ame Digital. Customers just need to fill in their personal information such as: CPF, which is the Brazilian abbreviation for, “National Tax Roll for Individuals". In addition to that, the individuals should inform their email and date of birth. The

advantage of this application is that individuals do not need to add any bank details or credit card numbers.

The application has different constructs and can be used in different ways. Customers have several options on how they will put money into the Ame Account (appendice 1 illustrates the options). Customers can make a bank transfer, use a credit card, add money via "boleto" or go to a partner physical store, called Lojas Americanas, to feed their account with money. In addition to that, users have the benefit to transfer money from its Ame Digital account to an account from another user of the application, and by doing so, this application can be considered as a facilitator for people who do not have a bank account.

Furthermore, users have the possibility to ask for loans, ask for a debit card from Ame Digital, pay bills and make phone recharge (appendice 2 illustrates some functionalities). Besides all this, customers are also able to browse in the application and discover other features, such as: donate for NGO's, make online purchases in e-commerce (such as Lojas Americanas, Submarino), purchase event tickets and more.

2.2.3 PicPay:

PicPay is similar to the previous e-wallet. The application does not ask for a credit card, nor bank details. The information required are the personal ones such as CPF, date of birth and others.

PicPay has been present in the market since 2012, therefore being more mature than Ame Digital. Through PicPay, customers can put money in through "boleto" and bank transfer (appendice 3). In addition to that, the APP allows members to pay bills. One advantage offered by PicPay is that people can divide their bills in monthly installments, instead of paying the entire amount at once.

In addition to that, people can use the application in physical stores, where the seller will present a QR code that the user will scan and add the amount in order to conclude the payment. Customers can also use the application to make digital payments. Stores that accept Ame Digital or PicPay will have this information provided in the payment method (appendice 4). The user will click on the payment with a digital wallet, and the customer will finish the purchase with one click.

2.3 Technology Acceptance Model (TAM): adaptation to e-commerce

2.3.1 Technology Acceptance Model overview

The growth of the internet use in the world and, consequently, of e-commerce, has led various researchers to study the general topic of e-commerce by using the Technology Acceptance Model (Hsiao & Yang, 2011). This model has been used in different studies to understand how consumers could better accept this type of technology. As stated by Sahut, this model "is an adaptation of the theory of reasoned action proposed by Ajzen and Fishbein". (Sahut, 2008).

Developed by Davis in 1986, its first version is known as a research model to explain the acceptance of new technologies. Among different theories, the TAM can be considered the most influential and valid model when describing an individual's acceptance towards a technology (Hsiao & Yang, 2011). The TAM is commonly used to explain the acceptance of an information system. Figure 1 shows the original version of the TAM model, which describes that two particular perceptions are important to the acceptance of a technology: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU and PEOU are the core of this model (Gefen, Karahanna, & Straub, 2003). These two perceptions affect the individual's intention to use a certain technology (Hsiao & Yang, 2011). One of the main advantages of this model is adaptability, since it can be used in different contexts (Sahut, 2008).

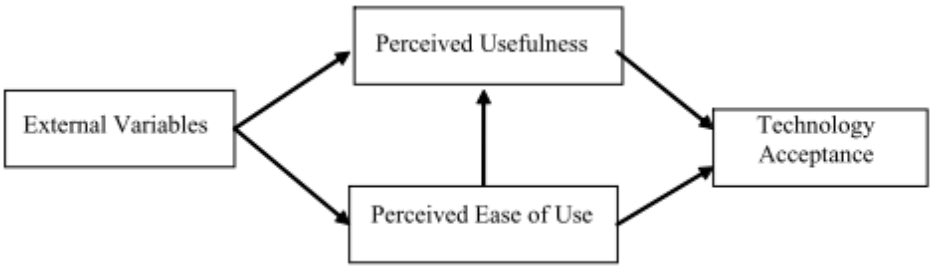

Figure 1: Technology Acceptance Model (adapted from Sahut 2008)

In figure 2, it is possible to observe an extended version of the TAM, which is composed of different features (Sahut, 2008). First, there are external variables (such as trust and risk) which affect the perceived usefulness (PU) and the perceived ease of use (PEOU) of a certain technology. Perceived usefulness is about people understanding that the technology studied is

useful for them. On the other hand, perceived ease of use is related to the easiness of a technology usage, making customers feel confident by using it (Sahut, 2008). These two will influence the attitude toward the use of this new technology, which will have an impact on the behavioral intention of the user, meaning that it will create a general impression related to this new technology. Finally, the last figure will lead to the end point of the model the "actual system use", the point all new technology wants to achieve to make the users able to use it (Sahut, 2008).

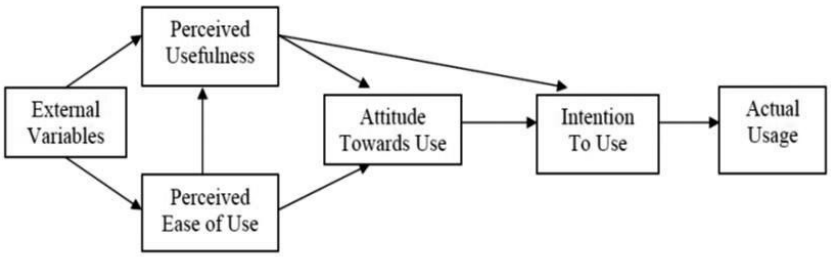

Figure 2: Modified version of Technology Acceptance Model (Lai, 2017)

It is important to mention that there are some limitations to this model, such as assuming that people have rational actions and plan their behavior. People are not completely rational when talking about their decision making and behavior. In addition to that, the TAM does not explain how to make technology easy to use or useful.

2.3.2 Technology Acceptance Model applied to e-commerce

As mentioned previously, the Technology Acceptance Model has been used and validated by different researchers who have proven that this theoretical foundation is suitable when studying the adoption of e-commerce (Cho & Sagynoy, 2015). When analyzing the setup of a new technology, it is possible to conclude that it is a long and difficult process in which network externalities are important (Sahut, 2008). For instance, the number of people using this new type of technology means a lot. The more users, the more trustful the technology will seem to be (Sahut, 2008).

Even though TAM fits in different contexts, its original version does not capture the most important aspects when trying to understand the acceptance of e-commerce. Therefore, Pavlou

proposed an updated version of the model to comprehend the acceptance of individuals on e-commerce by adding some external variables (Pavlou, 2003).

Attracting and retaining loyal customers is not easy when considering e-commerce (Gefen, Karahanna, & Straub, 2003). Therefore, some aspects are highly important when talking about acceptance of this technology. Taking into consideration the customer journey in the online environment, it is possible to assume that customers will firstly choose what they want to buy, make price comparison, and gather information. Secondly, they will provide personal information to continue with the purchase. Finally, customers will provide payment information such as credit card number and address to finally finish the process and buy the product or service required (Pavlou, 2003). Therefore, all interactions between customers and stores are made through the internet, with no personal contact, which can explain the difficulty of attracting new customers to this type of business (Gefen, Karahanna, & Straub, 2003).

Thus, in order to pass through all this process and understand how users accept e-commerce, it is important to add to perceived usefulness and easiness of use other variables which are especially relevant in the context of e-commerce, namely: trust on electronic commerce in general, perceived risk associated to transactions and transaction intentions (Pavlou, 2003). These constructs will be further explained and supported in the following paragraphs.

2.4 Proposition of theoretical model: Barriers and motivations of online purchases

When it comes to the intention to transact, it is possible to make a link with the two variables present on the TAM (perceived usefulness and perceived ease of use). This can be explained since the intention to transact is directly related to technology. Perceived usefulness directly influences customer's intention (Pavlou, 2003). Therefore, if customers believe the system is easy to use and that it will be useful for them, they will go until the final step and finish the transaction. Thus, this suggests that both variables contribute to consumer acceptance of e-commerce (Pavlou, 2003). In addition to that, Pavlou states "on-line transactions have certain unique dimensions, such as (a) the extensive use of technology for transactions, (b) the distant and impersonal nature of the on-line environment, and (c) the implicit uncertainty of using open technological infrastructures for transactions" (Pavlou, 2003). In this sense, the following hypotheses are proposed:

H1) *Consumers 'perceived usefulness towards digital wallets has a significant impact on their intention to transact using the digital payment method.*

H2) *Consumers perceived ease of use concerning digital wallets is positively related to their intention to transact using this payment method.*

Overall, there are different barriers and motivations related to online commerce. Both aspects may vary according to the country you are in. For instance, consumers that come from an individualistic culture (such as: USA, Germany and others) are more likely to use the internet to purchase online (Zhou, Dai, Zhang, 2007).

Technical infrastructure, education, information security, governmental and social topics, risk, banking and transaction systems, trust, delivery, lack of good communication and more can be considered factors that affect e-commerce in general (Aljifri, Pons, & Collins, 2003). These factors can be considered as barriers e-commerce needs to face.

As mentioned by the same authors, the LDC (lesser-developed countries) are countries of gross domestic product per capita of $900 or less. Even though Brazil is considered a developing country, some of the barriers explained previously directly affect the Brazilian e-commerce. The main ones include banking and transaction systems, trust and risk.

- **Trust/Security:**

Trust is an important aspect when it comes to economic and social interaction in a context where uncertainty is present (Pavlou, 106). Trust is the belief a person has, when interacting with another individual or a certain company, that they will not take advantage upon them (Gefen, Karahanna, & Straub, 2003). When specifically talking about Latin-Americans, trust can be considered an important element that influences consumer behavior and the intention of online shopping (Zhou, Dai, Zhang, 2007). Therefore, lack of trust is one of the main reasons for consumers not pursuing a purchase in e-commerce. Trust has been considered an important element in online commerce, since online transactions supposedly involve a high level of uncertainty (Pavlou, 2003). When users believe that the platform is trustful, the probability of

achieving the last stage of the TAM model, the "actual system use" is higher than in platforms that present a lack of trust.

Trust is a vital concept in a business relationship (Corbitt, Thanasankit, & Yi, 2003). This aspect can be considered as one of the biggest barriers that e-commerce may face. There is an important amount of people that do not feel comfortable buying online, they are afraid of being victims of a scam, having their credit card information stolen and more (Pavlou, 2003).

However, the fact that a customer thinks twice when deciding to proceed with the payment when buying online is not considered a matter of trust, which should be taken into account in many other aspects. For instance, when it concerns the products' quality or customers' expectations about service/product being delivered. Sometimes, consumers do not know what to expect when purchasing online, which is usually related to online stores that are not well known in the market. People tend to feel more comfortable when they are already familiar with the environment (Sirkka et al. 47). This fact is directly related to trust. People trust a person or a brand when they are able to make prior associations (Sirkka et al. 47). Therefore, when consumers trust online stores, they will feel safer to proceed with the purchase.

Culture is an important aspect when thinking about e-commerce adoption. Different cultures may lead to different shopping behaviors (Mohammed & Tejay, 2017). For instance, Latin-Americans tend to value face-to-face interactions, which can be a reason as to why they might feel reluctant to trust the online environment, since they do not know who the other involved party is (Aljifri, Pons, & Collins, 2003). The anonymity created by the internet is a barrier for consumers to become an online shopper. This can also be taken as an example of how much barriers may vary depending on the culture, since each society can have different preferences and values (Cho & Sagynoy, 2015).

In addition to that, when talking about an environment where uncertainty is present (such as the online one) trust will be a defining feature (Pavlou, 2003). It is not different in e-commerce; trust is one of the most important criteria. Generally speaking, people will not buy a product or a service of an online commerce that is known as not trustful (Cho & Sagynoy, 2015). Therefore, trust is an important aspect to be considered, but, at the same time, a hard one to be conquered by online stores. Customers should feel confident when buying a product in an online shop. They are looking for stores that will deliver the product they asked for, with the quality expected. Otherwise, the store will build a negative reputation that will hinder customers from

making future purchases. Thus, reputation is a key factor for a store to be trustful among potential and usual clients.

Furthermore, consumers are also afraid of supplying personal (Liebermann & Stashevsky, 2002). When buying online, consumers need to provide personal information to the website to finish the purchase. And they believe that there is a certain level of risk when proceeding with this step (Cho & Sagynoy, 2015). Consumers believes that the personal information they need to disclose is a threat to their privacy (Mohammed & Tejay, 2017). Most of the time, consumers are afraid of their personal data being shared with others. Thus, online stores should invest in their check-out procedure, which means it is advisable to acquire a robust fraud protection system, which will make their website more trustful. Hoffman et al. stated that lack of trust prevents clients from engaging in online transactions, since customers are unlikely to proceed with a payment if the website is not trustful, which is directly related to the internet infrastructure it provides (Pavlou, 2003). In view of that, the following hypotheses are proposed:

H3) *Trust in using e-commerce is significantly related to consumers´ intention to transact using e-wallet.*

- **Risk:**

As mentioned previously, online commerce is known for its impersonal and distant nature, once consumers do not have direct contact with the seller, nor with the product (Cho & Sagynoy, 2015). Therefore, this can generate what is known as perceived risk. Sometimes, consumers do not feel comfortable to share their personal information since they believe it is risky. Perceived risk is directly related to uncertainty (Pavlou, 2003) and negatively related with trust (Yang, Pang, Liu, Yen, & Michael Tarn, 2015). There are two types of uncertainty: behavioral and environmental uncertainty. The same is considered for risk. Consumers believe that there is an economic risk when they are afraid of possible monetary losses (Pavlou, 2003) and lack of privacy. This can explain why customers do not feel comfortable by sharing their personal information. Some people believe e-commerce may share their personal information through the internet (Pavlou, 2003).

The distant and impersonal environment created by e-commerce causes uncertainty, making people believe that it is risky to buy in a particular store (Pavlou, 2003). There are different types of risks, such as: internet credit card stealing, supplying personal information, information reliability, internet usage addiction and more (Liebermann & Stashevsky, 2002).

It is difficult for consumers to understand all the risks they are exposed when using the internet, since it is an unknown environment (Cho & Sagynoy, 2015). Therefore, risks will always be related to the consumer's perceived risk (Pavlou, 2003). Since limited information is provided to them about this topic, risk will be related to what the customer believes it is risky.

This topic can be directly related with trustfulness and reputation. If consumers believe it is risky to purchase online, they will not feel confident to use the internet to buy products or services. In addition to that, it is possible to make a correlation with privacy as well. Many online users believe it is risky to share their personal data on the internet, since they are afraid of losing their privacy. In this sense, the following hypotheses are proposed:

H4) *Consumers´ trust in using e-commerce negatively affects users perceived risk of using e-wallet.*

H5) *Consumers´ perceived risk is negatively related to consumers' intentions to transact using e-wallet.*

Despite all the barriers online shopping businesses may face, the online environment offers lots of opportunities, a market that is increasing rapidly. Consumers see the advantages of online shopping, since they believe it is convenient, time saving, there is an enormous variety of options, and prices are generally lower than at physical stores (Pavlou, 2003). Even though consumers do not have personal contact with the sellers, they see the easy access they have when buying online as a benefit. During the COVID-19 pandemic, such advantages offered by e-commerce became even more attractive.

Additionally, online environment can serve different types of customers. There are different categories of shopping orientation such as: "*economic, personalizing, ethical, apathetic, recreational and convenience-oriented" (Zhou, Dai, Zhang, 2007)*. Therefore, one of the

greatest opportunities rendered by e-commerce is the fact that it is able to reach a large and different number of consumers.

A model was developed to illustrate the relation between the independent and dependent variables. The dependent variables were the intention to transact and the risk. Figure 3 illustrates the relationship between variables.

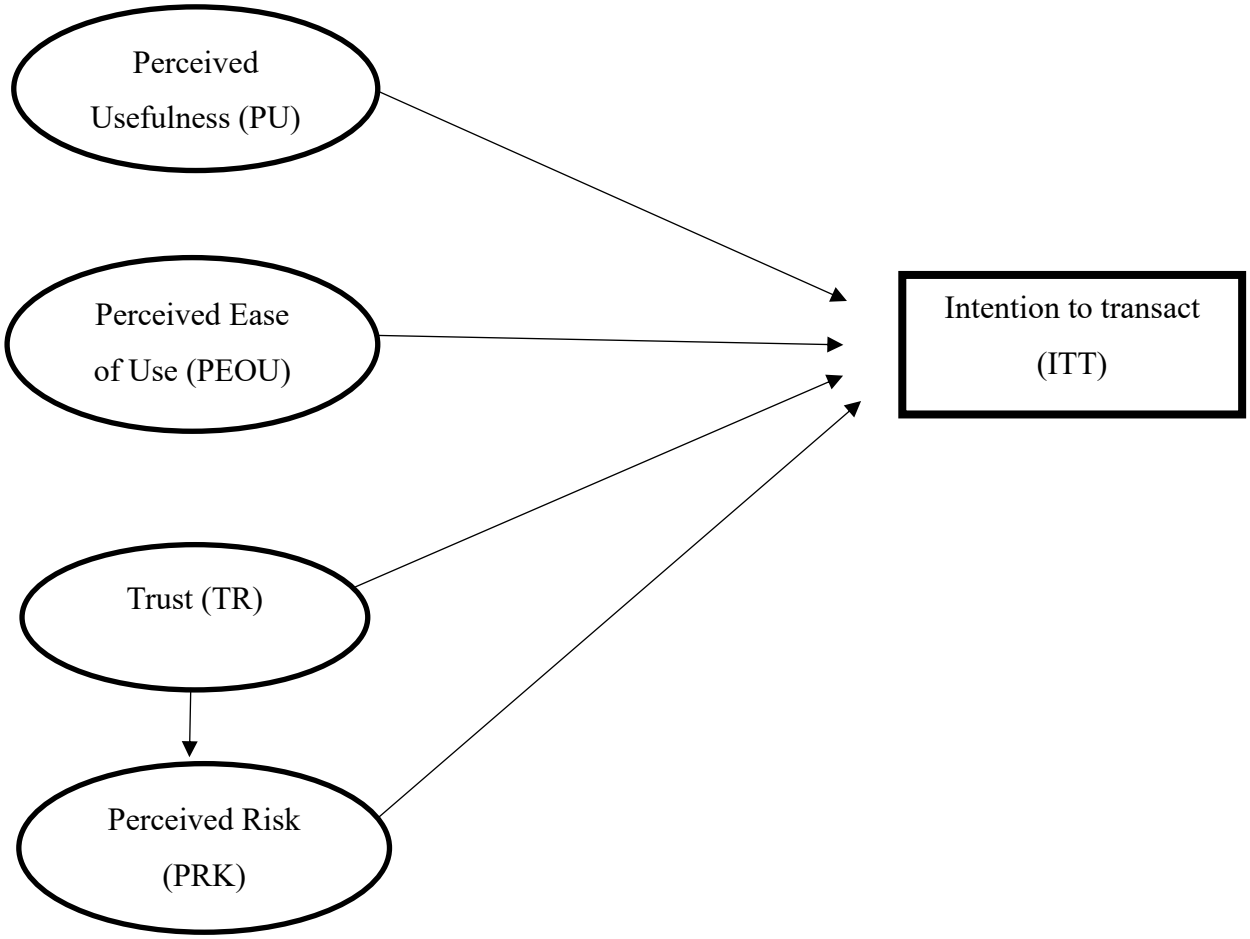

Figure 3: Proposed Model

3 METHODOLOGY

In order to validate the 5 hypotheses proposed, an explanatory quantitative study was implemented. A survey was elaborated in a platform called Qualtrics. This platform provides a link which can be shared with the public in order to collect the answers. All the participants were from Brazil. The main goal was to understand the barriers and motivations of the adoption of e-wallets as payment solutions for e-commerce in Brazil.

The questionnaire was distributed only among individuals that had a smartphone and internet access, otherwise the study would not be validated. It was shared through WhatsApp and Facebook. The survey comprised 6 main sections, based on the constructs. The first one was to understand if the respondents were familiar with the e-wallets applications or not. The second section was to measure trustfulness of e-commerce. Then, a brief explanation about e-wallets and the usage. The 4 following sections were related to 4 different constructs (perceived usefulness, perceived ease of use, perceived risk of e-wallets and the intention to transact) to measure each of them. Finally, the last section was about the individuals' demographic information. All the questions needed to be answered, meaning that the respondents could not submit the survey without answering all the questions.

Considering the fact that the interviewees were Brazilians, the survey was launched in Portuguese. The Portuguese and English version can be found in the appendices 5 and 6. The data was collected in the month of November, 288 interviews were started and 275 completed and validated.

3.1 Measures Constructs

Table 1 presents all the constructs used and the related sources. Almost all the constructs were measured using items from previous TAM research and adapted to the present research context. Furthermore, so as to obtain objective data, the seven-point Likert-scale was used. This scale is composed by seven options, which are the following: 1- Completely disagree, 2- Disagree, 3- Somewhat disagree, 4- Neither disagree or agree, 5- Somewhat, agree, 6- Agree and 7- Completely agree. This type of scales with odd categories (7) forces the respondents to answer the questionnaire. Even though the participants do not have an objective opinion, they are able to select the middle option (neither disagree nor agree).

Construct	Measurement Indicators		Sources
Perceived Usefulness	PU 1	Using e-wallets when purchasing online would make the experience more productive.	Adapted from: Hsiao, C. H., Yang, C. (2011); Pavlou, P. (2003); Holsapple and Wu (2007); Manis and Choi (2018)
	PU 2	Using e-wallets when shopping online will make the process faster for me.	
Perceived Ease of Use	PEOU 1	The easiness of e-wallet application (Ame Digital and PicPay) makes me to become a user.	Adapted from: Hsiao, C. H., Yang, C. (2011); Pavlou, P. (2003); Holsapple and Wu (2007); Manis and Choi (2018)
	PEOU 2	The e-wallet applications (Ame Digital and PicPay) are intuitive, encouraging their use.	
Trust in using e-commerce	TR1	The reputation of an online store is extremely important for me.	Adapted from: Aljifri, H. A., Pons, A., Collins (2003); Yoon, C (2015); Pavlou, P. (2003)
	TR2	I trust more in online stores that I already know or are recommended to me.	
Perceived risk of e-wallets	PRK 1	I do not feel comfortable sharing my personal data in e-wallet applications.	Adapted from: Liebermann, Y. Stashevsky, S. (2002); Pavlou, P. (2003).
	PRK 2	I am afraid of my personal data being shared with others when using e-wallets.	
Intention to transact	ITT 1	I intent to use e-wallets.	Adapted from: Pavlou, P. (2003). Yoon, C. (2015)

Table 1: Constructs and Measurement Indicators

4 RESULTS AND ANALYSIS

4.1 Sample characteristics and data analysis

A sample of 275 interviewees was collected between the 25th and 27th November 2020. Demographic questions were made in order to understand respondents' profiles. Table 2 represents the distribution of participants according to all the demographic variables, such as: age, gender, education level and internet usage. In addition to that, some questions related to e-wallets were developed. With the data provided from Qualtrics, it is possible to affirm that among the 275 respondents, 77,74% are already familiar with e-wallets, although only 51,09% had already used it at least once. 55,71% believed that electronic wallets offer a good service. In addition to that, 80,29% were used to purchasing online, and, just as curiosity, 70,80% engaged in online shopping because of the pandemic. 28,10% of the interviewees spend more than 8 hours a day on the internet, and 68,97% of the participants are 36 or older.

Age		**Gender**	
18-25:	13,50%	Male:	48,54%
26-35:	17,52%	Female:	51,46%
36-45:	13,25%		
46-60:	28,83%		
>60:	26,64%		

Education		**Internet Usage**	
Completed High School:	4,01%	1-2 hours:	5,47%
Incomplete High School:	0,36%	2-4 hours:	27,01%
Completed Bachelor:	41,61%	4-6 hours:	18,61%
Incomplete Bachelor:	11,68%	6-8 hours:	20,80%
Completed post-graduation:	33,58%	> 8 hours:	28,10%
Incomplete post-graduation:	8,76%		

Table 2- Sample Demographics

A principal component analysis (PCA) was performed and the components with an eigenvalue greater than 1 were selected. Table 1 represents the constructs after the tests were implemented. Through the pattern matrix, the variables were distributed among the main components found and the Cronbach test. alpha was used to test the constructs resulting from the PCA. In appendice 8 it is possible to see the considerations made after both tests.

When using parametric test, its assumptions must be respected, and most of them need for the distribution of the variables to be normal. Therefore, a normality test needs to be performed before choosing the hypothesis test. Shapiro-Wilk normality test was conducted with all constructs and other variables of interest. In the table below, all variables have returned p-values lower than 0.05, which means that normal distribution cannot be accepted for this dataset. Therefore, non-parametric tests should be used.

Table 3: Shapiro-Wilk normality test for interest variables

Variable	Normality Test	W	p-value
PU	Shapiro-Wilk	0.91038	9.456×10^{-12}
PEOU	Shapiro-Wilk	0.95705	2.948×10^{-7}
PRK	Shapiro-Wilk	0.93337	8.652×10^{-10}
TR	Shapiro-Wilk	0.80653	$< 2.2 \times 10^{-16}$
ITT	Shapiro-Wilk	0.91239	1.361×10^{-11}

In the present study, Spearman Correlation test was firstly conducted with the objective of studying simple pairwise correlations between the studied variables. In appendice 9 it is possible to find a table with the results related to the Spearman Correlation test.

This method is represented by the Greek letter "ρ" (Rho). It evaluates the relationship between 2 ordinal or continuous variables. In this case, it was used to evaluate the relationship between ordinal variables. Ordinal variables are the ones that can be ordered. This means that the variables could be ordered in different ways. In this case, it was ordered from completely disagree (1) to completely agree (7). Thus, the participant needed to choose between the 7 options offered. Two variables are correlated if a particular behavior presented by one variable affects the other somehow. The value found for Rho, when using Spearman correlation, may vary between -1 and 1. Being rho = 0, absence of correlation; -1 perfect negative correlation

and 1 perfect positive correlation. Besides the value of rho, it is also important to observe the p-value obtained when applying the Spearman's Correlation test, since a p-value higher than 0.05 indicates that it is not possible to affirm with 95% of confidence that true Rho is not equal to zero, which means the alternative hypothesis cannot be accepted, thus there are no significant correlation between the two variables tested.

In order to better understand the relationships between all variables, a multiple linear regression was conducted. With this analysis it is possible to measure the causality effect, i.e., if a certain behavior observed in the independent variables does explain the changes that happen in the dependent variable, or if the correlation previously measured was just the result of coincidence.

In Multiple Regression, when using ordinal independent variables, these must be inputted as dummy variables and the base R functions, such as lm (linear model), which can be applied normally. However, when all variables are ordinal, including the dependent variable, one must perform a logit regression. The clm (Cumulative Link Model) function from ordinal package is known as a form of logit regression that allows the utilization of ordinal dependent variables. The method used in this work was the Logit Linear Regression and Pseudo-R2 was calculated as an equivalent of the coefficient of determination (R2) to measure the proportion of the variance in the dependent variable is predictable from the independent variables. Table 7 illustrates results obtained by the test.

H1) Consumers' perceived usefulness (PU) towards digital wallets has a significant impact on their intention to transact (ITT) using this payment method.

H0 = Consumers 'perceived usefulness (PU) towards digital wallets has no significant impact on their intention to transact (ITT) using this payment method.

The rho value calculated for PU and ITT was of 0.4959932, with a p-value lower than a 2.2×10-16, meaning that it was lower than the significance level ($\alpha = 0.05$). Therefore, the rho value can be considered as reliable. Therefore, there is a significant positive correlation between perceived usefulness and the intention to transact.

Two models of Logit Regression were adjusted. The first model had the intention to transact (ITT) as dependent variable and perceive use (PU), perceived ease of use (PEOU), perceived risk (PRK) and trust (TR) as independent.

Table 4: Model 1

Dependent variable: **ITT**	
Independent variables:	Regression parameters:
PU	1.683314**
PEOU	2.974494***
PRK	0.1231307
TR	-0.0267514
Total number of respondents:	**275**
Pseudo-R^2	0.427069

Significance codes:
*** 0.1% of significance
** 1% of significance
*5% of significance

Thus, table 4 shows that PU is significant, with 99% of confidence, for predicting ITT and its relationship is positive, since the regression parameter (βi) that multiplies PU is positive (1.683314). Thus, it is possible to accept the alternative hypothesis that perceived usefulness has a significant impact on consumers intention to transact. In other words, PU is a good predictor of ITT, since the higher the consumers' perceived usefulness of digital wallets is, the higher their intention to make transactions with them will be.

H2) Consumers' perceived ease of use (PEOU) concerning digital wallets is positively related to their intention to transact (ITT) using this payment method.

H0 = Consumers 'perceived ease of use (PEOU) concerning digital wallets is not significantly related to their intention to transact (ITT) using this payment method.

The rho value calculated for PEOU and ITT was of 0.5165779, with a p-value lower than 2.2×10-16. Since it is possible to affirm with 95% of confidence that the true rho value is not equal 0, it means that consumers perceived ease of use concerning digital wallets is positively related to their intention to transact using this payment method.

In table 4, it is possible to observe that PEOU is significant, with 99.9% of confidence, for predicting ITT and its relationship is positive, since the regression parameter (βi) that multiplies PEOU is positive (2.974494). Thus, it is possible to accept the alternative hypothesis and affirm

that consumers' perceived ease of use concerning digital wallets is positively related to their intention to transact when using this payment method. This means that PEOU, as well as PU, is also a good predictor for ITT.

H3) Trust in using e-commerce (TR) is significantly related to consumers´ intention to transact using (ITT) e-wallet.

H0 = Trust in using e-commerce (TR) is not significantly related to consumers´ intention to transact using (ITT) e-wallet.

The pairwise correlation test between TR and ITT returned a rho of 0.1911165, and to that test the p-value was 0.001476. Therefore, since p-value is lower than 0.05 it is to affirm that there is a positive correlation between TR and ITT.

The logit regression showed that the variable Trust did not present a significant relationship with the intention to transact and did not have any impact on predicting ITT's variance. This means that it is not possible to accept the alternative hypothesis. Thus, for the present study trust is not a good predictor of consumer's intention to transact.

H4) Consumers´ trust in using e-commerce (TR) is negatively related to their perceived risk of using e-wallet (PRK).

H0 = Consumers´ trust in using e-commerce (TR) is not significantly related with their perceived risk of using e-wallet (PRK).

When calculating the Spearman's Correlation between PRK and TR a rho value of 0.2649419 was found and the test returned a p-value of 9.116×10-6. This means that there is the existence of a positive correlation of 0.2649419. However, the alternative hypothesis was for a negative correlation, and the test showed that consumer's trust in using e-commerce is positively related to their perceived risk of using e-wallets. This is the opposite of what was expected, but it can be explained, once in the original questionnaire there were four questions in each of these two constructs and some of them might have caused a misunderstanding among respondents. In addition, in 2 of those 8 questions, the answers were not falling where they should be within the principal component analysis and Cronbach alpha test.

In table 5, it is possible to observe that trust did not present a significant relationship with perceived risk either, being incapable of predicting PRK. Therefore, the alternative hypothesis is rejected, and the null hypothesis is accepted.

H5) Consumers´ perceived risk (PRK) is negatively related to consumers' intentions to transact using e-wallet (ITT).

H0 = Consumers´ perceived risk (PRK) is not significantly related to consumers' intention to transact using e-wallet (ITT).

The p-value observed for the correlation test between PRK and ITT was of 0.489. This means that the true rho value is equal to 0. Thus, consumers´ perceived risk and consumers' intentions to transact using e-wallet are independent variables with no relation.

While evaluating the logit regression model, a second model was estimated with perceived risk (PRK) as dependent variable and trust (TR) as independent. Table 5 illustrates the linear regressions results. These regression parameters demonstrate whether there is a positive or negative relationship between dependent and independent variables.

Thus, in table 5 it is possible to see that the multiple linear logit regression model showed that there is no significance of perceived risk in predicting the intention to transact. The variance shown by PRK is not capable of explaining the variance of ITT. Therefore, one cannot cause another, thus the null hypothesis should be accepted.

Table 5: Model 2

Dependent variable: **PRK**	
Independent variables:	Regression parameters:
TR	-0.14788
Total number of respondents:	275
Pseudo-R^2	0.0163014

- Discussion

The goal of the present study was to understand how payment apps may contribute to the adoption of e-commerce in Brazil. The aim of the survey was to understand if the barriers described previously were in fact present in real life. Therefore, the objective was to relate different constructs and understand if any correlation was present among them according to the answers of the participants.

This research has contributed to the integration of environmental uncertainty (perceived risk and trust) with the technology acceptance constructs (perceived usefulness, ease of use and the intention to transact) (Pavlou, 2003). All criteria combined have helped understanding consumer's acceptance of digital wallets in the adoption of e-commerce.

First, it was possible to observe that the effect of perceived usefulness and consumers' intention to transact are positively correlated. In addition to that, the multiple linear logit regression was able to confirm that the variance of perceived usefulness does cause variation in consumers' intention to transact. Usually, when the application interface is perceived by the customer as a facilitator, they will tend to finish with the transaction (Pavlou, 2003). In the present study, customers believe that digital wallets applications are useful for them, which means that the probability to proceed with a transaction in this case is higher than a scenario in which they believed the digital wallets were not useful to them.

Secondly, consumers' perceived ease of use concerning digital wallets is positively related to their intention to transact while using this application. Moreover, the multiple linear logit regression revealed a high level of significance of consumers' perceived ease of use when predicting their intention to transact. This proves what was already expected, that customers will proceed with the payment since they believe the technology is easy to operate. On the other hand, users that considered the application difficult to use usually give up using it.

The results found in this work are according to those found by Yang et al. (2021) when studying the intention and adoption of e-wallets. In their work, consumers' perceived ease of use and perceived usefulness also demonstrated a statistically significant and positive causal relationship between them and the adoption of e-wallets and the intention to make cashless transactions.

Karim et al. (2020), when studying the factors that influence the use of e-wallets as a payment method among Malaysian young adults also found that consumers' perceived usefulness and ease of use are one of the most significant variables for predicting behavioral intention to use e-wallets.

When discussing trust in the acceptance of a new technology, different research has shown that this point is crucial for the acceptance of a certain technology. Some researchers believe that there is a positive effect between trust and the intention to transact in North and South America, which is not the case in Western Europe (Zhou, Dai, Zhang, 2007). Trust is considered as a complex construct when studying online shopping acceptance (Zhou, Dai, Zhang, 2007). With the data analysis it is possible to affirm that trust and the intention to transact are positively correlated, however, based on the data collected, it is not possible to assume that there is a causal relationship between trust in e-commerce and consumer's intention to transact.

One other aspect discussed was the perceived risk among customers while using a new technology. According to the sample obtained from the survey, it was possible to affirm that there is a correlation between trust and perceived risk while using digital wallets when calculating Spearman's Correlation. However, this is not a causal relationship, since linear regression showed that perceived risk was not a good predictor trust in e-wallets. Therefore, it is not possible to affirm that the respondents of the present survey trust digital wallets less because of the possible risk involved while using it. Thus, since the hypothesis could not be accepted, intention to transact it is not related with trust.

Finally, when discussing the intention to transact, several researches state that perceived risk is expected to influence transaction intentions (Pavlou, 2003). Nevertheless, it is not the case among the sample studied. Only 16,06% of the users are afraid of having their personal data spread while using digital wallets.

It is important to mention that almost all the participants of this study (80,29%) are used to making online purchases. In addition to that, only 0,36% of the respondents do not intend to use e-wallets in the next future. This can prove that the adoption of e-wallets is positively seen by the population studied.

5 CONCLUSION, LIMITATIONS AND FUTURE RESEARCH

5.1 Conclusions

E-commerce is a growing industry in Brazil and has big potential to keep improving and attracting more customers. This type of business faces different barriers and motivations. The two main barriers presented in this study was perceived risk, perceived usefulness, easiness of use and trust/security. Both are complex to understand and to overcome. The internet is still an uncertain environment, in which people do not fully trust yet. However, taking into account the motivations present in the sector, it is easy to observe that it has a great potential to grow. People are looking for ways to save time, and one-click buying makes the process a lot faster. In this sense that meets e-wallets primary goal, which is to enable people to save time.

From a sample of 275 respondents, 77,74% had a previous knowledge of what an e-wallet was, however only 48,91% have already used the application. Most of the participants spend more than 8 hours a day on the internet.

The two main players present in Brazil, Ame Digital and PicPay are gaining place in the market and are present in different business types, such as: supermarket, gas station, but mainly in e-commerce.

The technology acceptance model (TAM) was used to explain the acceptance of digital wallets as payment method in e-commerce. There are different variables present in this model, which are external variables (trust and risk), perceived ease of use and perceived usage. All these aspects were developed during the present study in order to understand which ones plays a role in e-commerce acceptance.

By analyzing the data obtained, it was possible to observe that almost all dependent variables such as: perceived usage, perceived ease of use and trust had a significant correlation with the intention to transact when using e-wallets. In addition to that, there is correlation between trust and perceived risk.

On the other hand, when the data is analyzed within the linear regression model so as to understand the causality among independent and dependent variables, it is possible to observe that only perceived ease of use and perceived usage have a significant relationship with the intention to transact. Trust and perceived risk does not significantly affect customer's intention

to transact in e-commerce. Thus, it is possible to assume that the easier the e-wallet usage and the more useful it is, the higher its adoption and the intention to transact will be.

Therefore, these types of applications may strongly contribute to the adoption of e-commerce in Brazil. The one-click checkout plugin in e-wallets will attract more customers and will consequently enable business to grow.

5.2 Limitations and Future Research

Despite the contribution of the Technology Acceptance Model and the different research, there are some limitations in this study.

Considering that the goal of the present study was to understand how digital payment apps may contribute to the adoption of e-commerce among Brazilians, it is possible to state that the sample size was a limitation, once it did not represent the big part of the Brazilian population that uses the internet.

Another limitation could be the location. Almost all the participants were from Rio de Janeiro. For future research, the survey should be spread among different cities, in order to have a wider dataset and therefore understand effectively how digital payments apps in fact contribute to the e-commerce adoption in the country. One other aspect that can be considered is the education level. Almost all the participants had a high education degree, which can have a direct impact on the results. For instance, people that have a lower education level tend to think that the internet is a risky environment. Therefore, for a future study, a wider range of income should be comprehended by the survey, meaning that it should be spread throughout different social classes.

E-commerce managers should encourage the usage of e-wallets as a payment method. Thus, the e-wallets applications companies should focus on methods to facilitate the usage of the application. For instance, these applications should invest on visual aspects, in order to be very intuitive for the users and encourage the usage.

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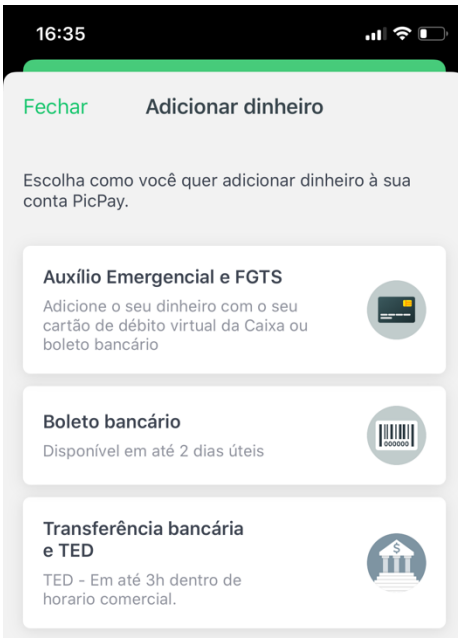
APPENDICES

Appendice 1: How to add money on Ame Digital Account.

Appendice 2 : What users are able to do with their money in Ame Digital

Appendice 3: How to add money on a PicPay Account.



Appendice 4: If a customer wants to buy, for instance, in Lojas Americanas, they will have the option to pay directly by one click with Ame Digital and will receive a cashback R$8,50 from the amount of R$ 169,90.

Appendice 5:

Survey – Portuguese version

Agradeço por disponibilizar seu tempo para participar desse questionário. Todas as respostas serão anônimas.

É necessário que responda todo o questionário de uma única vez, sem pausas ou distrações, e que, por favor, fique atento durante todas as perguntas. Só é possível escolher uma resposta. As opções variam de 1 (discordo completamente) a 7 (concordo completamente).

Você levará menos de 2 minutos para responder o questionário. Caso tenha qualquer dúvida em relação as perguntas relacionadas ao estudo, favor entrar em contato comigo:
Luisa Fanzeres (152119040@alunos.lisboa.ucp.pt).

Ao continuar, você estará concordando em participar.

Muito obrigada!

1) **Você conhece os aplicativos de meio de pagamento Ame Digital e/ou Picpay? (conhecidos como: carteiras digitais)**
    - Sim
    - Não

2) **Você já utilizou ao menos uma vez um aplicativo de carteira digital para efetuar um pagamento?**
    - Sim
    - Não

3) **Você considera o serviço das carteiras digitais bom?**
    - 1- Discordo completamente
    - 2- Discordo
    - 3- De certa forma, discordo

- 4- Não discordo, nem concordo
- 5- De certa forma, concordo
- 6- Concordo
- 7- Concordo completamente

4) **A reputação de uma loja online é de extrema importância para mim.**
    - 1- Discordo completamente
    - 2- Discordo
    - 3- De certa forma, discordo
    - 4- Não discordo, nem concordo
    - 5- De certa forma, concordo
    - 6- Concordo
    - 7- Concordo completamente

5) **Eu costumo confiar mais em lojas online que já são conhecidas ou recomendadas a mim.**
    - 1- Discordo completamente
    - 2- Discordo
    - 3- De certa forma, discordo
    - 4- Não discordo, nem concordo
    - 5- De certa forma, concordo
    - 6- Concordo
    - 7- Concordo completamente

6) **Acredito que as lojas físicas sejam mais confiáveis do que as lojas online.**
    - 1- Discordo completamente
    - 2- Discordo
    - 3- De certa forma, discordo
    - 4- Não discordo, nem concordo
    - 5- De certa forma, concordo
    - 6- Concordo
    - 7- Concordo completamente

7) **Quanto mais eu uso uma tecnologia (ex carteiras digitais), mais eu confio na mesma.**
    - 1- Discordo completamente
    - 2- Discordo
    - 3- De certa forma, discordo
    - 4- Não discordo, nem concordo
    - 5- De certa forma, concordo
    - 6- Concordo
    - 7- Concordo completamente

Por favor, leia com atenção o texto abaixo:

As carteiras digitais vêm crescendo com o tempo no Brasil e principalmente com a pandemia. No País, há dois aplicativos de carteira eletrônica que são muito conhecidos: Ame Digital e Picpay.

As carteiras digitais são consideradas dispositivos eletrônicos que permitem seus usuários realizarem transações eletrônicas. Podem ser utilizados tanto em lojas online, quanto em físicas. Basta você estar com seu smartphone!

Esses aplicativos de meio de pagamento oferecem diferentes benefícios como: armazenamento de cartões de crédito, pagamento de boleto, transferências e isso tudo de forma segura! Além disso, ajudam seus usuários a economizar tempo quando realizando uma compra. No momento de finalizar compra basta escanear o QR code disponível e em menos de 1 minuto o pagamento será efetuado. Ou seja, as carteiras digitais centralizam diferentes meios de pagamento em um só aplicativo, facilitando a vida do usuário.

8) **Usar carteiras digitais para efetuar o pagamento no e-commerce facilitaria minha experiência.**
    - 1- Discordo completamente
    - 2- Discordo
    - 3- De certa forma, discordo
    - 4- Não discordo, nem concordo

- 5- De certa forma, concordo
- 6- Concordo
- 7- Concordo completamente

9) **As carteiras digitais ajudam seus consumidores a economizar tempo no momento de compra, pois todos os dados pessoais já ficam armazenados.**
    - 1- Discordo completamente
    - 2- Discordo
    - 3- De certa forma, discordo
    - 4- Não discordo, nem concordo
    - 5- De certa forma, concordo
    - 6- Concordo
    - 7- Concordo completamente

10) **A simplicidade do uso dos aplicativos de carteiras digitais (Ame Digital, PicPay) fazem com que eu me torne adepto (a) ao mesmo.**
    - 1- Discordo completamente
    - 2- Discordo
    - 3- De certa forma, discordo
    - 4- Não discordo, nem concordo
    - 5- De certa forma, concordo
    - 6- Concordo
    - 7- Concordo completamente

11) **Os aplicativos de carteiras digitais (como Ame Digital e Picpay) são intuitivos. Assim, incentivando o seu uso.**
    - 1- Discordo completamente
    - 2- Discordo
    - 3- De certa forma, discordo
    - 4- Não discordo, nem concordo
    - 5- De certa forma, concordo
    - 6- Concordo
    - 7- Concordo completamente

12) **Não me sinto confortável em dividir minhas informações pessoais em aplicativos de carteiras digitais.**

- 1- Discordo completamente
- 2- Discordo
- 3- De certa forma, discordo
- 4- Não discordo, nem concordo
- 5- De certa forma, concordo
- 6- Concordo
- 7- Concordo completamente

13) **Tenho medo que minhas informações pessoais vazem na internet quando uso carteiras digitais.**

- 1- Discordo completamente
- 2- Discordo
- 3- De certa forma, discordo
- 4- Não discordo, nem concordo
- 5- De certa forma, concordo
- 6- Concordo
- 7- Concordo completamente

14) **Quando eu não acredito que o site seja confiável, eu não finalizo a minha compra e passo a não confiar na loja online.**

- 1- Discordo completamente
- 2- Discordo
- 3- De certa forma, discordo
- 4- Não discordo, nem concordo
- 5- De certa forma, concordo
- 6- Concordo
- 7- Concordo completamente

15) **Acredito que as carteiras digitais ofereçam um serviço de qualidade e que transmitam muita segurança aos usuários.**

- 1- Discordo completamente
- 2- Discordo
- 3- De certa forma, discordo
- 4- Não discordo, nem concordo
- 5- De certa forma, concordo
- 6- Concordo
- 7- Concordo completamente

16) **Eu adoraria ter a possibilidade de sempre poder pagar com as carteiras digitais em lojas online.**

- 1- Discordo completamente
- 2- Discordo
- 3- De certa forma, discordo
- 4- Não discordo, nem concordo
- 5- De certa forma, concordo
- 6- Concordo
- 7- Concordo completamente

17) **Você tem o hábito de fazer compras online?**

- Sim
- Não

18) **Você passou a fazer mais compras online com a pandemia?**

- Sim
- Não

19) **Uso diário de internet (celular, tablets, computador ou similares)**

- 1-2 horas
- 2-4 horas
- 4-6 horas

- 6-8 horas
- > 8 horas

20) Qual a sua idade?

- 18-25 anos
- 26-35 anos
- 36-45 anos
- 46-60 anos
- > 60 anos

21) Sexo

- Masculino
- Feminino

22) Nível de formação

- Ensino médio completo
- Ensino médio incompleto
- Ensino superior completo
- Ensino superior incompleto
- Pós-graduação completa
- Pós-graduação incompleta

Appendice 6:

Survey – English version

Thank you for taking the time to answer this questionnaire. All the answers will be anonymous.

All the questions need to be answered once, without interruptions. Please pay attention while answering the survey. It is only possible to choose one answer. The option varies from 1 (completely disagree) to 7 (completely agree).

You will take less than 2 minutes to answer the survey. If you have any doubts related to the questionnaire, feel free to get in touch with me: Luisa Fanzeres (152119040@alunos.lisboa.ucp.pt).

You agree to participate at the moment you start answering the survey.

Thank you!

1) **Do you already know the digital payment applications Ame Digital and/or PicPay? (Known as: e-wallets)**
    - Yes
    - No
2) **Have you ever used at least one time an e-wallet application?**
    - Yes
    - No

3) **Do you consider the e-wallets provides a good service?**
    - 1- Completely disagree
    - 2- Disagree
    - 3- Somewhat disagree
    - 4- Neither disagree or agree
    - 5- Somewhat, agree
    - 6- Agree

- 7- Completely agree

4) **The reputation of an online store is extremely important for me.**
    - 1- Completely disagree
    - 2- Disagree
    - 3- Somewhat disagree
    - 4- Neither disagree or agree
    - 5- Somewhat, agree
    - 6- Agree
    - 7- Completely agree

5) **I tend to trust more in online stores that I already know or are recommended to me.**
    - 1- Completely disagree
    - 2- Disagree
    - 3- Somewhat disagree
    - 4- Neither disagree or agree
    - 5- Somewhat, agree
    - 6- Agree
    - 7- Completely agree

6) **I believe that physical stores are more trustful than online stores.**
    - 1- Completely disagree
    - 2- Disagree
    - 3- Somewhat disagree
    - 4- Neither disagree or agree
    - 5- Somewhat, agree
    - 6- Agree
    - 7- Completely agree

7) **The more I use a technology (e-wallets), more I trust on it.**
    - 1- Completely disagree
    - 2- Disagree
    - 3- Somewhat disagree
    - 4- Neither disagree or agree
    - 5- Somewhat, agree
    - 6- Agree
    - 7- Completely agree

Please read carefully the text below:

By the time, the e-wallets are growing in Brazil and mainly during the pandemic. In the country, there are two main e-wallets applications: Ame Digital and Picpay.

The e-wallets are considered as electronic devices that allow their users make online transactions. The applications can be used in online stores and physical ones. You just need to have your smartphone with you!

These applications offers several benefits such as: credit card storage, payment of invoices (boletos) and bank transfers. All of this in a safe way! In addition to that, the application helps the users save time while purchasing online.

When you finalize your purchase you just need to scan a QR code available on the application and in last than 1 minute the payment will be made. The e-wallets centraliwe more than one payment method in one single application.

8) **Using e-wallets as payment methods in the e-commerce will facilitate my experience.**
    - 1- Completely disagree
    - 2- Disagree

- 3- Somewhat disagree
- 4- Neither disagree or agree
- 5- Somewhat, agree
- 6- Agree
- 7- Completely agree

9) **The e-wallets helps the users save time in the moment of the purchase since all the personal data is already saved.**
   - 1- Completely disagree
   - 2- Disagree
   - 3- Somewhat disagree
   - 4- Neither disagree or agree
   - 5- Somewhat, agree
   - 6- Agree
   - 7- Completely agree

10) **The easiness of the e-wallet application (Ame Digital and PicPay) makes me to become a loyal user.**

    1- Completely disagree
    2- Disagree
    3- Somewhat disagree
    4- Neither disagree or agree
    5- Somewhat, agree
    6- Agree
    7- Completely agree

11) **The e-wallet applications (Ame Digital and PicPay) are intuitive, encouraging their use.**
    - 1- Completely disagree
    - 2- Disagree
    - 3- Somewhat disagree
    - 4- Neither disagree or agree
    - 5- Somewhat, agree

- 6- Agree
- 7- Completely agree

12) I do not feel confortable sharing my personal data in e-wallet applications.

- 1- Completely disagree
- 2- Disagree
- 3- Somewhat disagree
- 4- Neither disagree or agree
- 5- Somewhat, agree
- 6- Agree
- 7- Completely agree

13) I am afraid of my personal data being shared on the internet when using e-wallets.

- 1- Completely disagree
- 2- Disagree
- 3- Somewhat disagree
- 4- Neither disagree or agree
- 5- Somewhat, agree
- 6- Agree
- 7- Completely agree

14) When I believe the website is risky I start no trusting on the e-commerce.

- 1- Completely disagree
- 2- Disagree
- 3- Somewhat disagree
- 4- Neither disagree or agree
- 5- Somewhat, agree
- 6- Agree
- 7- Completely agree

15) I believe e-wallets offers a good service and transmit security to users.

- 1- Completely disagree
- 2- Disagree
- 3- Somewhat disagree
- 4- Neither disagree or agree
- 5- Somewhat, agree
- 6- Agree
- 7- Completely agree

16) I intend to use e-wallets.

- 1- Completely disagree
- 2- Disagree
- 3- Somewhat disagree
- 4- Neither disagree or agree
- 5- Somewhat, agree
- 6- Agree
- 7- Completely agree

17) Do you usually shop online?

- Yes
- No

18) Have you started shopping more online with the pandemic?

- Yes
- No

19) Daily internet usage (smartphone, computer, tablets and similars)

- 1-2 hours
- 2-4 hours
- 4-6 hours
- 6-8 hours
- > 8 hours

20) How old are you?

- 18-25 anos
- 26-35 anos
- 36-45 anos
- 46-60 anos
- > 60 anos

21) Gender

- Male
- Female

22) Education level

- Completed High School
- Incompleted High School
- Completed Bachelor
- Incompleted Bachelor
- Completed Post graduation
- Incompleted Post graduation

Appendice 7 : First version of table of constructs

Construct	Measurement Indicators		Sources
Perceived Usefulness	PU 1	Using e-wallets when purchasing online would make the experience more productive.	Adapted from: Hsiao, C. H., Yang, C. (2011); Pavlou, P. (2003); Holsapple and Wu (2007); Manis and Choi (2018)
	PU 2	Using e-wallets when shopping online will make the process faster for me.	
Perceived Ease of Use	PEOU 1	The easiness of e-wallet application (Ame Digital and PicPay) makes me to become a user.	Adapted from: Hsiao, C. H., Yang, C. (2011); Pavlou, P. (2003); Holsapple and Wu (2007); Manis and Choi (2018)
	PEOU 2	The e-wallet applications (Ame Digital and PicPay) are intuitive, encouraging their use.	
	PEOU 3	Using e-wallets when shopping online will make the process faster for me.	
Trust in using e-commerce	TR1	The reputation of an online store is extremely important for me.	Adapted from: Aljifri, H. A., Pons, A., Collins (2003); Yoon, C (2015); Pavlou, P. (2003)
	TR2	I trust more in online stores that I already know or are recommended to me.	
	TR3	I believe that physical stores are more trustful than online stores.	
	TR4	The more I use a technology (e-wallets), more I trust on it.	
Perceived risk of e-wallets	PRK 1	I do not feel comfortable sharing my personal data in e-wallet applications.	Adapted from: Liebermann, Y. Stashevsky, S. (2002); Pavlou, P. (2003).
	PRK 3	I believe e-wallets transmit security to users.	
	PRK 4	When I believe the website is risky I start no trusting on the e-commerce.	

Intention to transact	ITT 1	I intent to use e-wallets.	Adapted from: Pavlou, P. (2003). Yoon, C. (2015)

Appendice 8: Principal Component Analysis (PCA) and Cronbach's alpha results explained.

Table: Matrix generated by the Principal Component Analysis (PCA).

Items	**RC1**	**RC4**	**RC2**	**RC3**
TR1	0,153	-0,162		0,817
TR2		0,102	0,155	0,79
TR3		0,127	0,615	-0,197
TR4	-0,264	0,724	-0,14	0,271
PU1	0,59	0,305		
PU2	0,991			
PEOU1	0,209	0,705		
PEOU2		0,867	0,171	-0,162
PEOU3	0,991			
PRK1		-0,153	0,771	
PRK2			0,844	
PRK3		0,629	-0,256	
PRK4			0,583	0,195

The PCA showed that all the variables can be averaged to form just 4 final variables. These components have been identified by the meaning of their questions asked in the questionnaire as Trust in e-commerce, Perceived Usefulness, Perceived Ease of Use and Perceived risk when using e-wallets APPs.

The Pattern Matrix showed in the table above have the information regarding how much each item contributes to explain the variances present in each component. These values showed that the items that should behave as Trust in e-commerce construct, such as TR1 and TR2 fall into the component 3, but TR3 and TR4 does not fall into that same component. This means that they are not behaving as expected since they should be explaining the same phenomenon. The Cronbach's alpha test for these 4 items of TR construct showed a very low value of alpha of

0.214. When TR3 and TR4 was removed, Cronbach's alpha test showed an acceptable value of 0.564. Therefore, only TR1 and TR2 were averaged to form one variable called TR (Trust in e-commerce).

For Perceived Usefulness, the two items that compose this construct, PU1 and PU2, are behaving as expected and falling into the first principal component. The Cronbach's alpha test for this construct showed an alpha value of 0.761. This is an acceptable value for alpha since values higher than 0.6 can be accepted. This result together with the results showed in PCA means that the answers from PU1 and PU2 can be averaged into one to become one variable.

For Perceived Ease of Use, the items PEOU1 and PEOU2 are falling into the component 4, but PEOU3 is falling into the first component, that is formed by PU items. This behavior can be explained since the question that originated PEOU3 is the same question that originated PU2 because this question involves both Usefulness and Ease of Use perceptions. This could be accepted and PEOU3 could be used together with PEOU1 and PEOU2, but the pattern matrix showed that PEOU3 has not contributed to explain component 4 variances. Therefore, the PEOU construct is formed averaging PEOU1 and PEOU2 since its Cronbach's alpha test returned an acceptable alpha value of 0.711.

Finally, for Perceived Risk, the items PRK1, PRK2, and PRK4 seems to be falling in component 2, but PRK3 is falling in component 4, where it should not be. The Cronbach's alpha test for this construct with all the four items was of 0.354, which is not acceptable. When removing PRK3 the alpha value raised to 0.698, which could be acceptable. But when analyzing the question that originated PRK4 answers, it was seen that it was an ambiguous question, and one could understand it completely wrong. Thus, PRK4 showed a significantly lower explained variance for component 2 when compared with those showed by PRK1 and PRK2. When performing Cronbach's alpha test considering only PRK1 and PRK2, the returned alpha value was of 0.807. Therefore, only PRK1 and PRK2 was averaged to form one variable.

Appendice 9: Illustrates the rho-value and p-value for the Spearman Correlation test.

Hypothesis	**rho-value**	**p-value**	**Result**
H1: PU → ITT	0.4959932	2.2×10^{-16}	Correlation
H2: PEOU → ITT	0.5165779	2.2×10^{-16}	Correlation
H3: TR → ITT	0.1911165	0.001	Correlation
H4: TR → PRK	0.2649419	9.116×10^{-6}	Correlation
H5: PRK → ITT	0.04187514	0.489	No correlation

Appendice 10: Results of the estimation of Logit Regression Model.

Hypothesis	Regression parameter	Result
H1: Intention to transact (ITT) and perceived use (PU).	1.683314	Accepted
H2: Intention to transact (ITT) and perceived ease of use (PEOU).	2.974494	Accepted
H3: Intention to transact (ITT) and trust (TR).	-0.0267514	Rejected
H4: Perceived risk (PRK) and trust (TR)	-0.14788	Rejected
H5: Intention to transact (ITT) and perceived risk (PRK).	0.1231307	Rejected