What drives consumers to use P2P payment systems? An analytical approach based on the stimulus–organism–response (S-O-R) model

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Abstract

Purpose – Traditional payment systems based on cash and bank cards are being replaced by new innovative formats. This research analyzes the success factors in the adoption by customers of Bizum, a peer-to-peer (P2P) mobile payment system widely used in Spain. This study proposes a theoretical framework based on the Stimulus–Organism–Response (S-O-R) model and includes the analysis of the moderating effect of perceived risk and the mediating effect of perceived trust.

Design/methodology/approach – To achieve the proposed objectives, an online questionnaire was administered to 701 Spanish smartphone users, potential users of the proposed P2P payment systems.

Findings – The results show that perceived usefulness is the most important predictor of intention to use. Additionally, a medium predictive relevance performance of the proposed model is found.

Originality/value – This research contributes to a more holistic understanding of the adoption of P2P payment systems and provides new business opportunities that companies can exploit through the use of this technology.

Keywords P2P payment systems, Intention to use, S-O-R model, Perceived risk

Paper type Research paper

1. Introduction

Mobile payments refer to making payments through the use of mobile devices (cell phones, personal digital assistants, radio frequency devices and near field communication-based

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devices) (Patil *et al.*, 2020). In addition, other new payment methods using encrypted networks, such as e-wallets and cryptocurrency for alternative payment modes to issued currency, are replacing cash on a regular basis (de Blanes Sebastián *et al.*, 2023). This fact is bringing about important changes in the financial sector as well as in the behavior of users in relation to these new technologies.

The growth of the Paytech sector is partly due to the adoption of the Revised Payment Services Directive 2 (hereinafter, PSD2) that came into force in all EU member states in 2018. The PSD2 created a legal framework for two new types of payment services: 'payment initiation services' (PIS) and 'account information services' (AIS). Since then, Fintech companies started to develop new business models by offering new ways to pay or view account information. As of the entry into force of the PSD2 regulation, banks are obliged to have and maintain Application Programming Interfaces (APIs) that allow other applications and services to access bank accounts, if the user wishes, in order to expand the possibilities of online payments (Hartmann *et al.*, 2019). Thus, entities with online services have the possibility of offering their customers immediate payment for their online reservations or purchases on the Internet, granting independence from the bank (Carbó-Valverde *et al.*, 2021). That is why both Verse and Twyp have their own virtual wallets to store money, without having to have a bank account. Thus, both applications can be used independently of the bank account, in contrast to Bizum, which is only available to users of 27 associated Spanish banks.

Currently, multiple classifications are used to analyze payment systems. Liébana-Cabanillas *et al.* (2021b) summarize the main classification criteria according to the type of service, technology used and purpose. Firstly, with regard to the type of service, the most important are the marketing of ticketing services for shows (mobile ticketing), payments for parking spaces (mobile parking), sending money by means of cash remittances (mobile remittances) and payment at the point of sale [mobile point of sale (PoS)]. Secondly, in relation to the type of technology, we highlight payment by sending an SMS (short message service), payment by WAP applications (wireless application protocol), payment by proximity (NFC), payment by predefined messages [unstructured supplementary service data (USSD)] and payment by voice recognition technology. Finally, depending on the purpose, it is also possible to classify the tools into m-payment, which refers to the actual payment of the purchase made, m-order, which manages mobile orders, m-banking, which refers to access to electronic banking via the device, m-delivery and m-contract, which refers to the delivery of the services acquired by the cell phone.

On the other hand, peer-to-peer (P2P) payments are becoming more popular as consumers switch from traditional physical payment methods, such as cash and bank cards, to new digital alternatives. It was precisely the financial institutions which, aware of this new trend, decided to embrace this paradigm shift, favoring joint business with Fintech companies (Palmié *et al.*, 2020; Luo *et al.*, 2022). Moreover, the COVID-19 pandemic has accelerated the adoption of new mobile payment formats among users themselves (Rodríguez-López *et al.*, 2023), to the point that P2P systems are now seriously threatening the use of classic purchasing systems for regular purchases (Insider Intelligence, 2022).

According to the latest report by Mordor Intelligence (2022), the global value of digital payment transactions was USD 7.36tn in 2021, with a forecast higher than USD 15tn for 2027. Along the same lines, according to Statista (2022), the total value of global cross-border P2P money transfer transactions is €59bn in 2018, which is projected to grow to €121bn by 2022. In addition, the value of the average transaction per user will increase from €327 in 2018 to €644 in 2022 globally.

This study examines the Spanish P2P payment service Bizum. This tool was created in mid-2016 by 27 banking institutions to make secure and immediate money transfers to

trusted individuals, whereby it was only necessary to know the recipient's cell phone number to send the money.

Today, Bizum is an integrated service in almost all the banks that founded the company. It is very simple to use since it is only necessary a bank account, the app of the bank where Bizum is integrated and a cell phone. It currently has more than 19mn users and has carried out 666mn transactions since its creation. Moreover, its expansion as a means of online payment is unquestionable, due to its current use in 30,000 associated online merchants and in purchases worth 480mn euros. It is also employed by more than 5,600 NGOs that have received almost 1mn euros (Bizum, 2022).

Given the importance that this type of payment system currently has and will probably have in the coming years, it is more than appropriate to analyze its research (Liébana-Cabanillas *et al.*, 2021a). From a scientific point of view, as indicated by Liébana-Cabanillas *et al.* (2021b), previous work on mobile payment has focused on other technologies, e.g., smart card payment systems, mobile point-of-sale payments, mobile wallets, when, in reality, P2P systems have very different characteristics (Li *et al.*, 2021), being simpler, faster and more convenient (Zhao, 2021).

This study is one of the first to address the adoption of P2P payment systems in particular, using the Stimulus–Organism–Response (S-O-R) model (Mehrabian and Russell, 1974). According to Chang *et al.* (2011), based on Bagozzi's (1986) proposals, when consumer behavior is represented as an S-O-R system, the stimuli (S) consist of both marketing mix variables and other environmental elements. In our research, we propose the inclusion of subjective norms, the perceived quality of the Bizum payment system itself as well as the user's level of innovativeness. The organism (O) refers to the internal processes involved between the stimuli and the final actions, reactions or responses emitted. Our proposal includes perceived usefulness and perceived trust as antecedents of the intention to use Bizum (R). Additionally, we include the analysis of the moderating effect of perceived risk, as it is considered by the scientific literature as one of the most influential variables in the adoption of innovations, reducing the intention of individuals to use P2P payments by mitigating the positive effect of other antecedents (Schmidthuber *et al.*, 2020).

In this sense, the purpose of this research is five-fold: firstly, to address a gap in the current literature on P2P payment systems; secondly, to propose the application of the stimulus-organism-response (S-O-R) framework to analyze the importance of various factors in explaining the intention to use P2P payment systems; thirdly, to explore the moderating effect of perceived risk in determining the intention to use; fourthly, to analyze the mediating effect of the perceived quality of P2P payment systems and finally, the results can be used by Fintech firms' decision-makers to strengthen the understanding of P2P payment adoption processes and to improve marketing strategies for P2P payment systems.

The remainder of the paper is structured as follows. Section 2 explains the importance of P2P payment systems and, namely, the case of Bizum. Section 3 presents the proposed research model as well as the proposed hypotheses. The methodology applied, the data collection, and the description of the sample are described in Section 4 whilst the analyses carried out are included in Section 5. The final section extracts the main contributions, limitations, implications and future lines of research.

2. Peer-to-peer mobile payment system: Bizum

P2P payments are Peer to Peer applications that facilitate mobile money transactions to be sent anywhere immediately. According to Mastercard's latest Small and Medium Business Payment Barometer (2002), an analysis of businesses with a turnover of between EUR 1mn and EUR 100mn, 83% of these businesses already support contactless payment by card or cell phone. This figure reflects a growth of 21 percentage points in the last four years, as data

from the same study in 2017 indicated that, in that period, the acceptance rate of contactless payments was 62%. This increase has also been reflected in the average amount of card transactions compared to cash purchases. The former is 290 euros, which is 50% more than cash purchases, 194 euros.

On the other hand, P2P payments, which were already widespread in the private sphere for transfers between friends, relatives or work colleagues, are also beginning to spread to the commercial sphere to pay for purchases made in physical establishments. In fact, more and more consumers are using P2P payment applications to pay for their purchases in shops. This is being helped by the fact that a growing number of merchants have started to accept P2P payments. This type of payments at the retail or hospitality level is occurring thanks to the rise of mobile applications for this purpose (Funcas, 2021). The success of these apps is reflected in the number of users.

Bizum is a mobile payment solution for sending money instantly and universally. To use this service, just a bank account in any of the banks offering the service, a cell phone and that both (payer and recipient) are registered for the service is necessary. Bizum currently allows money transfers between individuals, payments in shops, donations and even betting and collecting prizes through an innovative QR code system.

Although there are several companies that provide these services globally, Bizum is the leading company in Spain due to the dominant position of the banks that constitute this application. Despite this, there are other competitors, such as PayPal, Twyp and Verse. PayPal is the world's leading company in online payments, as it offers a system for sending or requesting money from other users through PayPal.me, as well as being able to send money to users in the list of contacts. Twyp is a payment service created by ING Direct but can be used by anyone regardless of their bank account. Finally, Verse is the clearest alternative to Bizum, improving some of its functionalities as it allows creating groups of friends to share expenses in a simpler way, dividing expenses automatically or even sending money at a European level, accepting banks from countries such as Germany, France, Italy, the Netherlands, Portugal and the United Kingdom, among others.

3. The stimulus–organism–response (S-O-R) framework and hypotheses development

3.1 S-O-R framework

Numerous behavioral models have been proposed in the previous scientific literature to explain the antecedents of intention to use and the behavior of the users regarding the adoption of different financial technologies as well as in mobile payment systems (Irimia-Diéguez *et al.*, 2023; Liébana-Cabanillas *et al.*, 2022). Most research has employed classical theories such as the theory of reasoned action (TRA) (Fishbein and Ajzen, 1977), technology acceptance model (TAM) (Davis, 1989), theory of planned behavior (TPB) (Ajzen, 1991), diffusion of innovation (DOI) (Rogersà Rogers, 2003), unified theory of acceptance and use of technology (UTAUT) (Venkatesh *et al.*, 2003) as well as its subsequent modifications (Lee *et al.*, 2022; Goel *et al.*, 2022; Shaikh *et al.*, 2023). Although previous studies have made important contributions in the field of mobile payments by applying these theories and have improved knowledge (Al-Okaily *et al.*, 2023; Dash *et al.*, 2023), we consider that the use of the S-O-R model would enrich both theory and practice in this field of study where, so far, few authors have used it as a reference in their research (Yuan *et al.*, 2020).

The S-O-R model was proposed by Mehrabian and Russell (1974) and later used by Donovan and Rossiter (1982) to define the environment as a stimulus, which causes an evaluation by the consumer, and consequently some behavioral responses. This psychological model explains human behavior through a three-stage process as shown in Figure 1; the perceptions of external or environmental stimuli associated with a purchase

decision (S) influence the individual's emotional and cognitive states resulting from perceptions, psychological factors, feelings and thoughts (O), which drive conscious or unconscious responses (R).

This model has been used in numerous investigations in many different scientific fields such as e-commerce (Le *et al.*, 2022), website design (Molinillo *et al.*, 2021), social commerce (Herzallah *et al.*, 2021), showrooming (Shankar *et al.*, 2021), online reviews based on text and photos using automatic processing patterns and conscious perceptions (Bigne *et al.*, 2020) and even in the analysis of consumer behavior in payment systems (e.g., Yuan *et al.*, 2020; Sun *et al.*, 2021; Zhou *et al.*, 2022).

3.2 Research model and hypotheses

3.2.1 Subjective Norms (SN). Subjective norms are defined as the individual's beliefs about whether significant others think he or she should or should not use a system or take some action (Fishbein and Ajzen, 1977). Subjective norms are assumed to capture the extent of perceived social pressures exerted on individuals to engage in a certain behavior (Shneor and Munim, 2019). In our study, we consider that the perceived quality of P2P payment services maybe influenced by subjective norms since word-of-mouth strategy is being currently applied in the Paytech industry. On the other hand, a direct relationship between subjective norms and perceived trust has also been proposed by several authors (Kalinic *et al.*, 2019). Finally, according to Yasin *et al.* (2019), there is a direct and positive link between subjective norms and perceived usefulness. Therefore, the following hypotheses are proposed:

H1. Subjective norms positively influence perceived quality.

H2. Subjective norms positively influence perceived trust.

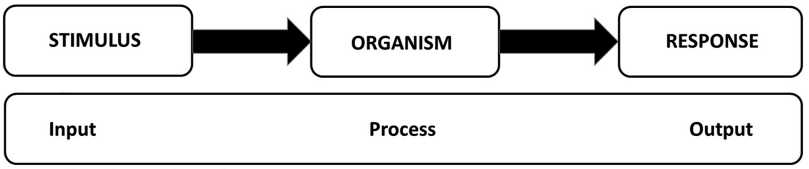
H3. Subjective norms positively influence perceived usefulness.

3.2.2 Personal innovativeness in information technology (PII). Personal innovativeness is considered an important construct in the study of individual behavior toward innovations (Agarwal and Prasad, 1988) and has had a long-standing tradition in innovation diffusion research. Personal Innovativeness can be defined as the willingness to try new information technology. Rogers (2014), in the innovation diffusion theory, explains that individuals who are more innovative are also early-adopters. Consequently, these individuals become more technically competent than others. According to Liébana-Cabanillas *et al.* (2017), it is conceptualized as a trait, i.e., the individual is not influenced by environmental or internal variables. On the other hand, previous studies (Leong *et al.*, 2015) found personal innovativeness to be a significant predictor of both perceived usefulness and perceived trust. Therefore, we state the following hypotheses:

H4. Personal innovativeness positively influences perceived quality.

H5. Personal innovativeness positively influences perceived usefulness.

H6. Personal innovativeness positively influences perceived trust.



Source(s): Own elaboration

Figure 1.
Conceptual framework of S-O-R theory

3.2.3 Perceived quality (QUAL). Perceived quality was defined by Zeithaml (1996) as the consumer or user's judgment of a product's superiority or excellence. Perceived quality comes from users' subjective comparison between the desired quality of the service and what is actually perceived (Lara-Rubio *et al.*, 2021).

According to Almarashdeh (2018), Perceived quality is a good predictor to measure the user acceptance of new technology. Namely, in online services, quality reflects aspects such as the response speed of the system, reliability, reduction of uncertainty, ease of use, adaptation to the users' needs and the fulfillment of their expectations, among other things (Ahn *et al.*, 2007).

Perceived quality communicates to the user the provider's ability to comply with the requirements of service provision, which fosters their trust. The results of Gao and Waechter (2017) show that information quality is positively related to initial trust. Therefore, we propose the following hypothesis:

H7. Perceived quality positively influences perceived usefulness.

H8. Perceived quality positively influences perceived trust.

3.2.4 Perceived usefulness (PU). Perceived usefulness was defined by Davis (1989) as the degree to which a person believes that the use of a particular system would improve their job performance. This influential factor is important regarding the final decision since many of the routine processes are already fulfilled by the users themselves in mobile apps (Pousttchi and Dehnert, 2018). Over the years, many researchers have provided evidence on a significant and direct effect of perceived usefulness on the intention to use a new system or technology (Hu *et al.*, 2019; Meyliana and Fernando, 2019; Ryu *et al.*, 2018). In accordance with S-O-R model, it is hypothesized that perceived usefulness would have a significant positive influence on the intention to adopt Paytech services, as we state in the following hypothesis:

H9. Perceived usefulness positively influences the intention to use P2P payment services.

3.2.5 Perceived trust (TR). According to Ennew and Sekhon (2007), perceived trust is defined as "an individual's willingness to accept vulnerability on the grounds of positive expectations about the intentions or behavior intentions or behavior of another in a situation characterized by interdependence and risk". Due to the inherent characteristics of Paytech services, perceived trust plays a key role owing to the high volume of data involved in the service offered (Hu *et al.*, 2019; Higueras-Castillo *et al.*, 2023). Meanwhile, Liébana-Cabanillas *et al.* (2019) point out that in the initial stage of implementation of a new online payment system, users may not trust without the protection provided by appropriate regulations and the use of modern technologies. In addition, ongoing branch bank closures and, consequently, less personal contact will have a further impact of perceived trust on intention to use Paytech services as Bizum, since online communication with banks is becoming the usual way. Thus, the following hypothesis is proposed:

H10. Perceived trust positively influences the user's intention to adopt P2P payment services.

3.2.6 Moderating effect of perceived risk (PR). Perceived risk was defined by Bauer (1960) as the customers' perception of the uncertainty and the possible negative consequences arising from the purchase of a product or service. In a Paytech context, Featherman and Pavlou (2003) define perceived risk as "the potential for loss in the search for the desired outcome of using an electronic service". According to Lara-Rubio *et al.* (2021), perceived risk is considered "a multidimensional construct composed of various factors that jointly explain the global risk associated with the adoption and use of a payment service". Regarding financial and private information risks, perceived risk is a negative factor that affects customer confidence in

online financial transactions if the online providers will not meet their security or money transfer requirements (Rouibah *et al.*, 2016). Hence, an online user may incur personal losses while managing payments transactions over the Internet (e.g., stealing secured personal information, theft of credit card information, false identity information and the disclosure of private consumer data or privacy information). Perceived usefulness and perceives quality have been confirmed to significantly improve users' trust in mobile systems as both reduce risk perceptions in terms of errors, complexity, etc., particularly in mobile payment services (Zhou, 2022).

H11. Perceived risk moderates the effect of both perceived usefulness and perceived trust on the user's intention to adopt P2P payment services.

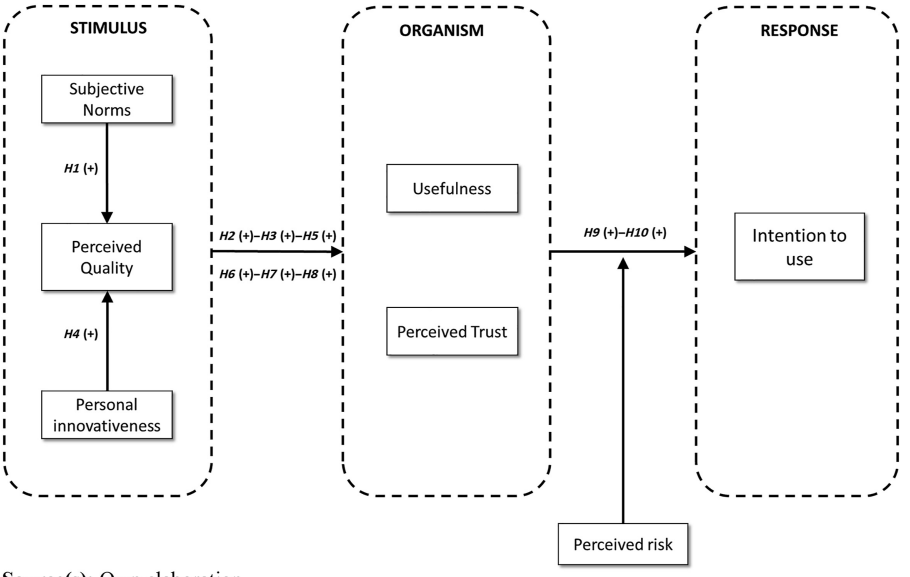
Figure 2 depicts the study research model.

4. Research methodology

4.1 Data collection

In this work, we use a primary source of data obtained from a survey made with 701 Spanish smartphone users, who are considered potential users of the P2P payment systems. All the users who participated in the survey had experience in using their cell phone for commercial activities, either for shopping or payment. To collect the data, non-probability snowball sampling was employed through a mailing list and social networks.

The final sample, after eliminating questionnaires that took too little time or exceeded the recommended time, amounted to 701 participants, of whom 46.22% were male and 53.78% were female. 42.37% were between 18 and 24 years old, 51.21% were between 25 and 44 years old and 6.28% were over 44 years old. 4.28% had doctoral studies, 49.93% had university studies, 26.68% had secondary school studies, 15.83% had primary school studies and the remaining 3.28% had no studies at all.



Source(s): Own elaboration

Figure 2.
Research model

To confirm whether our sample was suitable, the inverse square root method (Kock and Hadaya, 2018) was applied. The minimum sample size required for this study is 249 (where the significance value = 0.05 and a minimum path coefficient = 0.10, potential power = 90%). Therefore, the estimation for sample size confirms that the sample size is adequate for this kind of research.

4.2 Measures

The data for the empirical evaluation of the research model were collected through a self-administered online survey. The constructs of the model were measured through reflective measurement scales validated in previous research and adapted to the proposed payment context. Subjective norms were measured using 4 items adapted from Agarwal and Prasad (1998) and Taylor and Todd (1995). Perceived quality was measured with 7 items from Parasuraman *et al.* (1988) and Lai *et al.* (2007). Personal innovativeness was measured with 4 items adapted from Agarwal and Prasad (1998) and Ramos-de-Luna *et al.* (2016). Perceived usefulness was measured with 4 items from the research of Bhattacherjee and Premkumar (2004). Perceived trust was measured with 5 items adapted from Pavlou (2002). Perceived risk was measured with 4 items adapted from Jarvenpaa *et al.* (2000) as well as Wakefield and Whitten (2006) Finally, intention to use was measured with 3 items adapted from Venkatesh and Bala (2008). In all the cases, 7-point Likert-type scales were used (1 = strongly disagree; 7 = strongly agree) (see Table A2). As the original scales were in English, and the target population was Spanish, in order to maintain the accuracy of the original scales, the questionnaire was translated into Spanish by a professional service so that the level of comprehension was guaranteed.

Finally, two focus groups were set up, the first with the heads of the payment methods departments of five Spanish financial institutions and the second with ten customers who regularly use mobile payment systems. After these meetings, the questionnaire was established and proposed to a group of users as a pre-test to analyze the validity and reliability of the proposed scales.

4.3 Statistical methodology

Due to the characteristics of the indicators obtained from the survey, we have the opportunity of building constructs that can be related to the indicators by using PLS-SEM. Due to its maximum interest and applicability, PLS-SEM has been employed and recommended in previous studies which focused on the prediction of the constructs and the complex interrelationships between latent variables (Hair *et al.*, 2011). To this end, Smart PLS 3.2.7 software was used to conduct the research model (Ringle *et al.*, 2015).

The analysis and interpretation of PLS results has two main stages. The first stage, the measurement model, determines whether the indicators and constructs have been measured correctly (outer model) and the second stage, the structural model (inner model), determines whether the relations between the constructs are significant or not.

5. Results

5.1 Common method bias

Common method bias (CMB) happens when variations in responses are caused by the instrument rather than the actual predispositions of the respondents that the instrument attempts to uncover (Kock, 2015). A full collinearity test based on variance inflation factors (VIFs) was used to detect a potential CMB situation (Kock, 2015) following the guidelines described by Kock and Lynn (2012). Kock (2015) indicates that when a VIF achieves a value

greater than 3.3, there would be an indication of pathological collinearity. The present model, with a maximum VIF of 2.352 (Table 1), may be considered free of CMB.

5.2 Measurement (outer) model assessment

The measurement model section assesses the reliability and validity to prove the feasibility of the individual items and constructs employed in the research model. The results, reported in Table 2, display that all the standard factor loadings are larger than 0.7 Thus, all the items are considered satisfactory. In addition, the descriptive statistics of all the items are shown in

	Intention to use	Perceived usefulness	Perceived trust	Perceived quality
Perceived usefulness	1.693			
Perceived trust	1.693			
Subjective norms		1.800	1.800	1.638
Perceived quality		2.300	2.300	
Personal innovativeness		2.352	2.352	1.638

Source(s): Own elaboration

Table 1. Variance inflation factor (VIF) values

Constructs	Items	S.L.	Cronbach's Alpha	rho_A	C.R.	AVE
Subjective norms (SN)	SN1	0.900	0.931	0.933	0.951	0.830
	SN2	0.930				
	SN3	0.885				
	SN4	0.928				
Perceived quality (QUAL)	QUAL1	0.844	0.953	0.953	0.961	0.780
	QUAL2	0.822				
	QUAL3	0.896				
	QUAL4	0.917				
	QUAL5	0.901				
	QUAL6	0.916				
	QUAL7	0.882				
Personal innovativeness (PII)	PII1	0.908	0.955	0.955	0.967	0.880
	PII2	0.946				
	PII3	0.947				
	PII4	0.951				
Perceived usefulness (PU)	PU1	0.910	0.943	0.945	0.959	0.855
	PU2	0.958				
	PU3	0.900				
	PU4	0.929				
Perceived trust (TR)	TR1	0.927	0.974	0.975	0.980	0.907
	TR2	0.963				
	TR3	0.966				
	TR4	0.959				
	TR5	0.894				
Intention to use (IU)	IU1	0.964	0.969	0.969	0.980	0.942
	IU2	0.974				
	IU3	0.974				

Note(s): S.L = Standard loadings; rho_A = Cronbach's Alpha; C.R. = Composite reliability; AVE = Average variance extracted

Source(s): Own elaboration

Table 2. Measurement model results

Table A1 in the Appendix. As can be observed, all the values show that the data are not extremely non- normal since the absolute values of skewness and kurtosis are under /2/.

As shown in Table 2, all the constructs comply with Cronbach's Alpha, Dijkstra–Henseler's rho (rho_A) and composite reliability (C.R.) due to having figures over the critical 0.7 level, showing that all the constructs have convergence or internal consistency. Finally, it can be observed that all the constructs satisfy the criterion of 0.5 points (equal to or above) demanded by the average variance extracted (AVE), fulfilling the convergent validity of the constructs and dimensions.

Nevertheless, it is also necessary to assess the discriminant validity of the constructs. Under the Fornell-Larcker framework, the AVE should be greater than the variance shared between the construct and other constructs in the model. As shown in Table 3, the diagonal elements are significantly greater than the off-diagonal elements in the corresponding rows and columns for all the constructs obtaining an adequate discriminant validity (Hair *et al.*, 2021). Additionally, Table 3 also shows that all the constructs have a Heterotrait-Monotrait ratio of correlations (HTMT) value lower than 0.85 which indicates the existence of discriminant validity for all the constructs.

5.3 Structural (inner) model assessment

The evaluation of the structural model is based on the sign, magnitude and significance of the structural path coefficients and on the R2 values (Hair *et al.*, 2021). In order to ascertain the statistical significance of the path coefficients, a bootstrapping procedure is performed with 5,000 resamples (Hair *et al.*, 2011). A percentile bootstrap 95% confidence interval is also employed. As can be seen in Table 4, all the hypotheses were supported.

	IU	PU	TR	SN	QUAL	PII
Intention to use (IU)	*0.971*	0.801	0.656	0.739	0.670	0.670
Perceived usefulness (PU)	0.767	*0.925*	0.667	0.763	0.765	0.768
Perceived trust (TR)	0.638	0.640	*0.953*	0.644	0.733	0.633
Subjective norms (SN)	0.702	0.715	0.614	*0.911*	0.647	0.661
Perceived quality (QUAL)	0.646	0.728	0.707	0.613	*0.812*	0.757
Personal innovativeness (PII)	0.644	0.729	0.610	0.656	0.624	*0.938*

Note(s): The square roots of the AVEs are in italic on the main diagonal. The Fornell-Larcker criterion is depicted below the main diagonal. The heterotrait–monotrait (HTMT) ratio is above the main diagonal
Source(s): Own elaboration

Table 3. Discriminant validity

Hypotheses	β (path coeff.)	*t*-values	*p*-values	Confidence intervals	Sign	Decision
H1: SN→QUAL	0.265	18,252	0.000	(0.176; 0.353)	Yes	Supported***
H2: SN→ TR	0.258	9,908	0.000	(0.180; 0.332)	Yes	Supported***
H3: SN→PU	0.345	7,010	0.000	(0.277; 0.413)	Yes	Supported***
H4: PII→QUAL	0.557	7,690	0.000	(0.475; 0.641)	Yes	Supported***
H5: PII→PU	0.294	9,248	0.000	(0.210; 0.381)	Yes	Supported***
H6: PII→TR	0.110	6,832	0.015	(0.021; 0.201)	Yes	Supported**
H7: QUAL→PU	0.304	6,653	0.000	(0.227; 0.384)	Yes	Supported***
H8: QUAL→TR	0.469	5,929	0.000	(0.370; 0.566)	Yes	Supported***
H9: PU→IU	0.608	2,441	0.000	(0.540; 0.671)	Yes	Supported***
H10: TR→IU	0.249	13,165	0.000	(0.180; 0.319)	Yes	Supported***

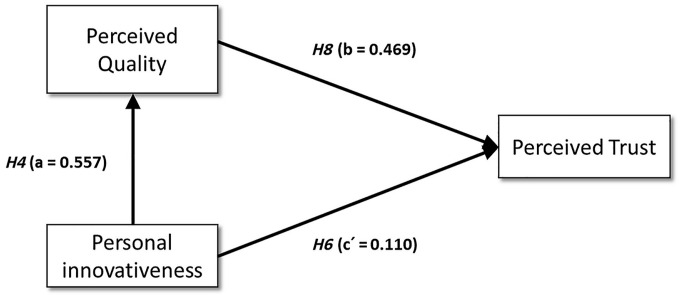
Note(s): Significant at $p^{***} \leq 0.001$ and $p^{**} < 0.05$
Source(s): Own elaboration

Table 4. Significant testing results of the structural model path coefficients

The results of the structural model reveal that all the hypotheses have significant relationships with their respective variables. The direct relationships are robust and acceptable because they have t-values greater than 0.226 and p-values lower than 0.10 except H8 whose level of significance is slightly lower. Due to this fact, the mediator effect of perceived quality in the relationship between personal innovativeness and perceived trust was analyzed as shown in Figure 3.

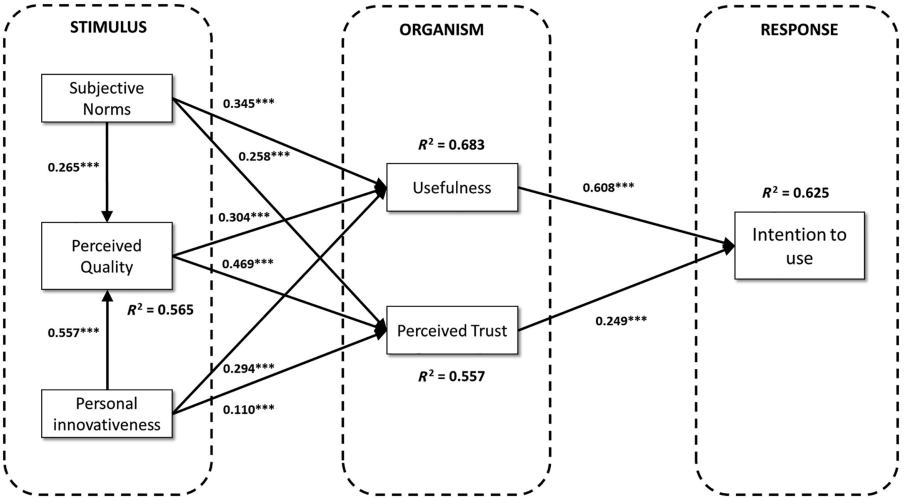
According to Nitzl *et al.* (2016), a complementary partial mediation of perceived quality in the relationship between personal innovativeness and perceived trust is found, due to the fact that both the direct effect ($c' = 0.110$) and the indirect effect ($a \times b = 0.261$) are significant and the sign of the mediation ($a \times b \times c'$) is positive. The strength of this partial mediation can be evaluated by calculating the VAF value which determines the extent to which the mediation process explains the dependent variable's variance. Since the VAF = 70.35% a partial mediation is confirmed.

Figure 4 shows the significance of the hypothesized relationships and the explanatory capacity of the proposed model. A large portion of the variance of the latent variance is



Source(s): Own elaboration

Figure 3.
The mediator role of perceived quality



Note(s): Significant at p*** = < 0.001
Source(s): Own elaboration

Figure 4.
Assessment of the structural model

explained. Additionally, the standardized root mean square residual (SRMR) value was 0.043 (lower than the maximum acceptable value of 0.08 recommended by Schuberth *et al.*, 2022). Thus, the proposed model has goodness of fit.

5.4 Assessment of the predictive validity

This study also performs a predictive analysis to verify the predictive ability level of the proposed research model. According to Shmueli and Koppius (2011), this analysis has the capacity to generate accurate predictions of new observations, temporal, interpretable or transversal. The current PLS predict algorithm of the SmartPLS software version 3.2.7 (Ringle *et al.*, 2015) was applied to value the proposed research model's predictive ability. The values obtained through these statistics are root mean squared error (RMSE), the mean absolute error (MAE) and the Q^2 predict values. These enable assessing the predictive performance of their PLS path model for the constructs (LV Prediction Summary) and indicators (MV Prediction Summary).

In the PLS predict routine, firstly a k-fold cross-validation was executed, setting k = 24 subgroups, with the aim of meeting the minimum size of N = 30 for the hold-out sample (Hair *et al.*, 2021), repeating this procedure ten times. Since all the values of the skewness for prediction errors of result indicators were under /1/, both for the PLS and the LM analyses, RMSE was selected as a basis of the predictive power assessment. Hence, since over half of the RMSE values of PLS-SEM are lower than those of the LM analysis, a medium predictive relevance performance is found (Table 5).

5.5 Importance-performance map analysis (IPMA)

The Importance-Performance Map Analysis, also known as the Importance-Performance Matrix, is a complementary analysis to let us know which constructs and items are most important and have a higher performance when determining a construct (Ringle and Sarstedt, 2016). Thus, this analysis allows for prioritizing the constructs as well as the

Table 5. PLS predict assessment of indicators and Skewness of Prediction Errors

	PLS		LM	PLS -LM	Skewness
	RMSE	Q^2_predict	RMSE	RMSE	Predic. errors
IU1	1.155	0.515	1.132	0.022	−0.264
IU2	1.158	0.508	1.142	0.016	−0.093
IU3	1.171	0.520	1.154	0.017	−0.219
QUAL1	0.974	0.457	0.974	−0.001	0.027
QUAL2	1.068	0.424	1.070	−0.002	−0.026
QUAL3	1.139	0.406	1.138	0.000	−0.214
QUAL4	1.058	0.484	1.065	−0.007	−0.142
QUAL5	1.014	0.468	1.009	0.006	−0.081
QUAL6	1.104	0.378	1.092	0.011	−0.019
QUAL7	1.045	0.423	1.025	0.019	0.120
TR1	1.033	0.408	1.038	−0.005	0.078
TR2	1.022	0.407	1.030	−0.007	0.203
TR3	1.024	0.415	1.021	0.003	0.114
TR4	1.036	0.418	1.041	−0.005	0.157
TR5	1.071	0.419	1.078	−0.007	0.157
PU1	1.070	0.581	1.081	−0.011	−0.285
PU2	1.175	0.520	1.187	−0.012	−0.266
PU3	1.193	0.505	1.177	0.016	−0.360
PU4	1.070	0.576	1.076	−0.006	−0.141

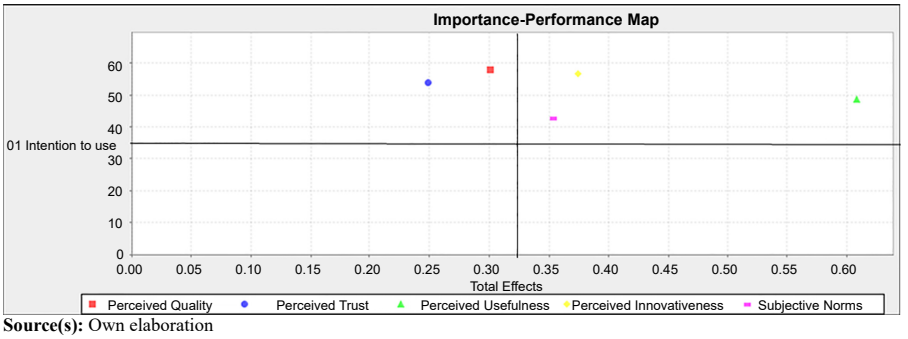
Source(s): Own elaboration

corresponding items to improve the targeted construct. In our current research model, IPMA was performed employing intention to use Paytech services as the target endogenous construct and this was established before executing the IPMA analysis.

Figures 5 and 6 display the diagrams that will let us analyze these relations from a more practical and intuitive approach. The first diagram focuses on the construct and the second one on the items of the proposed research model. To better understand the figures, it incorporates two supplementary lines that divide the importance-performance graph into four spaces or quadrants (Ringle and Sarstedt, 2016). The horizontal line represents the performance and the vertical line the importance represented by the average values of both dimensions. Hence, the graph has 4 quadrants that include the values above and below the mean: 1) Upper-right quadrant (+Importance; + Performance); 2) Lower-right quadrant ((+Importance; − Performance); 3) Lower-left quadrant (− Importance; − Performance) and 4) Upper-left quadrant (−Importance; + Performance).

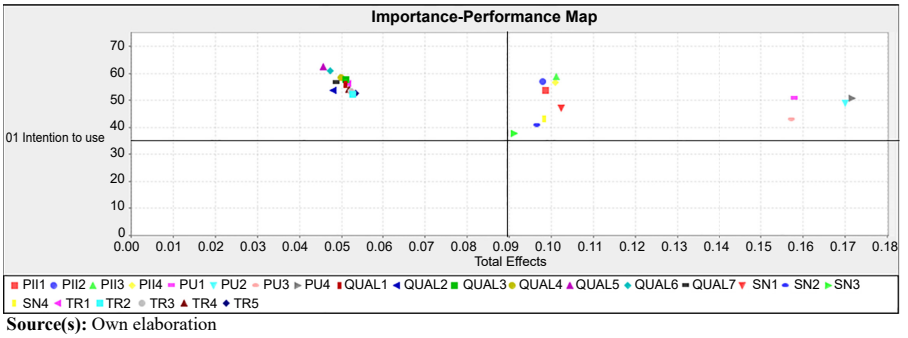
As may be observed in Figure 5, the variables perceived usefulness, subjective norms and personal innovativeness are in quadrant 1 (upper-right). Therefore, this analysis reveals that these constructs have the greatest (namely, over the average) levels of importance and performance. They can be considered as key factors in influencing consumer intention to use Paytech services. The variables perceived quality and perceived trust are in quadrant 3 (upper-left) meaning that users are paying little attention to them although they have a high performance for the target construct.

In Figure 6, we can see which indicators are the most important and have the highest performance. All the items are in the same quadrant as their construct. Thus, we reach the same conclusion.



Source(s): Own elaboration

Figure 5.
IPMA: Constructs' standardized effects



Source(s): Own elaboration

Figure 6.
IPMA indicators' standardized effects

5.6 The moderating effect of perceived risk

In order to analyze the moderator effect of perceived risk on the relationship between usefulness and intention to use and trust and intention to use, the following procedure was applied. First, the measurement invariance assessment procedure (MICOM) (Henseler *et al.*, 2016) was applied to determine whether, under different conditions of observation and study of the phenomena, the measurement models yield measurements of the same attribute. The MICOM procedure comprises three steps: (1) configural invariance, (2) compositional invariance and (3) the equality of composite mean values and variances.

Configurational invariance is the condition that both the items and the model in both groups are the same. If this condition is not met, it is not possible to conduct a multi-group analysis. Compositional invariance seeks to assess that respondents in both groups understood the same meaning to each question when answering the questionnaire. If this condition is met, "partial measurement invariance" is established, which is a sufficient condition for conducting a multi-group analysis. In our research, partial invariance is confirmed because steps 1 and 2 conform to the limits established in the literature, while step 3 does not find optimal values for all the variables. However, in practical applications, the full measurement invariance is often not fulfilled (Steenkamp and Baugarner, 1998).

Once the measurement invariance was verified, the structural model was estimated, using the PLS multigroup analysis method (Henseler *et al.*, 2009). To this end, the sample was divided into two groups, users with low perceived risk and those with a high perceived risk. Table 6 shows the results of the test of differences between the two groups for the relationships proposed in H11. As shown in Table 6, both relationships differ significantly between the two groups created (p<0.10%). Therefore, the results indicate that the risk perception moderates the relationships between both usefulness and trust with the intention to use the proposed P2P payment system.

We observe that, on the one hand, users with high perceived risk have a lower intensity in the relationship between perceived usefulness and intention to use ($\beta_{\text{HIGH RISK}} = 0.572$; $p = 0.000$; $\beta_{\text{LOW RISK}} = 0.684$; $p = 0.000$) as they probably value other elements derived from their own experience. On the other hand, for users with a high perception of risk, the relationship between trust and intention will have a greater intensity than in the case of users with a low perception of risk ($\beta_{\text{HIGH RISK}} = 0.298$; $p = 0.000$; $\beta_{\text{LOW RISK}} = 0.144$; $p = 0.012$).

6. Discussion

6.1 Conclusion

Fintech is considered by many researchers and practitioners as one of the most important innovations in the financial sector, due to its significant potential for change and disruption as well as its implications for all players in that sector (Bajwa *et al.*, 2022). Within these technological improvements, the use of cell phones and their practical applications in the financial sector are crucial. In this vein, mobile applications have generated new opportunities, such as improvements in the provision of advice and customer services,

Table 6. Moderating effect of Perceived Risk

	High-risk perceived		Low-risk perceived		Path difference		
Hypotheses	β (path coeff.)	p-value	β (path coeff.)	p-value	β	T test	p-value
PU→IU	0.572	0.000	0.684	0.000	0.112	1.628	0.100
TR→IU	0.298	0.000	0.144	0.012	0.154	2.145	0.032

Source(s): Own elaboration

access to almost any financial service and an increase in the number of PoS terminals due to the use of smartphones incorporating NFC technologies.

In this sense, as reported, mobile payment systems in general (Balachandran *et al.*, 2022) and P2P in particular (Lara-Rubio *et al.*, 2021), seriously threaten the use of banking and cash for everyday purchases. This fact should imply an effort in analyzing users' behavior as well as their background and barriers (Belanche *et al.*, 2022).

Among the different P2P payment systems, it is proposed to analyze the case of Bizum due to the growing interest that this new P2P payment system has aroused not only among users and Fintech companies, but also in previous academic studies. Due to this huge interest, we consider the research carried out to be innovative and timely.

This research proposes the development of a conceptual framework using the S-O-R model, where the proposed stimuli are subjective norms, the perceived quality of Bizum itself, as well as the user's level of innovation, while the body is identified with perceived usefulness and perceived trust as antecedents of the response, identified as the intention to use Bizum.

6.2 Theoretical implications

Our contributions to the research on P2P payment systems are, firstly, to better understand the crucial role of P2P payment systems nowadays. Their economic and social significance in our society is highlighted due to the enormous development of smart phones and the advantages that their use entails.

Secondly, many different theories have been extensively applied in the adoption of technology but not yet in Fintech services adoption studies. Our work is one of the first to propose and empirically evaluate a behavioral model that uses the S-O-R framework to study the intention of individuals about the use of a specific P2P payment tool. Consequently, this is a contribution to the improvement of the scientific knowledge and the academic literature on consumer behavior.

Thirdly, this study also performs an analysis of the out-of-sample predictive power of the proposed research model. From a methodological view, not only explanatory analyses but also predictive studies on fintech adoption are required to validly extrapolate the results. Thus, our work seeks to advance within this emerging line of research.

Fourthly, this study improves the understanding of the effects on perceived usefulness and perceived trust through three fundamental aspects in the analysis of technology adoption: Subjective norms through the influence of the potential user's immediate environment of P2P payment systems, perceived quality through the potential user's evaluation of the tool itself, as well as the individual's level of personal innovativeness toward Bizum. The best antecedents on perceived usefulness and on perceived trust were shown to be, respectively, subjective norms and perceived quality, which reinforces the findings of previous works in other online contexts (i.e., Yasin *et al.*, 2019; Gao and Waechter, 2017). The present study shows that both characteristics had a considerable influence and of a similar intensity. Thus, this research contributes to improving the understanding of the importance of both perceived usefulness and perceived trust by extending the results of previous studies to the P2P context. In addition, our results demonstrate the importance of perceived usefulness as the main antecedent of intention to use. This relationship corroborates the importance of this variable in innovations related to financial technologies (i.e., Singh *et al.*, 2021; Saheb *et al.*, 2022). Consequently, we can affirm that utility aspects have been decisive in assessing potential users' intention to use this type of payment systems. This result is also corroborated by the IPMA analysis where perceived usefulness, subjective norms and personal innovativeness are shown to have the greatest importance and performance.

Fifthly, the proposed model shows the moderating effect of perceived risk. Namely, this moderating effect was demonstrated in the two proposed relationships. Our results show that

perceived usefulness has more influence on intention among users who have a lower perception of risk, whilst in the relationship between trust and intention, the effect is higher for users who have a higher perception of risk. This is an important contribution that improves the understanding of the effect of risk on payment systems and addresses a gap identified in previous studies. The results are in line with recent work that identified the effect of risk related to intention (Daragmeh *et al.*, 2021; Mehta *et al.*, 2021; Qalati *et al.*, 2021; Poon and Tung, 2022).

Finally, the mediating effect of perceived quality on the relationship between personal innovativeness and perceived trust was analyzed. This conclusion is fundamental to understand the important role that the innovation of potential users plays in the adoption of a technology and, more specifically, the importance that it has on trust.

6.3 Managerial implications

This research also has important implications for the different sectors involved in the design, marketing and sale of these banking services. This P2P payment sector is a highly competitive market with great growth and potential; these financial solutions will reach out to the next generations since the majority are "digital natives" ready for innovative payment services. In addition, these P2P solutions are highly appreciated among end users due to involving a perception of belonging to a digital community. As a consequence of the networking effects, the various competitors are trying to win the race to dominate this "winners-take-all" market (Wirtz *et al.*, 2018). Furthermore, the knowledge of the factors fostering the adoption of these payment services would allow an international expansion of the financial providers without the inconvenience of establishing offices or companies in other countries. Other significant advantage is that P2P services can promote financial inclusion by allowing access to financial services to the entire population regardless of their location (e.g. rural areas) or of their age (e.g. elder people).

Thus, financial providers need to identify the competitive advantages that will allow them to lead P2P services in their markets. To this vein, firstly, P2P payment systems need to improve usability among users by ensuring that the agility and speed of transactions is adequate through the applications designed for this purpose.

Secondly, in order to improve user confidence, it will be essential to pay attention to the perceived quality of the payment system analyzed, through the reliability, accuracy and information provided, which are fundamental aspects for the potential users of the payment tools studied. As trust is the second most important factor influencing take-up, promotional campaigns should also focus on activities aimed at building consumer trust.

Thirdly, the results showed significant differences in perceived risk in the relationships between usefulness and trust with intention to use. In this respect, it will be necessary for P2P payment tools to implement rigorous security measures to keep not only users' transactions protected but also their personal data by ensuring the integrity of the information.

Finally, companies must take into account the changes in consumer behavior that are occurring due to social changes in the face of the COVID-19 pandemic (Daragmeh *et al.*, 2021; Liébana-Cabanillas *et al.*, 2022). In recent months, new payment systems have been established to reduce the contact between buyer and seller, which has improved the growth prospects of contactless payment systems and P2P systems themselves, so companies should encourage their use because of the advantages that they offer compared to other traditional payment systems.

6.4 Limitations and further research

Like any research, this study also has some limitations that can be considered a justified starting point for future research. Firstly, with regard to the sample, only cell phone users

with experience of purchasing through these terminals were used, but their experience with payment systems prior to P2P payment systems was not assessed. It would be interesting to contrast the effect of usage experience in future research and to analyze its importance in the decision process for a continuous use, as well as to review the drivers and barriers between users and non-users in a more exhaustive way.

Additionally, the research was conducted at a single point in time, which means that the study lacks the dynamism of including observations and measuring them at consecutive time intervals. To overcome this limitation, it is proposed to carry out a longitudinal study and to analyze over time the variations that may occur. A longitudinal approach would make it possible to check the robustness of the relationships and constructs established and to verify, from a temporal perspective, the evolution of the effects of the variables analyzed.

Regarding the proposed theoretical framework, in spite of being adequate due to the empirical evidence that numerous studies have obtained from it, it would be interesting to introduce new drivers in the analysis of the users' intentions, as well as in the measurement of the real behavioral use of P2P payment systems.

In addition, we propose a comparative analysis between the different services offered by Bizum, such as payments to merchants or donations among others.

To close, it would be also interesting to analyze the possible moderating effects of other variables related to payment systems included by other, recent research, as well as the effects of different cultural factors through a cross-national study.

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Appendix

Constructs	Items	Mean	S.D.	Excess kurtosis	Skewness
Subjective norms (SN)	SN1	3.832	1.510	−0.269	−0.126
	SN2	3.459	1.550	−0.503	0.040
	SN3	3.275	1.652	−0.854	0.120
	SN4	3.595	1.557	−0.557	−0.046
Perceived quality (QUAL)	QUAL1	4.348	1.320	0.287	−0.272
	QUAL2	4.227	1.475	−0.283	−0.328
	QUAL3	4.464	1.471	−0.061	−0.488
	QUAL4	4.512	1.388	0.275	−0.519
	QUAL5	4.755	1.398	0.456	−0.684
	QUAL6	4.658	1.373	0.412	−0.573
	QUAL7	4.407	1.406	0.050	−0.352
Personal innovativeness (PII)	PII1	4.215	1.581	−0.391	−0.299
	PII2	4.419	1.486	−0.037	−0.411
	PII3	4.521	1.479	0.019	−0.434
	PII4	4.408	1.412	0.244	−0.348
Perceived usefulness (PU)	PU1	4.066	1.695	−0.725	−0.260
	PU2	3.943	1.641	−0.679	−0.180
	PU3	3.591	1.694	−0.830	0.046
	PU4	4.051	1.652	−0.645	−0.293
Perceived trust (TR)	TR1	4.365	1.337	0.302	−0.261
	TR2	4.144	1.356	0.212	−0.163
	TR3	4.211	1.326	0.443	−0.193
	TR4	4.255	1.340	0.308	−0.210
	TR5	4.153	1.403	0.093	−0.158
Intention to use (IU)	IU1	3.499	1.656	−0.779	0.083
	IU2	3.508	1.649	−0.792	0.058
	IU3	3.553	1.687	−0.807	0.094

Source(s): Own elaboration

Table A1. Descriptive statistics of all items

Perceived usefulness
Peer-to-peer mobile payment systems are useful payment methods (PU1)
Using peer-to-peer mobile payment systems makes it easier to handle payments (PU2)
Peer-to-peer mobile payment systems allow quick use of mobile applications (PU3)
In general, peer-to-peer mobile payment systems could be useful for me (PU4)
Perceived trust
I believe the peer-to-peer mobile payment system will keep its promises and commitments (TR1)
The peer-to-peer mobile payment system is trustworthy (TR2)
I would describe peer-to-peer mobile payment system as honest (TR3)
I believe the peer-to-peer mobile payment system is responsible (TR4)
In general, I trust the peer-to-peer mobile payment system (TR5)
Personal innovativeness
If I find out about new information technology, I seek ways to experience it (PII1)
I am usually one of the first among my colleagues/peers to explore new information technology (PII2)
In general, I am reluctant to try new information technologies (PII3)
I like to try new information technologies (PII4)
Subjective norms
The people whose opinions I value would approve of me using peer-to-peer mobile payment system (SN1)
Most of the people I have in mind think that I should use a peer-to-peer mobile payment system (SN2)
They expect me to use a peer-to-peer mobile payment system (SN3)
The people who are close to me would agree with me in using a peer-to-peer mobile payment system (SN4)
Perceived quality
When peer-to-peer mobile payment systems promise they will do something, they do (QUAL1)
I consider peer-to-peer mobile payment systems to be dependable (QUAL2)
Peer-to-peer mobile payment systems provide the services they promise when they are supposed to (QUAL3)
Peer-to-peer mobile payment systems accurately maintain the statement (QUAL4)
It is easy to obtain related service information (QUAL5)
It feels safe to do business with the company (QUAL6)
The statement is clear and ease to understand (QUAL7)
Intention to use
Given the opportunity, I will use mobile peer-to-peer mobile payment systems (IU1)
I am likely to use peer-to-peer mobile payment systems in the near future (IU2)
I am open to using peer-to-peer mobile payment systems in the near future (IU3)
Perceived risk
Other people can get information about my online transactions if I use this tool (PR1)
There is a high potential for money wasted if I make purchases on the Internet/social networks using this tool (PR2)
There is significant risk in making purchases on the Internet/social networks using this tool (PR3)
I think that making purchases on the Internet/social networks with this tool is a risky choice (PR4)

Table A2. Constructs and measurement items

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