# RESEARCH



# Exploring the determinants of the user experience in P2P payment systems in Spain: a text mining approach



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# Abstract

**Purpose:** This study aims to identify which determinants are responsible for impacting the user experience of three peer-to-peer (P2P) payment services in the Spanish market.

**Design/methodology/approach:** A sample of all online reviews (n = 16,048) published in Google Play of three paytech apps—Bizum, Twyp, and Verse—was analyzed using text mining and sentiment analysis.

**Findings:** A holistic interpretation of the seed terms included in each aspect allowed to label them based on the preferences expressed by paytech app users in their reviews. Six latent aspects were identified: ease of use, usefulness, perceived value, performance expectancy, perceived quality, and user experience. In addition, the results of the analysis suggest a positivity bias in the online reviews of fintech P2P app users. Our results also show that online reviews of apps associated with banks or financial institutions, such as Bizum (to a greater extent) or Twyp, show more negative emotions, whereas independent apps (Verse) show more positive emotions. Moreover, the most critical users are those of unidentified gender, while women remain in a more neutral position, and men tend to express their opinions more positively regarding P2P payment apps.

**Practical implications:** Paytech providers should analyze the problems faced by users immediately after an encounter. By applying text mining analysis, service providers can gain efficiency in understanding user sentiments and emotions without tedious and time-consuming reviews.

**Originality/value:** This is a pioneering study on peer-to-peer (P2P) mobile payment systems from the user's perspective because it investigates the emotions and sentiments that users convey through bank reviews.

**Keywords:** Bizum, Verse, Twyp, Mobile apps, Paytech, P2P payment, Sentiment analysis, User experience

# Introduction

Terms such as "digital payments", "digital money", "electronic money", "online payment systems", or "mobile payments" are currently encompassed by the financial industry in a broader concept called "paytech"—a segment of fintech services that focuses on



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payments and transactions (Polasik et al. 2020) and is defined by AEFI (2022) as "all those entities that provide, either directly or through other entities, electronic means of payment." According to Capgemini (2021), payment solutions include any service ranging from digital applications to physically contactless wearables. These services vary from consumer needs (such as peer-to-peer or immediate online payments) to trading in markets and e-commerce (e.g., point-of-sale [POS] payment services; Palmié et al. 2020).

Paytech is considered the most important and fastest-growing segment of fintech services from the consumers' perspective (Belanche et al. 2022; Lim et al. 2019). The paytech sector is evolving from a context in which payments are simple transactions (payments 1.0) to the current post-pandemic context, where payments are embedded, invisible, and have an enabling function in a collaborative environment to boost customer experience (payment 4.x). Paytech methods are currently reducing the challenges of traditional (paper-based) processing while managing regulatory, compliance, and cost-based tasks with improvements in profitability and productivity (Capgemini 2021).

Although the pandemic affected businesses in all sectors, when lockdowns and economic uncertainty emerged, the already dynamic payment ecosystem offered a perfect storm for multidimensional disruption. However, well before 2020, consumers were already clamoring for digital experiences similar to what they had come to expect from other service providers. Subsequently, COVID-19 has infused urgency into the demand for convenient omnichannel payment services. As the crisis escalated, paytech and industry newcomers responded with novel business approaches and innovative, userfocused offerings that boosted user experience (UX), intensified disintermediation, and hit payment service provider profits (Capgemini 2021).

In this vein, paytech services must be compatible with traditional payment services and financial environments such as banks and card companies (e.g., VISA). The introduction of a paytech service is not a simple replacement but a convergence with an existing payment service because it must be compatible with the existing payment services as well as the infrastructure. Through this compatibility, paytech services can be widely used without user resistance (Kang 2018). In addition, paytech providers must minimize the costs of implementing a new environment using technology to enhance the delivery of banking services (Broby 2021). Banks and payment firms must rapidly accelerate their transformation efforts to address unmet customer demands and plug gaps.

The future landscape will be welcoming for companies that are open to change and innovation and forward-thinking. New innovators and business models are thriving as the adoption of digital payments continues to rise. Seamless, feature-rich, new payments are the way forward, while regulators strive to create a level-playing field for firms and a risk-free environment for customers.

Paytech is a highly competitive market with significant growth and potential. Paytech solutions are highly appreciated by end users because they are friendly (easy to use), ubiquitous (accessible through smartphones), fast, cheap, or free, and involve a feeling of belonging to a digital community that is inclusive in terms of age, gender, and experience (Liebana-Cabanillas et al. 2014a; 2014b, 2014c).

Regarding the quality of the experience, Minsait Payments (2022) states that Spanish Internet banking users are most satisfied when using this type of application to make P2P payments to friends or acquaintances. In addition, Inteliace Research (2019) states that, in Spain, Bizum, Twyp, and Verse are the preferred applications by the population when making payments between individuals, while PayPal stands out, especially for purchases in stores and e-commerce. Belanche et al. (2022) highlight the popularity of these three P2P apps. Bizum published on its webpage that it had more than 19 million users in 2021 and that the volume of transactions performed was higher than 40,000 million euros since its launch. Verse State has almost two million registered users and is the largest fintech company in Spain, apart from banks, ahead of important players such as Revolut and N26. Twyp was incorporated into the ING platform during the summer of 2022 because of its high volume of transactions, offering immediate transfers via a different app at a small cost ( $2.99 \notin/month$ ).

Given that P2P payments are becoming widespread and fintech companies are trying to exploit their potential, it is essential to examine the determinants contributing to their success (Belanche et al. 2022). Due to the intensive use of technology and the networking effects among users, the various competitors are trying to win the race to dominate this "winners-take-all" market (Wirtz et al. 2018); thus, further research is required to help paytech providers identify competitive advantages that will allow them to lead P2P services in their markets. Liébana-Cabanillas et al. (2021) found that the precursors and barriers to adopting P2P payments differ from those of smartphone-based payment systems. Thus, P2P systems have well-differentiated characteristics and are significantly different from mobile payments in general (Li and Xu 2021). These arguments highlight the need for a specific analysis of P2P payment adoption.

In addition, although online networks are a rich source of consumer data related to the use of services and products, only a few studies (Al-Qudah et al. 2020; Balakrishnan and Shuib 2021; Kar 2021; Liao and Yang 2020) have explored this significant field of data to analyze which determinants are fostering the use of paytech services.

Online reviews can play a dual role by providing information about the user experience (once the payment service has been used) but also potentially including a recommendation to potential users, becoming an easy way to find useful information. However, online comments represent an unstructured information source that is difficult to analyze, requiring high cognitive and time costs if performed manually (González-Rodriguez et al. 2016). The abundance and variety of online information are challenging and hinder the assimilation and processing of such a high volume of information by potential users.

Studies have clarified how online reviews influence customer decision-making in the travel and tourism, hotel, healthcare, online shopping, and food industries (Heng et al. 2018; Fang et al. 2016; Huang et al. 2016; Clemes et al. 2014). Nevertheless, the literature in the banking sector that identifies the reflectors and predictors of customer satisfaction based on online reviews is still scarce. The financial sector remains an area where much of the user-generated content readily available on online customer review platforms is underutilized (Mittal and Agrawal 2022). We highlight a scarcity of extant literature on banking services that uses online reviews to explain customer satisfaction. If so, few studies have combined quantitative and qualitative aspects to measure it and have assessed the dynamics of banking customers' positive and negative reviews on the web to detect service failures and provide solutions (Leem and Eum 2021; Plotnikov et al. 2020). Similarly, Chaturvedi and Chopra (2014) manually extracted banking features

from online reviews. However, text mining and sentiment analysis approaches can be better utilized in the banking sector (Bonsón et al. 2023).

Based on previous arguments, we decided to adopt a methodology capable of automatically extracting all online reviews without restrictions and analyzing reviews from both qualitative and quantitative perspectives. In sentiment analysis, the qualitative aspect focuses on the subjective interpretation and categorization of data using techniques such as coding and manual annotation. On the other hand, quantitative analysis uses mathematical and statistical techniques to measure sentiment in numerical terms, such as assigning scores or values to opinions or comments; therefore, this methodology can be applied to financial innovation.

Considering the theoretical framework, academic research on the use or intention to use paytech services is mostly based on research models, as shown in Table 1. These theories follow two different approaches that can be combined into a single research model. The former approach is based on technological features (perceived usefulness, perceived ease of use, perceived quality, etc.), whereas the latter is based on behavioral factors (social norms, personal innovativeness, attitude, etc.). Both approaches use surveys to obtain data from users or potential users with items obtained from previous studies to analyze the intention to use or adopt an innovative digital payment service. However, previous academic studies on Paytech services have focused on other technologies, such as smart card payment systems, mobile point-of-sale payments, and mobile wallets. The academic literature on P2P payment systems is scarce despite their vastly different characteristics (Liebana-Cabanillas et al. 2021), and only a few studies (Acker and Murthy 2020; Al-Qudah et al. 2020; Iman 2018; Visconti-Caparrós and Campos-Blázquez 2022) have applied a case study methodology.

This research is a pioneering study on peer-to-peer (P2P) mobile payment systems from the user's perspective as it investigates the emotions and sentiments that users convey through bank reviews. The sharing of ideas and opinions through online platforms

| Theory  | Reference study                            | Determinants   |
|---|--|--|
| Stimulus-Organism-Response<br>(S-O-R)                         | Mehrabian and Russell (1974)               | Stimulus (external factors), Organism<br>(Internal factors)                                  |
| Theory of Reasoned Action (TRA)                               | Fishbeinlcek and Ajzen, (1975)             | Attitude, Social Influence   |
| Technology Acceptance Model<br>(TAM)                          | Davis (1989)                               | Perceived usefulness, Ease of use,<br>Intention to use                                       |
| Extended TAM  | Venkatesh et al. (2007)                    | Subjective Norms, Image, Job Rel-<br>evance, Perceived Quality                               |
| Theory of Planned Behavior (TPB)                              | Ajzen (1991)                               | Perceived Control, Subjective Norms and Attitude   |
| Diffussion of Innovation (DOI)                                | Rogers (1995); Burritt and Welch<br>(1997) | Adoption and Innovation character-<br>istics, Innovation-decision process                    |
| Motivational Model  | Venkatesh and Speier (1999)                | Extrinsic & Intrinsic Motivation   |
| Unified Theory of Acceptance and<br>Use of Technology (UTAUT) | Venkatesh et al. (2003)                    | Effort expectancy, Performance<br>Expectancy, Social Influence, Facili-<br>tating Conditions |
| Extended UTAUT  | Venkatesh et al. (2012)                    | Hedonic Motivation, Price Value  |

 Table 1
 Theories used in adoption of Paytech Services

Source: Own elaboration

has not only influenced the way people communicate, but it has also allowed anyone with access to social media to have a voice, increasing public participation in various social, political, and economic domains (D'Andrea et al. 2015). Well-developed methods such as emotion or sentiment analysis can offer insightful information for paytech companies to predict outcomes based on user reviews. The objective of our study was to identify the determinants impacting the user experience of three different P2P payment services in Spain: Bizum, Twyp, and Verse. A sample of all online reviews (n = 16,048) published on Google Play was analyzed using text mining and sentiment analysis.

Our study addresses these gaps in the academic literature on mobile payments (Kar 2021). First, many studies have attempted to identify the antecedents of technology adoption, but the connection with usage experience is missing. Second, the academic literature shows that good perceptions of service quality facilitate adoption. However, no study has measured digital service usage experience by connecting these two bodies of literature, particularly by mining user-generated content. Finally, no attempts have been made to establish antecedents of service usage experience in existing digital service usage behaviors as researchers are distanced from customers at the time of the service encounter.

Thus, the main contributions of this study are fourfold. First, it contributes to the scarce academic research on the acceptance of P2P payment systems as it aims to expand the knowledge of user experience (UX) in the adoption of P2P payments, with UX being one of the most significant features of fintech services in general and paytech services in particular. Second, from a methodological perspective, new approaches to data mining (emotion and sentiment analyses, as well as Latent Rating Aspect Analysis) have been proposed to massively scrape and analyze a large amount of online data regarding the determinants that foster the use of P2P payment systems. Third, owing to the use of web scraping open-source intelligence (OSINT) tools, our study managed to obtain 100% of the historically available reviews by applying an automatized process. To the best of our knowledge, other studies have accessed only some of the available reviews. Finally, the source of data is generated immediately after the use of the service without knowing the purpose of our analysis, which, in turn, enables decision makers to develop effective strategic plans, knowing the problems faced by users immediately after the encounter.

The remainder of this paper is organized as follows. Section "Theoretical Background" reviews the literature. Section "Methodology" details the methodology applied, namely the sample structure and its origin as well as the research questions. Section "Results" shows the results of the study, followed by discussion. Finally, Section "Discussion" concludes the paper.

# Theoretical background

# Previous research of sentiment and emotion analysis of digital payments users

Al-Qudah et al. (2020) proposed a sentiment analysis approach for online payment services in Arabic. These authors aimed to examine user satisfaction with the main online payment system in Jordan, called eFawateercom, using two different datasets from Twitter and Facebook. Three algorithms were applied to extract and analyze the data.

Balakrishnan and Shuib (2021) investigate the sentiments and emotions of digital payment application consumers using a hybrid approach consisting of supervised and unsupervised machine learning techniques. Support vector machine, random, and Naïve Bayes were modeled for sentiment and emotion analyses, whereas latent Dirichlet allocation was administered to identify the top emerging topics based on English textual questionnaires from three digital payment applications.

The objective of the study by (Kar 2021) was to identify the determinants of mobile payment usage satisfaction, which could enhance service adoption. The "Digital Service Usage Satisfaction Model" has been proposed and validated by combining technology adoption and service science literature. First, the data were extracted from Twitter using hashtags and keywords. Subsequently, large volumes of text were analyzed using sentiment mining and topic modeling. Network science was also used to identify clusters among associated topics. Next, by employing a content analysis methodology, a theoretical literature-based model was developed and then validated using multiple regression analysis.

Liao and Yang (2020) investigated the role of mobile payments via a market survey in Taiwan and developed data mining analytics, including clustering analysis and association rules based on a snowflake schema database design. Mobile payment is determined in terms of a new retail payment mechanism that promotes a better consumer purchase experience in the online-to-offline business environment.

Within a broader field, retail banking (Pousttchi and Dehnert 2018) analyzes data from online consumer reviews from Germany, the UK, and the US using grounded theory coding techniques, supported by interdisciplinary literature. This study identifies and categorizes the relevant influence determinants to better understand the impact of digitalization on retail banking consumers. The outcome of this study is an integrated model of consumer decision making in today's retail banking, along with four detailed partial models of the respective decision stages.

The determinants of user experiences in P2P payment systems have been explored by applying different methodological approaches. However, a critical tone should be adopted in some of the previous investigations because of the extraction methods applied to subsequently perform an analysis of sentiments and emotions. In this vein, data can be obtained from different sources such as social networks (Al-Qudah et al. 2020; Kar 2021), reviews (Pousttchi and Dehnert 2018), and surveys (Balakrishnan and Shuib 2021; Liao and Yang 2020). In the case of using surveys to obtain the data, important limitations arise, such as the decrease in sincerity in the answers due to the reluctance of the respondents when knowing that they are being observed (Díaz de Rada 2012), if there is an interviewer, biases may arise owing to the interviewees' perception of a lower guarantee of anonymity that could enable them to express more critical and less socially accepted responses (Kreuter et al. 2008). However, the method applied in our study for extracting reviews does not have these limitations because we do not have any contact with the users whose reviews will be analyzed.

In addition, considering the current context of the expansion of P2P payment systems, data extraction methods must allow data to be obtained not only in real time but also from 100% of the users. The success of these applications, which are based on the interaction between people, is mainly based on the number of users, and their growth requires a community of users (Broby 2021). In short, the main objective of these apps is to send and receive money, so that the more people one can potentially connect with, the better. Thus, powerful tools capable of analyzing the maximum number of users are required.

# Institutional background

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 aim of PSD2 was to create room for innovations in technology and business models to give bank account holders more control over access to their account information, as well as new ways of initiating payment transactions.

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 have begun developing new business models by offering new ways to pay or view account information. However, these new payment service providers cannot offer services if traditional banks do not cooperate as banks control access to payment accounts, allowing them to limit competition in the payment services market. PSD2 restricts this possibility by facilitating payment services—in particular, by giving PIS and AIS providers access to user accounts. Wolters and Jacobs (2019) state that PSD2 is disadvantageous for banks, which are obligated to give payment service providers access to users' accounts free of charge while having to set up, maintain, and secure a system that facilitates this access.

As for the entry into force of the PSD2 regulation, banks are also obliged to have and maintain Application Programming Interfaces (APIs) that allow other applications and services to access bank accounts if the user wishes to expand the possibilities of online payments (Hartmann et al. 2019). Thus, entities with online services can offer their customers immediate payments for their online reservations or purchases, granting them independence from the bank (Carbó-Valverde et al. 2021). Therefore, both Verse and Twyp have their own virtual wallets to store money without having to have a bank account, and users can use both applications regardless of the bank they have, unlike Bizum, which is only available to users of 27 Spanish banks.

# P2P (peer-to-peer) payment applications in Europe

In their study on fintech investments in European banks, Kou et al. (2021a) suggest that European banks should focus on money transfer and payment alternatives as these can attract customers and meet their expectations, and fintech-based investments in money transfer systems could help decrease costs. According to the most recent report of Minsait Payments (2022), Europe is characterized by a high volume of P2P or immediate payments. The report reveals that immediate payments are most used between individuals (in other words, the reception and sending of money between friends and acquaintances), followed by payments for products or services (shops, taxis, public administrations, personal services, etc.) and payments in e-commerce. Within Europe, Spain is the leading country in P2P payments, with 81.7% of the adult Internet banking population using this means of payment and 98% of the bank accounts ready to use immediate transfers, whereas in other European countries, only 75% of the bank accounts use this means of payment. Although P2P payments have been available in the United Kingdom since 2008 and in Northern countries from 2012, none of them is either made in euros or under SEPA (Single Euro Payments Area) standards in the euro zone. Immediate transfers were launched in 2017 under the Instant Credit Transfer (SCT inst) SEPA framework and are based on ISO 20022 messaging, the new regulatory standard of messaging payments. Spanish leadership opens a window to anticipate the possible behavior of users in other European countries.

The traditional banking sector began to view fintech players as competitors when these new digital players introduced disruptions and higher value for users in the financial sector. The initial emergence of banks in the fintech sector involved simply using technology to improve existing business processes. However, banks soon changed their minds and started to see fintech companies as co-operators, developing new business models with them or acquiring these financial startups. The fintech phenomenon has provided an opportunity for the banking sector to streamline digitization processes, create synergies by incorporating new business models, increase the quality standards of banking services, and reduce risks (Romanova and Kudinska 2016). In this sense, traditional banks can create their own fintech functionalities that can compete with similar initiatives from other groups or Big Tech and become expert digital entities (Suprun et al. 2020). From a scientific viewpoint, several authors (Shah Hosseini et al. 2022) have analyzed the relationships between fintech companies and banks in terms of their motives (Błach and Klimontowicz 2021), forms of cooperation (Riikkinen and Pihlajamaa 2022), and whether to cooperate or compete (Harasim 2021).

In short, in this redefined financial sector, where different types of companies offer financial services, users can choose from various options. It turns out that 75% of the Spanish fintech companies actively collaborate with companies in the traditional financial and banking sector (Garcia-Rouco 2022). Nevertheless, although traditional banks are adapting to digitization (Accenture 2020), Spaniards have highly distrusted traditional banks as a result of the 2008 financial crisis (Ipsos 2021), which has promoted the fintech sector (Arcano Partners 2018).

PayPal, perhaps the most senior paytech company, began providing online and mobile payments in 1998. PayPal is considered a payment service provider (PSP) because it is responsible for the integration of online payment methods in e-commerce stores, and its networks grew exponentially after being acquired by eBay. At its inception, PayPal relied on eBay users for P2P electronic payments; however, the company soon grew beyond eBay users. PayPal had more than 426 million active users worldwide by the end of 2021, while Bizum has 17.8 million users, Twyp 0.85, and Verse 2.5 million users (Statista 2022). However, the P2P payment systems analyzed in our work started only in the private sphere for transfers between friends or work colleagues and are only beginning to spread to the commercial sphere to pay for purchases made in physical establishments owing to the growing number of merchants starting to accept P2P payments (Funcas 2021).

Bizum is a PSP founded in 2016 as an initiative in the Spanish banking system. Initially, Bizum led to easy instant payments between people (P2P), and later between people and e-commerce or institutions (for example, donations to non-governmental organizations) through www.bizum.es. Bizum acts as an Open Payment from a functional perspective, but in terms of constitution, organization, and development, it is a great example of a DBE (Visconti-Caparrós and Campos-Blázquez 2022). Bizum is an open transaction platform because any end user can participate as long as their bank is included on the platform, and it represents traditional banks' open-payment solution. The high number of Bizum users (more than 16 million in Q2 2021) indicates that this was one of the cases of incumbents' digital disruption with proven success.

Twyp is an initiative of the ING direct bank application, and similar to Bizum, it allows P2P transfers to be made without knowing the destination IBAN (i.e., by simply selecting the contact on the cell phone). In its most recent update, it enables the withdrawal of money regardless of the bank to which the user belongs. Twyp includes its own prepaid virtual card, which is valid for paying online purchases and can be added to Apple Pay or Google Pay to pay at any store via mobile.

Verse is a paytech company founded in 2016 by three entrepreneurs who were removed from management by the board of directors of proprietary funds. Since 2018, its president has been Bernardo Hernández, a former Google and Yahoo executive. Verse obtained an electronic money institution license from the Bank of Lithuania on May 30, 2019, which allowed it to operate across Europe. In June 2020, Jack Dorsey's Fintech Square, Inc. acquired it for more than 30 million euros. In October 2016, the startup obtained 8.3 million euros through a Series A financing round. Verse is considered a paytech provider independent of the banking sector because it was not born from a bank, unlike Bizum and Twyp, which are initiatives promoted by financial entities.

Consequently, this literature review highlights the need for improvement in fintech app research focusing on user experience. This study investigates several issues related to user experience in P2P (peer-to-peer) payment applications in Spain, which are summarized in the following research questions.

## **Research questions**

The following research questions aim to generate new knowledge about users' perceptions of paytech, which can be useful for the scientific community and society in general—especially in the financial sector. These questions guided the study methodology, allowing us to select appropriate tools and techniques for collecting and analyzing the data.

Specifically, the first question is related to the independence of the service; that is, the aim is to determine whether apps linked to banking generate different perceptions from those of independent apps. In this study, Bizum and Twyp are linked to financial institutions, unlike Verse, which operates independently. Therefore, the question is whether the popularity of paytech apps today in terms of reviews and positive emotions is greater when linked to the banking sector.

Research Question 1. To what extent is the user experience influenced by whether a P2P paytech service is bank-conditioned or independent?

Regarding the second research question, studies that have measured customer experiences immediately after digital service encounters are scarce; this may be due to the distance between the context and researcher at the time of the service encounter when an incident that triggers any unexpected reaction occurs (Kar 2021). In addition, P2P payments are usually simpler, faster, and more convenient, and they feature a social component that other payment systems lack (Belanche et al. 2022). Based on these arguments, we propose the following research questions:

Research Question 2. Which are the users' emotions generated by these applications? Through clustering analysis in social media sentiment analysis, similar comments can be grouped based on certain characteristics. For example, common themes include customer service issues, brand issues, and the categorization of comments into different groups (positive, negative, or neutral).

The following research question aims to cluster similar comments and understand the patterns and trends of comments around a series of major topics, which helped the researchers better understand users' opinions on a specific topic and identify the reasons behind them. Thus, the third research question is as follows:

Research Question 3. What feelings or topics are users worried about?

# Methodology

After data collection and before data analysis, we conducted text processing similar to that adopted in previous studies (Bonsón et al. 2019, 2020; Perea et al. 2021; Serrano et al. 2021). First, we performed data preprocessing in a comma-separated values (csv) file to clean the data collected from all irrelevant elements, such as stop words, emoticons, links, and irrelevant words. Then, we filtered all reviews and identified the relevant aspects to determine the dimensions of the online reviews.

Based on latent variables from previous studies (Kalinic et al. 2019) on peer-to-peer mobile payment acceptance prediction, seed words were extracted, and the values obtained are presented in the results section. Additionally, the latent sentiments behind the online reviews were detected. Finally, the latent topics of each implemented aspect were analyzed by applying Latent Aspect Rating Analysis (LARA).

## Data sample

A total of 16,048 reviews of the fintech apps Bizum, Twyp, and Verse were downloaded from the Google Play download platform in January 2022 using the "rvest" and "RSelenium" R package.

The reviews were selected based mainly on geographical criteria because we extracted all reviews published by Spanish users. In other words, 100% of the reviews posted in Spanish on Google Play were extracted. In addition, the period considered starts when there is a record of the first reviews of these apps in Spain (April 12, 2015) as a result of the launch of the first P2P payment app (Twyp), and it ends on December 31, 2021.

The selected apps were studied because they are the most popular apps in Spain for the P2P market for sending money between individuals, knowing only phone numbers. All these reviews were written in Spanish; thus, the analysis was conducted in this language; however, when presenting the results, they were translated into English and reviewed by a sociolinguistic professional who verified that they were presented correctly.

These three fintech companies are different in nature because they have been promoted by different organizations. First, Bizum is a collaboration among most of the country's banks (27) to create a system for instant payments between individuals. Second, Twyp is an initiative promoted by ING Direct. Verse is an app that is independent of traditional banks. Therefore, the three apps offer the same paytech service but with different degrees of integration with traditional banks. Of the three proposed apps, Bizum is the most integrated; Twyp is moderately integrated, and Verse is the least integrated. Verse is considered a paytech provider independent of the banking sector because it was not born from a bank, unlike Bizum and Twyp, which are initiatives promoted by financial entities.

Table 2 presents the distribution of the sample (n = 16,048 reviews on Google Play). As can be seen, most reviews are on Verse, followed by Twyp and Bizum. It should be noted that Bizum does not appear as its own app for download; rather, the download site was customized as Bizum with the logo of each financial institution—that is, it was associated with the bank's brand image.

Table 2 also shows that Verse has the highest number of positive reviews (87.79%), followed by Twyp (63.43%). However, Bizum received more negative reviews (70.81%) than positive ones (19.40%). Regarding the variable of gender, males were the majority in the three apps. With respect to the number of Likes, Bizum received the highest number (3,033), probably due to having the highest number of users.

# **Content analysis**

For Holsti (1969), content analysis is a search method for investigating a set of problems by systematically and objectively identifying the special characteristics of comments or reviews. Its success lies in the comparison of content in a systematic, complex, and objective manner using big data. Figure 1 presents all the stages of the applied method, which started with the download of reviews and their subsequent coding.

After downloading 16,048 reviews, the coding process began. For this purpose, the R library "tm" (Feinerer et al. 2017), which allows text processing, was used with a call to corpus, which represents a collection of text documents. The corpus was then transformed using several functions (Varangaonkar 2017), as shown in Fig. 1.

The most frequent words were collected, and a dictionary was built for each category using the R package "grepl" (R Core Team 2018). Classifying this content involves losing subjectivity because many reviews share more than one category. As in other research (Bonsón et al. 2019), this overlap error was incorporated into the content analysis framework, and the final coding was established. This type of content analysis is often applied in other fields such as marketing, economy, and tourism (Ríos-Martín et al. 2019).

| Fintech app  | Bizum  | Тwyp   | Verse  |
|--------------|--------|--------|--------|
| Reviews      | 2337   | 6543   | 7046   |
| Stars        | 2.07   | 3.54   | 4.52   |
| Likes        | 3033   | 1443   | 1627   |
| Positive     | 19.40% | 63.43% | 87.79% |
| Neutral      | 13.81% | 5.21%  | 2.38%  |
| Negative     | 70.81% | 31.36% | 9.82%  |
| Male         | 49.89% | 54.45% | 48.87% |
| Female       | 35.98% | 24.06% | 26.52% |
| Unespecified | 18.15% | 21.48% | 24.59% |

| Table 2         Descriptive stat | tistics |
|----------------------------------|---------|
|----------------------------------|---------|

Source: Own elaboration



Fig. 1 Flowchart of the methodology applied. Source: Own elaboration

This document also attempts to identify whether a fintech app should be independent of the bank. Recall that the online reviews of Bizum come from downloads of the apps of the banks themselves, whereas Twyp and Verse each have their own apps (RQ1). Table 2 shows the number of reviews, stars (ratings), and likes (support) for the three possible ways of offering P2P services: integration into a set of banks, promotion by a single bank, or the initiative of a private company.

Once the content was known and correctly coded, it was analyzed using the R library "dplyr" (Wickham et al. 2017). The R package summarizes the data using rows and columns. As seen in Fig. 1, data manipulation functions were used (Irizarry and Love 2017), and the data were consolidated by evaluating their differences.

# Sentiment analysis

This analysis applies computational linguistics methods and aims to identify topics, as well as to extract subjective information from texts and comments. One of the usual applications is to detect the polarity of reviews (positive, negative, or null)—in this case, from Google Play—concerning P2P fintech apps (Saura et al. 2018).

The procedure consists of a massive automatic classification of documents, cataloging them according to the positive or negative connotation of the analyzed word and performing an operational technique for each independent review (Bonsón et al. 2021). To do this, we first identified salient topics by clustering users' online reviews. Figures 6 and 7 present the results.

Figure 8 presents the results of the second part of sentiment analysis, assigning each online review a predominant emotion. We chose to use the Emotion Lexicon (NRC) based on Plutchik's 7-emotion grouping model (anger, anticipation, disgust, fear, joy, sadness, surprise, and trust).

Finally, based on the studies of Li et al. (2015) and through the Latent Dirichlet Allocation (LDA) algorithm of Blei et al. (2003), latent topics in online reviews were identified. From this calculation, the theta coefficients or probabilities that a text is associated with a topic (Serrano et al. 2021) expressed in their review comments (Luo and Tang 2019) were assigned. The implementation of these LDA calculations was done using the "Topicmodels" (Grün and Hornik 2011) and "Sentimentr" packages, which allowed to classify the polarity of the comments and assign an emotion to them.

## Latent aspect rating analysis (LARA)

This methodological approach consists of two sections as it explores the latent dimensions in parts of the text (online reviews from Google Play on three P2P fintech apps). The second section estimates the regression model (latent rating regression). The results indicate the extent to which the latent emotional intensity in textual pieces affects overall numerical ratings (Serrano et al. 2021). This analysis responded to RQ3.

When applying the analysis to LARA topics, no specific criterion was followed to name the topics; instead, LARA generates a topic distribution for each document and assigns words to each topic based on their distribution in the corpus (Liang et al. 2014). Analysts often assign topic names based on the most relevant words for each topic (Wang et al. 2018).

This text mining procedure makes three basic assumptions for the analysis (Serrano et al. 2021): (a) the attitudes expressed in online reviews of fintech apps are positive or negative (Solomon et al. 2006), as established by the emotional concept; (b) an online review of fintech apps presents different emotions with different intensities; and (c) the emotion contained in online reviews of fintech apps has some effect on users' rating scores.

## Results

## Time evolution of reviews

Today, before downloading an app, many users use search engines to find relevant information. The evolution of these three P2P fintech applications was first analyzed using Google Trends, which enabled users to understand their interest in search terms.

In addition, knowing the statistics of search terms on the Internet makes it easier to collect data through this tool, compared with other techniques, to get to know about a product or brand, such as a survey.

Some scientific works (Palos-Sanchez and Correia 2018) have demonstrated the predictive capacity of these Internet searches when it comes to being able to know the sales of a product—or in this case, the download of a certain fintech P2P app—in advance. Thus, they have been applied to quantify trends in public interest in keywords for different studies in economics (Choi and Varían 2009; Preis et al 2013).

In Fig. 2, Bizum is shown in blue, Verse in yellow, and Twyp in red. The trend of highest interest is in Bizum, with an average monthly search interest of 38, followed by Verse with 12 and Twyp with two. In all cases, an increase in interest after the end of the COVID-19 lockdown measures was noted.

Table 3 presents the evolution of the number of reviews between the years 2015 and 2021. The number of Bizum reviews increased from 2017 to 2018 and continued to grow steadily. Twyp did so in 2016–17 and subsequently, the variation in the number of reviews has been declining. Finally, Verse declined between 2016 and 2018, and the number of reviews steadily increased between 2018 and 2020.



Fig. 2 Trends in search terms from 2016 to 2022. Source: Google trends

Table 3 Evolution of the number and variation of the reviews between 2015 and 2021

| Years | Bizum | % variation | Тwyp | % variation | Verse | % variation |
|-------|-------|-------------|------|-------------|-------|-------------|
| 2015  | 0     |             | 196  |             | 0     |             |
| 2016  | 12    |             | 389  | 98.5        | 562   |             |
| 2017  | 16    | 33.3        | 1351 | 247.3       | 452   | - 19.57     |
| 2018  | 86    | 437.5       | 1583 | 17.2        | 104   | - 76.99     |
| 2019  | 209   | 143.0       | 1288 | — 18.6      | 228   | 119.23      |
| 2020  | 605   | 189.5       | 851  | - 33.9      | 2013  | 782.89      |
| 2021  | 1398  | 131.1       | 871  | 2.4         | 3664  | 82.02       |

Source: Own elaboration



Fig. 3 Expert users' behavior. Source: Own elaboration

# **Users' ratings**

With respect to user ratings, we analyzed the behavior of users who had written reviews of the three apps. These users are of great interest because they may have comparative knowledge of their advantages and disadvantages. Figure 3 shows that the behavior of the users who we qualified as experts reflects the percentage of users who switched from one app to another. It can be observed that Bizum has more users than it has lost. Most importantly, many users have switched from Twyp to Verse.

On the other hand, Fig. 4 shows the rating (with a maximum of five stars) that these users—the experts—give to the new P2P app after having used it. Thus, it shows the



Fig. 4 Variation in the rating (number of stars) given by the experts. Source: Own elaboration

rating points that each app lost or gained according to the users who used two of the apps. It can be seen how Twyp and Verse users, when switching to Bizum, rated the latter app lower, since Bizum received 0.428 points less from users who had previously used Twyp and 2.33 points less than those who had already used Verse. In addition, Bizum, in particular, improved its score when it was used again as it obtained 0.66 points more from users who used it again. In particular, those who used Bizum and then Verse rated this app higher, scoring 2.285 points.

## Correlations and term frequency of the online reviews

One important aspect is the level of integration of P2P apps with traditional banks. We know that the most integrated app is Bizum as it is an initiative of 27 banks, whereas Twyp has a medium level of integration as it is only associated with one bank. Instead, Verse is a completely independent application for banks. To verify this, we conducted a correlation analysis between the word "bank" and the reviews of each of the apps. The following Fig. 5 shows that the word "bank" is highly associated with the Bizum app (54%), associated to a lesser extent with Twyp (44%), and barely associated with Verse (7%).

Figure 6 presents the word correlations between the reviews of the P2P fintech apps. Online reviews of Verse and Twyp are correlated at 78%; therefore, many words are repeated in the reviews of both apps. However, between Bizum and Twyp, this correlation is lower (54%), and even lower with Verse (44%).

This confirms that these three apps are divided by the vocabulary used in the reviews into two separate blocks: Bizum on one hand and Verse and Twyp on the other. We must remember that Bizum is differentiated by download location, which is associated with the financial institution, whereas Verse and Twyp only have one download location, which is fully identified with the app.

Figure 7 shows the most frequent words classified according to sentiments in a word cloud. This figure shows that the largest words are the most frequent in all online reviews. The most used positive word is "great," while, of the negative ones, both "error" and "without" stand out. In addition, other adjectives of negativity ("absolutely



Fig. 5 Level of integration of P2P apps with banks: word "bank" correlations between apps. Source: Own elaboration



Fig. 6 Word correlations between apps. Source: Own elaboration

# positive

messenger inclusion formidable time prime cobra intestinal transaction inclusive success terribly base fun bank civil pa team cop enjoy rapidgenius diversion tutor mate excellent considerable reademonent islon contact balance init pastor install rebellion vision contact ambassador dare personal reademonor superior extra mayor mover valor fusion money master aga manual excel labor promotion fundamental daily option revise store checklist plan fiesta primer perfect accountpatron familiarprincipalcash acrobatfixed opera compatible was pay top vigor gold peri givingsonar legal rooted sense cafe real actual dame finally nose surge rota singgut invite ay status word dolor E inferior useless fake ead bugire mania ram embargomire wrong shell dire din fatal brutal black pop grave horrible crisis horror fiasco wear pique clash terrible publicad liar pare know coma bestial clash terrible evasion mad missing œde confusion incompatible mediocre CODV lava mafia inexplicably dap incalculable intolerable negative

Fig. 7 Word cloud. Source: Own elaboration

fatal" and "brutal") also appear in the latter sentiment. Other minor words of positive sentiment are vocabulary related to the financial sector (money, cash, payment).

Figure 8 shows a bar chart of the 10 most repeated keywords, ordered from most to least frequent. Three graphs are shown for the set of online reviews for each P2P fintech app and, finally, at the bottom right of the set of online reviews.

The graph indicates the exact frequency of each word. It is noteworthy that, in Bizum, the most repeated terms are "gives error" (7.04) and "goes wrong" (2.59), which have a negative polarity, followed by "last update" (4.89) and "works well" (4.52), which are positive.

In the case of Twyp, the associated terms are "make money" (9.13), "easy to use" (6.29), "works well" (4.92), and "good application" (3.29). Among the negative terms, only "gives error" (4.09) appears.

Finally, Verse has higher positive terms associated with it, such as "good app" with a very high value (14.79), "easy to use" (6.51), and terms that attract attention, namely "earn money" (4.24) and "promotional code" (2.02). None of the 10 terms were negative.

In the graph dedicated to the set of all online reviews, the following positive values stand out as the highest: "good app" (7.78), "easy to use" (6.28), and "make money" (5.44).



Fig. 8 Word frequency. Source: Own elaboration.

Among the negative terms, and with less intensity, is only "gives error" (3.84). "Paying friends" (3.32) stands out, which provides a social dimension.

Finally, at the level of financial institutions, Bizum is associated with "Bankia app" (4.15) and Twyp with "ING account" (3.51) and "ING customer" (2.94).

# **Emotions underlying the reviews**

A relational semantic analysis was performed. Sentiment analysis was used to deepen the knowledge of emotions contained in Google Play's online reviews of P2P fintech apps. The emotion analysis indicated eight emotions from the NRC Emotional Lexicon described above.

These were classified into positive ("trust," "hope," "joy," and "surprise") and negative ("fear," "anger," "sadness," and "disgust") feelings and emotions. The results show that the majority were positive.

Figure 9 shows that in general (see bottom right), among the positive aspects is "trust," which was the most frequent emotion (0.223), followed by "joy" (0.162) and "anticipation" (0.152).

Trust appears in other studies as a determinant to be highlighted since it is a rational belief in the behavior of another person (Lahnos, 2001) or of an organization, product, or service. This high value indicates that users of fintech P2P apps base their decisions on rational components.

However, among the negative feelings and emotions, "sadness" (0.179), "anger" (0.103), and "disgust" (0.048) are also present in the online reviews.

Among the individual analysis of each app, this general behavior varies, "sadness" (0.198) being the largest for Bizum along with "trust" (0.192).

However, in Twyp, the result is somewhat different: again, "trust" (0.225) is the highest value but followed by "sadness" (0.178).



Fig. 9 Emotions identified in the reviews. Source: Own elaboration

| Gender       | Bizum  | Тwyp   | Verse  |
|--------------|--------|--------|--------|
| Unidentified | 18.15% | 21.48% | 24.59% |
| Female       | 35.98% | 24.06% | 26.52% |
| Male         | 49.89% | 54.45% | 48.87% |

Source: Own elaboration

In Verse, the results are more aligned with positivity, with "trust" (0.238) being the highest again among all the apps analyzed, followed by "joy" (0.204). Thus, we can establish this app as the one that best arouses positivity in users, and its lowest value is "sadness" (0.168), followed by "anticipation" (0.140).

It is also noteworthy that "disgust" shows higher values in Bizum (0.085), followed by Twyp (0.065) and Verse (0.026). In "anger," the highest values are in Bizum (0.107), followed by an almost similar value in Twyp (0.106), and, far behind, Verse (0.094).

Looking deeper into sentiment analysis, we studied how gender may influence user opinions in their reviews. We used a method previously employed by many other researchers (Jadesi 2022; van der Nagel 2017; Xu et al. 2020; Cornetto and Nowak 2006), which classifies users according to their gender using their names on the platform (usernames). Three genders were identified: female, male, and unidentified (Table 4); the latter is used for usernames that do not distinguish between genders. Like many other social platforms, Google Play asks users to provide their real identities but allows them to remain anonymous by not using their real names (Matook et al. 2022; Lapidot-Lefler and Barak 2012), which prevents the identification of the user's gender.

As Table 4 shows, men are generally more frequent users of this type of app. If we focus on each type of app, we find that users of unidentified gender tend to use Verse

| Gender       | Bizum    |         |          | Тwyp     |         |          | Verse    |         |          |
|--------------|----------|---------|----------|----------|---------|----------|----------|---------|----------|
|              | Negative | Neutral | Positive | Negative | Neutral | Positive | Negative | Neutral | Positive |
| Unidentified | 55.10%   | 14.30%  | 30.60%   | 43.10%   | 11.80%  | 45.10%   | 38.50%   | 9.30%   | 52.30%   |
| Female       | 46.50%   | 15.60%  | 37.90%   | 42.40%   | 13.70%  | 43.90%   | 33.60%   | 10.30%  | 56.10%   |
| Male         | 44.70%   | 15.10%  | 40.20%   | 41.00%   | 11.90%  | 47.10%   | 35.60%   | 12.20%  | 52.10%   |

| Table 2 Analysis of user sentiments of 121 payment apps according to genu | Table 5 | Analysis of | user sentiment | s of P2P payme | ent apps according to | gender |
|---|---------|-------------|----------------|----------------|-----------------------|--------|
|---|---------|-------------|----------------|----------------|-----------------------|--------|

Source: Own elaboration

more; women use Bizum more, and men prefer Twyp. The feelings expressed by gender regarding the different P2P payment apps are listed in Table 5.

Table 5 indicates how, in the case of Bizum and Twyp, the most negative users are the unidentified ones, while women maintain a more neutral position, and men advocate for a more positive tone. In the case of Verse, the users with the most negative tone are also those of unidentified gender; however, men remain neutral, and women are the most positive users of this app.

Table 6 presents this information in a nutshell, showing that in relation to the three P2P payment apps, the most critical users are those of an unidentified gender, while women remain in a more neutral position, and men tend to express themselves more positively.

# Determinants influencing the adoption of payment services

The literature on the adoption of mobile payment services has identified a wide range of latent variables that can conceptualize the research framework (Kalinic et al. 2019). Based on this, Table 7 presents the word count associated with the terms in the first column, obtaining the average number of stars marked and likes received as defined in the table with the term "support."

| Gender       | Negative | Neutral | Positive |  |
|--------------|----------|---------|----------|--|
| Unidentified | 45.53%   | 11.80%  | 42.67%   |  |
| Female       | 40.83%   | 13.20%  | 45.97%   |  |
| Male         | 40.43%   | 13 10%  | 46 47%   |  |

Table 6 Summary of the sentiment analysis of users of P2P payment apps according to gender

Source: Own elaboration

| Table 7 | The measurement | of determinants | in the adoptio | n of peer-to-j | peer payn | nent systems | (0-5) |
|---------|-----------------|-----------------|----------------|----------------|-----------|--------------|-------|

| Scoring              |       |      |       | Support of P2P payments (like) |       |       |  |
|----------------------|-------|------|-------|--------------------------------|-------|-------|--|
|                      | Bizum | Тwyp | Verse | Bizum                          | Тwyp  | Verse |  |
| Perceived quality    | 2.93  | 4.35 | 4.75  | 4.672                          | 1.363 | 3.875 |  |
| Subjective norms     | 2.63  | 3.86 | 4.60  | 7.600                          | 1.655 | 2.589 |  |
| Perceived risk       | 2.27  | 3.50 | 3.60  | 3.391                          | 4.204 | 7.528 |  |
| Perceived usefulness | 2.10  | 3.45 | 4.53  | 3.864                          | 1.830 | 3.477 |  |
| Perceived trust      | 2.08  | 2.48 | 3.70  | 5.960                          | 1.636 | 4.900 |  |

Source: Own elaboration

As shown in Table 7, based on the average number of stars assigned, quality has the highest value among the three P2P fintech apps analyzed. Perceived quality of a financial institution is the overall evaluation of all interactions that the customer has had with it (Liébana-Cabanillas et al., 2014b; Liébana-Cabanillas et al. 2013).

Quality is followed by subjective norms that refer to the approval of other members of society to participate in that behavior. The probability of performing this behavior increases if other members approve of it (Ajzen 1991). With reference to mobile payments, subjective norm implies that the society's perception of this form of payment is desirable (Schierz et al. 2010).

Third, perceived risk is equivalent to the uncertainty and possible negative effects generated on customers by commercial transactions.

However, in the case of Verse, perceived usefulness comes in third, implying the possibility that technological services can be improved to meet consumers' needs.

# Latent aspects based in sentiment analysis

After emotion analysis, we applied the LDA algorithm (Xiang et al. 2017), which served to obtain latent topics from the online reviews of P2P fintech app users.

From the application of Gibbs sampling, two tables were obtained: the document and term matrices. Based on a parameter called perplexity and following Wang et al. (2010), we established how many latent topics are extracted (which, in this case, turned out to be six), to group the users of P2P fintech apps that rated online reviews on Google Play.

Beta coefficients were calculated for each term to assign each of the six extracted latent aspects, which is illustrated in Fig. 10. A holistic interpretation of the seed terms included in each aspect allowed them to be labeled because of the preferences expressed by paytech app users in their reviews:



Fig. 10 Groups of topics: algorithm LDA (LARA). Source: Own elaboration

- The first latent aspect, "ease of use" or facilitating conditions, describes the features and resources of fintech apps ("application," "use," "app," "easy," "can," "useful," "useful," etc.). As defined by Davis (1989), ease of use refers to the "individuals' perception that using a certain system will be effortless and/or uncomplicated."
- The second aspect, "perceived usefulness," includes seed terms related to "money," "good," "do," or "account," and it refers to customers' transaction requirements and finance-related issues that must be satisfied (Pachpande and Kamble 2018; Ramosde-Luna et al. 2015).
- The third aspect, "perceived value," is linked in the comments to the reason for which an app is valued, such as "bizum," "app," "application," "good," "fine," and "account." According to Heskett et al. (1997), this can be defined as the ratio of process quality and results delivered to customers to the price and other costs incurred in acquiring the service.
- The fourth latent aspect is "performance expectancy," which is defined by the words "works," "'performance expectancy' leave," and "card" and indicates the regularity of the desired outcome of digital transactions (Gholami et al. 2010; Venkatesh et al. 2016).
- The fifth latent aspect is "user experience," which refers to every feeling related to the use ("bizum," "money," "app," "good," "payment," "great," and "bank"). Hassenzahl (2008) defines it as a momentary, primarily evaluative feeling (good-bad) while interacting with a product or service.
- The last aspect is "perceived quality," where "app," "code," "good," "fast," "more," and "I can" stand out. As indicated by several authors (Gefen et al. 2003; Zhou 2013), this is derived from users' subjective comparisons between the desired QoS and what is actually received.

The corresponding theta coefficients were calculated to rank the preferences revealed by users of the fintech P2P apps, where a higher mean value indicates the latent aspect that the users of the coefficients obtained.

"Ease of use" (0.169) and "user experience" (0.169) are linked to "anticipation"; "anticipation" and "ease of use" (0.183) to "joy"; and the topic "usefulness" (0.101) to "surprise." Regarding negative emotions, "performance expectancy" (0.058) is linked to "disgust" and (0.101) to "fear." It is also interesting that "user experience" (0.125) is linked to "anger" and "perceived quality" (0.247) to "sadness."

The last step of the analysis is to apply aspect-based sentiment analysis (ABSA) to link the six latent aspects identified with the polarity of feelings aroused in fintech P2P app users with satisfaction (Zhao et al. 2019).

Logically, each aspect generates mixed feelings, distributing its preeminence among the eight basic emotions described by Plutchik (1994). However, as the previous general analysis of sentiment analysis anticipated, the feelings aroused by each aspect in the users of fintech P2P apps are concentrated in positive emotions, in particular, and in this order: "joy," "trust," "joy," and "anticipation" (see Fig. 9).

The procedure followed to obtain Table 8 begins with the identification of each existing topic using LDA. Based on this, the weighting was calculated for each review according to the number of words associated with each topic with respect to the total

| Торіс                  | Anticipation | Joy   | Trust | Surprise | Anger | Fear  | Disgust | Sadness |
|------------------------|--------------|-------|-------|----------|-------|-------|---------|---------|
| Ease of use            | 0.169        | 0.183 | 0.207 | 0.075    | 0.113 | 0.047 | 0.022   | 0.184   |
| Usefulness             | 0.162        | 0.156 | 0.247 | 0.101    | 0.119 | 0.054 | 0.025   | 0.136   |
| Perceived value        | 0.144        | 0.133 | 0.225 | 0.059    | 0.088 | 0.092 | 0.045   | 0.214   |
| Performance expectancy | 0.155        | 0.119 | 0.210 | 0.043    | 0.102 | 0.101 | 0.058   | 0.210   |
| User experience        | 0.169        | 0.170 | 0.237 | 0.082    | 0.125 | 0.050 | 0.028   | 0.139   |
| Perceived quality      | 0.082        | 0.152 | 0.201 | 0.045    | 0.082 | 0.091 | 0.055   | 0.247   |
|                        |              |       |       |          |       |       |         |         |

# Table 8 Topic-based emotions analysis: results of each topic

Source: Own elaboration



Fig. 11 Distribution of document probabilities for each topic. Source: Own elaboration

number of words contained in each review. In this way, each review was assigned one of the topics according to the highest weighting it contained to enable filtering by topic. Finally, once each review was classified into different topics, the eight emotions of the NRC Emotional Lexicon described above were analyzed.

Table 8 shows how each topic is related to each of the eight emotions raised in this study. The highest value(s) for each emotion are in bold. The most predominant emotion in all topics is "trust," while the emotion that appears the least in most topics is "disgust," except for the topics "performance expectancy" and "perceived quality," where the lowest emotion is "surprise." As for the categories that are most strongly related to each emotion, "anticipation" predominates equally in both "ease of use" and "user experience." "Joy" is also more prevalent in "ease of use"; "usefulness" is the topic where "trust" and "surprise" are felt the most; "performance expectancy" is the topic that generates the highest "fear" and "disgust"; and finally, "anger" and "sadness" predominate in the topics "user experience" and "perceived quality," respectively.

Figure 11 shows the distribution of the document probabilities for each topic. Thus, "user experience" is the topic with the highest number of associated reviews, followed by "ease of use" and "perceived value." The topics with the lowest number of online reviews were "usefulness" and "perceived quality."

# Discussion

The increase in the use of P2P payment apps is reflected in our analysis of the Spanish market, both in the Google search trends for the three P2P apps studied and in the increase in the number of reviews compared with the previous year.

We explored the preferences revealed by users of paytech apps selected to answer the research questions previously posed. Different analyses showed the centrality of the related elements. This finding does not detract from those of user preferences and attitudes toward other aspects of the use of apps, which are also important and produce satisfying emotions. In addition, we obtained a high correlation between the comments of each app; that is, they used the same words, although with different emotions, which makes it clear that users behave similarly when using different P2P apps.

In relation to RQ1, according to expert users (those who have used more than one P2P app), many started with Twyp, which was the pioneer app, but then moved on to Bizum and, to a greater extent, to Verse. It was the latter app—the most independent from traditional banking—that not only attracted a greater number of users who had previously tried another P2P app, but it was also the one most highly rated by users. To arrive at a more complete finding, in addition to analyzing the experts' reviews, we also considered what users said in general. We found that online reviews of apps associated with banks or financial institutions, such as Bizum or Twyp, show more negative emotions, whereas Verse shows more positive emotions. This finding implies that users prefer P2P apps that are independent of traditional banks.

One reason may be that Verse, being a start-up totally independent of banks with a more commercial than financial nature, uses word-of-mouth (eWOM) marketing strategies (Irimia-Dieguez et al., 2023; Velicia-Martin et al. 2022), such as promotions for joining or bringing acquaintances. This aspect is one of the most highlighted by users, as reflected in the frequency of words commented on promotional codes and in the fact that one can obtain money by recommending the app.

A second reason could be the value proposition of these apps based on the pillars that form one of the most complete frameworks of business models according to Teece (2018)-the so-called Canvas BM (Osterwalder and Pigneur 2010), which follows the ontological argument of Osterwalder et al. (2005) and has been widely validated by other authors in the field of mobile payments (Pousttchi et al., 2009). The common value proposition of all of them is both the accessibility of their app anyone with a smartphone can use it—and the immediacy of its use—the economic transaction is made and received in seconds and is free of charge for users. Nevertheless, each paytech service provides a different value proposition to differentiate it from its competitors' services. Bizum, created as a collaboration between national financial entities, offers a security system that gives app providers a competitive advantage that they must exploit. In addition, because it is not necessary to download any additional apps, it is an integrated functionality in bank applications. Twyp, one of the first services to appear globally, is distinguished by allowing users to withdraw money at various stores, such as supermarkets and department stores. Verse focuses on the event segment, which allows users to create groups and events to pool funds. Another of its main value propositions is the acquisition and retention of relevant consumers as Verse suggests specific offers to consumers based on enriched data and trained algorithms. In short, the business model is based on offering an easy-to-use and secure mobile payment platform, generating revenue through transaction fees, additional services, and the sale of users' data. Table 9 shows some sample reviews that highlight aspects of each app's business model.

Regarding users' perceptions, we found that perceived quality is the most frequently mentioned aspect of P2P apps, followed by subjective rules. However, it should be noted that the comments are positive in Verse, neutral in Twyp, and negative in Bizum, owing to the low score given by users in this area. The aspects that are least valued in this type of app and generate the greatest consensus according to the number of likes received are trust and perceived risk. Although widespread, this new modality of monetary transactions generates certain misgivings.

These results also answer two other Research Questions (RQ2 and RQ3). In RQ2, the emotions aroused in users by these apps are of a different intensity, with Bizum arousing the most negative ones, especially "sadness," "fear," and "anger" in that order. As for the positive ones, Verse is the one that by far reaches the highest values in the betas obtained in the online reviews in "trust," "joy," and "expectancy." In short, P2P apps that are more independent of banks show more positive emotions than bank-integrated P2P apps.

Regarding gender, we found that the most critical users of these P2P payment apps were those of an unidentified gender, which may be due to the fact that they hide behind an unclear username that makes it difficult to identify them (Gylfason et al. 2021; Lu and Bol 2007). Anonymity gives users the freedom to behave without taking responsibility for their actions (Sia et al. 2002). The impact of user anonymity on the Internet has been a widely studied topic (Christie and Dill 2016; Koschmann and Hoadley 2005; Hosseinmardi et al. 2014), and most authors have concluded that anonymous users are significantly more impolite than identifiable users (Santana 2013).

Regarding the male and female genders, we found that women remained more neutral, while men tended to express their opinions more positively. According to several authors (Chhatwani and Mishra 2021; Jacobsen et al. 2014), men tend to be significantly

| Арр   | Review   |
|-------|--|
| Bizum | "Free and works for all banks (unlike other options). The chat lacks a bit of fluidity, but nothing serious."  |
|       | "Hopefully they implement that when you do and they make you bizum <b>you see who you have sent it to in the expenses</b> , because if you do not have to see the notification in case of receiving, and in case of sending I have not yet found out how to know who I sent it to a bizum. Otherwise, everything is fine." |
|       | "Fast, practical and safe operation, I love bizum!"  |
| Тwyp  | "Incompatible with bizum, all my friends and family have bizum, bizum is more universal, so this app is useless When it is compatible I will download it, otherwise I will try to find other alternatives"   |
|       | "So that my friends pay me, without any commission. I can also send it to my bank account without any commission up to a maximum of 999 euros, it's great"   |
|       | "All of our friends have worn it (well, almost all of them) and it's great and fast!!!!!"  |
| Verse | "Incredible application. More useful than the famous Bizum. If you enter the following code <b>they give you €5</b> FREE: NDZDD7"  |
|       | "Instant transfers, all free, there are no commissions and very transparent. A very careful platform. I see myself using the app every day with my friends."   |
|       | "I love an <b>alternative to banks! Free without commissions and with games</b> from time to time highly recommended, fast and simple"   |

Table 9 Examples of reviews on aspects of the business model of each app

more optimistic than women regarding a wide range of issues, including the economy and financial markets.

Regarding RQ3, regarding topics of concern to users, it should first be noted that six topics were detected. These findings are closely related to the study performed by Kar (2021), which establishes that cost, usefulness, trust, social influence, credibility, information privacy, and responsiveness are more important determinants in increasing the usage quality of mobile payment services.

The topic "ease of use" is more associated with "performance expectancy" and "joy," and "usefulness" with "trust," although the remaining topics also show very high values for "trust." The topic "performance expectancy" is associated with higher values for negative emotions and feelings such as "fear" and "disgust." The topic "user experience" is related to "fear" with higher values than the others, and finally, "perceived quality" is linked to "sadness."

In general, both "ease of use" and "usefulness" generate the highest positive emotions, since P2P apps are characterized by their immediacy and usability without having so much information about the beneficiary (it is only necessary to know the phone number), which makes these apps easy to use and with a multitude of applications. On the other hand, "performance expectancy," "user experience," and "perceived quality" are accompanied by negative emotions as users are concerned about the financial and technical aspects of these transactions as well as the fact that, after app updates, this service is not operational. According to the words' frequencies, problems generated by installing the latest updates occurred, particularly in Bizum and Twyp. However, the "perceived value" aspect is the most neutral of all as it does not generate any noticeable emotion. This may be because these apps are free services that have no cost for users and do not give rise to discussions.

## **Conclusions and implications**

The present study analyzed, through sentiment analysis, significant evidence of the usage experience of P2P paytech services. Considering the needs and demands of users constitutes a crucial issue when designing a new payment landscape because the lexical pattern that emerges from the analysis represents the voice of the user experience. Our findings reveal high negative sentiments among bank-supported paytech apps and great concerns about both trust and perceived risk, which are key variables analyzed in the academic literature. It is necessary to indicate that the level of integration with traditional banks is one of the determinants that affect the emotions of users; however, other determinants are expected to be studied in future research.

The most critical users of these P2P payment apps are those of an unidentified gender, while women remain in a more neutral position, and men tend to express their opinions more positively.

Our results show a consensus on the main determinant of the user experience of the three most valued P2P paytech apps in Spain, this is, perceived quality. The determinants receiving the most support from users vary depending on the level of bank integration. In the case of Bizum, the main determinant of user experience is subjective norms, whereas users of apps with a lower level of integration with banks (Twyp and Verse) face subjective norms as the main determinant of perceived risk. Despite beginning to

spread to the commercial sphere to pay for purchases, the reviews did not include any comments related to merchant services, probably because of their novelty. The relevance of our findings is highlighted by analyzing 100% of the available historical reviews. However, it is necessary to recognize the limitations of the study with regard to the number of downloads and updates. As Google Play does not provide the exact number or history of downloads, their evolution cannot be studied, as is the case with the history of updates made by app developers. Therefore, it is hoped that solutions or alternatives, such as recording downloads and updates over time, will be sought in future research.

Recently, some authors have adopted new methodological approaches applicable to financial mining tasks (Cheng et al. 2023; Kou et al. 2021b; Li et al. 2022; Wang et al. 2020). In this vein, our methodology, based on OSINT tools, breaks with the habit of many researchers of analyzing users' opinions through surveys as the adopted methodology overcomes the two limitations of traditional surveys. First, the decrease in the sincerity of the answers was due to the reluctance of the respondents to know that they were being observed (Díaz de Rada 2012). This problem was solved by analyzing a platform, in our case Google Play, where users voluntarily offer their reviews without knowing that they will be analyzed. In this sense, respondents felt free to express their opinions, answer at their own pace, select the best moment, and use the time they needed. In addition, since there were no interviewers, there were no biases due to their influence, which implied a greater guarantee of anonymity that helped interviewees express more critical and less socially accepted responses (Kreuter et al. 2008). Second, an additional limitation is the existence of sampling bias when analyzing only a non-representative sample of the population.

However, our approach, based on Big Data (the OSINT tool), allowed us to conduct sampling that considered the entire population, giving rise to the concept of All = N (Mayer-Schönberger and Cukier 2013). Thus, we collected and analyzed all data potentially related to P2P applications without facing the economic and technical realities normally required to obtain data from the entire population (Perrons and McAuley 2015). In our study, extraction costs were relatively low; however, in general, extensive knowledge of the methodology was necessary. When using big data, datasets and analytical techniques are so large and complex that they require advanced data storage, management, analysis, and visualization technologies (Chen et al. 2012) and involve giving up carefully selected clean data and tolerating some clutter (Cukier and Mayer-Schoenberger 2013).

Finally, the implications of this study can be considered from both theoretical and practical perspectives. The main theoretical implication of our study is that it makes a methodological contribution by presenting a new approach to exploring the determinants of the user experience of paytech services. Our research obtained data from users at the time of a service encounter, which is a scarce source of information in the academic literature on paytech services. In addition, the methodology can be applied to a variety of social domains, such as business, finance, health, and education. From a practical point of view, the identification of sentiments and emotions is necessary not only to understand the users' experience but also to enhance the services offered. By applying text-mining analysis, service providers can gain efficiency in understanding users' sentiments and emotions without the tedious and time-consuming screening of reviews.

## Abbreviations

| AIC   | Account Information Convico          |
|-------|--------------------------------------|
| RM    | Business Model                       |
| CSV   | Comma-separated values               |
| DBE   | Digital Business Ecosystem           |
| DOI   | Diffusion of Innovation              |
| LARA  | Latent Aspect Rating Analysis        |
| LDA   | Latent Dirichet Allocation           |
| OSINT | Open Source Intelligent              |
| P2P   | Peer-to-peer                         |
| PIS   | Payment Initiation Service           |
| POS   | Point-of-sale                        |
| PSD2  | Payment Service Directive 2          |
| PSP   | Payment Service Provider             |
| RQ    | Research Question                    |
| SEPA  | Single Euro Payments Area            |
| S-O-R | Stimulus-Organism-Response           |
| TAM   | Technology Acceptance Model          |
| TPB   | Theory of Planned Behavior           |
| TRA   | Theory of Reasoned Action            |
| UTAUT | Unified Theory of Acceptance and Use |
| UX    | User Experience                      |

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#### Author contributions

Conceptualization, DPK, AID and PPS; methodology and data analysis, DPK, AID and PPS; Writing—Original draft preparation, DPK, AID and PPS; Writing—Review and editing, AID and DPK; supervision, DPK, AID and PPS. All authors read and approved the final manuscript.

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## Availability of data and materials

The datasets used during the current study are available from the corresponding author on reasonable request.

## Declarations

## **Competing interests**

The authors declare that they have no competing interests.

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