Research article

Decoding the cryptocurrency user: An analysis of demographics and sentiments

José Campino [a,*], Shiwen Yang [b]

[a] *Nova School of Business and Economics, Portugal*
[b] *ISCTE-Instituto Universitário de Lisboa, Portugal*

ARTICLE INFO	ABSTRACT
	In recent years, new payment methods have emerged, aimed at improving convenience for users. Cryptocurrencies, in principle, are no different. In this study, we seek to analyze the general population's attitudes towards the adoption of cryptocurrencies as a payment method. To achieve this, we have developed a descriptive survey that targets both current cryptocurrency users and non-users, recognizing that differences in perception may exist. Additionally, we have conducted a sentiment analysis of open-ended questions to understand respondents' views on the future of the cryptocurrency market and its potential as a payment tool, utilizing different lexicons in the English language. Our findings indicate that most cryptocurrency users prefer to invest in these digital assets, often choosing coins based on their popularity rather than other intrinsic features. E-commerce payments are the most attractive activity, followed by international transactions when using cryptocurrencies as a payment method. However, high volatility and a lack of ease of use are the most common difficulties reported by users. Our study also highlights the importance of regulation in a time when users are increasingly demanding higher levels of oversight, in contrast to the past. While users are concerned about the instability and volatility of crypto-currencies, they also value the anonymity these transactions offer. Our analysis showcases an innovative approach to analyzing interviews and qualitative questionnaires that can be applied in other research fields.

1. Introduction

In ancient societies, a barter system facilitated the exchange of goods and commodities, but its limitations, such as a restricted trading circle and a lack of a common unit of account, hindered the fulfillment of diverse demands. Approximately 5000 years ago, to enhance scalability and flexibility, an intermediary known as the "neutral commodity" or money was introduced [1]. This innovation allowed individuals to sell goods for money, enabling subsequent trade for a variety of items and facilitating exchanges between multiple goods [2]. In contemporary times, the use of physical cash has diminished, notably in countries like China, where digital payment methods through mobile phones have become predominant [3]. Similar trends are observed globally, with people preferring bank cards and digital payment options to avoid the inconvenience of carrying cash and receiving change. Online payments, facilitated by a single click, have significantly increased payment efficiency [3]. The array of available payment methods has expanded to include cash, bank accounts, and third-party options such as Alipay, WeChat, PayPal, Paytm, and Google Pay. These third-party methods,

---

functioning as electronic cash, resemble traditional banknotes but in an online, digital format [4]. The transition from offline to online payments has removed physical constraints, elevating payment efficiency from tangible to virtual realms.

Despite the convenience of electronic cash payments, challenges persist, particularly concerning regional policies, currency differences, and inconsistencies in the banking system. In response to these limitations and the 2008 financial crisis, Satoshi Nakamoto introduced Bitcoin, the first cryptocurrency, proposing a decentralized electronic cash system [5,6]. The foundational technology of Bitcoin and other cryptocurrencies is blockchain, characterized by secure, encrypted, and distributed digital transactions. Additional features include decentralization, 24/7 availability for fast settlement, transparent transaction data, user information confidentiality, absence of intermediary fees, and irreversible transactions [7]. Blockchain technology fosters trust among transaction participants, facilitating peer-to-peer value exchange without intermediaries [8]. Nevertheless, the adoption of this technology and cryptocurrencies as transaction tools remains controversial. While offering convenience, they also provide opportunities for criminal activities, and concerns about substantial electricity and energy consumption have been raised globally [9]. Despite ongoing improvements in payment methods, challenges and risks persist.

This study seeks to explore the transformative impact of evolving payment methods, focusing on the contemporary shift towards cryptocurrencies. The historical progression from the barter system to the digital revolution in payments reflects an ongoing pursuit of increased efficiency, security, and convenience in financial transactions. As society embraces decentralized electronic cash systems like Bitcoin, powered by blockchain technology, a critical assessment of user sentiments becomes imperative. This comprehensive sentiment analysis aims to unveil the intricacies of user perspectives on cryptocurrencies, shedding light on factors influencing widespread adoption or resistance. The research's significance lies in its potential to inform policymakers, industry stakeholders, and the public about the evolving dynamics of digital currencies, ultimately contributing to the refinement and development of future financial systems aligned with users' needs and concerns in a changing economic landscape.

2. Background

2.1. Cryptocurrency as a payment mechanism

In the process of transferring money to someone at a considerable distance, the bank assumes the role of an intermediary. Particularly, if the sender and receiver maintain accounts in different banks, the time it takes for the funds to arrive is contingent upon the interbank fund delivery duration, as illustrated in Fig. 1. In such scenarios, real-time completion of transactions is not guaranteed; the overall process is influenced by bank working hours and delivery frequency. Moreover, variations in standards and system interfaces among different banks can further impede the efficiency of cross-bank transaction services [10].

Since the onset of the 21st century, e-commerce has experienced rapid and extensive growth, fundamentally altering the dynamics of daily consumption on a global scale. As the e-commerce landscape became more expansive and competitive, the pivotal issue of trust prompted the emergence of third-party payment systems. These systems function as intermediaries, effectively managing and securing transactions between sellers and buyers. For instance, when an individual decides to purchase a shirt from an online platform and opts to pay with a credit card, the transaction details undergo verification by the card-issuing bank. The funds are then held or credited to the third-party, and only upon the buyer's confirmation of a successful transaction does the third party release the payment to the seller. Moreover, third-party payment services typically provide a broad array of networks and bank account options [10], enhancing the convenience of their services, as depicted in Fig. 2. In contrast, these services streamline procedures, minimizing the effort and information requirements for users.

Whether conducting transactions through traditional bank channels or third-party intermediaries, an intermediary, either directly or indirectly, always plays a crucial role in verifying transactions. In such instances, transactions are deemed centralized due to the involvement of a third party [11]. In contrast, cryptocurrencies operate on a decentralized model. This implies that, beyond the payer and payee, no additional parties participate in the verification of payment. All transactions pass through and are recorded on a blockchain, which can be either permissioned or permissionless. A permissioned blockchain involves a designated group validating ongoing developments, which can be delegated to individuals or an organization. On the other hand, a permissionless blockchain operates without the need for validators. Notably, a blockchain maintains records of all transactions while ensuring the anonymity of users [11]. Beyond their role as currencies, cryptocurrencies have gained popularity as financial assets. Individuals and institutions trade them on exchange platforms for profit, akin to stocks, securities, other tradable commodities, and foreign currencies. Investors
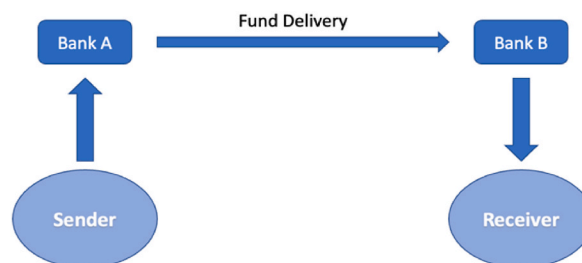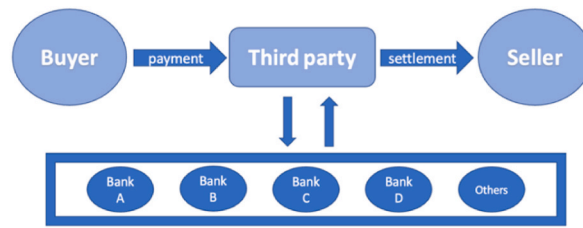

Fig. 1. Bank transfer process.

Fig. 2. Third-party transfer process.

also store cryptocurrencies with the anticipation of potential future value appreciation.

2.2. Cryptocurrency acquisition and exchange

Acquiring cryptocurrencies is relatively straightforward, often accomplished through a cryptocurrency exchange directly from a digital wallet. In this process, fiat currency is deposited into the exchange, and the equivalent value in cryptocurrency is purchased [12]. However, the direct exchange between different cryptocurrencies can be somewhat challenging, contingent upon the exchange's features and the availability of specific cryptocurrency pairs as direct swaps [13]. The variety of cryptocurrencies accessible also relies on the particular cryptocurrency exchange being used.

Every cryptocurrency exchange provides users with a distinct wallet, and all cryptocurrency transactions necessitate the use of a wallet. The wallet address is publicly visible, and the details of all transactions conducted through that wallet are recorded on a public blockchain. Importantly, the wallet address does not require any personal information from the user [14]. Alternatively, cryptocurrencies can be deposited or withdrawn using dedicated cryptocurrency ATMs. Globally, there are approximately 38,000 cryptocurrency ATMs facilitating the deposit and withdrawal of major cryptocurrencies like Bitcoin or Ethereum. The withdrawal process is automated, with the ATM converting the cryptocurrency into the local fiat currency and delivering it directly to the consumer, mirroring the functionality of traditional ATMs. Despite the rapid proliferation of cryptocurrency ATMs, there are regions, such as mainland China, South Korea, Japan, Malaysia, Singapore, and various other Asian countries, where this infrastructure is not yet widespread. This is primarily due to regulatory constraints and market demands [15].

2.3. Cryptocurrency stability

The analysis of Fig. 3 reveals a noteworthy contrast in the volatility levels between Bitcoin/USD and EUR/USD, underscoring the inherent instability within the realm of cryptocurrencies. Bitcoin, as represented in the graph, exhibits a considerably higher level of volatility when juxtaposed with the EUR/USD pair. The pronounced fluctuations in the value of Bitcoin not only demonstrate its susceptibility to market dynamics but also underscore the unique challenges associated with digital assets in comparison to traditional
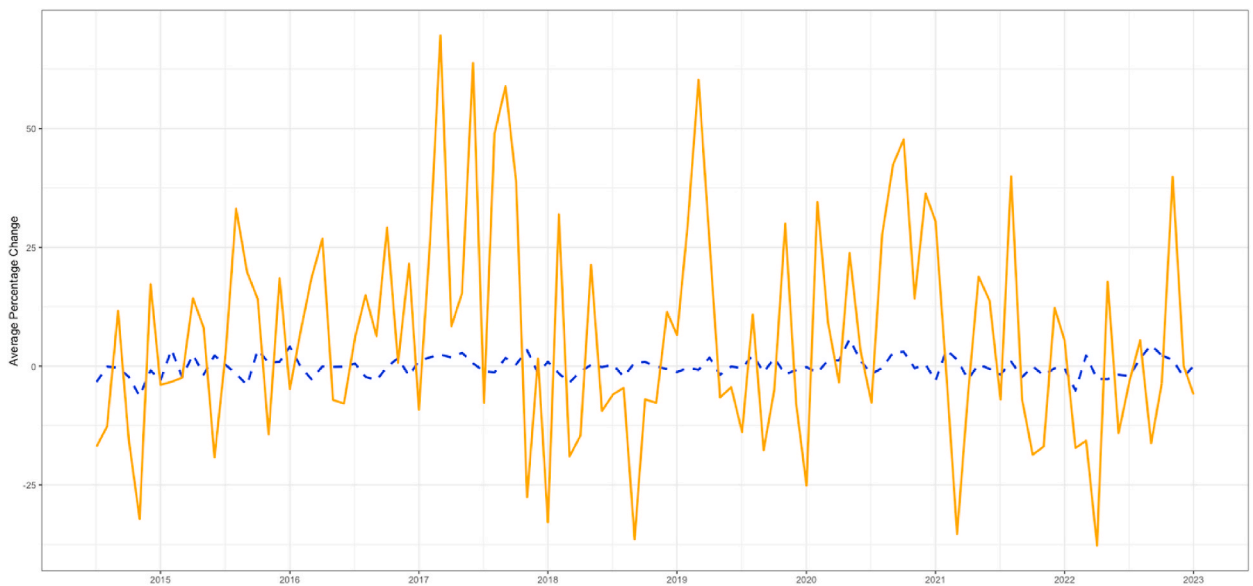

Fig. 3. Monthly percentage change in the exchange rates of BTC/USD (line) and EUR/USD (dashed)
Data: Yahoo Finance.

fiat currencies. If we take the example of Bitcoin (BTC), it has mostly been used as a financial investment of speculation as opposed to its purpose of serving as currency due to its volatility [16,17]. This emphasizes the imperative for stakeholders, including investors and policymakers, to navigate this distinctive landscape with a nuanced understanding of the inherent risks and uncertainties associated with cryptocurrencies, particularly Bitcoin, in contrast to more established fiat currencies like the Euro.

2.4. Cryptocurrency adoption

There are previous studies focused on the adoption of cryptocurrencies and the characteristics of their users. An early study by Dwyer [16] asserts that Bitcoin represents a significant innovation in trading, facilitated by a peer-to-peer network that validates and finalizes transactions without the need for trust in a central authority. The paper considers the potential success of Bitcoin and similar digital currencies in exchanges for other currencies, citing the feasibility of order-driven exchanges. The ability of Bitcoin to disintermediate banks and payment processors in remittances is acknowledged, albeit with major regulatory challenges. The paper also suggests that digital currencies may undermine government revenue generation from substantial inflation. Finally, the paper raises the question of whether some countries or the world might be on the verge of denationalizing money, acknowledging the difficulty in reaching a conclusive answer but suggesting that recent developments have brought the possibility into consideration. In the same manner, Shahzad et al. [18] addresses the challenges faced by traditional financial mechanisms in adapting to the virtual economy globally and examines the unpredictable future of Bitcoin currency and Blockchain technology regarding their adoption in existing or new financial systems. The anonymity feature of Bitcoin poses difficulties in acceptance and raises legal concerns for governments, leading to instances like China, the second-largest market for Bitcoin, imposing a ban on Bitcoin and other cryptocurrencies. The study focuses on investigating the adoption of this innovation in Mainland China's financial system, employing the Technology Acceptance Model (TAM) along with key factors of awareness and perceived trustworthiness. Awareness is identified as a crucial factor influencing perceptions and cultivating a culture of technology adoption. The study uses organized surveys to measure individuals' intentions to use Bitcoin as a mode of exchange. The results reveal a significant positive association among awareness, perceived ease of use, perceived usefulness, and perceived trustworthiness with the intention to use Bitcoin. The study concludes that the respondents are eager to adopt Bitcoin as a mode of exchange when well-informed about its functions and usage, coupled with a high level of trust. However, the lack of government approval and control reduces trust and individual intention to adopt Bitcoin, potentially hindering its role and growth in the global financial system. The study emphasizes the need for government and financial institution regulation to ensure the successful integration of Bitcoin into the financial landscape.

A study by Baur et al. [14] delve into various aspects of Bitcoin, aiming to address key research questions surrounding its advantages, disadvantages, adoption drivers, barriers, and future potentials. The findings reveal that while stakeholders acknowledge Bitcoin's high convenience, issues of perceived ease of use persist, with concerns about mobile wallet usability, implementation, storage, and transfer, as well as the need for user training. The perceived usefulness of Bitcoin is confirmed, particularly due to low transaction fees, potential international reach, and acceptance. Subjective norms regarding Bitcoin usage are somewhat split, with emphasis placed on using Bitcoin for innovation and competitive advantage. The study suggests that Bitcoin's future potential is promising, despite being considered a niche phenomenon at present. The paper concludes that Bitcoin's unique decentralized nature positions it as a significant player in the online payment market. Jonker [19] explores the current state of acceptance of crypto-payments, focusing on retailers engaged in online product sales. The findings indicate that the current acceptance of crypto-payments, such as Bitcoin, among online retailers is modest. However, there is a notable interest among retailers to adopt crypto-payments in the near future, suggesting that acceptance may rise as perceived barriers are addressed. The study identifies three key factors influencing the adoption intention of online retailers: consumer adoption of crypto-payments, retailer's perceived net transactional benefits associated with crypto-payments, and retailer's perceived level of accessibility. The limited acceptance is attributed to retailers perceiving little added value of crypto-payments compared to other methods. Despite potential mitigations, low consumer demand emerges as a critical factor limiting crypto adoption by retailers. The study concludes that the challenges related to increasing transaction fees and transfer times for crypto-payments, along with low consumer demand, pose hurdles for substantial adoption by retailers. Consequently, the potential for cryptos to significantly alter the existing retail payment ecosystem is deemed small.

From a perspective of the individual users in Pakistan, Li et al. [20] explores the adoption of blockchain-based cryptocurrencies, particularly Bitcoin, through the lens of the Unified Theory of Acceptance and Use of Technology (UTAUT). The study notes that a complex and unintuitive system might hinder usage, while emphasing the need for cryptocurrency service providers to address challenges related to user learning and interaction. The results reveal that performance expectancy positively influences the intention to use cryptocurrency. In contrast, the study finds that users may perceive difficulties in learning and interacting with cryptocurrencies, requiring attention from service providers to enhance user experience. Social influence is found to have a non-significant effect on determining the intent to use cryptocurrencies, while the integration of trust with social influence shows a significant positive influence, emphasizing the importance of trust in blockchain technology. Perceived risk emerges as a significant factor affecting cryptocurrency adoption highlighting the necessity of addressing perceived security risks in promoting cryptocurrency use. The study also finds that higher levels of financial literacy positively influence cryptocurrency adoption, enabling individuals to make more informed financial choices. The positive impact of trust on customers' intentions toward blockchain-based applications is also addressed, emphasizing the role of trust in inspiring confidence in new technologies. Following the same perspective but for the Chinese market, Nadeem et al. [21] investigates the factors influencing the individual's intention to use Bitcoin. The findings demonstrate the significant effects of perceived ease of use on the intention to use Bitcoin, emphasizing that technology adoption is more likely when the technology is user-friendly, flexible, and understandable.

Concerning the demographics and characteristics of cryptocurrency users, both Yeong et al. [22] and Doraisamy et al. [23] have focused their research on the Malayan market. According to Yeong et al. [22], the respondents who embrace cryptocurrencies are predominantly male, constituting 89.9% of the sampled population. Additionally, a significant portion of cryptocurrency users falls within the young age bracket (40.3%) and possesses a higher education background, with 54.5% holding a university degree. Doraisamy et al. [23] substantiates these findings by presenting a similar sample and extends the analysis by asserting that performance expectancy plays a crucial role in influencing the adoption of Bitcoin. The study highlights a perceived high risk associated with cryptocurrency use, indicating a negative correlation with the adoption of such assets. Simultaneously, social influence emerges as a significant factor in adoption decisions. This study aligns its methodology with that of Li et al. [20], yielding analogous results regarding the adverse impact of risk and the positive influence of performance expectancy on adoption. However, there is a disparity between the studies concerning the role of social influence. Li et al. [20] dismisses its significance, while Doraisamy et al. [23] emphasizes its importance.

Overall, Al-Amri et al. [24] has developed a systematic literature review on the topic which identifies critical research gaps, including the need for a more comprehensive understanding of factors influencing adoption, the limited use of technology adoption models, concerns about sampling size and geographical coverage, a dearth of human perspectives in the literature, and a call for more high-quality, thorough publications contributing significantly to the understanding of cryptocurrency adoption dynamics. The research advocates for a nuanced and multifaceted approach to studying cryptocurrency adoption, recognizing the importance of both qualitative and quantitative methodologies for a comprehensive understanding of this evolving phenomenon. Part of the avenues for future research were developed since the publication of this study [20–23] but others remain to be answered, for example, a more qualitative approach over the users and non-users opinions about the crypto assets and further geographical coverage.

2.5. Research aim

The landscape of digital currencies and the adoption of cryptocurrencies as a payment method have witnessed substantial growth in recent years. However, within this evolving paradigm, there exists a noticeable research gap that this study aims to address. While previous research has explored aspects of cryptocurrency adoption, our study uniquely focuses on the nuanced attitudes of both current cryptocurrency users and non-users, recognizing potential disparities in perception. The novelty lies in the combination of a comprehensive descriptive survey and a sentiment analysis of open-ended questions, providing a multifaceted understanding of the general population's sentiments toward cryptocurrencies. Additionally, the study delves into the perceived attractiveness of specific activities, such as e-commerce payments and international transactions, shedding light on the practical implications of adopting cryptocurrencies. Furthermore, our research underscores the shifting dynamics regarding the demand for regulatory oversight, representing a novel contribution to the discourse on the future trajectory of digital currencies. In essence, the research offers a fresh perspective on the intricacies surrounding cryptocurrency adoption, making it a valuable addition to the existing body of knowledge.

3. Methodology

This research follows mainly two approaches, namely, a descriptive statistics approach based on the questionnaire developed and a qualitative analysis based on the sentiment analysis developed. Regarding the participation in the questionnaire, all the respondents were informed of its purpose and the respondent's anonymity was assured. Furthermore, informed consent to participate in the questionnaire was obtained from all the respondents who must be at least 18 years old.

3.1. Questionnaire

The survey was available during the period from June to August of 2022 and the dissemination of the survey is conducted completely through online platforms, mainly from social networks and cryptocurrency-related social media forums and groups. The target group is people who have already some knowledge about cryptocurrencies. We were able to filter for these people in the first question which. After the filter is done, the rest of the respondents will be divided into 2 groups: (i) group 1 being the respondents who have already used cryptocurrency for transactions or payments; (ii) group 2 being the respondents who have knowledge about cryptocurrency but have never conducted any transaction with cryptocurrency.

This division will allow the authors to conduct an analysis from different levels: (i) group 1 will help to understand, from their experience during cryptocurrency usage, what are the positive and negative aspects of cryptocurrency payment methods compared to traditional payment methods, as well as the improvements they believe cryptocurrency needs; (ii) group 2 will help to understand the reasons why people chose not to use cryptocurrency, their willingness to adopt cryptocurrency, their worries, and concerns.

3.2. Sentiment analysis

To gain a deeper understanding of the responses, we included open-ended questions in our questionnaire, allowing for qualitative analysis rather than relying solely on descriptive statistics. To perform this analysis, we utilized the R-Studio software, which offers a range of dictionaries or lexicons consisting of extensive collections of words, each with an assigned sentiment.

Lexicons can be useful in several applications such as in social media analysis and online brand reputation management to identify positive and negative sentiment in customer feedback, reviews, and comments. They can also be used in other text analysis applications, such as market research and customer feedback analysis, to gain insights into how customers or target audiences feel about a

product, service, or brand. Our analysis is focused on the following three lexicons.

- The Bing lexicon [25] is also known as the Bing Liu Opinion Lexicon. It is a pre-compiled list of words that have been manually labeled as positive or negative based on their polarity. The lexicon contains over 6000 English words and phrases that are commonly used in opinion mining and sentiment analysis applications. In R, the Bing lexicon is often used to perform sentiment analysis on text data. By matching words in a text corpus to their corresponding entry in the lexicon, the sentiment of the text can be determined. Words with positive polarity are assigned a score of +1, while words with negative polarity are assigned a score of −1. The scores of all the words in the text are then summed to get an overall sentiment score for the text.
- The AFINN lexicon [26] is similar to the Bing lexicon. It is a list of words that have been assigned a polarity score based on their sentiment. AFINN stands for "Affective Norms for English Words". In the AFINN lexicon, each word is assigned a score ranging from −5 to +5, where negative scores indicate negative sentiment, and positive scores indicate positive sentiment. The score of a word represents the strength of its sentiment, with larger absolute values indicating stronger sentiment.
- The NRC (National Research Council) lexicon [27] is a lexicon that includes a set of words, phrases and emotions associated with eight basic emotions: anger, fear, anticipation, trust, surprise, sadness, joy, and disgust. The NRC lexicon has been created by researchers at the National Research Council Canada in 2013. The lexicon includes more than 14,000 words that have been manually annotated with a binary value of 1 or 0 indicating whether they express a particular emotion or not. For example, the word "love" has a binary value of 1 for the emotion "joy" and the word "hate" has a binary value of 1 for the emotion "anger". Therefore, it can provide more valuables insights than the binary dictionaries distinction between a positive and a negative sentiment.

It's worth noting that the lexicons we used are based on the English language. For analyses in other languages, alternative lexicons or appropriately adapted versions of the current ones would be necessary. To perform our analysis, we tokenized each word, removed stop words such as "to" and "from," converted plural words into singular, and performed text cleaning to ensure consistency and accuracy in the results.

4. Results

Overall, 380 answers to the survey were collected and the confidentiality of the answers were ensured. Out of 380 answers, 17 respondents showed no basic knowledge about cryptocurrencies being automatically excluded from the analysis. Therefore, the analysis of this research will be mainly based on the 363 answers. Of the valid 363 answers, it was divided into two groups, group 1 (the respondents who have already used cryptocurrency) which consists of 154 (42.3%) respondents, and group 2 (the respondents who have knowledge about cryptocurrency but have never conducted a transaction with cryptocurrency), which consists of 209 (57.7%) respondents.

4.1. Descriptive statistics for group 1 (who use cryptocurrencies)

Most of the respondents in our sample are residing in the USA, which accounts for 81.1% of the sample (125). Canada, the UK, India and Croatia contribute 2.6% (4), 2.6% (4), 1.9% (3) and 1.3% (2) respectively. Besides these countries, there we also had respondents from Australia, Czech Republic, Denmark, France, Germany, Ireland, Israel, Malaysia, Mexico, New Zealand, Nigeria, Romania, Senegal, South Africa and Switzerland which all have 1 respondent each. The main reason for the large weight of American respondents is due to the large number of active users from the USA on social media platforms (e.g., Facebook or Reddit), and forums (e. g., Trading View or Finance Forum) where the survey was published. Furthermore, most of the respondents are male amounting to 132 (85.7%), whereas female respondents amount to just 17 (11%). 5 respondents preferred not to disclose their gender.

Most of the respondents are aged between 18 and 45. The most common age group is between 25 and 35 which accounts for 37% (57), then the age group between 35 and 45 accounts for 27.3% (42), age group of 18–25 accounts for 20.1% (32). Regarding the education level, 83.8% (129) of the group 1 responded that they have at least a university degree. There are 12.9% (20) of the sample with high school and middle school degrees. The remaining preferred not to disclose their education.

Concerning the gross monthly income, 51.9% (80) of the respondents in group 1 make more than 5000 dollars a month, and 16.9 % (26) make between 3000 and 5000 dollars a month.

In sum, the group 1 mainly consists of people who are male, residing in the USA, between the age of 18–45, with a university

Table 1
Answers for "How often do you usually use the following payment method?" for group 1.

	Third-party	Cryptocurrency	Credit/Debit Card	Cheques	Cash
Always	13	2	63	0	2
Never	33	75	3	85	11
Occasionally	43	13	21	11	50
Ofter	36	1	66	2	26
Rarely	29	63	1	56	65
Total	154	154	154	154	154

degree, and who have a monthly income of over 3000 dollars.

4.1.1. Findings

Firstly, we would like to know which was the most used payment method by the respondents summarized in Table 1. The most used payment method is credit/debit card, there are 129 (83.8%) respondents who use it very frequently. However, there are 4 people (2.6%) in the sample who seldom or never used it. Cheque is the least used payment method, for which there are only 2 (1.3%) respondents who often use it for payment, and more than half of the sample (55.2%) has never used cheques. With the fast development of digital payment, cash has been used much less than before with data showing that only 28 (18.2%) respondents in Group 1 use cash and 50 (32.5%) people use it occasionally. Notably, almost half of the sample (49.4%) rarely or never used cash. Third-party payments (Apple pay, google pay, WeChat etc.) are frequently used by 49 (31.8%) respondents, yet 33 (21.4%) have never used them. Cryptocurrency is still not considered as a well-known payment method, it has just 3 (1.9%) regular users among the sample of Group 1 and 13 (8.4%) respondents use it occasionally, notably 75 (48.7%) respondents have never used it thus far.

One of the main features of cryptocurrencies is removing some obstacles when conducting an international transaction. The data shows that in general, an international transaction is not considered as a common activity among all the respondents as per Table 2. Of the entire sample, 51.9% never made an international transaction. Whereas 9% conduct international transactions regularly, and 38.9% occasionally transfer money internationally.

Considering the type of network used to perform international transactions, the bank is the most used method for international transactions. There are only 4 people who frequently use cryptocurrency for international transactions and 13 people often use the third-party payment method. Therefore, we can tell, although the sample of group 1 have all adopted cryptocurrency, they are utilizing it mainly for financial investment or as a trading instrument. The reasons why respondents use the payment method selected are convenience, reliability, accessibility, simplicity and low cost. From the data collected, in addition to these main common characteristics that most of the respondents would consider, there are also unique points for each different payment method that can benefit a certain group of people. For example, a credit card can provide service of prepaid, as well as reward and discount programs. Third-party methods allow users to link multiple bank cards.

Concerning the experience using cryptocurrencies summarized in Table 3, the sample shows that 74.7% are users with 6 months to 5 years of experience. 20% have more than 5 years of experience. 8 people (5.2%) are new to cryptocurrency with less than 6 months of experience. As already briefly explored, most of the sample uses cryptocurrency primarily for investment or trading activities. There are 57 users (37%) who use cryptocurrency as a payment or transaction tool. 43 of them use it a few times a year and 14 use it on a regular basis. Therefore, we can tell that currently cryptocurrency is being adopted mainly for investment purposes rather than a payment method. Regarding the amounts of the transactions, 70.8% (109) use cryptocurrency for the transactions under 500USD, 24% (37) use it for transactions between 500 and 2000USD. Overall, transactions above 2000 USD with cryptocurrency are not very common within the sample. We can assume that the respondents either don't have needs to make big amount transactions over 2000 or they prefer other methods to conduct big amount transactions.

The usage of cryptocurrencies is also a focus of this work. From our sample, 79.2% trade or invest in cryptocurrencies, 24% of the sample shop online with cryptocurrency, and 5.8% use cryptocurrency for face-to-face payments. Only 9.1% of the respondents use cryptocurrency to make international transactions. As virtual gaming is developing rapidly and has gained a lot of popularity, some of the games are developed on the blockchain technology, thus game transactions with cryptocurrency has become very common or even essential for certain games [28]. Within the sample, 6.5% of the respondents have already used cryptocurrencies to play virtual games. Apart from these activities from the given choices, some respondents also added other transactions that they used cryptocurrencies for. For example, drugs, sports gambling, transferring votes, a utility for networks and black market on the deep web. These answers raise the awareness of illegal activities that may be performed using cryptocurrencies due mainly to their anonymity.

With the expansion of blockchain technology, new coins keep emerging in the market. The respondents were asked which cryptocurrency exchanges they use and what coins do they usually buy and why do they choose them. The platforms that the respondents usually use are mainly Coinbase, Binance, Robinhood, Gemini, crypto.com and Kucoin. From the answers given by all respondents, there are more than 30 platforms that they are using. We can tell that the business derived from cryptocurrencies have greatly expanded, users have many options in coins and exchange platforms for them to make transactions and trading activities. The most used coin is Bitcoin (BTC), the second is Ethereum (ETH) and the third is Dogecoin (DOGE). Less commonly used coins account for Solana (SOL), Ripple (XRP), Monero (XMR) and Cardano (ADA) as summarized in Table 4.

Popularity is the most important factor for the user when they select a cryptocurrency to use. Popularity can help some users save efforts to do research by just following the crowd, but popularity is also a signal of high liquidity which would be ideal for some trading

Table 2
Answers for "How do you usually transfer/receive money internationally?" for group 1.

	Bank	Cryptocurrency	Third-party
Always	26	2	6
Never	63	110	108
Occasionally	23	13	15
Ofter	22	2	7
Rarely	20	27	18
Total	154	154	154

Table 3
Answers for "How long have you been using crypto-currency?" for group 1.

Time	Frequency
5 years +	31
2–5 years	48
6 months to 2 years	67
6 months -	8
Total	154

Table 4
Answers for "What is the coin that you use the most often?" for group 1.

Coins	Frequency
Bitcoin (BTC)	108
Ethereum (ETH)	79
Dogecoin (DOGE)	21
Solana (SOL)	8
Ripple (XRP)	7
Cardano (ADA)	4
Monero (XMR)	4
Shiba Inu (SHIB)	3
Others	24
Total	258

activities. Popularity can make it easier for people to use or make payments, as there would be a higher chance that the other party is also familiar with the same coin, considering there are too many coins in the market and some of them may not be known by many people. The second most important feature for the respondents is stability and thirdly is network. Good stability implies less risk in price and a trustworthy network guarantees the user experience. Cost and speed are also important for many users, low cost can save users' money and high speed helps users to make payments fast, especially for face-to-face payments. Apart from the given choices there are also other reasons in the answers, like potentiality for investment, security, being decentralized, used for mining, and because of high market cap.

Concerning the reasons that attracted users to use cryptocurrencies for the first time in Table 5, the most common one was to "make a profit by trading" as 67.5% of the group 1 sample chose it. The second most chosen answer is the "decentralized concept" of cryptocurrencies (34.4%). As 31.2% of the sample chose "revolutionary technology", we assume that the innovative technology or concept can also attract many new users. Furthermore, 19.5% said they have adopted cryptocurrency because of the internet's influence, in other words, advertisements and influencers can help to attract new users. Nevertheless, 14.3% were recommended by other people. After their first contact with cryptocurrencies, we would like to understand the factors that lead people to adopt them. As expected, coin appreciation is the most common factor among all the users as most of the users. Anonymity is the second most common reason followed by avoiding intermediaries, avoiding currency exchange, high security and low cost. When using cryptocurrencies, 29.9% (46) of the users liked the experience and 22.7% disliked it. On the other hand, 47.4% are neutral towards it. Overall, 43 respondents find it rather hard to use cryptocurrencies for transactions. Nevertheless, 56 respondents were neutral about the process and 55 respondents find it relatively easy to use cryptocurrencies. Regarding the difficulties in using cryptocurrencies, most users faced difficulties: (i) the transfer process; (ii) purchasing and selling; (iii) exchange cryptocurrencies; (iv) government restrictions; (v) blockchain disruptions. Other difficulties mentioned less frequently concern high volatility, learning how to read cryptocurrencies' price curves and poor support systems from crypto exchanges. The users of cryptocurrencies mentioned as needed improvements: (i) price stability; (ii) procedures to buy/sell; (iii) regulation; (iv) transaction costs and speed.

Table 5
Answers for "What attracted you to adopt cryptocurrency initially?" for group 1.

Reasons	Frequency
Make a profit trading	104
Decentralized concept	53
Revolutionary technology	48
Internet influence	30
Recommendation	22
Others	28
Total	285

Crypto ATMs have been put in use recently as it maybe can be considered a fundamental trial for exchange with other currencies and as a transaction tool to deposit and withdrawal. In our sample, 78.6% have heard about Bitcoin ATM. However, 48.1% of the sample have a positive attitude towards the concept and 38.3% don't feel optimistic about it. When it comes to the willingness to adopt the Bitcoin ATM, 48.1% (74) of the sample do not want to use it, 24% would like to use it and 27.9% maybe willing to use it in the future. In general, the potential adoption of Bitcoin ATM among the current cryptocurrencies users is not considered high. The main reasons for this result are that the Bitcoin ATM has not provided too many attractive functions that could persuade users to choose them over other methods. Some of the respondents have also mentioned that the price instability has made it unreliable to make a transaction on the ATM.

4.2. Descriptive statistics for group 2 (who do not use cryptocurrencies)

The second group of respondents consists of people of who have knowledge about cryptocurrencies but have not yet adopted them. The sample characteristics share similar attributes as group 1. Most of the respondents in group 2 are also male residing in the USA, between the age of 18–45, who received a university education and make more than 3000 USD per month. They use credit/debit cards the most for payments, rarely use cheques, use cash occasionally and used third-party payment often. Most of them have never made international transactions, for those who have transferred money abroad, mostly conduct international transactions a few times a year through banks and some of them use third-party payment.

Although the group 2 have never used cryptocurrency, many of them have good knowledge about cryptocurrency and know where to obtain them, although the majority do not know how the transaction works.

4.2.1. Findings

The main reasons that Group 2 do not want to adopt cryptocurrencies are due to fear of the high volatility, potential scams, and lack of knowledge. The features that may attract them to adopt cryptocurrency are simplicity for international transactions, security, low transaction fees and anonymity. Therefore, improving the cryptocurrencies from these aspects can possibly help the developer to get more users. The respondents in group 2 generally think cryptocurrencies need to improve their price stability, regulation, and their availabilities in different regions and industries. Regarding the advantages and disadvantages of cryptocurrencies compared to traditional payment methods, most of the respondents think the advantages are the anonymity provided and fewer restrictions. Besides, some respondents also mentioned speed, lower costs, and a simpler process. Concerning the disadvantages, almost 80% of the group 2 consider high volatility as a disadvantage, followed by lower availability, and non-revertible transactions. It is worth noting that anonymity is also regarded as an advantage of cryptocurrencies. This point has been controversial as anonymity could provide convenience for illegal activities.

If the respondents in group 2 come to adopt cryptocurrency, they would like to use them for e-commerce and investment purposes, followed by international transactions, face-to-face payment and then virtual gaming. Only 22.5% of our sample assertively believe that cryptocurrencies will not become more largely adopted and 40.2% believe they will become more popular. Regarding the future of cryptocurrencies, 62.7% of the sample believe they can be more regulated as part of the expansion of this digital asset. However, 53.6 % think there is a possibility for it to collapse and 25.4% expect it will be used more for illegal activities.

4.3. Sentiment analysis

The present section presents an analysis of the sentiment towards cryptocurrencies using open-ended questions posed to our sample of respondents. To avoid potential bias, we analyze the responses of different subgroups separately, as users and non-users of cryptocurrencies may hold different perceptions towards the topic. Our objective is to obtain a clear understanding of the overall feelings and perceptions of the respondents regarding the future of cryptocurrencies as a payment tool and the future of the cryptocurrency market in general. To ensure that the sentiment analysis is accurate and reliable, we formulated a set of control questions (questions 1 and 2). The control questions are designed to elicit positive and negative sentiment towards cryptocurrencies, respectively. These questions serve as a benchmark to validate the effectiveness of our sentiment analysis approach.

We summarized the open-ended questions used in Table. 6, which was designed to capture the sentiment of respondents about the future of cryptocurrencies as a payment tool and the future of the cryptocurrency market. The open-ended questions were carefully crafted to ensure that the responses obtained were as detailed and comprehensive as possible. Analyzing the subgroups separately allows us to compare the differences in perceptions between users and non-users of cryptocurrencies. This approach enables us to

Table 6
Questions used for the sentiment analysis.

Index	Question
Q1	From your knowledge, what are the advantages of using cryptocurrency compared to traditional payment methods (bank and third-party payment methods)?
Q2	From your knowledge, what are the disadvantages of using cryptocurrency compared to traditional payment methods (bank and third-party payment methods)?
Q3	What's your opinion on the future of cryptocurrency as a payment tool?
Q4	What's your opinion on the future of cryptocurrency market?

obtain a more comprehensive understanding of the factors driving the sentiment towards cryptocurrencies. By analyzing the responses of different groups separately, we can identify the key drivers of sentiment and gain insights into the underlying reasons for these differences.

4.3.1. Word cloud

To gain a preliminary understanding of the data, we utilized a word cloud in Figs. 4 and 5 to display the most frequently used words by both users and non-users of cryptocurrencies. This visual representation enables a quick grasp of the data and the respondents' most salient concepts. The word cloud highlights the most used concepts in the center with larger fonts and colors, while the less central concepts appear in smaller font sizes around the periphery. This word cloud is built with the most frequently used 300 words using a pre-defined function for that purpose in the R-Studio package *Wordcloud2*.

Our analysis reveals that both groups place similar emphasis on the concepts of instability, volatility, price, and anonymity. Additionally, the concepts of availability, adoption, and collapse were also frequently mentioned by respondents. Importantly, the concept of regulation emerged as a crucial theme in our study. Both users and non-users of cryptocurrencies recognize the significance of regulation, which they associate with transparency. Notably, cryptocurrency users expressed a greater emphasis on the need for regulation, representing a departure from earlier attitudes. This shift in attitude suggests that cryptocurrency users now demand greater regulation to safeguard their investments and prevent instability and collapse while preserving the essential concept of anonymity.

4.3.2. Words frequency

To further refine our analysis, we created a frequency graph that displays the most frequently used words by both users and non-users of cryptocurrencies, clustered by positive and negative sentiments according to the Bing lexicon. Unlike the word cloud methodology, we depicted words used more than 20 times by the users. Figs. 6 and 7 display the graphs, which reveal a higher frequency of negative words when users refer to cryptocurrencies.

On the positive side, both groups highlighted the well-functioning of the cryptocurrency market, which enables faster and simpler transactions. Users mentioned the large availability of exchange platforms and their simplicity of use, providing instant transactions. However, the concept of availability is also linked with the perceived need to the make cryptocurrencies more available when compared to traditional payment methods. Although with a much smaller compound sentiment, some users expressed concern about the possibility of slower transactions and worse performance than regular fiat currencies. However, the most significant results came from the negative side, with both groups displaying large compound sentiment scores for the concepts of instability, volatility, and restrictions. Users were concerned with the unstable cryptocurrency market, suffering from high volatility. They also mentioned the negative impacts of restrictions on the use of cryptocurrencies, highlighting their increasing concerns. These findings are consistent with the preliminary results depicted in the word cloud. Non-users of cryptocurrencies perceived them as being much more unstable and volatile than users. The compound negative sentiment for the word instability was over 200 for non-users, while users had a score of about 170. Similarly, the concept of volatility received a score of about 180 for non-users, while users had a score of about 125. It is also worth noting that non-users were more concerned about the collapse of the cryptocurrency market than users. These negative perceptions of non-users can be attributed to their lower knowledge of the market functioning and the use of cryptocurrencies. As investment and trading become clearer and simpler, most barriers are overcome, and users tend to display a more positive approach.

4.3.3. Frequency of the NRC sentiments

We have employed the NRC lexicon to assign sentiments to words used by respondents and draw generalizations about their attitudes towards cryptocurrencies as per Figs. 8 and 9. The lexicon identifies eight emotions, which we group into positive and negative sentiments for a broader view of the respondents' attitudes. Our analysis reveals that negative sentiments are more frequent than positive sentiments for both users and non-users of cryptocurrencies. Moreover, the non-users show a higher negative sentiment compared to the users. A similar trend is observed for positive sentiments, with users expressing more positive emotions.

Concerning the basic human emotions detected by this lexicon, both users and non-users show a similar hierarchy. Not surprisingly,

Fig. 4. Word cloud based on the answers and word frequency of users.

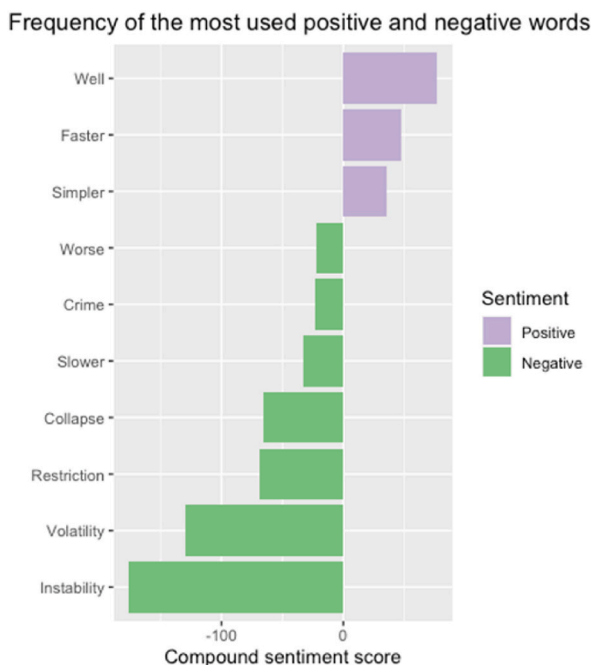**Fig. 5.** Word cloud based on the answers and word frequency of non-users.

Fig. 6. Compound sentiment score based on the Bing lexicon for users.

the users show a sentiment of fear, with a frequency of about 2000 for users and 2500 for non-users, when faced with the use of cryptocurrencies. This emotion represents feelings of apprehension or anxiety. Words such as "afraid," "nervous," and "terrified" are associated with fear. This emotion is linked with previously explored concepts such as collapse, volatility, instability, and fraudulent activities. Therefore, fear is the most relevant emotion detected with the highest frequency among both users and non-users of cryptocurrencies. The anger emotion is also detected with a high frequency of about 1500 for both respondents' groups. Anger is also an important emotion when analyzing the sentiment of the respondents due to its weight in the analysis. This emotion represents feelings of hostility, frustration, and annoyance. Words such as "angry," "annoyed," and "frustrated" are associated with anger. Anger is followed by sadness which represents feelings of sorrow or despair. Words such as "sad," "gloomy," and "depressed" are associated with sadness. Sadness has a frequency of about 1400 for users and 1500 for non-users. Disgust is the emotion that follows with a frequency of 1300 for users and 1500 for non-users. This emotion represents feelings of revulsion or disapproval. Words such as "disgusted," "repulsed," and "revolted" are associated with disgust. The trust emotion shows similar frequencies for users and non-users of about 1400. This emotion represents feelings of confidence or faith in someone or something. Words such as "trusted," "reliable," and "credible" are associated with trust. It is important to mention that this emotion is not on the top of the list revealing that there is a lack of trust in the cryptocurrencies market which derive from the lack of regulation and the intrinsic volatility, as mentioned previously. Anticipation follows trust with a similar frequency for users and non-users of about 1200. This emotion refers to feelings of excitement or expectation. Words such as "excited," "hopeful," and "optimistic" are associated with anticipation. It is also important to notice the fact that both groups are expectant concerning the development in the cryptocurrency market which is constantly evolving. Joy and surprise are the last emotions expressed in our sample with frequencies below 1000. The users of cryptocurrencies put joy above

Fig. 7. Compound sentiment score based on the Bing lexicon for non-users.
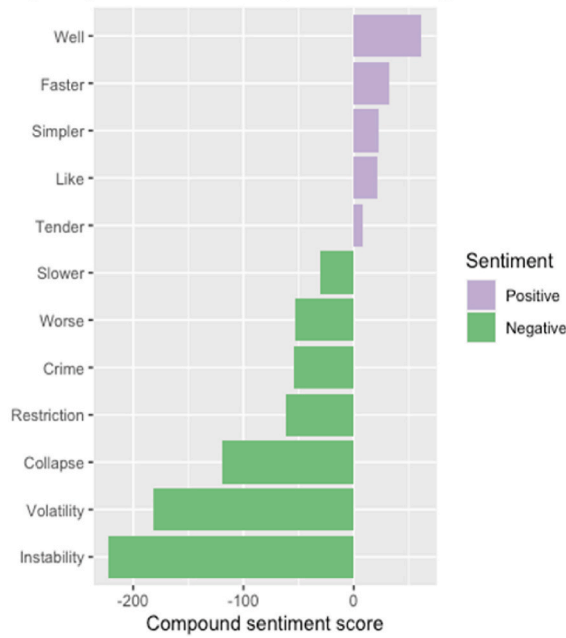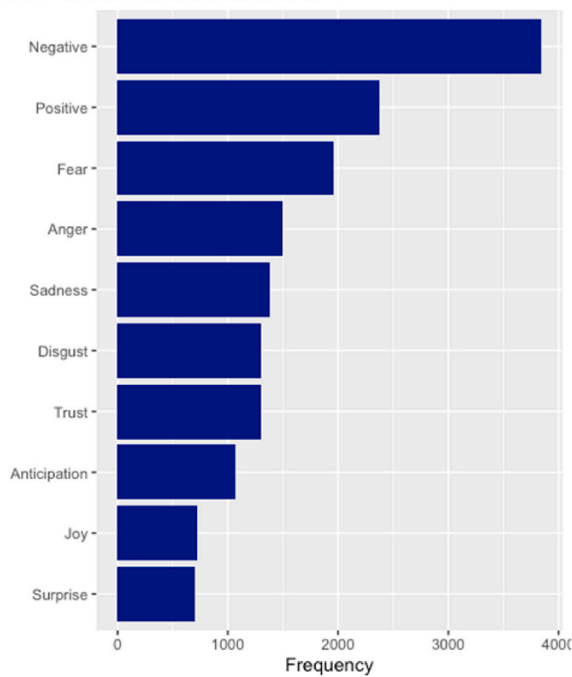

Fig. 8. Frequency of NRC detected sentiments for users.

surprise and the opposite happens to the group of non-users. Joy represents feelings of happiness or delight. Words such as "happy," "delighted," and "ecstatic" are associated with joy. On the other hand, surprise represents feelings of shock or amazement. Words such as "surprised," "amazed," and "astonished" are associated with surprise.

In sum, our analysis using the NRC lexicon provides insights into the emotions expressed by respondents towards cryptocurrencies.
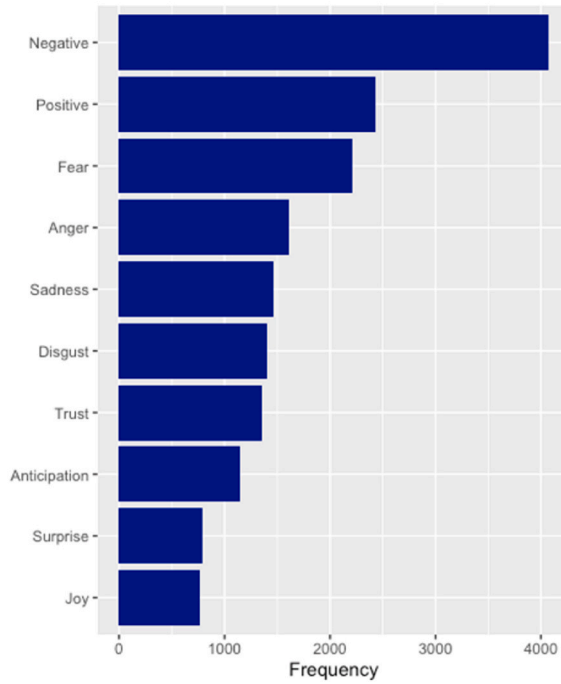
Fig. 9. Frequency of NRC detected sentiments for non-users.
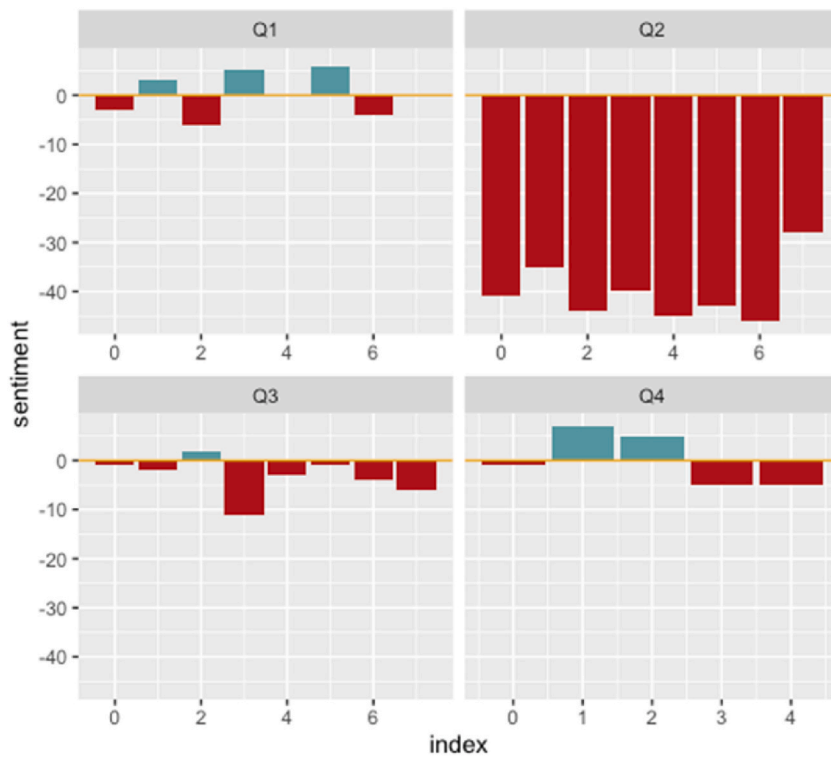
Fig. 10. Sentiments per question based on the Bing lexicon for users.

The predominance of fear and the lack of trust and anticipation suggest that negative sentiments prevail. The positive sentiments are more expressed by users, indicating a more positive attitude towards cryptocurrencies. This analysis underscores the need for increased regulation and stability in the cryptocurrencies market to reduce negative emotions and increase positive emotions among potential users.

4.3.4. Sentiment per question

We further developed our analysis by performing separate analysis by question using the dichotomy of positive and negative sentiments of the Bing lexicon as per Figs. 10 and 11. The first step involves getting the sentiments from the lexicon and storing them in a list. The analysis is then performed on the dataset using the sentiments from this list. The index is used to group the lines of the dataset into blocks of a certain size (i.e.: 20 lines). The sentiment for each block is then calculated by counting the number of positive and negative sentiment words in each block. The resulting data is stored in a table, which includes the sentiment for each block, the question being analyzed, and the overall sentiment. To visualize the sentiment data, a bar chart is created. The x-axis represents the index (block number), and the y-axis represents the sentiment score. The bars are colored based on whether the sentiment is positive or negative, and the chart is faceted by the question being analyzed. The horizontal line at y = 0 represents a neutral sentiment score.

The first two questions in this study, (i.e.: Q1: advantages of using cryptocurrencies and Q2: disadvantages of using cryptocurrencies), were designed as control questions with the expectation that Q1 would receive predominantly positive sentiments and Q2 would elicit predominantly negative sentiments. However, the responses to Q1 were mixed, indicating that there is no clear consensus on the advantages of using cryptocurrencies. Once more, the users reveal a higher positive sentiment is this question than the group of non-users. Conversely, Q2 was found to have predominantly negative sentiments, as expected, about the disadvantages of using cryptocurrencies. Not surprisingly, the non-users show a deeper negative sentiment when compared to the users. This analysis concludes that the respondents believe that the disadvantages of using cryptocurrencies currently outweigh the advantages.

Regarding the last two questions, (i.e.: Q3: future of cryptocurrencies as a payment tool and Q4: future of the cryptocurrencies market), we have obtained different results for users and non-users. For Q3, both groups show a negative sentiment, but the users group show a much less negative score when compared to the group of non-users. This analysis leads to the conclusion that both groups still do not believe in the wide adoption of cryptocurrencies as a payment tool in the current environment. For Q4, the group of users shows a mixed sentiment score which ends up being neutralized. Whereas, for the same question, the group of non-users shows a clearer negative sentiment but with some indexes revealing a slight positive attitude. Therefore, we conclude that the users group is still expectant regarding market developments while the non-users group is expecting a worst outcome.
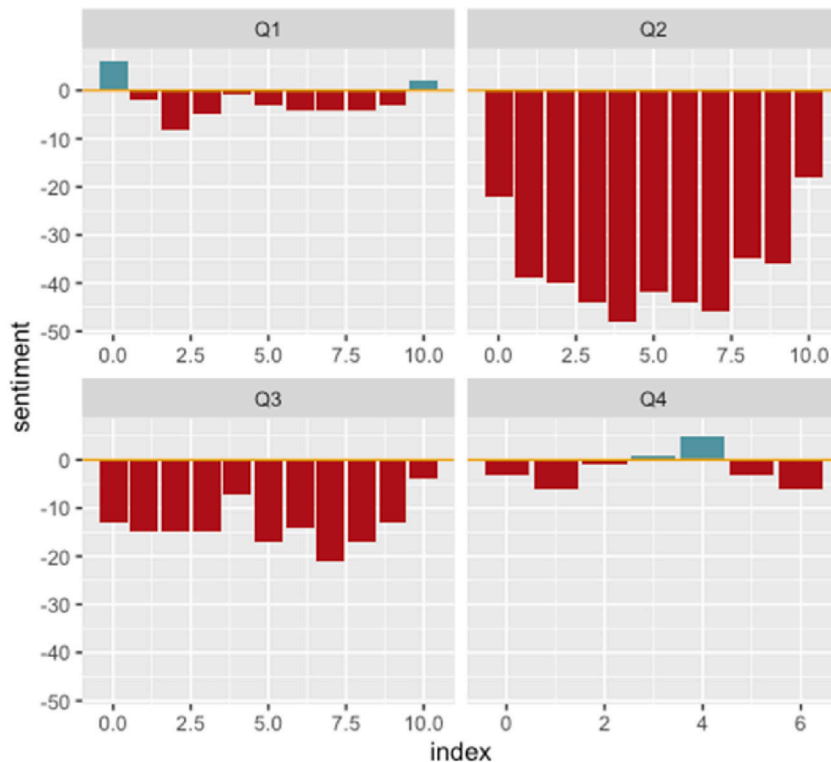

Fig. 11. Sentiments per question based on the Bing lexicon for non-users.

4.3.5. Confirmatory analysis per question

In order to confirm the results obtained with the Bing lexicon in the previous section, we have combined the 3 lexicons in the same analysis per question as per Figs. 12 and 13. This process involves comparing the sentiments per question using different lexicons, namely AFFIN, NRC, and Bing. Firstly, the AFFIN sentiment lexicon is applied to the data and the sentiments are grouped by question and index. The index is calculated based on the number of words in each response and is adjusted to ensure that the analysis is consistent, as explored before. The same process is then repeated for the Bing and NRC dictionaries, and the results are combined into a single table. The sentiments are visualized using a bar graph that shows the sentiment score for each method and index, grouped by question. By comparing the sentiment scores for each dictionary, it is possible to identify any differences in the sentiments expressed by the respondents.

Comparing the results per question using the different lexicons, we confirm that they are in accordance with each other. We verify small differences among the lexicons in certain questions as expected due to differences in their specific contents. Nevertheless, the results show a correlation among them, providing convincing proof of the quality of the analysis per question performed using the Bing lexicon.

4.3.6. Correlation map

To conclude our sentiment analysis, we have developed a correlation map between the words used by the respondents, depicted in Figs. 14 and 15. This process is analyzing the correlation between words that appear in the same question. It begins by counting the number of times each word appears in the dataset and only keeping the words that appear 65 times or more. Then, it calculates the correlation between words within the same question and keeps only the pairs of words with a correlation greater than 0.3. To visualize the results, a graph is created. Each word is represented as a node in the graph, and the edges between them indicate a high correlation between the words. The alpha parameter of the edge link is set to the value of the correlation coefficient, so the stronger the correlation, the thicker the edge. The node size is proportional to the number of times the word appears in the dataset, and the color of the node reflects the count. This process aims to uncover any interesting correlations between words that appear in the same context and to visualize them in a graph for further analysis. In sum, it plots the words according to their closeness, in other words, plots in the same region the words which were more frequently used together. Then, the graph plots the correlation among these words and depicts it according to the thickness of the line linking them. Whenever needed, the analysis will recur to the original answers to provide context.

The first similarity to notice between the graphs of users and non-users is the existence of two main clusters of words linked with each other. For the group of users, the first cluster of words reveals the need for industry regulation as a users' requirement. The respondents highlight the importance of the industry becoming regulated in order to avoid possible negative consequences, such as a possible collapse of the market due to the high, unpredictable, and unstoppable volatility. Furthermore, the group of users highlights
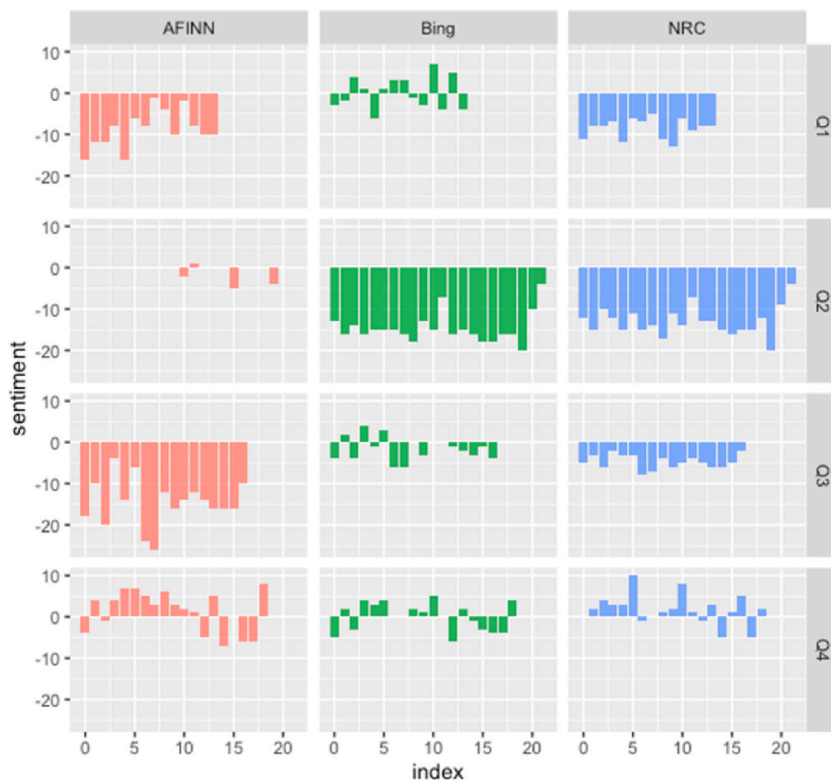

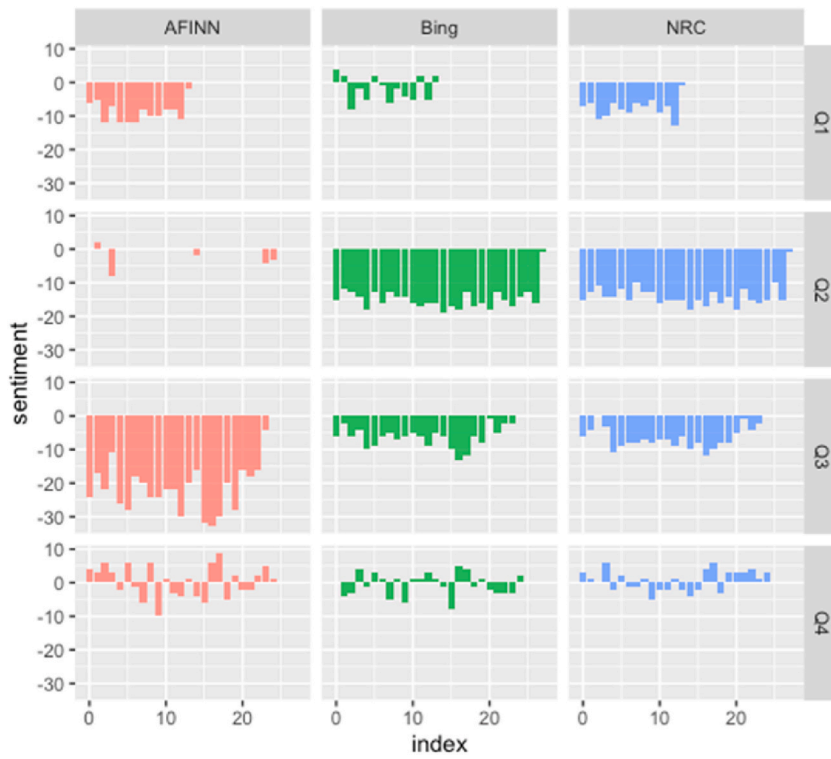**Fig. 12.** Sentiments per question comparison using the 3 lexicons for users.

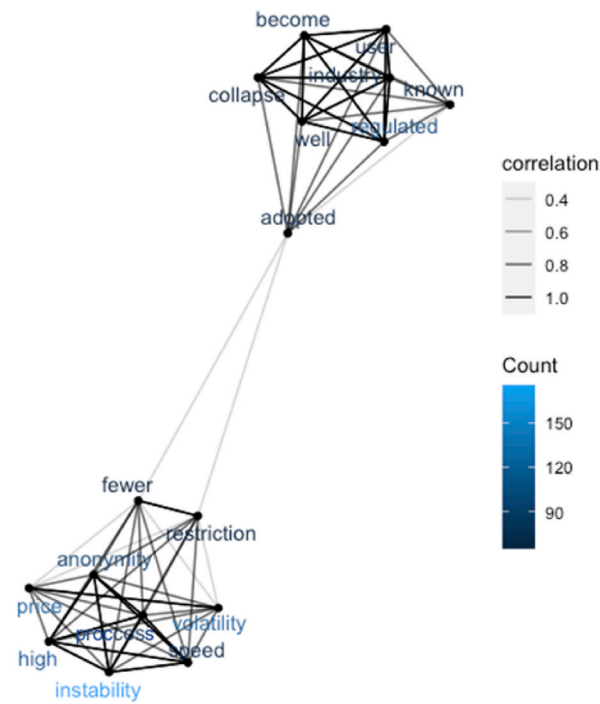**Fig. 13.** Sentiments per question comparison using the 3 lexicons for non-users.

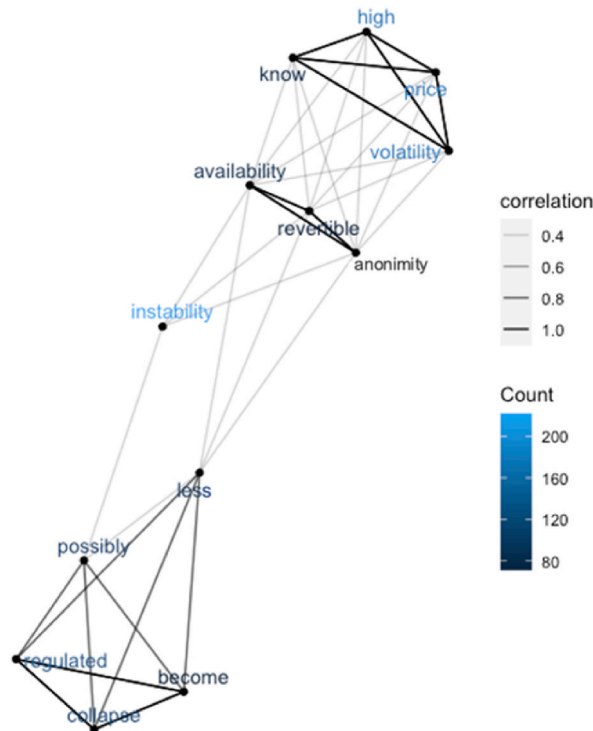**Fig. 14.** Correlation map for users based on word frequency and their correlation.

Fig. 15. Correlation map for non-users based on word frequency and their correlation.

the importance of regulation as a predominant factor to the wide adoption of cryptocurrencies. This adoption also depends on fewer restrictions which is referred by the respondents in two different meanings: to identify the need to reduce the increasing country restrictions to the use of cryptocurrencies but also to mention that these currencies usually have less restrictions than traditional ones in their use. The fewer restrictions to the trading of cryptocurrencies are also explained by the users as the possibility to remain anonymous while doing so. However, there are some consequences while using cryptocurrencies. The group of users identifies these consequences as the volatility and instability in the price. The volatility and instability are perceived as high and happening at a fast pace. In this graph, both clusters of words are linked via the word adopted. This bridge word is directly linked with adopting cryptocurrencies due to fewer restrictions but also the adoption of regulation.

The group of non-users provides a more limited number of words however creating two clusters. The first cluster clearly points out the well-known high price volatility. This cluster is directly linked with a sub-cluster with the concepts of availability, revertability and anonymity. The non-users which mentioned the volatility of the cryptocurrencies also mention their less availability when compared to traditional payment methods and that frequently the cryptocurrencies are non-revertible. Although anonymity is well perceived as the main reason to use cryptocurrencies by the users, some non-users also link this characteristic with negative concepts highlining the need for less anonymity, as the graph shows. On the second cluster of words, the non-users express the need to improve regulation to avoid negative consequences and as a factor to improve the use of cryptocurrencies, similarly to the sentiment of the users. The concept of instability is the link between clusters being the central word in the graph highlighting its importance to the non-users. The instability as the bridge word reveals, after a further analysis of the answers, that it is the central concept around cryptocurrencies for non-users and that regulation could provide some stability to the market.

4.4. Discussion

The findings presented in this research shed light on the patterns and characteristics of individuals involved with cryptocurrencies, with a particular focus on two distinct groups: those who actively use cryptocurrencies (Group 1) and those with knowledge about cryptocurrencies but have not yet adopted them (Group 2). The majority of respondents in Group 1 are from the USA, constituting 81.1% of the sample, followed by contributions from other locations less representative in our sample. The demographic breakdown reveals a predominantly male user base, aged between 18 and 45, with a substantial proportion holding at least a university degree. Income distribution indicates that over half of the respondents earn more than $5000 per month. Similar to Group 1, the demographics of non-cryptocurrency users (Group 2) reflect a predominantly male, USA-based, university-educated population with monthly incomes exceeding $3000. Our sample's demographics is aligned with the samples in Yeong et al. [22] and Doraisamy et al. [23] who also highlight predominantly male cryptocurrency users, in younger ages and educated at university level.

The most frequently used payment method in Group 1 was credit/debit cards (83.8%), while cryptocurrency usage was limited

(1.9% regular users, 8.4% occasional). International transactions were not common, with the bank being the primary method. As highlighted by Dwyer [16], the adoption of cryptocurrencies is still low with the potential to increase in the future due to the interest by consumers. On the other hand, the most frequent payment method identified is credit/debit cards most likely due to lack of availability of payment in cryptocurrencies. As Jonker [19] highlighted, there is a vicious circle where retailers do not offer this payment method as consumers have not adopted it and consumers do not adopted it more due to lack options to use it. E-commerce appears to be more appealing to the use of cryptocurrencies according to our sample and in line with the findings from Baur et al. [14].

In our sample, the Bitcoin was the most used cryptocurrency. Indeed, many of recent studies have focused on this particular coin due to its popularity and wide usage [14,16,20,21]. Reasons for adopting cryptocurrencies included trading for profit (67.5%), decentralized concept (34.4%) [14], and revolutionary technology (31.2%) [16]. Challenges included transaction difficulties, price volatility, and government restrictions [18]. Group 2, without cryptocurrency usage, cited fear of volatility, potential scams, and lack of knowledge as reasons. They viewed simplicity in international transactions, security [20], low fees [14], and anonymity as attractive features. Anonymity seems to play an important role in our sample leading to the adoption of cryptocurrencies. However, as highlighted by Shahzad et al. [18], anonymity is also a main reason for concern among governments when accepting and regulating cryptocurrencies. They identified areas for improvement such as price stability and regulatory aspects [16,18]. If they adopted cryptocurrencies, it would likely be for e-commerce and investment. The majority believed cryptocurrencies might become more popular but had concerns about regulation, collapse, and increased use in illegal activities. The sentiment analysis conducted in this research aims to explore the perceptions and feelings of both users and non-users of cryptocurrencies regarding the future of cryptocurrencies as a payment tool and the overall cryptocurrency market. The analysis involves various techniques, including word cloud representation, word frequency analysis, NRC sentiment analysis, and a comparison of sentiments across different lexicons. The word cloud visually presents the most frequently used words by both users and non-users of cryptocurrencies. Notably, concepts such as instability, volatility, price [16], and anonymity stand out [11]. Users and non-users exhibit similar concerns, emphasizing the significance of regulation. The analysis reveals a shift in attitude among cryptocurrency users, who now advocate for greater regulation to ensure transparency and safeguard their investments [18].

Utilizing the NRC lexicon, the analysis identifies eight emotions, categorizing them into positive and negative sentiments. Fear emerges as the predominant emotion, indicating apprehension or anxiety, particularly concerning collapse, volatility, instability, and fraudulent activities. Both users and non-users express more negative sentiments, with users demonstrating a slightly more positive outlook. Lack of trust [20] and anticipation are apparent, emphasizing the need for increased regulation [18] and stability [16] in the cryptocurrency market. In the same manner, analyzing sentiments per question using the Bing lexicon reveals insights into respondents' perspectives on the advantages and disadvantages of using cryptocurrencies. While users express more positive sentiments, non-users display deeper negative sentiments, particularly regarding the disadvantages of cryptocurrencies. The sentiment analysis for future scenarios indicates that both groups are skeptical about the wide adoption of cryptocurrencies as a payment tool but differ in their expectations for the future of the overall cryptocurrency market [14]. The confirmatory analysis conducted, combining sentiments from different lexicons, validates the consistency of results.

Lastly, the correlation map identifies clusters of words and their relationships. Users emphasize the need for industry regulation to ensure market stability, adoption, and fewer restrictions. Non-users focus on the challenges of high price volatility, availability issues, and the importance of improving regulation for market stability.

5. Conclusion

This research provides valuable insights into the dynamics of cryptocurrency adoption, focusing on two distinct groups: active users (Group 1) and those with knowledge but no adoption (Group 2). The demographic profiles of both groups align with previous studies, highlighting predominantly male, USA-based, university-educated populations. The study indicates that credit/debit cards are the most common payment method among cryptocurrency users, emphasizing a potential vicious circle of limited cryptocurrency adoption due to the lack of payment options. E-commerce emerges as a sector more open to cryptocurrency usage, supporting findings from prior research. Bitcoin stands out as the most widely used cryptocurrency in the sample, with motivations for adoption ranging from profit trading to the appeal of decentralized and revolutionary technology. However, challenges such as transaction difficulties, price volatility, and government restrictions persist. Group 2, consisting of non-cryptocurrency users, cites fear of volatility, potential scams, and lack of knowledge as deterrents. They find simplicity in international transactions, security, low fees, and anonymity attractive features. Anonymity appears to be a significant factor, though governments express concerns about its implications.

The sentiment analysis reveals shared concerns among users and non-users, emphasizing issues such as instability, volatility, and the need for regulation. Fear emerges as a predominant emotion, indicating apprehension about market collapse and fraudulent activities. Users express a slightly more positive outlook, advocating for increased regulation to ensure transparency. The analysis of sentiments using different lexicons provides consistent results, reinforcing the overall sentiment trends observed. The correlation map further highlights the distinct priorities of users and non-users. Users emphasize the importance of industry regulation for stability, adoption, and reduced restrictions, while non-users focus on challenges like high price volatility and availability issues, underscoring the need for improved regulation.

In summary, this research contributes to the understanding of cryptocurrency adoption patterns, motivations, and challenges. The findings underscore the importance of addressing concerns related to regulation, stability, and transparency to foster broader cryptocurrency acceptance. As the cryptocurrency landscape evolves, continued research will be crucial for policymakers, businesses, and users to navigate this dynamic and transformative space effectively.

5.1. Practical implications

The study highlights a significant shift in payment preferences among respondents, with credit/debit cards being the preferred method for daily transactions due to their convenience and familiarity. This suggests a continued evolution in payment methods, with cryptocurrencies gaining traction, especially for international transactions. Cryptocurrencies, particularly Bitcoin (BTC) and Ethereum (ETH), are gaining popularity among users, primarily driven by the desire for profitability and investment/trading opportunities. The study underscores the importance of popularity as a driving factor, potentially overshadowing considerations of intrinsic aspects such as cost, speed, and technological features. Cryptocurrencies have found a prominent use in e-commerce, indicating a potential avenue for further adoption in online shopping. Both current users and non-users express a keen interest in utilizing cryptocurrencies for e-commerce and international transactions, highlighting a substantial market opportunity in these areas.

The advantages of cryptocurrencies, such as less restriction, faster speed, and lower costs, are acknowledged by many users. However, the study emphasizes the need for users to carefully select coins based on transaction speed and cost. Challenges include the complexity of transfer procedures, government restrictions, and high volatility. Respondents express concerns about the lack of regulations in the cryptocurrency space, particularly regarding price stability and security. The study underscores the pivotal role of regulations in ensuring stability, with an emphasis on the need for regulatory measures to foster long-term user confidence and adoption.

Despite concerns about potential misuse and collapse, most users anticipate increased regulation and adoption of cryptocurrencies. Additionally, regulators can use the study results to understand user concerns and expectations, such as price stability and the need for appropriate regulation while maintaining anonymity. The study suggests a growing user base in the future, but it warns of accompanying risks, including financial loss due to volatility, fraud, and cybercrime. This underscores the importance of ongoing user education and vigilance. With a multitude of cryptocurrency platforms and coins available in the market, users are urged to exercise caution and identify reliable platforms and coins to mitigate unnecessary losses. The study emphasizes the need for informed decision-making and highlights the importance of distinguishing trustworthy options from potential pitfalls in the crowded cryptocurrency landscape.

5.2. Limitations

While our sample spans diverse regions, it's essential to highlight an uneven geographical distribution, with a substantial 75% of respondents hailing from the USA. This imbalance may introduce bias, potentially skewing findings to primarily reflect the cryptocurrency landscape within the USA. Although a geographic analysis to delineate results for each region would enhance the research, the large proportion of American respondents precluded such an analysis due to insufficient representation from other geographies.

To maintain response consistency, certain questions were presented with predefined options. However, it's crucial to acknowledge that not all conceivable options were included, and these provided choices could have influenced respondents' initial perceptions. This aspect of our research may have constrained the measurement validity of the survey, potentially overlooking additional insights not captured by the limited predetermined choices.

The primary objective of our study was to scrutinize respondents' attitudes toward cryptocurrencies. While quantitative methods were employed for sentiment analysis, qualitative analysis played a pivotal role in result interpretation. Notably, applying a standard qualitative approach to analyze sentiment analysis results proved unfeasible, introducing an element of subjectivity that constitutes a limitation. To mitigate this, we applied multiple lexicons and conducted a conjoint analysis, enhancing result robustness through cross-confirmation of lexicon outcomes.

As elucidated by Dwyer [16], the cryptocurrency sector is characterized by volatility in aspects such as value, exchange prices, and demand. Given these dynamics, it's plausible that cryptocurrency users' perceptions may swiftly evolve. Our approach captures a snapshot of users' perspectives at a specific moment, thus unable to reflect future changes or historical evolution. Despite this limitation, our study provides a contemporary view on the topic, suggesting potential application of similar methodologies in the future for updated insights.

5.3. Avenues for future research

Studies like Baur et al. [14] have utilized comparable data, primarily derived from interviews exploring the adoption and potential of cryptocurrencies. Notably, this data distinguishes between respondents' experiences with crypto assets, offering a more specific and distinct analysis, albeit with a smaller sample size than ours. Baur et al.'s [14] focus on applying econometric models to latent concepts presents a valuable avenue for future research, suggesting the potential for exploring econometric relationships between sentiments and the actual adoption of crypto assets. In subsequent studies, questions could be directed towards understanding sentiments and directly analyzing the described relationships.

Moreover, it is recommended that future research places emphasis on collecting data from forums specific to different regions. This strategic approach aims to obtain a more diverse sample, allowing for a geographic analysis that can yield conclusions specific to each region. Such a comprehensive approach sets the stage for an international comparison of perceptions regarding cryptocurrencies, providing valuable insights into the global landscape of sentiments and attitudes towards these assets.

CRediT authorship contribution statement

José Campino: Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis, Data curation, Conceptualization. **Shiwen Yang:** Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e26671.

References

[1] N. Arvidsson, Building a Cashless Society: the Swedish Route to the Future of Cash Payments, Springer International Publishing, 2019, https://doi.org/10.1007/978-3-030-10689-8.

[2] P.C.P. Bhatt, What's new in computers, Resonance 19 (6) (2014) 549–569, https://doi.org/10.1007/s12045-014-0058-2.

[3] J. Wu, Exploring user acceptance OF an innovative mobile payment service, AN EMERGING MARKET: THE MODERATING EFFECT OF THE DIFFUSION STAGES OF WECHAT PAYMENTS IN CHINA 17 (2016).

[4] S. Tang, Z. Wu, X. Zhang, G. Wang, X. Ma, H. Zheng, B.Y. Zhao, Towards Understanding the Adoption and Social Experience of Digital Wallet Systems, vol. 10, 2019.

[5] S. Barber, X. Boyen, E. Shi, E. Uzun, Bitter to better—how to make bitcoin a better currency, in: A.D. Keromytis (Ed.), Financial Cryptography and Data Security, vol. 7397, Springer Berlin Heidelberg, 2012, pp. 399–414, https://doi.org/10.1007/978-3-642-32946-3_29.

[6] B. Weber, Bitcoin and the legitimacy crisis of money, Camb. J. Econ. 40 (1) (2016) 17–41, https://doi.org/10.1093/cje/beu067.

[7] Ž. Turk, R. Klinc, Potentials of blockchain technology for construction management, Procedia Eng. 196 (2017) 638–645, https://doi.org/10.1016/j.proeng.2017.08.052.

[8] Q.-F. Shao, C.-Q. Jin, Z. Zhang, W.-N. Qian, A. Zhou, Blockchain: architecture and research progress, Jisuanji Xuebao/Chinese Journal of Computers 41 (2018) 969–988, https://doi.org/10.11897/SP.J.1016.2018.00969.

[9] M. Niranjanamurthy, B.N. Nithya, S. Jagannatha, Analysis of blockchain technology: pros, cons and SWOT, Cluster Comput. 22 (6) (2019) 14743–14757, https://doi.org/10.1007/s10586-018-2387-5.

[10] Y. Lu, S. Yang, P.Y.K. Chau, Y. Cao, Dynamics between the trust transfer process and intention to use mobile payment services: a cross-environment perspective, Inf. Manag. 48 (8) (2011) 393–403, https://doi.org/10.1016/j.im.2011.09.006.

[11] S.S. Hazari, Q.H. Mahmoud, A parallel proof of work to improve transaction speed and scalability in blockchain systems, in: 2019 IEEE 9th Annual Computing and Communication Workshop and Conference (CCWC), 2019, pp. 916–921, https://doi.org/10.1109/CCWC.2019.8666535.

[12] L. Cocco, G. Concas, M. Marchesi, Using an artificial financial market for studying a cryptocurrency market, Journal of Economic Interaction and Coordination 12 (2) (2017) 345–365, https://doi.org/10.1007/s11403-015-0168-2.

[13] M.H. Miraz, D.C. Donald, Atomic cross-chain swaps: development, trajectory and potential of non-monetary digital token swap facilities, Annals of Emerging Technologies in Computing 3 (1) (2019) 42–50, https://doi.org/10.33166/AETiC.2019.01.005.

[14] A.W. Baur, J. Bühler, M. Bick, C.S. Bonorden, Cryptocurrencies as a disruption? Empirical findings on user adoption and future potential of bitcoin and Co, in: M. Janssen, M. Mäntymäki, J. Hidders, B. Klievink, W. Lamersdorf, B. van Loenen, A. Zuiderwijk (Eds.), Open and Big Data Management and Innovation, Springer International Publishing, 2015, pp. 63–80, https://doi.org/10.1007/978-3-319-25013-7_6.

[15] Ju O. Sivicka, The influence of cryptocurrency on the future of the international financial payment system through the example of a bitcoin, Economic Scope 0 (134) (2018) 40–55, https://doi.org/10.30838/P.ES.2224.050618.40.111.

[16] G.P. Dwyer, The economics of Bitcoin and similar private digital currencies, J. Financ. Stabil. 17 (2015) 81–91, https://doi.org/10.1016/j.jfs.2014.11.006.

[17] P. Katsiampa, Volatility estimation for Bitcoin: a comparison of GARCH models, Econ. Lett. 158 (2017) 3–6, https://doi.org/10.1016/j.econlet.2017.06.023.

[18] F. Shahzad, G. Xiu, J. Wang, M. Shahbaz, An empirical investigation on the adoption of cryptocurrencies among the people of mainland China, Technol. Soc. 55 (2018) 33–40.

[19] N. Jonker, What drives the adoption of crypto-payments by online retailers? Electron. Commer. Res. Appl. 35 (2019) 100848.

[20] C. Li, N. Khaliq, L. Chinove, U. Khaliq, J. Popp, J. Ol ah, Cryptocurrency acceptance model to analyze consumers' usage intention: evidence from Pakistan, Sage Open 13 (1) (2023) 21582440231156360.

[21] M.A. Nadeem, Z. Liu, A.H. Pitafi, A. Younis, Y. Xu, Investigating the adoption factors of cryptocurrencies—a case of bitcoin: empirical evidence from China, Sage Open 11 (1) (2021) 2158244021998704.

[22] Y.-C. Yeong, K.S. Kalid, K. Savita, M. Ahmad, M. Zaffar, Sustainable cryp- tocurrency adoption assessment among it enthusiasts and cryptocurrency social commu- nities, Sustain. Energy Technol. Assessments 52 (2022) 102085.

[23] B. Doraisamy, S. Appannan, P. Varatarajoo, J.K. Shanmugam, N.J. Aziz, An empirical research on factors affecting the acceptance of bitcoin in the northern region of Malaysia, East Asian Journal of Multidisciplinary Research (2023), https://doi.org/10.55927/eajmr.v2i5.3840.

[24] R. Al-Amri, N.H. Zakaria, A. Habbal, S. Hassan, Cryptocurrency adoption: current stage, opportunities, and open challenges, Int. J. Adv. Comput. Res. 9 (44) (2019) 293–307.

[25] Minqing Hu, Bing Liu, Mining and summarizing customer reviews, in: KDD-2004 - Proceedings of the Tenth ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, 2004, pp. 168–177, https://doi.org/10.1145/1014052.1014073.

[26] Finn Årup Nielsen, A new ANEW: evaluation of a word list for sentiment analysis in microblogs, CEUR Workshop Proceedings 718 (2011) 93–98. http://arxiv.org/abs/1103.2903.

[27] Saif M. Mohammad, Peter D. Turney, Crowdsourcing a word-emotion association lexicon, Comput. Intell. 29 (3) (2013) 436–465, https://doi.org/10.1111/j.1467-8640.2012.00460.x.

[28] O.J. Scholten, N.G.J. Hughes, S. Deterding, A. Drachen, J.A. Walker, D. Zendle, Ethereum crypto-games: mechanics, prevalence, and gambling similarities, in: Proceedings of the Annual Symposium on Computer-Human Interaction in Play, 2019, pp. 379–389, https://doi.org/10.1145/3311350.3347178.