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Global Market Perceptions of Cryptocurrency and the Use of Cryptocurrency by Consumers: A Pilot Study

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Abstract: Cryptocurrencies, like Bitcoin and Ethereum, have garnered global attention in recent years as digital alternatives to traditional fiat currencies. This paper explores the complex landscape of cryptocurrency adoption, consumer behavior, and perceptions. Beginning with the origin of cryptocurrencies and the dominance of Bitcoin with its USD 1.23 trillion market capitalization, the paper highlights popular online platforms facilitating Bitcoin trading. It also examines the varying legal statuses and regulations across different countries, with a notable divide between Eastern and Western nations, attributed to factors like wealth, risk tolerance, and government restrictions. The role of blockchain technology as the foundation of cryptocurrencies is explained, emphasizing its role in ensuring secure and transparent transactions. The paper delves into the processes involved in handling cryptocurrencies, including the blockchain, exchanges, wallets, and mining. Consumer behavior and the factors influencing cryptocurrency usage are analyzed, with a focus on speculation, algorithm trust, spending power, and demographics. Survey findings and case studies from diverse geographical areas reveal patterns of adoption and local consumer perceptions. The paper concludes by discussing the cryptocurrency market's inherent volatility and sensitivity to regulatory changes, as well as the different types of cryptocurrencies and online exchanges shaping this evolving financial landscape. Overall, it offers insights into the complex dynamics surrounding cryptocurrency adoption and its potential impact on global finance.

Keywords: cryptocurrency; bitcoin; consumer behavior; security issues; blockchain methods

1. Introduction

Cryptocurrencies have become increasingly popular among consumers in both developing and developed countries in recent years. A cryptocurrency is a digital and virtual currency that allows consumers to buy, store, and sell using online wallets. Digital currency is not controlled by any government or bank and is intended to replace fiat currency [1]. Nakamoto [2] introduced the first cryptocurrency, Bitcoin, in 2008, and over 2000 variants have since emerged. By an overall market capitalization of USD 1.23 trillion [3], Bitcoin is the most widely used cryptocurrency with USD 570 billion (48%), followed by Ethereum with USD 227 billion (19%). In addition to being a virtual currency, Bitcoin relies on the peer-to-peer network to keep track of all transactions [2]. Coinbase, Gemini, BlockFi, Kraken, eToro, Bitcoin IRA, and BitPay are some of the most popular bitcoin trading sites online, according to a recent study [4]. These sites help manage Bitcoin wallets as well as make it easier to convert bitcoins into fiat currencies. At the end of 2021, the market cap of
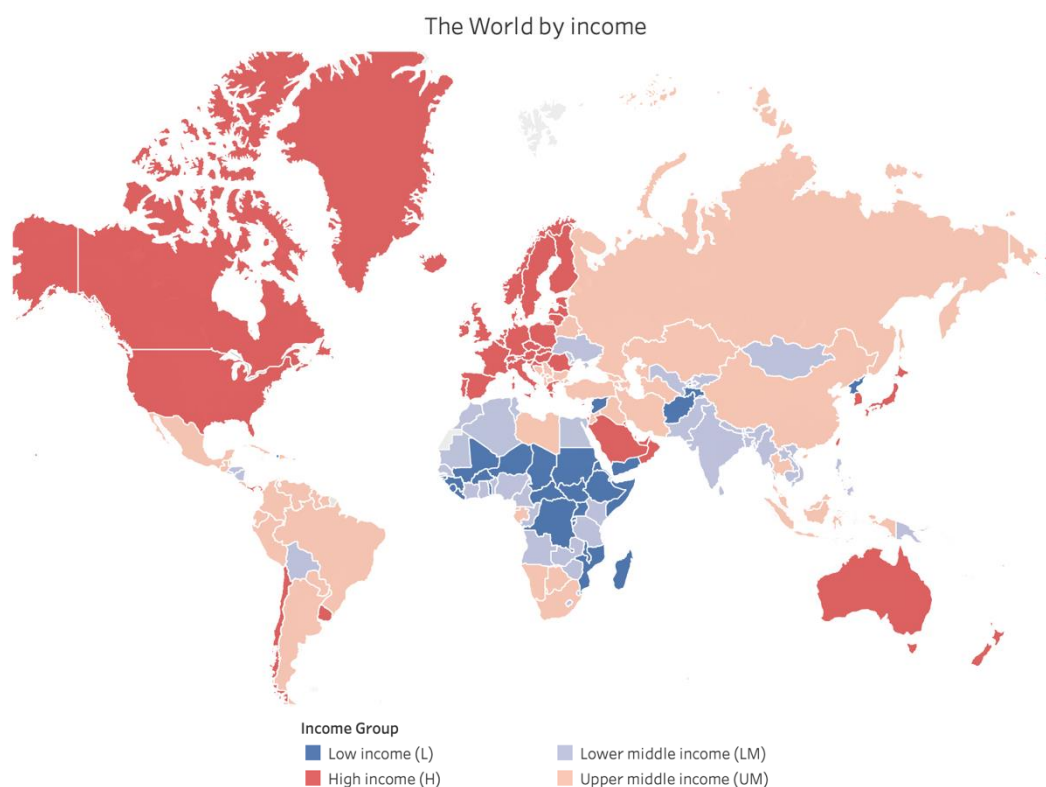
the company was USD 3 trillion, an increase of USD 4 trillion from its inception. Although cryptocurrency is legal in over 60 countries, including the USA, UK, Canada, Australia, the UAE, China, and Japan [5], North America holds the largest market for this digital exchange. A major driving force behind cryptocurrency applications is blockchain technology.

According to Figure 1, cryptocurrency is distributed around the world and is perceived differently by consumers in different countries. A *green* country represents a country in which Bitcoin is legalized and is used to make transactions as an alternative to traditional methods. *Orange* countries are neutral on Bitcoin, and despite not legalizing it, they do not place significant restrictions on its use. Bitcoin use is restricted or limited in *light-pink* countries because they have government-imposed restrictions. A number of *dark pink* countries have declared Bitcoin illegal. It is evident from the map that there is a clear division between Eastern and Western countries. There is a greater barrier to using Bitcoin in the eastern countries than in the western countries. There are several reasons for this, including residents' wealth, their acquiescence to the currency, and their aversion to risk.

Figure 1. Distribution of Bitcoin legality in different countries [6].

A map of the world based on national income published by the World Bank is presented in Figure 2. It is evident from comparing the above figures that countries with higher incomes tend to use cryptocurrency more often. Wealth does play a key role in shaping societal perspectives, and having more income can also allow individuals to diversify and experiment with different modes of payment. A number of countries (Venezuela and Russia) are developing national cryptocurrencies to boost transparency in digital money transactions and reduce corruption. Bitcoin transactions usually take 20 min to complete. In the event that a transaction does not reach completion within the time limit, that transaction is not added to the block. This ensures that there are no failed transactions in the supply chain. In the supply chain of its products, Walmart uses the blockchain to identify points of failure. Cryptocurrency price charts illustrate the application of crypto in a wide range of industries. Statistics indicate that Bitcoin's return over the past year has been 760%. As a result of the USD 1.5 billion investment in Bitcoin by Tesla, the company allows customers to pay with Bitcoin when buying cars. A milestone has been achieved by the crypto community [7].

Figure 2. Distribution of countries based on income [8].

Based on four major factors such as power prestige, retention time, distrust, quality, and anxiety during the COVID-19 pandemic in the USA, the researchers examined the impact of Bitcoin use in a sample of subjects from various income groups. Their findings indicate no significant differences in the use of Bitcoin by different income groups during COVID-19. Also, the behavior of consumers in one region may not be representative of the behavior of consumers in another region [9]. In a recent study, researchers evaluated the perception of cryptocurrency among 391 subjects in Turkey from different backgrounds (education, gender, income, and others) [10]. According to their report, most of the subjects were aware of cryptocurrency and interested in using it for online shopping. However, the subjects felt more confident when they understood the technology behind cryptocurrencies. People are generally willing to learn new technology and use new forms of currency for their day-to-day lives. According to another study, researchers have examined consumer interest in utilizing cryptocurrency platforms for savings and investment over the next three years (2019–2022). According to their findings, most consumers are highly motivated to invest in cryptocurrencies [11].

Indian researchers have reported that people between 30 and 40 years of age are not interested in investing in cryptocurrency [12]. This is due to legal issues and India's government regulations against accepting cryptocurrency for investment or spending. Participants in the study, however, expressed a keen interest in investing in cryptocurrencies as an alternative to conventional financial tools for higher returns. There is, however, a strong interest among consumers in learning more about the benefits and advantages of using cryptocurrencies in [13]. Although they had sufficient knowledge of financial budgeting and an awareness of cryptocurrencies, consumers were incapable of understanding the technology behind cryptocurrencies.

A recent study has found that people are more interested in investing in cryptocurrency and that the recent crash of the cryptocurrency market in 2022 had no impact on their intention to invest in cryptocurrency [14]. Structural Equation Models were used to analyze the data collected from 400 people such as on its convenience, popularity, usefulness, credibility, recommendation, price stability, and risk. The researchers collected responses

from 138 Nigerians regarding an advertisement on their intentions, awareness, and desire to invest in cryptocurrencies [15]. To investigate their interest in cryptocurrencies, the researchers used regression models and descriptive statistics. Based on the advertisement, the participants were highly interested in investing in cryptocurrencies.

Mashatan et al. conducted a survey involving undergraduate students in Canada regarding their interest in investing in cryptocurrencies [16]. During the study, all subjects were unconvinced about the privacy and security of their information. Cryptocurrencies are not preferred because of the above factors along with government regulations and restrictions. The majority of the earlier studies used partial least squares (PLS) to examine the effect of attributes, while fuzzy-set qualitative comparative analysis (fsQCA) was used to examine consumer behavior in cryptocurrency investments in terms of perceived and effort expectations, facilitation conditions, and social influence [17]. Besides facilitation conditions, perceived and effort expectations play a significant role in studying consumer behavior when investing in cryptocurrency. Compared with the studies that use PLS in the literature, these empirical results are completely inconsistent [18].

Although cryptocurrencies have attracted many consumers around the world, they still face several challenges when compared to fiat currencies. Several factors influence consumers, such as: (i) *Security and legal issues*—most consumers are still concerned about the security issues associated with transacting currencies online and in wallets, the legal use of cryptocurrencies in their countries, and how to convert cryptocurrencies into fiat currencies according to their needs. (ii) *Safety concerns*—how can they manage their online wallet transactions safely?

In most of the early works, the focus was on reviewing the manner in which the consumer behaves in a particular region of the world, and to the best of our knowledge, we were unable to find any review that investigated consumer behavior in different regions across the globe. Furthermore, most of the earlier works have used customized questions that were based on the authors' expertise in order to study consumer behavior through the use of online platforms, such as Google Forms and interview methods, as well as through verbal responses collected using online platforms (Google Forms, etc.). A very limited number of researchers have discussed the different types of cryptocurrency platforms available to consumers and the technology behind cryptocurrency transactions (blockchain). Therefore, it is necessary to study the behavior of consumers across the globe in relation to cryptocurrency, the technology that supports it, and the different types of platforms that allow cryptocurrency transactions and to develop a novel method of assessing consumer behavior based on their physiological responses in order to prevent bias. In light of the above factors, the present work makes the following contributions:

(a) In this study, we review and assess the consumer behavior and perceptions of cryptocurrency based on several factors: (i) the factors that influence cryptocurrency usage, (ii) consumer perception and behavioral factors associated with cryptocurrency use, (iii) case studies about the use and influence of cryptocurrencies in different countries, and (iv) the technological processes involved in handling cryptocurrencies.

(b) Furthermore, it sheds some light on how this relatively new exchange medium is perceived around the world.

(c) We also review the various processes involved in handling cryptocurrencies online, types of cryptocurrencies, common challenges, and security issues in managing cryptocurrencies, their effects on consumers, and their future directions.

(d) We propose a physiological signals-based consumer perception assessment in cryptocurrency to understand consumer behavior more accurately.

This paper is organized as follows: Section 2 discusses the various processes involved in handling cryptocurrencies, Section 3 discusses common influences in utilizing cryptocurrencies, Section 4 examines the perceptions and behavioral factors related to cryptocurrency usage, and Section 5 describes the various types of cryptocurrency exchanges around the world, along with their major strengths and weaknesses. Finally, Section 6 discusses the impact and influence of cryptocurrencies, while Section 7 concludes the work.

2. The Process Involved in Handling Cryptocurrencies

Cryptocurrency transactions are primarily based on blockchain technology, cryptocurrency exchanges and wallets, and cryptocurrency mining (Figure 3).
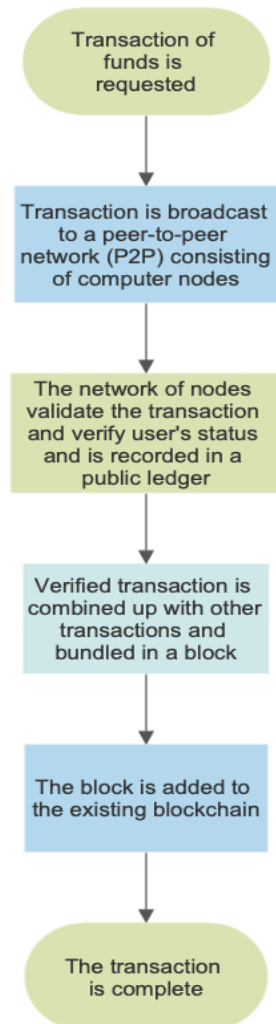

Figure 3. Transaction processes involved in cryptocurrency.

a. **Blockchain Technology:** Blockchain technology and mining are the two fundamental elements involved in creating cryptocurrency. Blockchain is the backbone technology involved in cryptocurrency operations. It is a decentralized platform used for handling transactions and data processing without an intermediate agent [19]. It is a framework that enables transactions to be performed through a distributed chain of blocks that are stored on a secured ledger. This makes them permanent and anonymous [20]. Cryptocurrencies are stored in secure wallets and processed by the blockchain, in which each block is associated with a fixed time stamp and distributed through a decentralized ledger. All details regarding each transaction are saved in blocks from A to Z [21].

b. **Exchanges and Wallets:** The common elements in a basic transaction are the number of bitcoins exchanged, the wallet address to whom the bitcoins must be transferred (the receiver of the bitcoins), and a private key (of the sender) used for verifying the transaction. This stands in stark contrast to regular transactions in any other form of currency as there is no central authority directly involved. However, similar to other currency markets, cryptocurrency value fluctuates and changes due to various factors

in the economy. These factors include the cost of producing bitcoin through mining, the exchange it trades on, regulations regarding its sale, and other internal regulations.

c. **Cryptocurrency mining:** The network is accessible to the public. Miners are individuals who work tirelessly to solve problems related to online transactions which require heavy computing equipment, specialized software, large amounts of bandwidth, and large amounts of electricity. Bitcoin's system needs to be aggravated with cumulative computational control that supplements the mining's substance. New bitcoins created by miners are usually paid off with bitcoins that can now be withdrawn from the currency. Bitcoins can also be made through other means besides mining. There is also free software available that allows people to convert their fiat currencies into bitcoins and vice versa [21].

Bitcoin was the first peer-to-peer electronic currency introduced to the world and was developed by Nakamoto [2] as shown in Figure 4. It is a chain of transactions encrypted with a hash key. The owners have their private and public keys for broadcasting transactions and digital signatures for verifying their authenticity.
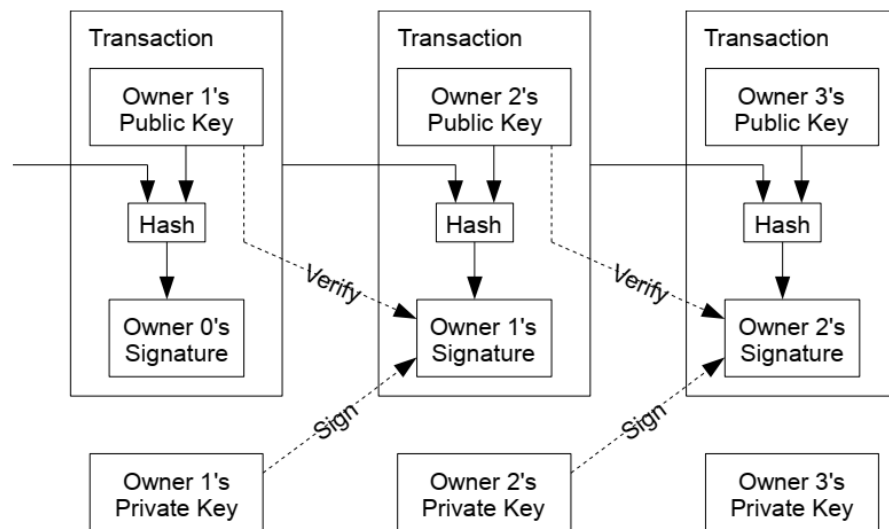
Figure 4. Electronic coin transactions [22].

A cryptocurrency is a first-generation blockchain application followed by a smart contract and a Dapp. A blockchain can be classified into three categories: public, private, and consortium. Cryptocurrencies belong to a public blockchain since their transactions are broadcast to all network nodes for validation. Cryptocurrency transactions are not governed by a trusted third party; they are governed by cryptographic consensus protocols and miners. In peer-to-peer networks, miners are usually a group of nodes that validates transactions. According to estimates, there is a maximum number of bitcoins that can be present in the blockchain network of approximately 21 million, and no more can be added afterward. The number of bitcoins in circulation has already reached 19 million (90%) as of March 2023.

3. Factors That Influence the Use of Cryptocurrency

There are a variety of factors that affect the use of cryptocurrency among people. According to Christopher [23], speculation, algorithm trust, spending power, and money laundering all have a strong correlation with cryptocurrency usage. Moreover, Bohr and Bashir [23] concluded that demographic factors play an important role in usage patterns. Many studies, including one by Khairuddin et al. [24], have highlighted the importance of immediate monetary gratification and consumer empowerment. Sun et al. [25] analyzed the push–pull–mooring theory to determine why investors withdraw from traditional financial markets (push effect), why individuals are drawn to cryptocurrency markets (pull

effect), and how this intentional switching behavior (mooring) is constrained. Traditional financial markets have similar investment products, and individual investors could earn a reasonable profit by putting in a fair amount of time and money.

The cryptocurrency market, however, offers thousands of cryptocurrencies to choose from, so investors can invest according to their level of risk tolerance and profit expectations [26]. Investments in traditional markets are regarded as risky, and investors are also concerned about investment institutions dominating the markets [27]. As investors are motivated by the sense of increased reward as a result of investing in cryptocurrency, Reinforcement Sensitivity Theory (RST) is assumed to contribute to the pulling effect. A personal innovation factor is also involved in the mooring effect. Based on empirical evidence, it is concluded that consumers' primary reasons for investing in the volatile cryptocurrency market include impact, innovativeness, perception of risk, reward sensitivity, and knowledge of the cryptocurrency process [28].

The study conducted by Yelowitz and Wilson [29] indicates that the majority of cryptocurrency consumers are computer programmers or those previously or currently involved in illegal activities. According to Alqaryouti et al. [1], the participants involved (three computer engineers) had good knowledge of cryptocurrency, market capitalization, mining, etc., and they could identify some of the advantages of using Bitcoin over fiat currency.

4. Consumer Perception and Behavioral Factors Related to the Use of Cryptocurrency

A majority of consumers expect cryptocurrency to be user-friendly, safe, and secure; to have minimal volatility; and to gain higher profits within a short period of time. Cryptocurrencies are known to a number of people, but their adoption has been sparse. According to Straub [30], adopting technology involves behavioral change with the application, which can be explained by contextual, cognitive, or affective factors. Spenkelink [31] identified three major pillars encouraging mass technology adoption: ease of use, price stability, and governance. Despite this, bitcoin nor any other cryptocurrency does not appear to provide any of these three elements in a predominant manner. Due to the cumbersome nature of sending and receiving bitcoins and the risks involved in owning bitcoins, bitcoins are not the most user-friendly cryptocurrency. The instability, driven primarily by speculation, constant price fluctuations, and the lack of liquefaction means, can further propel individuals away from investing and trading with this virtual currency [32]. Online transactions are subject to two kinds of uncertainty: behavioral uncertainty and environmental uncertainty [33]. Cryptocurrency consumers are susceptible to behavioral uncertainty due to a sense of being taken advantage of by web retailers. In addition to monetary losses, imperfect monitoring, privacy risks, etc., fear of loss could also be involved. A lack of predictability in internet technology leads to environmental uncertainty. Consumers' adoption of cryptocurrency is also highly variable and may be explained by trust, perceived usefulness, and perceived ease of use [34].

If a person is to become a repeated user of any product or service, the product must stimulate three important affects: primitive affect (connection with the product/service), description affect (combination of user experience and personality), and evaluative affect (subjective user valuation in comparison to previously used products/services) [35]. Individuals (especially in developing countries like Korea) mostly associate Bitcoin with the words 'hacking', 'inconvenient', and 'safety'. The unfamiliarity of the product creates a sense of alienation in the minds of users, and they are often unwilling to switch from their traditional currency, which is associated with security and is habitually used [36]. In developed countries, the situation is better as more people are learning to adapt to this new system and consumers are linking bitcoin with 'virtuality' and 'value' [37]. There are a variety of reasons for this prevalent adoption by only developed economies, such as the fear of losing money that is prevalent among people in developing nations. It is because of its limited nature that they tend to value their assets and wealth significantly more. Also, it is observed that poor citizens are risk-averse due to limited access to financial services, looking for ways to protect themselves from financial shortages. Furthermore,

most developing countries lack the infrastructure and internet access needed to benefit from cryptocurrency use [38]. A lack of sufficient knowledge and familiarity with the traditional banking system could also contribute.

4.1. Survey and Case Studies in Different Countries

In different geographical areas in the world, surveys were conducted to examine the adoption of cryptocurrency as a payment method, compared to traditional payment methods and online and mobile payments. The technology adoption model was developed based on the perceived usefulness, ease of use, and risk of the technology among 333 Z-generation respondents [39]. A lack of financial literacy can limit cryptocurrency adaptability. Consumers' behavioral intentions play a crucial role in embracing cryptocurrency-based financial transactions. As a result of the adoption of modern virtual transfer, the country's financial power and its citizens' autonomy will increase. Jordanian cryptocurrency usage was explored using the Extended Theory of Reasoned Action (TRA) model [40]. In Malaysia, investors have found cryptocurrencies to have a potential influence on the finance sector [41]. To determine a retail investor's perception, innovation factors (compatibility, relative advantage, trialability, ease of use, and observability) are taken into account. It is estimated that 15,000 companies worldwide accept cryptocurrency payments [42]. The survey looked at how traditional, mobile, and cryptocurrency payments are used in the hospitality and travel industries of Chinese and Korean countries. According to the study, Chinese and Korean consumers have different concerns about using these payment methods, which influence factors such as trust and attitudes toward them. In [43,44], key factors such as performance expectancy, effort expectancy, social influence, use, and risk are discussed for the acceptance of cryptocurrencies by consumers and/or investors. The perception of risk and illegality differs between the USA and China [45]. As part of the acceptance criteria, there are also factors such as evolving standards, Standard Operating Procedures (SOPs) for resolving daily cryptocurrency usage issues, and compatibility with existing processes/technology. The methods and factors involved in the different surveys are summarized in Table 1. These surveys show that the adoption of cryptocurrency depends on technology development, perceived usefulness and trust, the perception of local consumers, and other factors.

Table 1. Cryptocurrency adoption in different countries [39–45].

Ref. No	Model	Factors	Country	Consumer Adoption
[39]	Technology Acceptance Model (TAM)	Usefulness, ease of use, risk	Pakistan	Technology awareness and behavioral intention will impact
[40]	Extended Theory of Reasoned Action (TRA) model	Risk, Usefulness, enjoyment, ease of use, trust	Jordan	Perceived risk may have a negative effect on attitude and intention to use.
[41]	SmartPLS Structural Equation Modelling	Compatibility, trialability, ease of use, observability	Malaysia	Factors influence the intention to invest in cryptocurrency
[42]	Technology Acceptance Model	Usefulness, ease of use, and security	Chinese and Korea	Perceived security and ease of use for Chinese; while ease of use and trust form the Korean consumers' attitude.
[43]	Technology Acceptance Model	Performance expectancy, effort expectancy, social influence, use, risk	Spain	Performance expectancy is the determinant variable in the acceptance of cryptocurrency
[44]	Theory of planned behavior (TPB)	Behavioral intention	South Africa	Attitude and perceived behavioral control can make an impact.
[45]	Theory of planned behavior, financial behavior, and cultural	Attitude, perceived behavioral control and herding behavior	USA and China	Factors have a positive impact on the use of cryptocurrency, except financial literacy, which has no influence.

4.2. Cryptocurrency Investors Market Analysis

Cryptocurrencies are very volatile when compared to equity and commodity markets. As a result, it is very difficult to perform a market analysis on them. In this direction, some attempts have been made. The persistence norms are constructed using time series data by ranking the different coins using the point cloud method [46]. The persistence norm is indirectly proportional to the correlation between coins. The persistence norms will be low if the market is uncertain and correlations between coins rise. Some countries promote crypto trading, while others ban or prohibit it. Different countries follow different regulations for crypto trading. Since most bitcoin mining is generated by Chinese traders, the Chinese crypto ban in 2021 negatively affected crypto market dynamics [47].

The marginal expected shortfall (MES) and change in conditional value-at-risk (CoVaR) methods are used [48] to estimate and forecast the market. In real-time, early warning system indicators can detect unexpected extreme changes in the market. The volatile crypto market offers investors the opportunity to get a higher return [49], and during uncertain times, investors are more likely to invest. Investments in cryptocurrencies decline when investors' sentiment is pessimistic. Popularity, emotion, and sentiment are all factors that influence price and trading. The market value and investor behavior are also affected by public sentiment, such as bullish tweets on Twitter. Additionally, bitcoin returns correlate with stock market returns, so extreme bitcoin returns can also be seen in stock market returns. A lot of new and inexperienced crypto investors follow the lottery stock and rely on social media posts and herding behavior. Crypto markets are considered speculative assets and are independent of macroeconomic conditions. There are four crypto coins whose market share is the most significant (Bitcoin, Ether, Litecoin, and Ripple). Almost all crypto coins exhibit co-explosivity behavior, such that price explosions occur in the same manner. In light of the complex scenarios that prevail in the crypto market, machine learning models can be used to analyze and predict the various cryptocurrencies in real-time and alert investors about false claims.

5. Cryptocurrencies—Types, Exchanges, and Platforms

There are three types of cryptocurrencies [50]: bitcoin, altcoin, and token. Cryptocurrencies such as Bitcoin are widely used and are known as "cash for the Internet". Major investments are held by it in the cryptocurrency market. The term altcoin (alternative coin) refers to any coin other than Bitcoin. A few examples of altcoins are Peercoin, Litecoin, Dogecoin, Ethereum, and Ripple. Despite the fact that many altcoins follow the same algorithm/protocol as Bitcoin, some use different protocols such as proof of stake, proof of work, etc. by slightly changing the rules to appeal to different users. It is possible for each altcoin to operate according to its own rules. In the third category, tokens are usually used in Dapps, but they do not have their own blockchain network. Crypto coins (bitcoins and altcoins) can be used for payment processing, whereas tokens can be used for security tokens, utility tokens, etc. Cryptocurrencies with fixed market values such as stablecoins [51] are among the altcoins. A well-known stablecoin is Tether (USDT), which has an equivalent value to traditional fiat currencies. Accordingly, its value is pegged to the U.S. dollar and maintains a one-to-one relationship.

The types of tokens are divided into product tokens, general payment tokens, platform tokens, and security tokens by Cong and Xiao [52]. In comparison to fiat currency, payment tokens (bitcoins, dogecoins) can be viewed as an alternative to fiat currency. Exchanges use platform tokens (Ethereum, NEO) for fee discounts and consumer transactions. Exchanges typically issue platform tokens as part of their initial coin offerings (ICOs) to raise capital and facilitate liquidity movement among wallet consumers. A predetermined quantity of products or services can be redeemed using product tokens (BNB, GAS). The non-fungible tokens for digital assets are non-fungible tokens. Security tokens (KCS) are regulated under securities law and are entitled to future cash flows from a business, such as dividends. There are thousands of cryptocurrencies available on the market. The top cryptocurrencies by market capital are Bitcoin, Ethereum, Ripple, Bitcoin Cash, and EOS. Also, Litecoin and

Stellar play a vital role in the cryptocurrency market [53]. They differ in supply, mining rate, transactions per second, network, and block time.

Online exchanges manage the cryptocurrency market similarly to fiat currency exchanges. They oversee the sale and purchase of various cryptocurrencies by consumers. A number of major cryptocurrency exchanges are listed in [54], and consumers use them to conduct online cryptocurrency transactions. These include CME, CBOE, Binance, Coinbase, BitMex, and Bitstamp, among others. In addition to the above exchanges, WazirX (acquired by Binance) and CoinDCX are some of the most popular online cryptocurrency exchanges in India. Despite the ban on crypto exchanges put in place by the Reserve Bank of India (RBI) in 2018, it was lifted in March 2020, enabling consumers to trade crypto coins. There has been a consistent increase in volume and the consumer base in the Indian market, which shows its potential.

There are also exchanges that offer their own tokens, which are native to the exchange. There are several reasons why they are incorporated into exchanges, including multi-party trust, enhanced liquidity, fee discounts, and governance. Digital currency is bought, sold, transferred, and stored by millions of consumers through crypto exchange platforms. Crypto exchanges allow consumers to create wallets for doing transactions. The platforms support consumer-friendly interfaces both online and through mobile apps (Android, Mac, iOS). The following is a list of some of the major cryptocurrency exchange platforms [55]:

d. **Coinbase (https://www.coinbase.com/) (accessed on 20 January 2023):** In more than 100 countries, this platform is one of the largest exchanges for trading BTC, BCH, ETH, ETC, LTC, and ERC-20 tokens. Both iOS and Android platforms are supported for instant and scheduled trading (daily, weekly, monthly).

e. **PrimeXBT (https://primexbt.com/) (accessed on 5 June 2023):** Through this platform, consumers can sell and buy cryptocurrencies, stock indices, commodities, and Forex through a single account. This module allows users to copy the best trading activity from the covering module in order to create their trading strategy. Using the intuitive platform, users can manage and execute orders in real-time and analyze market data in real-time.

f. **Binance (https://www.binance.com/) (accessed on 20 July 2023):** This online platform supports trading in more than 150 countries and is compatible with Web, iOS, and Android platforms. Approximately 2 billion transactions are executed per day with more than 1.4 million transactions per second. Binance has one of the highest transaction speeds among online trading platforms.

g. **Cex.io (https://cex.io/) (accessed on 20 July 2023):** A consumer using this platform is protected from DDOS (Distributed Denial-of-Service) attacks with full data encryption during crypto transactions. A variety of coins, including Bitcoin, Ethereum, and XRP (Ripple), can be traded here. The system accepts MasterCard, Visa, or PayPal as payment methods.

h. **Cointree (https://www.cointree.com/) (accessed on 10 June 2023):** Cryptocurrency exchange platform owned and operated by Australians, regulated by the Australian Transaction Reports and Analysis Centre (AUSTRAC). More than 130 cryptocurrencies are supported, as well as instant AUD deposits using PayID.

i. **Changelly (https://changelly.com/) (accessed on 30 June 2023):** A platform offering secure and fast trading of 150+ cryptocurrencies is provided by this company. It provides flawless purchases, sales, swaps, and trading of cryptocurrencies through 350 API partners. The consumer can choose the crypto pair for exchange, then after confirmation, the exact amount will be sent to the address provided, and the crypto will be delivered to the wallet within minutes.

6. Discussion

It is undeniable that digital transactions have several advantages that are attracting new investors to the money market, although the concept of cryptocurrency is still relatively new and its role in the money market is highly debatable. In particular, it eliminates the need

for a centralized, focal authority, allows unknown participants to participate, and has quick and minimal transaction costs, making it a more economical way for micropayments [56]. Furthermore, bitcoins require individuals to fix computational issues to record blockchain transactions on the blockchain, making the system more trustworthy and reliable. It can also assist in solving the double-spending problem (DSP), exposing cheating to the public, and improving fraud detection. In view of the wide fluctuations in the value of cryptocurrencies, consumers seeking immediate economic gratification are particularly attracted to them [57]. Currently, cryptocurrency transactions tend to have lower transaction costs due to the absence of a third-party intermediary, and the transaction speed can vary [58]. It may take from 15 min of minimum time to 15 h of maximum time for a transaction to be completed. In spite of this, the lower transaction fee offsets both the high transaction time and the volatility in the market.

In a recent work, the authors investigated the predictive power of bitcoins in US sectoral stocks for a four-year period (2017–2021) [59]. The researchers found that Bitcoin prices have significant predictive power for US stock volatility, and Bitcoin prices are inversely related to stock sector volatility. They found that tracking Bitcoin prices was useful for forecasting the volatility of US stock sectors, which is important for practitioners and policymakers. Another study examined Bitcoin and Ethereum over the past two years (2020–2022) to determine whether these cryptocurrencies are independent like fiat currencies or still not aligned with them [60]. Researchers collected a variety of data for studying currency fluctuations and used the q-dependent detrended cross-correlation coefficient. According to the researchers, the prices of the above cryptocurrencies changed after the COVID-19 pandemic, and they are no longer dependent on it. Nowadays, cryptocurrencies also play a vital role in determining the consumer price index (CPI) similarly to fiat currencies. An autoregressive distributed lag (ARDL) framework was used by Nimesh et al. to study time-series data collected from four cryptocurrencies, oil and gas prices, stock prices, and gold prices [61]. Finally, they suggested that cryptocurrencies could serve as a platform for investment diversification and that their dynamics are similar to those of other commodities. Fang et al. investigated the relationship between asset valuation and cryptocurrencies using logistic regression (LR) [62]. It was concluded that the valuations of cryptocurrencies have a direct impact on the asset valuations of blockchain- and cryptocurrency-based stocks. Additionally, they mentioned that the COVID-19 outbreak did not cause co-jumping behavior.

(a)   Challenges and Issues in Cryptocurrency

Researchers Grant and Hogan [63] identified six potential risks associated with cryptocurrency usage, including price volatility, exchange rate risk, future legislation, theft or loss, third-party reliability, and e-commerce vulnerabilities. Although it is generally thought that cryptocurrency's blockchain technology promotes privacy and security, this belief was challenged by Maurer et al. [64]. Maurer et al. also presented a qualitative study of cryptocurrency consumers, concluding that privacy regulation cannot be addressed from an anthropological perspective [64]. The participants in the study conducted by Alqaryouti et al. [1] also expressed concerns about their safety.

The administrators in emerging economies are still reluctant to accommodate this form of payment, which suits the needs of advanced and developed economies [65]. According to previous research, Bitcoin is incompetent to serve as an alternative currency and can only be used as a speculative asset. In addition, the research points out the reasons, including its low level of network effects and inability to be adopted in daily transactions [66–68].

Furthermore, its wide fluctuations result in asset bubbles, which can lead to price destabilization, resulting in dire consequences for investors [69]. Currently, cryptocurrency is not regulated and is accepted by governments around the globe for risk mitigation, creating substantial currency market risks [24]. A number of policymakers have assessed the risks involved in investing in Bitcoin, and they are trying to prevent speculative trading in it. During the year 2017, the People's Bank of China instructed financial companies to stop providing funds for cryptocurrency-related activities [70].

(b) Security issues in cryptocurrency

However, it is important to mention that the blockchain added an additional layer of security to industrial and financial applications. A blockchain-secure mechanism, such as public/private keys and digital signatures, constitutes all cryptocurrencies [71]. In cryptocurrency, the anonymity of the sender and receiver is highly confidential, so dark markets and potential hackers also use it [72,73]. Despite its powerful consensus protocols, the blockchain network does not involve any trusted third parties. The consensus model used by each cryptocurrency is different.

Currently, crypto exchanges are loosely regulated, making the cryptocurrency stock market highly volatile. In order to conduct secure cryptocurrency operations, investors should be careful when selecting exchanges. A UK-based company, EXMO [74], lost USD 52 million from its hot wallets (5% of EXMO's assets). Approximately USD 70,000 worth of cryptocurrency was lost by Altsbit, an Italian cryptocurrency in February 2020. Twelve crypto exchanges were hacked in 2019, resulting in the theft of USD 292,665,886 worth of cryptocurrency and 510,000 user logins. It is therefore required that crypto assets be protected by better regulations and standards at the global level in order to ensure the security of transactions [75]. There are legal and security issues [76] that prevent China from allowing Bitcoin-based financial transactions. These legal issues are categorized into six types: 1. the validity of a currency transaction; 2. the validity of foreign currency transactions; 3. tax incidences and stamp duties; 4. in the event of legal disputes, filing a lawsuit; 5. participant and promoter organization status; 6. fiscal and monetary policies. In addition to wasting the computational power of honest miners, selfish mining is also more vulnerable to cryptocurrency attacks [77].

(c) Physiological signals-based consumer perception assessment in cryptocurrency

A large number of studies have been conducted in the past that have utilized the online questionnaire, the Google Sheet-based questionnaire, verbal responses, and other modalities to collect the respondents' responses regarding their usage of cryptocurrency as a means of payment and investment. In most cases, the subject may withhold the truth while answering questions during the experiment, and it is also possible that at times, the subject is not serious enough to participate in the experiment in order to answer the questions honestly. It would be very difficult, if not impossible, in this scenario to develop any model that can be used to analyze consumer perceptions when it comes to the use of cryptocurrencies.

We would therefore like to propose an experiment based on physiological signals, such as electroencephalograms (EEGs) and electrooculograms (EoGs), in which the subject's neuronal responses and eye movements will be identified using physiological signals (Figure 5). It has been reported in the literature that there are several studies that have proposed that EEG and EoG could be used as a potential tool to reveal the neuronal responses of the subjects while watching the stimuli using different protocols such as Event-Related Potential (ERP), etc., to reveal their neuronal responses. During the experimental session, the above-mentioned signals could be recorded to acquire direct responses from the subjects to all the stimuli related to the cryptocurrency, which could not be concealed or hidden by the subjects while they looked at the stimuli related to the cryptocurrency. The acquired signals are usually contaminated with noise and other interferences, which can be easily removed using digital filters to detect and remove the interference. Later, the clean (noise-free) signals would be used to extract some statistical characteristics to make a decision-making model for the system to be operated using artificial intelligence tools (AI). The methodology proposed in this study is capable of precisely revealing the emotions and perceptions of cryptocurrency users.
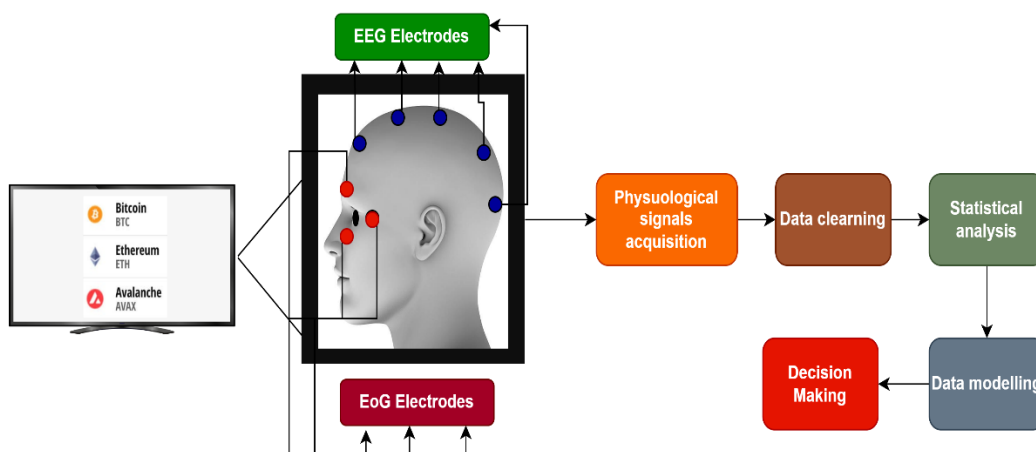
Figure 5. Physiological signals-based consumer perception assessment in cryptocurrency.

(d)   Further scope of the study

Currently, researchers and financial analysts are investigating how individual investors perceive cryptocurrency versus fiat currency. Consumers who use cryptocurrency are influenced by a variety of factors, as well as factors that discourage them from using cryptocurrency. Furthermore, future research should compare investor behavior and expectations in developing and developed countries when it comes to investing in cryptocurrency. In addition, it is important to analyze the influence of emotional intelligence on cryptocurrency investment motivation.

7. Conclusions

There is an increase in interest in cryptocurrencies as they grow in popularity and as more people are learning how they work. In a World Economic Forum report [78], it was projected that by 2027, about 10% of world GDP will be transacted through cryptocurrencies, with an average annual growth rate of 62.1%. Cryptocurrencies have increased from less than USD 0.1 in 2010 to over USD 25,000 in 2020 over the last decade [79,80]. Cryptocurrencies are currently the most efficient and transparent form of exchange, despite not being a model currency. Cryptocurrencies are subject to many challenges and risks, such as security and legal problems, volatility, and others [78]. In contrast to investing in traditional securities, the revolution is attracting more people because of the sense of fulfillment they get from obtaining large returns. Consumers from countries that restrict cryptocurrency use have more knowledge of cryptocurrencies but are hesitant to use them due to security and safety concerns. African and Middle Eastern consumers are attracted to cryptocurrencies and investing in them in the same way as their Western counterparts. In comparison to traditional questionnaire surveys, physiological signals-based assessments could be more accurate, bias-free, and robust in determining consumer behavior regarding cryptocurrency investment.

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