The Dynamics Behind the Diffusion and Adoption of Cryptocurrencies:
The Case of Bitcoin in South Korea

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List of Abbreviations

AGFI	Adjusted Goodness-of-Fit Index
AMOS	Analysis of Moment Structures
ASV	Average Shared Squared Variance
AVE	Average Variance Extracted
BI	Behavioral Intention
BTC	Bitcoin
CBDC	Central Bank Digital Currency
CBOE	Chicago Board Options Exchange
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CME	Chicago Mercantile Exchange
CR	Composite Reliability
Defi	Decentralized Finance
DEXs	Decentralized Exchanges
DLT	Distributed Ledger Technology
DOI	Discounting Own Information
ECM	Error Correction Model
EE	Effort Expectancy
EMH	Efficient Market Hypothesis
ES	Expected Shortfall
ETF	Exchange Traded Fund
ETH	Ethereum
FATF	Financial Action Task Force
FC	Facilitating Conditions
FETA	Foreign Exchange Transactions Act
FETR	Foreign Exchange Transactions Regulations
FIU	Financial Intelligence Unit
FSC	Financial Services Commission
FSS	Financial Supervisory Service
FTRA	Financial Transaction Reports Act
G20	Group of Twenty

GDP	Gross Domestic Product
GFI	Goodness of Fit Index
GNP	Gross National Product
HM	Hedonic Motivation
ICO	Initial Coin Offering
IDT	Innovation Diffusion Theory
IMF	International Monetary Fund
IMI	Imitating Others
IPO	Initial Public Offering
IT	Information Technology
Kofiu	Korea Financial Intelligence Unit
LTC	Litecoin
MPCU	Model of Personal Computer Utilization
MSV	Maximum Shared Squared Variance
NEET	Not Currently Engaged in Education, Employment, or Training
NFC	Near Field Communication
NFI	Normed Fit Index
NFTs	Non-Fungible Tokens
OECD	Organization for Economic Cooperation and Development
P2P	Peer-to-Peer
PBC	Stands for The Perceived Behavioral Control
PE	Performance Expectancy
PEU	Perceived Ease of Use
PLS-SEM	Partial Least Squares Structural Equation Modeling
PNFI	Parsimony Normed Fit Index
PU	Perceived Usefulness
PV	Price Value
RMSEA	Root Mean Square Error of Approximation
RMSR	Root Mean Square Residuals
SCPC	Survey of Consumer Payment Choice
SEM	Structural Equation Modeling
SI	Social Influence
SN	Subjective Norm

SNA	Social Network Analysis
SNS	Social Networking Sites
SWIFT	Society for Worldwide Interbank Financial Telecommunication
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
TPP	Technological Product and Process
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology
Var	Value-at-Risk
VIF	Variance Inflation Factor
VSD	Value-Sensitive Design

1 Introduction

1.1 Background

In recent decades, the financial system has undergone a significant transformation process, driven by technological innovation and digitalization, which has led to a dynamic reshaping of the financial services landscape. In the course of this transformation, cryptocurrencies and their underlying blockchain technology are considered to play an important role by enabling a new, decentralized and cryptographically secured handling of transactions without the dependency on central institutions such as banks and government authorities.

The emergence of cryptocurrencies is rooted in the ongoing automation of financial technologies, which can be traced back to the first half of the 20th century. At that time, a significant shift occurred as interbank payments moved from a reliance on physical cash or gold to electronic funds transfers. Notably, the introduction of the IBM 801 Bank Proof Machine in the 1930s exemplified this transition providing a framework for efficient electronic payment settlement (Sellers, 1985; Abad-Segura *et al.,* 2020, p. 3). Another key development came in 1950 with the introduction of the Diners Club credit card, marking the emergence of independent credit card companies. This breakthrough provided consumers with new ways to access and use credit. At the same time, the field of artificial intelligence and machine learning began to take shape, due to the pioneering work of computer scientists such as John McCarthy and A. Samuel. Their contributions laid the foundation for these transformative technologies, which have since become integral to various aspects of the financial sector. In 1967, the launch of the first automated teller machine (ATM) revolutionized the accessibility and convenience of banking services. ATMs have allowed individuals to withdraw cash and conduct basic banking transactions outside of traditional banking hours (Simon, 1995; Abad-Segura *et al.,* 2020, p. 3).

The 1970s witnessed further developments, including the formation of NASDAQ in 1971, which became the largest electronic stock exchange in the United States. In 1973, the Society for Worldwide Interbank Financial Telecommunication (SWIFT) was founded, providing a global network for financial communications between banks and financial institutions. The 1980s brought significant contributions to financial technology, such as the creation of E-Trade Financial Corporation (E*TRADE) in 1982, providing electronic commerce platforms for trading financial assets. In addition, the term "big data" was introduced by J.R. Mashey, highlighting the importance of handling and analyzing large amounts of data in the financial sector. The 1990s marked several transformative milestones, including Citicorp's creation of the Financial Services Technology Consortium in 1993, which promoted collaborative efforts to advance technology. Wells Fargo introduced online banking services in 1995, marking a significant shift toward digital banking experiences. The same decade saw the advent of mobile payments in 1997 and the founding of PayPal in 1998, providing secure software solutions for online financial transactions (Tian *et al.*, 2015; Abad-Segura *et al.*, 2020, p. 3).

The turn of the millennium brought forth the concept of blockchain, first introduced in a white paper by Satoshi Nakamoto in 2008. This decentralized and secure method for recording transactions laid the groundwork for transformative financial systems. In 2009, the introduction of Bitcoin, the first cryptocurrency based on blockchain technology, marked a significant milestone in the development of digital currencies and decentralized financial systems (Schneider, 2019). Bitcoin serves as a comprehensive framework that integrates diverse concepts and technologies to facilitate the secure storage and transfer of value within its network. In addition to the concept of the "Internet of Information" that already exists today, blockchain technology enables an "Internet of Values": it allows the establishment of a global register that unambiguously assigns ownership and enables value transactions without the intermediation of third parties such as banks (Prinz *et al.,* 2022, p. 169). Blockchain in general can be defined as "a digital, distributed transaction ledger, with identical copies maintained on multiple computer systems controlled by different entities" (Schatsky and Muraskin, 2015). Due to its decentralized nature, with millions of computers participating in the network and without intermediaries such as governments and banks, the blockchain technology is inherently resistant to manipulation and control. While blockchain technology is anticipated to have transformative implications and applications across various economic sectors and activities, cryptocurrencies presently hold a more prominent position, despite being just one of the numerous potential applications of blockchain technology.

According to the Bank for International Settlements, cryptocurrencies share three key characteristics. First, they are digital in nature, designed to be a convenient payment method while providing cryptographic security against forgery and fraud. Second, they represent no liability of any entity and are not redeemable. Their value depends solely on the anticipation of continued acceptance by other individuals. This characteristic resembles commodity money, despite the fact that cryptocurrencies have no intrinsic value. Finally, cryptocurrencies enable seamless digital peer-to-peer exchange, facilitating direct transactions between individuals without the need for intermediaries (Bank for International Settlements, 2018b, p. 95).

Since the inception of Bitcoin as the pioneering cryptocurrency, the business and economic landscapes have been actively exploring ways to adapt to and harness the potential of this emerging financial technology. The first retail transaction using Bitcoins occurred in 2010, when Laszlo Hanyecz exchanged 10,000 Bitcoins for two pizzas (at the time of the transaction, the value of 10,000 Bitcoins was 41 US-Dollar, in 2021 this would be worth more than 600 million US-Dollar) (Louie, 2022). As of today, Bitcoin is accepted by over 32,000 businesses spanning various economic sectors globally, while the number of cryptocurrency users worldwide is estimated to be around 420 million (Coinmap, 2023; Ariella, 2023). Additionally, the cryptocurrency market has witnessed remarkable growth, comprising over 10,000 individual cryptocurrencies by 2022, with a combined market capitalization surpassing $2 trillion (Statista, 2023a, 2023b).

However, the inherent volatility of cryptocurrencies has hindered their widespread acceptance and adoption as a viable means of payment or standard unit of account. The fluctuating prices make it impractical to set fixed values or utilize them effectively in valuing real-world economic transactions. Moreover, the cryptocurrency system primarily operates within its own realm and does not significantly contribute to financing tangible investments in the real economy. In addition, the efficiency and usefulness of cryptocurrencies have been subject to controversy due to factors such as complex mining processes, significant energy consumption, and the lack of sufficient regulation (Sixt, 2017).

Despite these concerns, cryptocurrencies have gained significant momentum in the financial market over the past 13 years. In general, the pattern of interest in cryptocurrencies at the global scale has been highly heterogeneous, both at the institutional level of different countries as well as at the individual level of different users, with various countries experiencing the impact in different ways. For instance, in developing countries such as Venezuela, Zimbabwe and Nigeria, cryptocurrencies have emerged as a useful tool to address specific economic challenges. In Venezuela and Zimbabwe, where hyperinflation has devalued national currencies, individuals have turned to cryptocurrencies, particularly Bitcoin, as a means of preserving wealth and storing value. Similarly, in Nigeria, where access to traditional banking services is limited for many individuals, cryptocurrencies offer a way to conduct digital financial transactions and facilitate cross-border remittances (Domjan *et al.*, 2021).

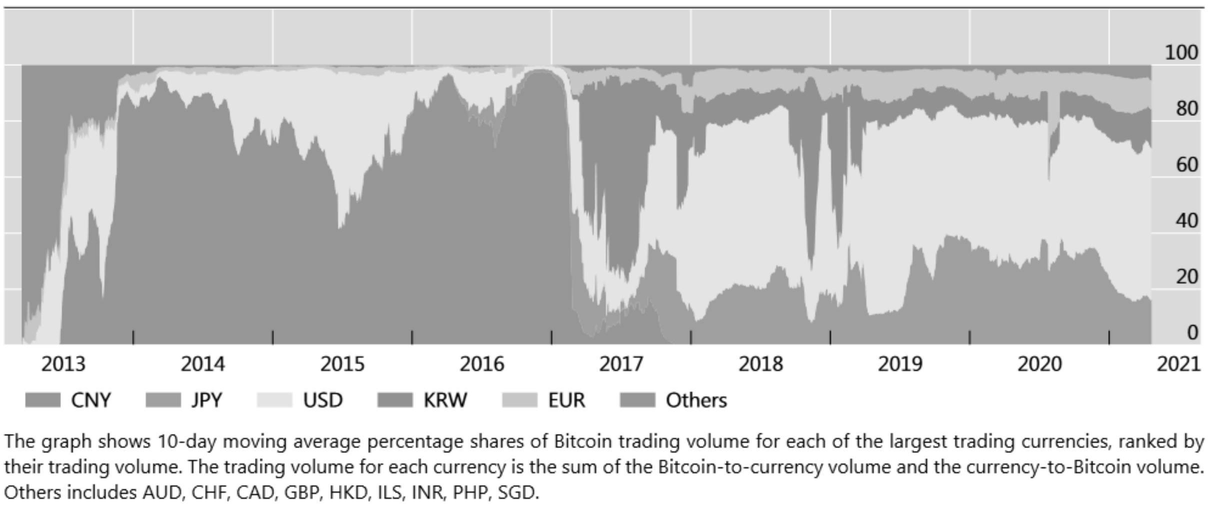
Contrarily, in advanced economies, instances of institutional failures and lack of trust in domestic financial infrastructure or fiat currencies are less prevalent and relatively uncommon. Therefore, these factors are unlikely to be major drivers for cryptocurrencies within such context. Moreover, it can be argued that in such circumstances, the factors shaping cryptocurrency adoption are more likely to be individual-based rather than institutionally-driven. The motivations for investing in cryptocurrencies vary among different individual levels. Some perceive cryptocurrencies as a store of value and a safe haven, often referred to as "digital gold," that cannot be easily appropriated (Uddin *et al.*, 2020). Others see in cryptocurrencies the chance to participate in a new and potentially profitable asset class. With the potential for high returns, some individuals are attracted to the speculative nature of cryptocurrencies and see them as an opportunity to diversify their investment portfolios.

For instance, despite a national population of roughly 51.7 million and a less than 2% share of the world economy, South Korea[1] plays a preeminent role in the cryptocurrency spectrum. In fact, Korea alone accounts for about 20% of the global trading volume of Bitcoin, which makes it the world's third largest Bitcoin market in terms of trading volume (Low and Wu, 2019, p. 3). Moreover, Korea is responsible for about 17% of global trading

[1] In the following mostly referred to as "*Korea*".

volume for all cryptocurrency trading (see figure 1). The country was home to two of the three largest cryptocurrency exchanges in the world as of 2018 (Choi *et al.*, 2018). It is estimated that about 10% of the Korean population invested in cryptocurrencies during the Bitcoin boom in the first half of 2021, an increase of more than 50% since 2017, when the hype around cryptocurrencies first peaked in the country (Yoon, 2023a). In a survey of employees in Korea, about 30% reported that they have invested in cryptocurrencies with an estimated average investment of 5,000 US-Dollar (Jo, 2017). In terms of the international cryptocurrency market, Korea holds a particular position due to the above-average demand for cryptocurrencies, as this local development has led to higher prices than in the rest of the world. This phenomenon is often referred to as the "Kimchi premium". In the period between January 2016 and February 2018, the average "Kimchi premium" was 4.73%, but reached a level of 54.48% in January 2018 (Choi *et al.*, 2018, p. 1). While the "Kimchi premium" vanished in early 2018 after the government announced regulatory measures, it returned in the first half of 2021 and exceeded 20% in April and May 2021 (Yoon, 2021). In general, it can be stated that cryptocurrencies have become a mainstream phenomenon in the Korean society, and considerable numbers of Koreans already regard cryptocurrencies as a broadly accepted investment instrument that can provide an alternative to conventional forms of securities (Yim *et al.*, 2018, p. 30).

Figure 1: Bitcoin Trading Volumes in Major Currencies



Source: Auer *et al.* (2022a, p. 13)

Therefore, South Korea emerges as a prominent case and an ideal research subject from a methodological point of view to empirically investigate the adoption and diffusion of cryptocurrencies. The combination of a technologically advanced society, widespread Internet access, a large community of investors and traders, and a strong affinity for new technologies and investment opportunities make the country unique in terms of Bitcoin adoption.

1.2 State of Research

According to Hairudin *et al.* (2022, p. 2), the rise of cryptocurrencies into the public consciousness is the result of a convergence of advances in cryptography, information technology, computing capability, finance, and transformative ideologies that seek to challenge established monetary systems. As consumer interest in Bitcoin has grown, there has been a corresponding increase in academic research focused on understanding the underlying mechanisms of Bitcoin and its functionalities. Earlier literature regarding Bitcoin focused primarily on developing a suitable definition providing an accurate characterization and interpretation of the Bitcoin system (Grinberg, 2012; Maurer *et al.*, 2013; and Plassaras, 2013). The initial scope of these studies revolves around technological issues and scopes of potential vulnerabilities such as cryptographic concerns, security risks and potential attack surfaces (Eyal and Sirer, 2014).

With the rise of Bitcoin, researchers have sought to enhance the understanding of this innovative technology. Extensive research has been conducted to explore a wide range of important aspects related to cryptocurrencies. Within the field of economics, research on cryptocurrencies exhibits a high degree of heterogeneity and can be broadly categorized into the following areas, providing an overview of the primary research focus within the field. While there may be some overlap between these categories, they serve to capture the diverse range of topics covered in cryptocurrency research.

A) Underlying Monetary and Technological Aspects

In this context, researchers associated with the Austrian school of economics, which advocates for individual and decentralized decision-making systems, are drawn to cryptocurrencies due to their decentralized structure and their autonomy from governments

(Kher *et al.*, 2021, p. 1705). Ammous (2015, p. 30) proposed that the architects of Bitcoin were inspired by the position of the Austrian school of economics that the monetary quantity itself is insignificant, and that any supply of money is sufficient to run the economy as long as it maintains purchasing power in terms of real goods and services, rather than focusing on its numerical quantity. According to Koenig (2015), the emergence of blockchain technology remains closely associated with anarcho-capitalism. Proponents of libertarianism, who embrace principles such as free trade, property rights, and opposition to authoritarian government intervention, see Bitcoin as a means to challenge government-sponsored regulation and compete with fiat currencies (Kher *et al.*, 2021, p. 1706). Bariviera *et al.* (2017) argued that the introduction of cryptocurrencies, particularly Bitcoin, in 2009 can be seen as a reaction to the global financial crisis of the previous year. It was intended to send a message to the authorities and government-linked financial institutions, to challenge their mandate, and to address the prevailing mistrust of the traditional financial system. In this context, Milne (2017) suggested that banking should be reformed along the lines of the Austrian school of economics, utilizing the technology employed to track cryptocurrency transactions to ensure that bank failures do not hinder bank payments.

Other studies have argued that cryptocurrencies will not replace traditional fiat currencies because of, for example, high switching costs and network effects (Luther, 2015); Bitcoin's volatility, which undermines its suitability as a stable unit of account (Tut, 2022); or the technology's underlying trilemma, as it is difficult for blockchain technology to simultaneously achieve accuracy, cost efficiency, and decentralization (Abadi and Brunnermeier, 2018). In addition, Budish (2018) emphasized that trust in blockchain systems depends on relative costs, with the cost of running the blockchain necessarily outweighing the potential cost of malicious attacks. Yermack (2013) argued that Bitcoin does not meet the criteria to be recognized as a currency, but rather acts as a speculative investment.

Furthermore, some empirical studies have focused on technical analyses, employing machine learning techniques to gain insights into the dynamics of the cryptocurrency market (El-Bahrawy *et al.*, 2017; Alessandretti *et al.*, 2018), investigating the characteristics and inefficiencies of the Bitcoin peer-to-peer network (Pappalardo *et al.*, 2018), and exploring the design and classification of the payment network on the Bitcoin blockchain (Tasca *et al.*, 2018). Scholars also widely studied the strengths and weaknesses of Bitcoin and its underlying blockchain algorithms (Rosen *et al.*, 2014; Pinna *et al.*, 2017). These studies have identified various advantages and disadvantages, leading to the exploration of alternative protocols, for example with respect to the consensus or proof-of-work mechanisms, to improve transaction performance and scalability (Sompolinsky *et al.*, 2016; Wustrow and VanderSloot, 2016). In addition, some researchers have proposed the development of new cryptocurrencies as potential solutions to existing challenges related to security, energy consumption, and transaction speed (Duffield and Diaz, 2015; Chepurnoy *et al.*, 2017; Balvers and McDonald, 2017).

B) Financial Market Analysis

The second area of research is financial market analysis. Alternative assets, such as cryptocurrencies, exhibit different market behavior than traditional fiat currencies. For this reason, research in this area has received increasing attention. For example, studies have highlighted the factors that influence the prices of different cryptocurrencies, such as trading volume, volatility, market beta, and asset attractiveness (Sovbetov, 2018). Another study by Corbet *et al.* (2018a) focused on the links between various cryptocurrencies and their relationships with other financial asset classes, and was able to show that while cryptocurrencies may offer portfolio diversification potential, they remain ineffective as hedging instruments. Other studies have been conducted to explore the reasons and dynamics behind the high price volatility of cryptocurrencies (Blau, 2017; Aloosh and Ouzan; 2020; Li *et al*., 2018); and to compare the differences in volatility between different cryptocurrencies (Gkillas and Katsiampa, 2018). In this context, Biais *et al.* (2019) and Chiu and Koeppl (2019) emphasized the importance of forking as a crucial factor for price equilibrium.

Further research focused on the issue of price valuation of cryptocurrencies. For example, studies examined various factors for the value and pricing of cryptocurrencies, such as mining difficulty, production rate per coin, and underlying algorithms (Hayes, 2015). According to Kristoufek's (2013) study, the price of Bitcoin is determined by investors' belief in perpetual growth, while Wijk (2013) argued that global macroeconomic measures, such as GDP per capita as well as financial indicators, such as stock exchanges, exchange rates, and oil prices, are the primary drivers of Bitcoin's price, rather than unquantifiable investor expectations. However, other researchers challenged this view by emphasizing the importance of considering multiple factors in Bitcoin's price formation at the same time, as individual assessments may introduce bias. Whereas short-term dynamics may be tied to macroeconomic and macro-financial factors, the long-term relationship remains ambiguous (Ciaian *et al.*, 2015; Hairudin *et al.*, 2022, p. 4641-4642). Moreover, unlike traditional currencies, Bitcoin's price formation is not explainable by conventional economic and financial theories, such as purchasing power parity, the future cash flow model, or interest rate parity (Hairudin *et al.*, 2022, p. 4641).

Another area of research involves conducting studies to examine the predictability of cryptocurrency returns and to determine the efficiency of this market. According to the Efficient Market Hypothesis (EMH), inefficient markets imply that asset prices fail to fully capture all existing information, leading to potential opportunistic gains (Fama, 1970). Urquhart (2016) analyzed Bitcoin returns from 2010 to 2016 and found significant levels of inefficiency. According to the findings, cryptocurrencies can be considered both either as a speculative asset or as a functional currency for payment and exchange. Investors who perceive cryptocurrency markets as inefficient tend to view them as trading instruments and engage in speculative activities. Conversely, investors who are convinced of market efficiency may view cryptocurrencies as a medium of exchange and use the alternative currencies for portfolio diversification (Hairudin *et al.*, 2022, p. 4637). On the other hand, Bartos (2015) highlighted the importance of emotions and illogical trading behavior as factors often neglected within the Efficient Market Hypothesis (EMH) when discussing market efficiency. He argued that these factors can significantly influence decision-making and challenge traditional assumptions of rationality. The author employed in his study the Error Correction Model (ECM) to analyze daily Bitcoin data. The results suggest that the Bitcoin market is moderately efficient, demonstrating that publicly available information is unable to consistently beat the market, despite the fact that insider information may still provide an advantage. The findings challenge the binary view of Bitcoin's efficiency, with some arguing that Bitcoin is either completely inefficient or completely efficient, and highlight the importance of considering the semi-strong form of market efficiency (Hairudin *et al.*, 2022, p. 4638). Within this context, Aoyagi and Adachi (2018) developed a theoretical model to examine the fundamental values of cryptocurrency and blockchain technology under asymmetric information conditions.

The launch of a Bitcoin futures contract by the Chicago Mercantile Exchange (CME) and the Chicago Board Options Exchange (CBOE) in December 2017 was seen as a potential means to stabilize Bitcoin's value and provide hedging strategies. However, a study conducted by Corbet *et al.* (2018b) found that the futures contract failed to have a positive impact on stabilizing Bitcoin's value. In fact, spot volatility increased after the introduction of futures. The authors argued that the futures contract was intended to reduce price volatility and risk, but the presence of speculative traders in the futures market may have contributed to the increase in spot volatility. This supports the view that Bitcoin should be considered a speculative asset rather than a functional currency (Yermack, 2015).

Several studies employed game theory to analyze mining behavior and identify the most appropriate strategies to attain Nash equilibrium under different scenarios. Some research demonstrated how individual incentives can lead to undesirable behavior (Eyal, 2015; Zhang and Preneel, 2017), while others explored the best timing for revealing newly mined blocks (Garay *et al.*, 2017). Miners tend to perform better when they act independently than when they cooperate, as game theory simulations suggest. This could potentially mitigate adverse behavior in pooled mining constellations (Zamyatin *et al.*, 2017). Easley *et al.* (2017) applied a game-theoretic model to analyze the development of transaction fees, shedding light on the strategic behavior of miners and users. Kim (2017b) found that on average, Bitcoin transactions have lower costs by 2% compared to typical conventional exchange rates. In addition, researchers explored optimal strategies for various stakeholders, including individuals with savings at risk, dictatorial governments, and speculators, with the aim of providing conditions for the presence and the singularity of the Nash equilibrium (Caginalp and Caginalp, 2019; Kher *et al.*, 2021, p. 1706).

Moreover, research on the economics of tokenization has addressed aspects of crypto token issuance. For instance, Conley (2017) employed monetary theory, financial economics, as well as game theory to evaluate the value of tokens and design initial coin offerings (ICOs). Pazos (2018) applied the quantity theory of money in order to assess the valuation of utility tokens. Teutsch *et al.* (2017) performed an experiment to examine the equilibrium of coin purchases, in which individual buyers of tokens are able to define their preferred purchases at different valuations, facilitating broad participation in the purchasing process (Kher *et al.*, 2021, p. 1706).

C) Regulation and Legal Issues

The balance between independence and regulation is critical to the success of cryptocurrencies, as overly unregulated platforms may attract illegal activity, while overly restricted platforms may lack demand due to their inflexibility. Research on regulation and ethical implications of the use of cryptocurrencies highlights both potential benefits and concerns. Dierksmeier and Seele (2016) as well as Kshetri and Voas (2018) asserted that cryptocurrencies can alleviate poverty and empower underprivileged citizens by providing transparent financial systems and accessible platforms for savings and property registration, especially in regions with high levels of state corruption.

There are several reasons why governments have concerns and incentives to regulate cryptocurrencies. Cryptocurrencies enable anonymous transactions, bypassing traditional remittance channels and potentially facilitating illegal transactions. They also present a challenge to governments in terms of taxation and seigniorage revenues. In addition, there are concerns about the potential for fraud and manipulation of reported revenues (Marian, 2013). As pointed out by Wei (2018), cryptocurrencies are often associated with anonymity and unregulability, which can lead to both illegal activity and security vulnerabilities. Cases such as the shutdown of the Silk Road website in 2013 and the hacking and subsequent bankruptcy of the Mt. Gox exchange in 2014 highlight the associated risks. Meera (2018) argued that governments often resist the spread of cryptocurrencies due to concerns about their potential impact on the price fluctuations of the national currency and the overall money supply. According to Foley *et al.* (2019) around 46% of Bitcoin transactions are associated with illegal activities. Dumienski and Smith (2018) emphasized the need for government regulation in the cryptocurrency space, not only for taxation reasons, but also to counter terrorist financing and to combat frauds.

Another line of research is the discussion of trust in the context of the decentralization of blockchain technology, precisely because the essence of blockchain-based systems is the claim to solve the issues of centralized, trust-based systems (Herian, 2017). Researchers explored the legal aspects of trust and privacy in blockchain-based systems, highlighting the necessity of re-evaluating traditional assumptions about trust in organizational theories (Seidel, 2017) and addressing financial intermediary and administrative regulatory solutions for governments (Harwick, 2016). As the disruptive power of digital continues, some researchers see the potential for new organizational structures to emerge based on distributed collaboration, analogous to blockchain structure (Scott *et al.*, 2017). Advocating for the need of smart contracts, Shermin (2017) addressed the challenges of decentralized governance and trust regulation, by showing how blockchains overcome the traditional principal-agent dilemma. Other scholars argued that the legal system can help to build greater trust in blockchain by creating new laws that combine legal frameworks with the underlying code, providing clarity and stimulate economic growth (Werbach, 2018; Kher *et al.*, 2021, pp. 1709-1710). Other studies pointed to the importance of "human trust-based institutions" in order to ensure the reliability and integrity of cryptocurrencies (Chohan, 2019) and discussed the advantages and disadvantages of a central bank digital currency (Eichengreen, 2019; Bech and Garratt, 2017; Carapella and Flemming, 2020).

Some research suggested that the adoption of cryptocurrencies may lead to greater scope for money laundering, highlighting the need for enhanced governance measures (Brenig *et al.*, 2015). Bartoletti *et al.* (2017) argued that it is difficult to distinguish between legitimate investments and Ponzi schemes, due to the complexity of hybridizing multi-level marketing, token sales, and gaming in some crypto cases. Although criminals may take advantage of cryptocurrencies' lack of regulation and anonymity, Bitcoin's code allows for token tracing, and researchers advocated for regulatory policies that reduce the risks, especially as cryptocurrencies increasingly enter the mainstream economy (Böhme *et al.*, 2015). In addition, Wang *et al.* (2017) found that even with comprehensive regulation, weekly cryptocurrency returns have not been negatively affected, indicating that investors maintain a positive outlook on cryptocurrencies despite the fact that fraud exists (Kher *et al.*, 2021, pp. 1709).

D) Motivation, Perception and User Behavior

This prominent group of research topics shifts the perspective from the examination of cryptocurrency as a technological innovation with its various characteristics and implications for the financial market, regulation and legal status, to the perspective of the user, to explore the experiences of users in using cryptocurrencies. The vast majority of these publications focuses specifically on Bitcoin and extends their findings to cryptocurrencies in general. In this context, a number of studies have examined the underlying motivations behind the general public's interest in cryptocurrencies. Despite the lack of a universally accepted taxonomy, similar patterns have emerged across these researches (Fröhlich *et al.*, 2022, p. 160). For instance, Abramova *et al.* (2021) provided a quantitative analysis categorized by user groups based on their age as well as on their knowledge and experience with cryptocurrency, and showed that while there are still major concerns about the technology, users are mainly interested in cryptocurrencies because of their innovative idea. Fröhlich (2020) summarized the motivations of users into the categories of financial interest, ideological interest, and technical interest. Sas and Khairuddin (2017) as well as Khairuddin *et al.* (2016) reported similar motivations for using cryptocurrencies, involving anticipation of a monetary revolution; users' increased empowerment through decentralized cryptocurrency use; and perceived increasing value of Bitcoin. In addition, Krombholz *et al.* (2017) identified curiosity and the decentralized nature of cryptocurrencies as key motives for using cryptocurrencies. On the other hand, researchers have also studied the motives that lead to the rejection of cryptocurrencies among users such as the association of cryptocurrencies with illegal activities such as drug trafficking, misconceptions about how cryptocurrencies work, and the belief that Bitcoin has already peaked and therefore it is difficult to make further financial gains (Voskobojnikov *et al.,* 2021; Gao *et al.,* 2016).

Some of the research has also focused on the risks associated with cryptocurrency adoption. Studies in this context focused on examining individual differences in risk perception (Abramova *et al.*, 2021; Fröhlich, 2020). Perceived risks include human error, such as lost passwords or lack of knowledge about how cryptocurrency works, betrayal and malicious hacking attacks (Sas and Khairuddin, 2017; Mai *et al.,* 2020; Voskobojnikov *et al.,* 2020). In addition, numerous research studies have been conducted to gain insight into the behavior and perceptions of cryptocurrency users (Faqir-Rhazoui *et al.*, 2021; Knittel *et al.*, 2019; Busse *et al.*, 2020). For instance, studies have looked at online communities to identify the role of collective meaning-making processes (Knittel and Wash, 2019; Jahani *et al.*, 2018; Krafft *et al.* 2018; Fröhlich *et al.*, 2022, pp. 160-161).

In summary, these studies provide a broad overview of the current state of research and offer interesting insights into various topics. However, it becomes noticeable that due to the relatively short existence of cryptocurrencies, many areas of research are still in their preliminary stages. A comprehensive consideration of the wide range of relevant issues is currently lacking in the research. A research gap is the holistic study of the dynamics of the adoption and diffusion of cryptocurrencies at the individual level. Although Bitcoin and other cryptocurrencies serve as global instruments and operate internationally, it would be beneficial to address such research objectives in a specific and focused context. This is due to the fact that there are significant differences between nations in terms of institutional development, political and financial systems, as well as cultural and socio-economic factors. As a result, the factors influencing adoption and acceptance may vary from region to region, and individual motivations may differ. A comprehensive analysis of these factors would be an appropriate approach to provide a solid understanding of this research question.

1.3 Research Objectives

This study intends to build a new stream of Bitcoin research by analyzing the socio-economic factors underlying the diffusion and adoption of cryptocurrencies in South Korea. The research focuses on understanding the paradigms that influence individuals' adoption of cryptocurrency as a financial technology-based product. Cryptocurrencies are defined in the context of this study as a digital-based alternative investment instrument that can be employed by investors either as a portfolio component alongside traditional assets such as stocks, bonds and gold, or as a purely speculative investment vehicle with the aim of promptly achieving individual financial goals. The primary objective of this research is to investigate the diverse factors that shape the adoption and acceptance of Bitcoin at the individual level in South Korea, employing a multidimensional analysis approach.

This study aims to explore the influence of individuals' perceptions and expectations of Bitcoin usage on their decision-making process, as confidence in the technology and belief in its potential outcomes are crucial factors in the adoption decision. The availability and perception of sufficient resources, including technical and digital infrastructure, also play a significant role in facilitating or hindering technology adoption. Moreover, the research recognizes that the adoption of a new technology requires efforts to acquire knowledge, which may vary among individuals, impacting their acceptance and adoption. Thus, the study considers the role of local technical digital infrastructure, such as digital investment frameworks and crypto tools, in shaping adoption patterns.

Furthermore, individual motivational factors are vital in determining how and where individuals choose to allocate their money, including their intentions to save or use specific investment vehicles. In the context of cryptocurrencies, there are associated costs, both non-monetary indirect costs and direct financial expenses, which individuals weigh against the expected advantages and returns compared to other alternatives. Previous behavior and technological or investment habits can also constrain individuals' willingness to adopt a particular financial technology. Familiarity with digital-based applications, for example, might make it easier for individuals to participate in the Bitcoin system. In addition, the perception of value attributed to the system by others and the influence of reference groups on an individual's intention to use a technology or engage in an activity are considered. Therefore, the research investigates the degree to which factors such as social influence, personal motivations, cost-return expectations, as well as digital and investment habits influence the adoption process.

Moreover, when it comes to cryptocurrencies and participating in the Bitcoin system, the decision to get involved might be influenced, to some extent, by uncertainties related to socioeconomic and financial factors. Individuals may experience uncertainty about the potential outcomes of their participation, the fear of missing out if they choose not to participate, and the evaluation of comparative alternative options. On the basis of asymmetric or limited information and the associated uncertainty regarding the realization of undesirable consequences, individuals are likely to discount their own "uncertain" information and join a herd, where the popularity of a particular decision is observed, in order to overcome the uncertainty of their decisional process. Therefore, this study addresses the implications of herding behavior in order to maintain a holistic approach toward understanding the dynamics of Bitcoin diffusion and adoption in Korea.

In addition, the study aims to identify the social, cultural, and economic factors that are unique to South Korea and may have an impact on the adoption of Bitcoin at the individual level. By examining these specific contextual factors, the research aims to provide valuable insights into the country-specific dynamics that influence the adoption-decision process.

By addressing these research objectives, this dissertation strives to contribute to the existing body of knowledge on the adoption and acceptance of Bitcoin. The findings of this study will provide valuable insights for professionals and researchers interested in understanding the factors driving or hindering the adoption of cryptocurrencies, particularly at the individual level in the South Korean context.

1.4 Theoretical and Methodological Approach

The adoption and implementation of new technologies are influenced by a complex interplay of social and psychological factors. There has been an ongoing research effort to understand human behavior related to technology adoption, resulting in the development of various theories and models. In fact, the field of technology acceptance research has received considerable attention over several decades, reflecting the broad integration of new innovations into various aspects of contemporary human life. In this context, several theoretical models have been formulated to shed light on end-users' technology acceptance behavior (Taiwo and Downe, 2013, p. 48).

Therefore, studying the adoption of technological innovations requires the application of social models and hypotheses that provide a rationale for understanding the ways in which individuals perceive utility in implementing new technologies. Social science theories of technology adoption attempt to explain the behavioral characteristics and decision-making processes of individuals as they evaluate and decide whether to adopt a particular technology. By analyzing individual attributes and behaviors, these theories contribute to a deeper understanding of how users perceive and realize the utility associated with adopting new technologies.

According to the diffusion of innovation theory (Rogers, 1962), the decision to adopt or reject an innovation is not a spontaneous reaction, but a social process that takes place over a certain period of time and involves a series of actions. In general, the process of adopting an innovation can be identified at two levels: at the micro level through the decision-making process of a single individual, and at the macro level of the respective social system. The innovation decision-making process at the micro level can be divided into five phases: knowledge (learning about an innovation); persuasion (being convinced of an innovation in a positive or negative sense); decision (deciding for or against an innovation); implementation (implementing the innovation); confirmation (confirming the innovation decision and continuing to use it or reversing it). At all stages of the process, market actors try to reduce the existing uncertainty about the new idea (Rogers, 2003, pp. 221–225). The diffusion of a technological innovation within a social system at the macro level can be visualized in relation to time by means of a characteristic S-shaped curve. While the gradient of the curve is still relatively low at the beginning of the diffusion process and thus only a few successively adopt the innovation, the curve increases rapidly at the point of the so-called critical mass, since here the early adopters begin to adopt the innovation and at the same time, as opinion leaders, spread the innovation further by means of their extensive social networking. Once the last adopters take over the innovation, the curve gradually flattens out (Hall and Khan, 2003).

While the diffusion of innovation theory focuses on the perceived characteristics of an innovation in relation to the adoption decision process, the attitude-behavior theories (TRA and TPB) examine the variables that influence the intention and behavior of decision makers. Both diffusion of innovation and attitude-behavior theories examine the perceptions of the decision maker (Weigel *et al.,* 2014, p. 621). The Technology Acceptance Model (TAM) adopts this approach and conceptualizes behavioral intention as an endogenous variable to understand technology acceptance in the context of information technology. On the one hand, the TAM has been recognized for its applicability and validity in explaining individuals' behavioral intentions regarding the use of a particular technology. On the other hand, it has been criticized for not taking into account external variables that could affect its main constructs, which led to the extension of the model (Teo *et al.,* 2018, p. 462). In this field of discourse, Venkatesh *et al.* (2003) developed the

Unified Theory of Acceptance and Use of Technology (UTAUT) to combine the approaches of different acceptance models into a unified research model. Due to its comprehensive meta-framework and its ability to explain individuals' behavioral intentions toward technology adoption, the UTAUT and its extension UTAUT2 (Venkatesh *et al.,* 2012) have since been used extensively by scholars in their efforts to understand the acceptance and adoption of information systems and technology-based products.

However, recent technology acceptance research has expressed the need to add further endogenous factors from additional theories as well as new moderating variables into the model in order to increase the validity of the results (Blut *et al.,* 2022). In the present study, the UTAUT 2 model is applied and extended with the factors of herd behavior as well as with moderating cultural variables to explore the complexity of the behavior of Bitcoin users in Korea with regard to the adoption and acceptance of this new technology.

In this study, a quantitative method is applied to gain an in-depth comprehension of the conceptual framework in order to provide a validated basis for the research. Therefore, a survey approach relying on the positivism principle in conducting research is considered to be the most adequate method to be applied in this context. In this regard, a web-based survey is employed as a data collection technique for the research design, for which the development and scope of the questionnaire are detailed based on scientific evidence from academia as well as the characteristics of the potential participants. Subsequently, the surveys of the study were conducted in South Korea in the period from December 2021 to April 2022. The collected data were subject to a preliminary examination, that has displayed a high degree of robustness of the data in terms of normality assumption, outliers, homogeneity of variance in the dataset (homoscedasticity), multicollinearity and reliability tests. The major data analysis method implemented in this research relies on confirmatory factor analysis (CFA) and structural equation modeling (SEM) by utilizing analysis of moment structures (AMOS).

1.5 Chapter Outline

The dissertation is structured as follows: The second chapter discusses the financial technology features and functionalities of cryptocurrencies, with a specific focus on Bitcoins, in order to gain a better understating of the nature of cryptocurrencies and to provide a working definition of the economic characteristics of Bitcoins. Building on relevant monetary theories, this chapter examines the capabilities and functionalities of Bitcoin as a novel digital-based asset class. It explores the distinctive characteristics of Bitcoin relative to traditional asset classes, drawing parallels and highlighting key similarities and differences. By considering the theoretical foundations and empirical observations, the chapter provides an in-depth analysis of Bitcoin's role and potential within the broader landscape of financial assets.

Chapter 3 reviews the theoretical perspectives of technological acceptance and diffusion theories. After a definition of the most relevant terms "acceptance" and "technological innovation", this chapter presents the development of diffusion of innovations theories and technological acceptance models in order to then establish a comprehensive research method for examining the adoption and use of the Bitcoin technology in Korea that also takes into account current transformation processes of the digital change.

Chapter 4 presents the country-specific aspects of the rise of Bitcoins in South Korea. Moreover, the chapter sheds light on some relevant country-related social, political and financial developments that might shape the adoption behavior of South Korean users. It outlines the economic development in South Korea with its impact on wealth, education, and social mobility, and discusses the social and political responses to the rise of cryptocurrencies in order to provide the socioeconomic context for analyzing the adoption and diffusion of Bitcoin in this country.

Chapter 5 outlines the methodological framework of the study. It systematically reviews existing empirical studies in the literature on the diffusion and adoption of cryptocurrencies. The chapter then develops the research hypothesis and situates it within the relevant theoretical framework. It goes on by presenting the empirical model, along with an explanation of the applied methodological approach and analytical techniques.

Chapter 6 primary presents the preliminary statistics analysis of the data gained from the surveys, followed by an examination of the relationships between the variables in the conceptualized research model. The chapter then addresses the model testing procedure.

Chapter 7 presents and discusses the results of the tested hypotheses based on the UTAUT 2 model and examines the outcomes derived from incorporating the determinant of herd behavior. Additionally, the chapter includes an empirical analysis of the moderating variables, specifically exploring the role of cultural values.

Chapter 8 serves as the concluding section of the research study and provides a comprehensive discussion of the study's findings and insights. Additionally, it addresses the limitations that may have influenced the research process and the interpretation of the results. Through a critical evaluation of the study's scope, methodology, and data analysis, the chapter offers a perspective on the research study and its implications. This discussion enhances the scholarly contribution of the dissertation and provides valuable directions for future research in the field.

2 The World of Cryptocurrencies

Cryptocurrencies refer to a novel class of digital assets that utilize cryptographic techniques to both secure their creation and validate transactions. Their decentralized nature and potential to transform the traditional financial system have made them a prominent topic of academic debate in recent years. This chapter aims to explore in detail the basic concepts and characteristics of cryptocurrencies, including their mechanisms, advances, drawbacks, and their potential implications for the broader global economy. As the first and most prominent cryptocurrency, this chapter focuses on Bitcoin as the representative of the world of cryptocurrencies. The chapter is organized as follows: Section 2.1 addresses the classification of the different currency types. Section 2.2 illustrates the technical aspects of the Bitcoin's network structure. Section 2.3 discusses the economic characteristics of Bitcoin based on the relevant monetary policy theories and according to the classical properties of modern currencies such as medium of exchange, unit of account and store of value. In this context, the ability and the functionality of Bitcoin as a novel digital-based asset class is also discussed, as well as its parallelism with other conventional asset classes such as gold. Finally, section 2.4 summarizes the findings of the chapter and concludes with a definition of cryptocurrency that serves as the underlying basis for the further methodological approach of this study.

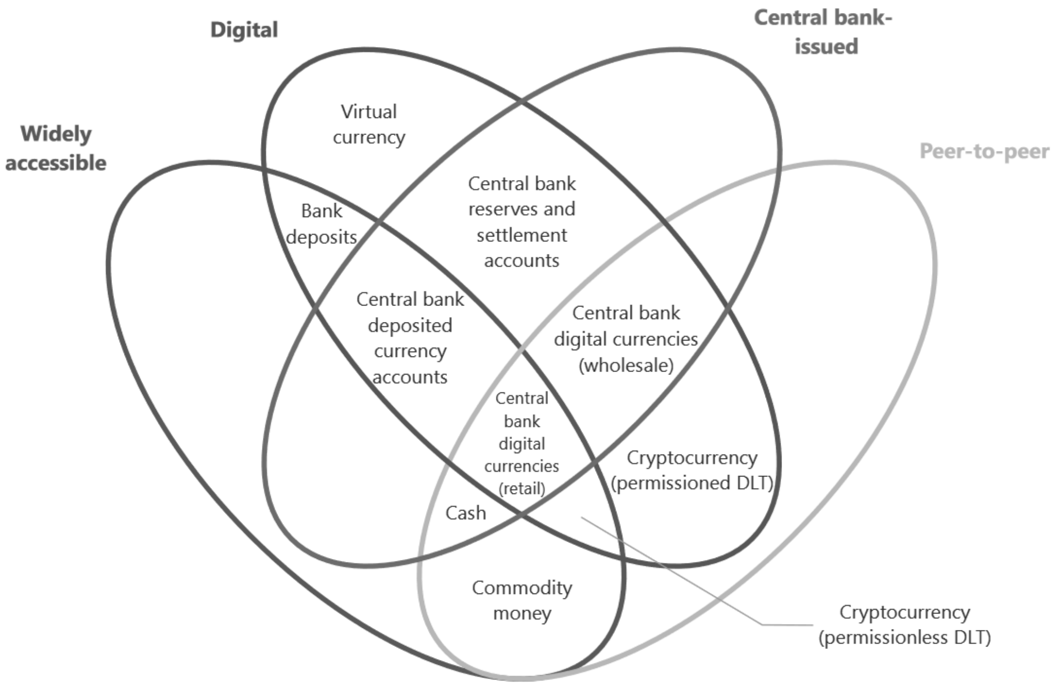
2.1 Currency Classification

Although the terms electronic, digital, virtual and crypto are often used interchangeably in the discourse on digital payment and currency systems, a terminological differentiation is essential, particularly in the context of addressing a specific aspect of this multidimensional topic. As defined in the E-Money Directive (2009/110/EC), the term "*electronic money*" means a monetary value represented by a claim on the issuer, stored electronically, issued against the receipt of money whose value is not less than the monetary value issued and accepted as a means of payment (European Central Bank, 2012, p. 16). Electronic money remains linked to the traditional money format and has a legal basis as the stored funds are denominated in the same unit of account. It can therefore be easily converted, for example by using ATMs that turn the electronic record of currency holdings into cash. Digital currencies, on the other hand, have similar characteristics to other currencies and are also stored electronically, but do not have the physical equivalent of banknotes and coins. They only exist in the digital space. Therefore, digital currency refers to a balance or record stored in a distributed database on the Internet, in an electronic network database, in digital files or on a memory card. In distinction, the European Central Bank (2012, p. 5) defines "*virtual currencies*" as "a type of unregulated, digital money, which is issued and usually controlled by its developers, and used and accepted among the members of a specific virtual community." Thus, while all virtual currencies are digital, not all digital currencies are virtual, because they can exist outside of a specific virtual community. In that sense, Bitcoin is a digital currency, but at the same time a sort of virtual currency. However, Bitcoin cannot be considered electronic money, as the value of cryptocurrencies is not represented by a claim on the issuer (Bank for International Settlements, 2018b, p. 112).

The term "*crypto*" refers to digital and virtual currencies that are based substantially on the tools of cryptography. Cryptography provides a framework that allows the system to securely enforce a set of predefined rules and structures by making use of specific mathematical protocols (Narayanan *et al.*, 2016). In the context of money classification (see figure 2), cryptocurrencies unite three essential characteristics. First, they are a digital, virtual means of payment based on cryptography to avoid the risks of falsification and manipulation. In the world of fiat currencies, centralized institutions such as central banks take over the supervision role by controlling the money supply, determining monetary policies and enforcing rules aiming to enhance the stability of the currency system. Unlike fiat currencies, the natural concept of cryptocurrencies and its system's rules relies purely on technological frameworks without the need of central authorities. Second, they are privately issued, which means they do not involve liability of any type and hence they cannot be redeemed. A characteristic that resembles commodity money, however, is that the intrinsic value of cryptocurrencies is purely based on the anticipation that they will continue to be accepted by the rest of the community. Third, cryptocurrencies facilitate a digital peer-to-peer interaction, which means that they do not need banks as intermediaries, and are thus removed from the influence of any central authority. Digital peer-to-peer interaction is not a completely new phenomenon in this sense. Digital bank deposits, for instance, have been in existence for long periods of time; and privately issued virtual currencies – such as those used in mass multiplayer online games like *World of Warcraft* –

are a decade ahead of cryptocurrencies. However, unlike these, cryptocurrency transactions can, in principle, be decentralized without the need for a central counterparty to carry out the exchange (Bank for International Settlements, 2018b, p. 95).[2]

Figure 2: Currency Classification



Source: Bank for International Settlements (2018b, p. 94)

Insofar as cryptocurrencies are not issued by a centralized authority and are not based on the status of official legal tender for their acceptance, they can be seen as a significant departure from the development of the creation of national money and a key step towards

[2] Whether a central bank digital currency can be designated as a cryptocurrency depends on its particular design and characteristics (International Monetary Fund, 2021). Whereas certain schemes of central bank digital currencies could potentially be classified as cryptocurrencies, the classification would ultimately depend on a number of factors, including the degree of decentralization, the use of cryptographic protocols and the absence of a central authority controlling their supply and distribution. In terms of their architecture and design, there are several models of central bank digital currencies. Some of these models, such as the account-based model, involve a centralized ledger managed by the central bank, while others, such as the token-based model, involve decentralized ledgers using cryptographic protocols similar to those used by cryptocurrencies (Bank for International Settlements, 2020).

the "denationalization of money" promoted by Hayek (1976).[3] Hence, "the theoretical roots of Bitcoin can be found in the Austrian school of economics and its criticism of the current fiat money system and interventions undertaken by governments and other agencies, which, in their view, result in exacerbated business cycles and massive inflation" (European Central Bank, 2012, p. 22). Nevertheless, the consensus on the theoretical roots has been controversial. The objections refer to two main issues. On the one hand, Bitcoins have no intrinsic value like gold and are merely a set of data stored on a computer. On the other hand, the system does not comply with the "Mises's regression theorem"[4], which states that money is accepted not because of government regulation or social convention, but because it has its roots in a commodity that indicates a particular purchasing power (Fantacci, 2019; European Central Bank, 2012, p. 23). The correct functioning of a decentralized cryptocurrency, such as Bitcoin, is ensured by multiple, geographically dispersed stakeholders such as developers, miners, users, and others within the ecosystem. Trust, and thus the associated risk, is spread across a network of multiple parties with conflicting interests. Therefore, by trusting a cryptocurrency, the trust is ultimately placed in mathematics and cryptography to maintain an incentive system that in turn encourages all participating groups to ensure the integrity of the cryptocurrency (Stöferle, 2018).

As of 2022, the cryptocurrency market consists of over 10,000 individual cryptocurrencies with a combined market capitalization that exceeds $2 trillion (Statista, 2023a, 2023b). In terms of popularity, there are three major cryptocurrencies; *Bitcoin* (*BTC*), which was

[3] In 1971, US President Richard Nixon's decision to end the US dollar's peg to gold marked the failure of a gold standard monetary system, resulting in the circulation of unbacked banknotes. In the light of these developments, the economist Friedrich August von Hayek recognized the need to reassess the foundations of a sustainable monetary order. In Hayek's view, the abandonment of the gold standard, as well as the widespread adoption of Keynesian economic principles, undermined the prospects for the development of stable, non-inflationary money within a state-controlled monetary system. In his 1975 lecture, "*Choice in Currency*", Hayek proposed the elimination of the state monopoly on money and emphasized the need for alternative approaches. His subsequent publications, "*Choice in Currency*" and "*Denationalization of Money*," published the following year, elaborated on Hayek's ideas regarding competition between private money providers and the advantages associated with such a system (Stöferlem 2018; Hayek, 1976a; and Hayek, 1976b).

[4] According to the regression theorem, money can regress in value to its non-monetary value. The basis for this regression is the subjective valuations and expectations of individuals in the economy. This indicates that people initially accepted commodities as money because they believed in their value for non-monetary purposes, such as their use in barter or their physical properties. For more on the regression theorem that was initially proposed by Ludwig von Mises in his book *The Theory of Money and Credit* (1912) see Hansen (2019).

established in 2009 and has gained considerable recognition; *Ethereum* (*ETH*) based on a specialized blockchain with a distinct token called Ether that launched in 2015; and *Litecoin* (*LTC*), a peer-to-peer cryptocurrency designed after the Bitcoin protocol but using a rather distinctive hashing algorithm (Fang *et al.*, 2022, pp. 5-6). As the crypto pioneer and most prominent cryptocurrency, the following discussion will focus on Bitcoin as the representative of the world of cryptocurrencies.

2.2 Bitcoins' Design and the Bitcoin Blockchain

2.2.1 Background

The first Bitcoin was issued in 2009 after the release of an online paper by Satoshi Nakamoto (2008) outlining the proof of concept for a currency that deploys a cryptographic approach instead of trusting a central authority.[5] The design of Bitcoin is characterized by several distinctive features that set it apart from traditional currencies and payment systems.[6] Bitcoins are peer-to-peer electronic cash systems that make it possible to send online payments directly from one party to another without going through a financial institution (Nakamoto, 2008; Corbet *et al.*, 2018). One of the key features of Bitcoin's

[5] *Satoshi Nakamoto* is the pseudonym used by the unknown person or group of people who created the cryptocurrency Bitcoin and wrote the original white paper in 2008 titled "Bitcoin: A Peer-to-Peer Electronic Cash System," published in October 2008 Since then, Satoshi Nakamoto has been credited with establishing the Bitcoin network and creating the original protocol. The true identity of Satoshi Nakamoto, however, has never been revealed, and its anonymity continues to be a subject of considerable speculation and debate within the cryptocurrency community (Vigna and Casey, 2015; Campbell-Verduyn, 2018, pp. 1-2). The first Bitcoin was issued in January 2009, when the first block of the Bitcoin blockchain was mined. This block, referred to as the genesis block, carried a message from Satoshi Nakamoto that referenced a headline in *The Times* newspaper about the British government's bank bailout. The insertion of this message was viewed as a symbolic act to highlight Bitcoin's underlying nature as a decentralized alternative to traditional banking systems (Nakamoto, 2008; Antonopoulos, 2014, p. 167).

[6] The concept of Bitcoin and the blockchain were not entirely invented by Nakamoto. Rather, Nakamoto's contribution was to merge existing concepts. The blockchain concept encompasses three fundamental ideas: distributed ledger, decentralization, and incentivization, all of which existed prior to the emergence of Bitcoin. In addition, the concept of a cryptocurrency itself was not entirely novel. As early as 1998, Nick Szabo and Wei Dai proposed conceptual versions of digital currencies referred to as Bit gold and B-Money, respectively. However, both of these ideas were never realized. Moreover, the hashcash algorithm, which was introduced by Adam Back 1997 to combat email spamming, offered a potential application for Dai's proposal. Finally, what distinguishes Nakamoto's invention is the integration of these concepts, including Bit gold, B-money, hashcash, and others, leading to a unique and innovative framework for Bitcoin along with the blockchain (Chowdhury, 2019, pp. 7-8).

design is that it is based on publicly disclosed open-source code. This means that the source code for Bitcoin is freely available and can be viewed and modified by anyone, which is generally considered an important aspect of the transparency and decentralization of the Bitcoin system. Thus, any software developer can examine the protocol and generate own versions of the software for testing or further development. In order to ensure that software developers who change the Bitcoin source code in their own versions of the software cannot force a harmful modification of the Bitcoin protocol without compromising the integrity of the rest of the system, Bitcoin is constructed to perform only with the full consensus of all network participants. For a transaction to be confirmed and added to the blockchain, it must be validated by a network of computers using a complex cryptographic algorithm known as proof-of-work. This consensus mechanism ensures that transactions are secure and irreversible, and that the integrity of the blockchain is maintained. Hence, the authority to modify the Bitcoin protocol requires the full consent of Bitcoin users and developers (Nian and Chuen, 2015).

A Bitcoin unit can be divided into 100 million "*Satoshis*", the smallest division of a Bitcoin, providing a high degree of divisibility and flexibility for users (Berentsen and Schar, 2018, p. 4). The coins on their own do not represent physical objects or even digital files, but rather records in the blockchain ledger. The ownership and transfer of Bitcoin is purely an entitlement to a fragment of information contained on the blockchain. In this context, the ownership is established through possession of the private keys that are required to access and transfer the digital currency (The Economist, 2015; Antonopoulos, 2014).

2.2.2 The Blockchain

The blockchain is a cryptographic technology that forms the essential core of the Bitcoin system, challenging the traditional reliance on central banks and other intermediaries. As a digital ledger, the Bitcoin blockchain records all past transactions involving each individual Bitcoin unit, including the creation of new coins. This immutable ledger establishes undeniable proof of ownership and enables transparent asset transfers. Hence, the blockchain provides documentation of who owns what at any given interval. In contrast to centralized ledgers, the blockchain functions as a distributed ledger[7], spread across thousands of computers, called "nodes"[8], located around the globe (Chowdhury 2019). Such a decentralized network of nodes promotes transparency and public accessibility, allowing anyone to verify the transaction history. Despite its openness, the blockchain integrates a sophisticated combination of cryptographic complexity and computational power into its consensus mechanism (Sathya and Elngar, 2021; Antonopoulos, 2014). The consensus mechanism[9] plays a central role in maintaining the blockchain, most notably during Bitcoin transfers across users. This mechanism allows nodes to reach a consensus in order to determine the most accurate and valid version of the blockchain, thus ensuring the integrity and security of the system. In this context there is no single instance nor a central authority with an exclusive right to keep accounts, rather each participant is free to manage an own copy of the ledger based on a pre-defined set of rules and the ability for the community members to observe and control other participants adhering to the rules. The decentralized design provides the system with a substantial degree of robustness. Under such constructions there is neither a central vulnerability spot that can be threatened nor any system-relevant nodes that could cause the network to crash. Consequently, the system can operate even when some network nodes are unachievable, and it can permanently launch new links and communication channels (Berentsen and Schar, 2018, pp. 7-10).

[7] By definition, a distributed ledger is "a consensus of replicated, shared, and synchronized digital data geographically spread across multiple sited, countries, or institutions, without any central administrator or centralized data storage (Chowdhury, 2019, p. 8).

[8] Nodes are the peers of the network, as they are responsible for verifying transactions and ensuring the integrity of the blockchain. Through working together to verify transactions and build the blockchain, they create a decentralized system that is resistant to attacks and censorship. A node is basically a computer that is connected to the Bitcoin network and participates in the process of validating and routing transactions. As such, there are two main types of nodes on the Bitcoin network: full nodes and lightweight nodes. Full nodes always store a complete and constantly updated copy of the blockchain locally. This allows them to independently verify all transactions and ensure the integrity of the network. Lightweight nodes, on the other hand, rely on full nodes to obtain transaction data and do not store a full copy of the blockchain. Nodes communicate with each other via a peer-to-peer network, through which they can share information about new transactions and blocks. When a new transaction is created, it is sent to the network and picked up by multiple nodes, which check its validity and forward it to other nodes. When a new block is added to the blockchain, it is also sent to the network and verified by several nodes before being attached to their local copy of the blockchain (Sixt, 2017, pp. 34-37; Narayanan *et al.*, 2016, pp. 90-96; Antonopoulos, 2014, p. 140-142).

[9] Bitcoin's *consensus mechanism* is a critical element enabling multiple nodes on the network to mutually reach agreement on the state of the blockchain without relying on a central authority. The *consensus mechanism* is obtained through a process that is known as *Proof-of-Work (PoW)* (Antonopoulos, 2014, pp. 181-182; Narayanan *et al.*, 2016).

The blockchain system is technically described as a sequence of blocks, in where each block builds on its precursors and involves new Bitcoin transactions information. On average, there are 10 minutes between any two blocks in the chain. The first block, block #0, was created in 2009; and block # 730,661 was added to the chain at the time of writing this thesis. Since everyone can download and read the Bitcoin blockchain, it can be defined as a public record that entails information about Bitcoin ownership at any given time (Berentsen and Schar, 2018, p. 5).

Every participant can generate new transactions and spread them across the network. In this process, each transaction is communicated to the network nodes addressing the transmission of the ownership of a specific Bitcoin unit from the seller to the buyer. The network in which the nodes are linked together is called a P2P network. Thereby, network nodes operate as both client and server. They forward the received information until all nodes have been informed about the transaction. P2P network operation is more rapid and requires less maintaining compared to the client-server model (Sathya and Elngar, 2021, p. 4). In this system, there is no centralized, official copy of the data, and no single operator is trusted more than another. To validate the transaction legitimacy, the Bitcoin network goes through a range of steps. As the transaction information spreads over the network, the different nodes examine the ledger to verify that the seller actually owns the Bitcoin he or she is about to sell. Once all the parameters match, a network of dedicated nodes, called miners, validate the proposed transaction and subsequently distribute the completed block to the remaining nodes for integration into the blockchain ledger as a new entry (Chowdhury 2019, p. 14).

The transaction legitimacy is guaranteed using asymmetric cryptography. This means that the data is frequently run through a cryptographic "*hash*"[10] function, which breaks the

[10] In the Bitcoin blockchain, a hash is a unique digital fingerprint that result from an encryption process generated for each block of transactions added to the chain. A hash algorithm, such as the SHA-256 (Secure Hash Algorithm 256-bit) and ECDSA used in the Bitcoin system, converts a non-random string into a largely random string. Each block header carries several pieces of information, including the version of the block, a timestamp, a reference to the hash of the previous block, and a list of all the transactions in the block. Applying the SHA-256 algorithm to the block header generates a unique 256-bit hash that identifies the block. The encryption of information, which is prevalent on the Internet, serves security purposes and would not be possible without hash functions. Hence, by providing a way to confirm that a block has not been tampered with, the hash is used to ensure the integrity of the blockchain. Therefore, by changing any of the information in

block down into a sequence of digits of a given length. The cryptographic nature of hashing guarantees that data can be traced back to its hash, while reversing the process and extracting the original data from the hash is practically impossible. Such irreversibility is a fundamental feature of hashing (Sixt, 2017, pp. 37-38).[11]

The foundation of the asymmetric cryptography in Bitcoin relies on the application of two separate pairs of keys, namely the private key and the public key. A public key is a string of alphanumeric characters used to receive Bitcoins from other network participants and is derived from a user's Bitcoin address. When receiving Bitcoins, the user provides the sender with the Bitcoin address generated from the public key. In turn, the sender encrypts the transaction message by using this public key; thereby assuring that only the holder of the corresponding private key will be able to decrypt it. The private key, in other words, is a confidential and secure means of signing transactions and authorizing the transfer of Bitcoins out of a user's account. By digitally signing the transaction message with the private key, the user verifies the legitimate ownership of the Bitcoins being transferred. Each participant in the network holds a private key and its corresponding public key, whereby the private key is kept secret for the purpose of signing transactions (Antonopoulos, 2014, pp. 61-64; Narayanan *et al.*, 2016).

This method of encryption is often described as "*signature.*"[12] The use of such signatures clearly states that no information is intended to be hidden in the encrypted message. When the transaction circulates in the network, every user is able to decrypt a message by using its respective public key, however, the signature acts as evidence that the message was

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the block, the hash of the block header will automatically change as well, and the block will no longer be regarded as valid (Sixt, 2017, p. 11; Antonopoulos, 2014; Narayanan *et al.,* 2016).

[11] Although the hash does not include the data, it is still exclusive to them. Any adjustment of the parameters going into the block, e.g. altering the transaction by a single digit, leads to a modification of the hash (Narayanan *et al.*, 2016; The Economist, 2015; Antonopoulos, 2014).

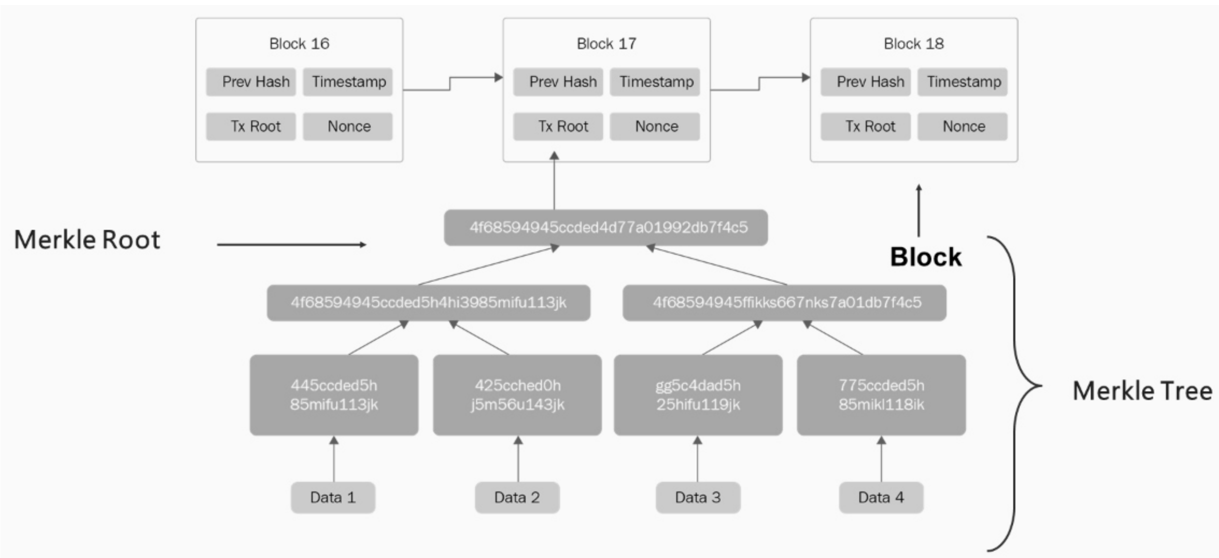
[12] Each transaction is sent to the recipient's public key and signed by the transmitter with his or her private key. Both keys can be compared to a bank account. The public key would represent the IBAN of the bank account: the private key would be the pin code for accessing and using the funds in that bank account (Hawle, 2018; Sathya and Elngar, 2021, p. 13). The creation of the signature is the result of an algorithm called the Elliptic Curve Digital Signature Algorithm (ECDSA). This algorithm creates a digital signature unique to the transaction message using the private key. The signature is then appended to the transaction message and the message is sent out to the network (Antonopoulos, 2014).

initially encrypted using its respective private key.[13] Hence, other network users cannot re-encrypt to manipulate the transaction, since they do not know the private key (Berentsen and Schar, 2018, p. 12).

2.2.3 Mining

One of the main concerns with digital currencies is the risk of double spending; i.e., making two parallel transactions with the same coins to two different users. For this reason, a system has been developed to prevent such a scenario (Sathya and Elngar, 2021, p. 2). Once a transaction is made, its encrypted code, the so-called hash value, is further pooled in a system known as a "*Merkle Tree*", which is a hierarchical structure of hashes that allows large transactional sets to get verified. Each block in the blockchain contains a Merkle root, which is a hash of all the transactions that are included in the block. The outcomes of all this hashing go into the block's header, along with the hash of the previous block's header and a timestamp (Chowdhury, 2019, pp. 45-47) (see figure 3).

Figure 3: The Blockchain Structure



Source: Kulkarni (2018, p. 22)

[13] Such concept can be compared to handwritten signature but associated with high degree of security.

This header is going to be than the initiation of a challenging mathematical equation, which once more includes using the hash function. This mathematical equation can only be solved by applying the trial-and-error procedure. Only that block which can prove that it contains the correct answer to that particular mathematical problem is included as the next block in the block chain. Throughout the network the so-called miners compete to find the appropriate solution of the equation by going through a tremendous number of possibilities. Once a miner eventually solved the equation, other nodes immediately verify the solution and every node that confirms the outcome updates the blockchain consequently.[14] The hash of the header then becomes the identifying string of the new block, and that block becomes a component of the ledger (The Economist, 2015; Antonopoulos, 2014; Nakamoto, 2008; Narayanan *et al.*, 2016). Hence, the transaction is now confirmed. The miner who collected the pending transaction, verified their validity and successfully convinced all other network members to add his or her block candidate to their copies of the Bitcoin blockchain, gets awarded by earning newly created Bitcoin units (Sathya and Elngar, 2021, p. 9). There is no specific permission or license needed to act as a miner within the Bitcoin network. Theoretically, every participant can become a miner by downloading the corresponding computer application and the latest version of the system's blockchain. However, due to the competitive nature of generating the new blocks, the mining operation is usually concentrated among large miners having better hardware infrastructure and access to low-cost electrical power resources (Berentsen and Schar, 2018, p. 6).[15]

Bitcoin's mining is structured based on some specific characteristics aiming to contribute to the security of the network. For instance, it is hard to predict in advance which miner is going to solve the transaction equation and hence to update the outcome in the blockchain. This decrees the risk of transactions frauds. Moreover, every new header involves a hash of the header of the preceding block, which consecutively involves a hash of the header before

[14] It is worth to mention here that the verification of the solution of the equation is much easier and faster than solving the equation (Sathya and Elngar, 2021).

[15] The primary driver of the high-energy consumption of several blockchains is their proof-of-work (PoW) consensus mechanism. This process is both computationally intensive as well as resource-intensive, all of which result directly in high-energy consumption. A newer type of consensus mechanism, Proof-of-Stake (PoS), is less energy demanding. To a certain extent, PoS-based crypto assets have seen an explosion in market capitalization. Nevertheless, the market capitalization of PoW-based crypto assets persists at around 80% of the overall market capitalization of crypto assets (Financial Stability Board G20, 2022).

that and so forth on the way back to the starting point. Such frequent serial structure is what makes the blocks to a chain. Any change on any piece of earlier blocks would lead to a completely different chain outcome, which would risk the ledger mismatching the latest block identifier and getting rejected by the network. A network participant who has just spent a Bitcoin unit could theoretically rewrite the history of the made transaction by generating new hash value coins. Simultaneously, the same participant could involve in mining activities to solve the requisite hash equation and produce a new version of the blockchain that allows him to keep ownership of the spent coins. However, in the meanwhile the rest of the network participants would have extended the original blockchain based on the original first made transaction. Hence the rewritten fraud block would be worthless, since the network nodes have to work on the longest blockchain (Sathya and Elngar, 2021; The Economist, 2015; Chowdhury, 2019).[16] Therefore, Bitcoin's mining relies on using a so-called "*hashcash proof-of-work*"[17] function that is operated by individual miners and proved by the decentralized nodes in the P2P Bitcoin system. This enhances the security of the system considerably, since a fraudulent transaction has to generate a block by solving the mathematical puzzle and then has to compete against all other miners for the generation of all subsequent blocks in order to be accepted by the network. Any double spending, using the same single coin to conduct a transaction, can be avoided by accepting only the transaction that is primary added to a valid block candidate and accordingly added to the blockchain (Sixt, 2017).

From a game theoretical point of view, the miners' approach of only adding valid blocks to their produced versions of the coins blockchain can be considered as a *"Nash equilibrium"*.[18] If an individual miner assumes that all other miners are operating consequently, then it is the best reaction for that individual to add a valid block component

[16] The only way that such fraud could work is by controlling 51% of the network (Chowdhury, 2019, p. 58).

[17] The Hashcash Proof of Work concept was developed by Adam Back in 1997 to limit email spam and denial of service attacks. The concept means that computers prove a certain amount of work to perform an action. For example, to post a comment on a blog or send an e-mail, a computer has to perform some mathematical tasks for a few seconds. Because these tasks are expensive, there is a significant cost associated with trying to flood a network with messages (Sixt, 2017, p. 7).

[18] The Nash equilibrium represents a concept in game theory that helps to specify the optimal outcome in a non-cooperative game where each actor is given little incentive to alter his original strategy. See, for instance, Kagel and Roth (1995).

to his or her version of the Bitcoin blockchain. Any variation is in this context not useful, as operating on a version of the Bitcoin blockchain that is not widely accepted is not beneficial and does not lead to a reward. Therefore, although miners are constantly able to adjust their version of the blockchain, they are forced by the monetary incentives to permanently follow the network rules and hence maintaining consensus about the ownership of all Bitcoin units in the system (Berentsen and Schar, 2018, p. 7).

According to the system rules, the miner that generates a valid block gets to contain a special transaction, so-called *"coin-creation transaction*", in that block. Such extra-added transaction acts as a compensation, so-called "*block reward*", to the miners in exchange for the service of generating a valid block in the consensus chain. The value of the block reward was fixed in the earlier years of launching the system at 50 Bitcoins and is determined to halve with every 210,000 blocks created (approximately every 4 years).[19] The applied geometric series mechanism in the creation of new coins leads to a mathematically predefined finite sum of 21 million created Bitcoins.[20] Miners could also optionally choose the total value of the transaction output lower than the total value of its input. The difference between the input and output acts as a voluntary transaction fee, another incentive mechanism that is designed to play a significant role after the block reward runs out by achieving the peak of newly created Bitcoins (Narayanan *et al.*, 2016, p. 62-63).

The miners can collaborate with other miners by combining their processing power and therefore increase their chance to find the right answer first. When miners join together with others, it is referred to as a miners' pool. Due to the enormous amount of processing power required to find the right answer to the puzzle, it is very common for Bitcoin miners to join together to form mining pools. The five largest mining pools control more than 56% of processing power and hence indirectly the mining activities of the entire network

[19] The rewards associated with Bitcoin mining are cut in half about every four years. In 2009, when Bitcoin first began to be mined, it was possible to earn 50 BTC by mining a block. In 2012, this was cut in half to 25 BTC. In 2016, the amount was again reduced by half to 12.5 BTC. On May 11, 2020, the reward was once again halved to 6.25 BTC (Hong, 2022).

[20] This sum is expected to be achieved in 2140 (Nakamoto, 2008).

(Hawle, 2018).[21] In the early years, miners were capable of mining through their computer central processing unit (CPU). As the number of miners joining the Bitcoin network increased, the mathematical puzzle's challenges became more difficult. The increasing numbers and size of mining pools have been criticized within the Bitcoin community as the central structure of the network could suffer due to this increasing miner pooling (Smith, 2018).

2.2.4 Bitcoins Wallets and Crypto Exchanges

In order to participate in the Bitcoin system, a so-called *"Bitcoin Wallet"* is needed. A Bitcoin wallet is an application that allows units or fractions of Bitcoin – its digital credentials – to be received, stored and sent. Contrary to a common misconception, Bitcoin wallets do not directly store Bitcoin units, instead they only hold the corresponding cryptographic keys. The effective possession and ownership of Bitcoin is stored in the blockchain, a decentralized ledger. The keys of the wallet are used to authenticate and authorize transactions, similar to a keychain providing access to the recorded units of Bitcoin in the blockchain (Antonopoulos, 2017). Hence, the digital wallet can be described as a collection of the public and private cryptographic keys on which the Bitcoin cryptosystem is based. A public key enables other wallets to send payments to the wallet's address, while a private key permits the spending of Bitcoins from that address. To balance the trade-off between accessibility, security and suitability, there are several available types of Bitcoins wallets. Users of Bitcoins can store their private keys for example on their hard drive by downloading so-called desktop wallets on their personal computer. For users, who actively use Bitcoin for frequent transactions such as currency trading or e-commerce activities, a mobile BTC wallet represents another storage tool. It runs as an app on the smartphone, enabling to store the cryptographic private keys that allow to making transactions directly from the smartphone. While many desktop wallets rely on the so-called "full client" concept by directly downloading a full copy of the entire blockchain ledger that is constantly growing and requires high storage capacity, mobile wallets leverage the capabilities of simplified payment verification technology allowing to send

[21] *BTC.com* is currently the largest mining pool and controls about 22% of the total processing power (Hawle, 2018).

and receive transactions without requiring a local copy of the entire blockchain (Narayanan *et al.*, 2016; Sathya and Elngar, 2021, pp. 13-14).

Besides storing Bitcoins locally by using desktop or mobile wallets, network members can also use so-called e-wallets to store their private keys on a server or a cloud that is constantly online and controlled by a third party. On the one hand, this option provides the network participants with a degree of convenience, since there is no need to install any furthers computer software or mobile applications to manage the cryptographic keys of the stored coins. Users can use the website-based online wallet on their browser that encrypts the Bitcoins keys by using a password that is shared between them and the online wallet server. On the other hand, the online wallets are associated with several security concerns. For instance, the server operators or any third parties such as hackers or a breach in server security, might gain access to the private cryptographic keys and thus gaining total control over the stored Bitcoins (Narayanan *et al.*, 2016).[22]

Moreover, users of digital cryptocurrency can still make use of analog tools by printing the key materials onto offline papers (see figure 4). A paper wallet is shaped with a key pair produced on a computer in offline modus, where the private key is transmitted to the paper and then deleted from the computer. The paper wallet can then be stored in a secure physical place for later application. Paper wallets are often designed in the form of QR-codes to enable scanning them and adding the keys to a software wallet to carry out a transaction. The main advantage of using a paper wallet is the associated security, since the keys are stored offline, the risk of hacker attacks or malwares is eliminated (Barski, 2014; Antonopoulos, 2017, pp. 105-106).

[22] See, for example, the security breach and hacks that occurred at the Bitcoin exchange Mt. Gox in 2011 and 2014 (Pollock, 2018).

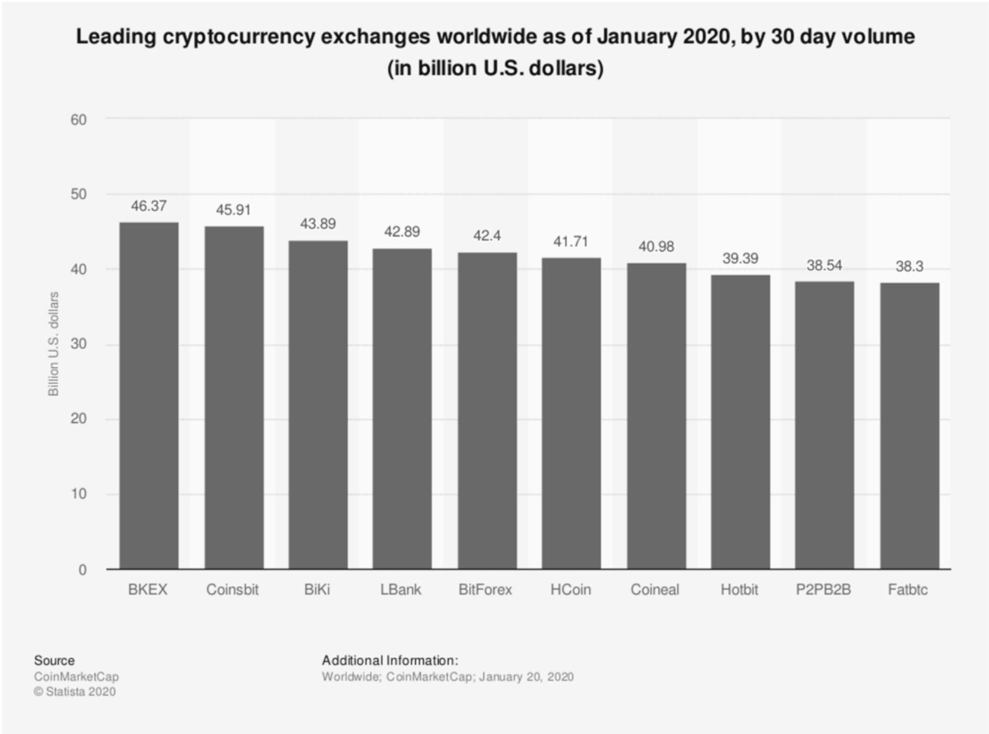
Figure 4: Offline Paper Wallet

Source: blockchaincenter.net

Another form of storing Bitcoins is using the so-called hardware wallet, where the participant's private keys are stored in a secure hardware device. This type of offline wallets is considered to be the most secure alternative of storing Bitcoins. In a contrast to paper wallets, that must be introduced to a software sooner or later, hardware wallets can be used securely and interactively. Additionally, hardware wallets are not exposed to computer viruses and malwares risk. Thus, their private keys and the respective Bitcoins stored cannot be transferred out of the wallet in an unauthorized manner (Barski, 2014).

Apart from the type of crypto wallets that are used by the different users, to trade conventional fiat money for cryptocurrencies (for instance, buying or selling the Bitcoin units in exchange for U.S. Dollar, Euro or the Korean Won) a market maker is usually needed. The most popular method is to open an account and transfer fiat currency to one of several Bitcoin exchanges. The account holder can then use these resources to buy cryptocurrency such as Bitcoin. The exchanges can send the purchased cryptocurrency to the user's private cryptocurrency wallet. The market maker charges the bid-ask spreads as a transaction fee for the provided service of matching sellers with buyers. Because of Bitcoin's relatively widespread adoption, pricing on the major exchanges is highly competitive with mostly slight bid-ask spreads. Most exchanges offer order books as well as several other financial tools to ensure transparency in the trading process (Berentsen and Schar, 2018, p. 5). The crypto exchanges are considered to be one of the biggest winners of the cryptocurrencies boom, as their trading volumes and revenue is surging with the increasing popularity of Bitcoins and other cryptocurrencies (Russo, 2018). Figure 5 shows the average monthly trading volume on the world biggest crypto exchanges as of January 2020.

Figure 5: Trading Volume on the Leading Cryptocurrency Exchanges



Source: CoinMarketCap, Statista (2020)

Crypto exchanges play a similar role in the cryptocurrency cosmos as the one played by a classical financial intermediary such as a stock exchange or a market maker bank within the spectrum of conventional financial assets. This might represent a dilemma for some network participants, since the initial ideology of launching Bitcoin was, among others, to avoid centralized authorities as well as to avoid the risks associated with classical financial intermediaries such banks.

On the one hand, the transactions carried out on the crypto exchanges between the seller and the buyer only mean the switching of the ownership of specific Bitcoin units offered and listed on that particular exchange without having any effect on the blockchain ledgers.

Similar to the classic bank deposit mechanisms, the exchange has simply switched the promises for its account holders (the buyer and the seller) from fiat currency to Bitcoins and vice versa. In this way the crypto exchanges connect the crypto world with the fiat economy without changing the blockchain structures and compromising the core stability of the network systems. On the other hand, the operation of a crypto exchange is exposed to several risks similar to those of a classical financial intermediary. These include the risk of a bank (crypto exchange) run, the risk that the operators of the exchange are running a Ponzi scheme, and the risk of a technical hack resulting in the theft of funds from the exchange (Narayanan *et al.*, 2016, p. 114). An example of facing such risks can be presented by the failure of the Japanese exchange Mt. Gox, formerly the world's largest Bitcoin exchange that ended up declaring bankruptcy in 2014. Due to hacking attacks the Tokyo-based company had lost 750,000 of its users' Bitcoins and 100,000 of its own. At the time, the price of Bitcoin was around 565 US-Dollar, resulting in a total loss of 480 million US-Dollar which represented about 7% of the estimated global total of Bitcoins at the time (Takemoto and Knight, 2014).

2.3 The Economics of Bitcoins

2.3.1 Background

Throughout most of the 19th and early parts of the 20th century, the majority of the world's common currencies were convertible into fixed values of commodities such as gold or silver. Linking the currency to valuable metals aimed to generate public confidence on the monetary system driven from an extensive social tradition of constructing currencies out of gold and others precious metals (Eichengreen, 1992). The gold standard was abandoned by most countries between the 1920s and the 1970s, mainly due to high war financial reparations costs, competitive devaluations and limited global gold production relative to global economic growth. As a result, fiat currencies experienced a renaissance based solely on the public perception that the issuing national authority or central bank would guarantee a stable value of the currency by limiting the manipulation of the money supply. However, the history of fiat monetary system has been characterized by the failure of many circulated currencies, due to hyperinflation, public finance pressures or financial crises (Ferguson, 2008). Bitcoins, on the other hand, attempt to balance the trade-off between the fiat-based money and the gold standard by replacing centralized authorities' monetary frameworks through decentralized predefined cryptographic rules (Yermack, 2013, p. 4). In this context, however, the question arises as to whether Bitcoin can be considered a form of money or currency at all.

Some scholars argue that Bitcoin should be classified as a currency based on how it is characterized and used. According to Kristoufek (2015), Bitcoin displays characteristics of both a standard financial asset and a speculative asset. Woo *et al.* (2013) assert that Bitcoin exhibits a certain fair value due to its money-like features. Garcia *et al.* (2014) and Hayes (2017) illustrate that the cost of Bitcoin mining creates a fundamental value for the cryptocurrency. Catalini and Gans (2019) argue that Bitcoin is an emerging form of currency that is more flexible and adaptable to new technologies than traditional fiat currencies. Gans and Halaburda (2018) state that the unique characteristics of Bitcoin, such as its decentralized nature and lack of government or central authority backing, constitute a distinct digital type of currency that might compete with state-issued currencies.

On the other hand, some scholars argue that Bitcoin falls short of fulfilling certain criteria traditionally linked to fiat currencies, such as stability and widespread acceptance as a unit of account (Ciaian *et al.*, 2016; Dyhrberg *et al.*, 2018). Hanley (2013) similarly notes that Bitcoin lacks fundamental value to support its market valuation against traditional currencies. The volatility of Bitcoin's price, limited merchant adoption, and regulatory uncertainties have raised concerns regarding its suitability as a mainstream currency (Bariviera, 2017; Baur *et al.*, 2018). Yermack (2013) notes that Bitcoin operates more like a speculative investment than a currency, largely due to its high market capitalization relative to the volume of its economic transactions. Yermack (2015) also suggests that the volatility of Bitcoin hinders its usefulness as a currency.

Meanwhile, Glaser *et al.* (2014) note that most of the interest in Bitcoin stems from its asset-like nature rather than its currency aspect. Popper (2015) views Bitcoin as digital gold, while Bouri *et al.* (2017a) and Bouri *et al.* (2017b) emphasize its valuable investment characteristics. Muellerleile (2020) argues that Bitcoin is a hybrid asset because it is used simultaneously as a means of payment and as a speculative asset, giving it both currency-like and commodity-like characteristics. Overall, whether Bitcoin can be considered a currency remains a topic of ongoing discussion and research. Despite having certain characteristics of currencies, its unique features and challenges complicate its classification. In the following, these issues will be discussed and addressed in the light of the classical economic dimensions of a currency system.

2.3.2 Medium of Exchange

Medium of exchange is one of the three central functions of money in the economic theories (Mankiw, 2007). Physical and digital coins can fulfill such currency function by acting as an intermediary instrument in the process of exchanging goods and services in order to avoid the limitations of barters, where consumption and production needs have to be matched coincidently and exchanged simultaneously. Hence, to be an effective medium of exchange, money is required to be broadly acceptable in exchange for goods and services (Wolla, 2018). Theoretically speaking, the value of a medium of exchange can be described through following utility function $u(T) = (an + b)\int_{T}^{\infty} e^{-r(t-T)}dt = \frac{an+b}{r}$, where *T* is time, *a* and *b* refers to fixed parameters, *r* is the discount rate, $n = ln(\theta N)$, and $0 \leq \theta \leq 1$ is the share of agents using the medium as currency in the total population N (Luther, 2019, p. 190). The monetary value of using a particular currency as a medium of exchange depends on the share of other users willing to do the same and is expressed by the term *an/r* in the utility function equation. Using an item as a medium of exchange generates no advantages if no other people accept it; the more people that use the item, the more user benefits are generated; in the early stages, the marginal value of each new further user is large but decreases as the network grows. Therefore, $an = 0$ when $\theta N = 1$ then *n* rises with θN but at a shrinking proportion. Generally, *a* covers the essential characteristics of accepting an object as money. The function *b/r*, on the other hand, describes the non-monetary value and refers to the benefits that users might generate from an object apart from using it as a medium of exchange. Hence, the non-monetary value does not depend on the size of the user's network. For instance, fiat monies are per se valueless objects ($b=0$), however, when some users obtain non-monetary benefits from the banknotes and coins, e.g., through the design or the physical construction of the currency, the value of *b* would increase leading to $b/r > 0$ (Luther, 2019, pp. 190-191).[23]

[23] The \$20 bill of the United States can serve as an illustrative example. The \$20 bill has a large network ($n > 0$) with billions of users worldwide. It has properties such as durability, portability,

The acceptance of a newly introduced money as a medium of exchange is rather feasible in the presence of governmental authorities that declare a specific currency as a legal tender and require their populations to pay taxes and carry out transactions in that particular currency as well as by imposing penalties on the use of alternative monies ($\theta N > 1$ and $n > 0$, even if $b/r \leq 0$). In the absence of such sovereign authorities' mechanisms, new private currencies rely highly on non-monetary value in order to gain acceptance as a medium of exchange. The monetary benefits of newly launched private money are initially ($an = 0$) at the time of the users' network size ($\theta N = 1$). At this stage, nobody is willing to exchange goods or services in exchange for a private money that nobody else uses, even if the features of the object used *(a)* indicate that the object is perfectly suitable for the use as money. In this case, users would choose to use the new private currency only if they could obtain non-monetary benefits from its use ($b > 0$) (Luther, 2019, p. 189 and 191). According to Mises (1934) and Menger (1892) the emergence of money as medium of exchange has its roots from items that provide users with particular non-monetary advantages. "It follows that an object cannot be used as money unless, at the moment when its use as money begins, it already possesses an objective exchange value based on some other use" (Mises, 1934, p. 131).

Considering these characteristics in the context of Bitcoins, one can initially assert that the emerge of Bitcoin relies mainly on the coordination and foresight of the system developers, since the currency scheme is based on circulating abstract, intrinsically worthless, virtual items. It is only the belief that these items may be accepted by someone else for a higher value that allows the entire functionality. Thus, Johnson and Christensen (2014, p. 23) argues that "when Bitcoin was first invented, Bitcoins had no exchange value and were given away free just to generate interest. However, once the right entrepreneurs began to suspect that Bitcoins might actually be used as money someday, they were willing to pay dollars to have larger amounts than were available for free."

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and uniformity that make it a convenient medium of exchange. Its usability is further enhanced by the fact that it can be easily divided by exchanging it for smaller denominations ($a > 0$). Therefore, users benefit from using the $20 bill in transactions. Even though the physical $20 bill has no intrinsic value ($b=0$), some people appreciate the aesthetic value of the physical $20 bill. This aesthetic appeal, beyond its role as a medium of exchange, may be enjoyed by the general public and collectors alike, resulting in a positive non-monetary value ($b/r > 0$). See Luther (2016, 2018, 2019).

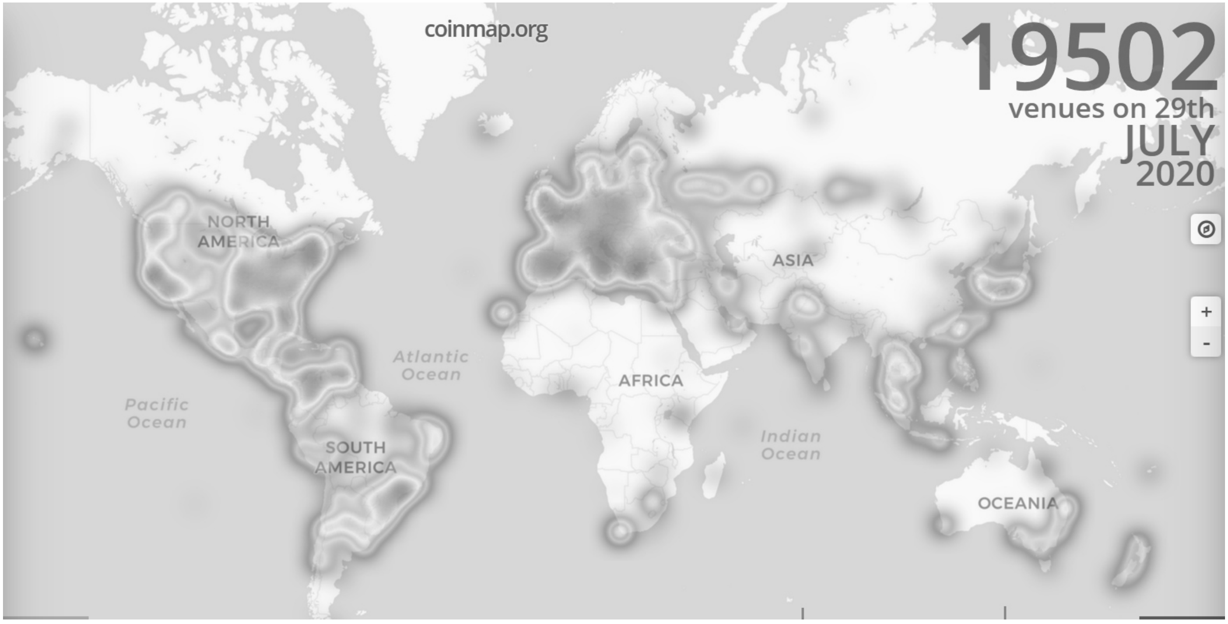
However, in the early stages of Bitcoins it may be possible to indicate a certain non-monetary value of acquiring the virtual coins. For example, such value could be psychological, sociological, or even political-ideological in nature (Luther, 2018, pp. 11-12). Graf (2013a) indicates the potential non-monetary value for individuals with a philosophical or scientific interest in cryptographic topics, technologists who value a difficult coding task or as a collector's item of significant personal value for individuals who are seeking digital objects in general or wishing to show the extent of their involvement in the Bitcoin anarcho-capitalist community through a display of membership and commitment. Moreover, Bitcoins seem to have an almost mystical and curious value, especially for newcomers who, unlike the developers and early users, usually do not understand the underlying functionality of the system, so that the use of Bitcoins by this group serves to promote their image of being technically well-informed and up-to-date. (Graf, 2013b, p. 28; Luther, 2018, p. 11).

Nevertheless, as soon as someone is willing to accept Bitcoin for the purchase of goods and services, it can be considered as medium of exchange (Hawle, 2018). The number of merchants and services that accept Bitcoin is growing. According to Coinmap (2023), there are approximately more than 32,000 venues around the world where customers can shop for goods and services with Bitcoin.[24] However, the effective figure of vendors accepting Bitcoin is estimated to be much higher, as Bitcoin is considered to be a legal form of means of payment in countries such as Japan (see figure 6). As the acceptance of merchants using the Bitcoin network for payments continues to grow, payment transactions, especially cross-border transactions, represent a further area of usability for Bitcoin. Hileman and Rauchs (2017, p. 75) reported that 86% of the surveyed network participants use Bitcoins as their main payment for cross-border transactions. In this context, international remittances are one of the most important applications of the blockchain technology. Bitcoin can be used by people who work or live abroad and send part of their earnings home to their families. Traditional transaction processors often apply high commissions for cross-border transactions, which reduces the amount of money the family receives. By using the Bitcoin network, they can be certain that the funds will reach their families in a

[24] The list of merchants accepting Bitcoin includes companies such as Microsoft, Dell, Expedia, Virgin Airlines, Zynga and Bloomberg (Hawle, 2018).

matter of a few hours, it is unmanipulable and the transaction fees are only a small portion of those of conventional processors (Carlozo, 2017).

Figure 6: Acceptance of Bitcoins as a Medium of Exchange Worldwide



Source: Coinmap.org

Moreover, crypto assets have been shown to be gaining traction in some economies due to economic hardship, in order to preserve savings in the face of currency devaluations and high inflation risks, or to make remittances. For instance, in the course of inflation pressures and fears of economic instability, the Turkish lira became one of the most traded currencies on the crypto markets in late 2021 (Ostroff and Malsin, 2022). In September 2021, El Salvador officially announced the implementation of Bitcoin as legal tender, making it legally equivalent to the US- Dollar. Given that 70% of the country's population is unbanked, the Salvadoran authorities argued that the adoption of Bitcoin in its territory would simplify remittances coming from abroad. In addition to legally recognizing Bitcoin as legal tender, the law also requires businesses to accept Bitcoin as a method of payment. In addition, other parties have argued that the use of Bitcoin as a currency may potentially result in economic instability in the country (IMF, 2022).

Hence, the cost efficiency associated with Bitcoins offers alternative payment option not only for some developing countries with underdeveloped banking systems such as Kenya or India but also for several users in developed countries. Some South Korean banks, for instance, have intensified their requirements regarding opening a bank account. Clients have to be willing to make monthly transaction of at least 400 US-Dollar to get a new bank account. As a result of the stricter rules, users have been encouraged to use alternatives such as Bitcoin for their transactions (Young, 2016).

Furthermore, in the context of functioning as a medium of exchange, the value of Bitcoin can be derived not only from its ability to facilitate transactions, but also through its potential utility for speculative activities. Thus, the perceived value of Bitcoin can be enhanced by the ability to buy Bitcoin at one price with the anticipation of eventually selling it at a higher price in the future, or to utilize it as an investment vehicle. As such, Bitcoin appears to share similarities with gold and other commodities in that it is a speculative asset whose value can experience significant fluctuations in a short period of time due to market dynamics and investor sentiment (Baur *et al.*, 2018). Such speculative aspects of Bitcoin may attract investors and traders looking to profit from price fluctuations, and this speculative demand may contribute to the perceived value of Bitcoin. Furthermore, the prospect of speculation can also affect the level of adoption and acceptance of Bitcoin as a medium of exchange. For instance, if users expect the value of Bitcoin to appreciate over time, they may be more willing to accept it in transactions, resulting in higher distribution and liquidity in Bitcoin trading communities (Gandal *et al.*, 2018). In turn, this speculative expectation may impact the perceived value of Bitcoin as a medium of exchange even beyond its transactional capacities.

2.3.3 Unit of Account

The current application of Bitcoin as a unit of account is entirely diverted from its function as a medium of exchange and is therefore of secondary significance. In practice, when merchants accept Bitcoin as a means of payment, they actually tend to quote prices in standard local currencies such as USD or EUR rather than Bitcoins. Additionally, many of them choose to hedge the exchange risk by instantly or frequently converting Bitcoin into the standard local currency that is used as a unit of account (Lo and Wang, 2014, p. 10). For instance, *BitPay*, the first payment service provider for Bitcoin, enables merchants to accept Bitcoin without being confronted with its volatility. *BitPay* receives incoming payments from customers, exchanges them into a fiat currency and then transfers the fiat money to the merchant's bank account (Hawle, 2018).

Moreover, in order for a currency to function as a unit of account, consumers must consider it as a numerical expression when comparing the prices of alternative commodities. In this context, Bitcoin faces a series of barriers on its transition to a functional unit of account. A major problem results from its extreme volatility. As the value of a Bitcoin varies greatly on a daily basis compared to other currencies, merchants willing to accept the coin would have to recalculate prices very often, a process that would be both expensive for the retailer and irritating for the end-user. Furthermore, the prices of Bitcoins are not only highly volatile but also tend to be sometimes inconsistent on the different exchange platforms at a certain point of time. Such price divergences are a fundamental breach of the law of one price (LOOP)[25], a situation that would be inconceivable to maintain in a developed currency market under the arbitrage mechanism (Yermack, 2015, p. 38).

One of the most recent obstructions preventing Bitcoin from emerging as a standard unit of account is the relatively high price of one Bitcoin relative to most other common products and services. This is a circumstance that has resulted from the steady rise in the value of Bitcoins in recent years. As a result, retailers now have to quote Bitcoin prices to four or more decimal places with leading zeros for most goods, making it difficult for consumers to comparing and calculate prices. However, such obstacle can be, for instance, solved through applying comprehensive visualized computing interfaces in e-commerce. Moreover, as the price of Bitcoin rises excessively above what is practical for everyday transactions, the network allows Bitcoins to be broken down into eight decimal units, which allows smaller quantities such as milli-Bitcoins (mBTC) or micro-Bitcoins to be traded (μBTC) (Yermack, 2015, pp. 38-39).

[25] The law of one price is a key concept in terms of understanding price formation and market efficiency. It indicates that the same good or asset should have the same price in all markets, after taking all relevant costs into account. The law reflects market efficiency and the absence of arbitrage opportunities. See, for instance, Rashid (2007).

2.3.4 Store of Value

Under the concept of currency as a store of value, the owner receives the currency at a certain point of time and then trades it for goods and services at a later time of his preference. As soon as the currency is going to be spent, the holder expects to receive at least the equivalent economic value of the currency at the time of its acquisition (Mankiw, 2018; Yermack, 2015, p. 39). Gold, for instance, has historically been considered as a store of value. On the other hand, the volatility of Bitcoins has been considered as the main obstacle to fulfilling the function of a store of value. However, a comparison between the volatility of gold in the early stages of the post-gold standard era in the 1970s and the current volatility of Bitcoin allows for a certain degree of parallelism (Hougan, 2018). When Richard Nixon abolished the gold standard in the US in 1971, a period of extreme volatility followed, as gold struggled to emerge as an autonomous store of wealth. As a result, the price of gold rose 73% in 1974 before falling 24% in 1975. Another example of volatility took place in 1981, when the price of gold lost 33% of its value. This drop came after a period of significant growth, as gold had risen 121% in the previous two years (Hougan, 2018). These fluctuations underscore the challenges that gold has faced in establishing its autonomy in the post-gold standard era, and highlight the difficulty of maintaining a consistent store of value during transitional periods. In this context, Hougan (2018) argues that gold and Bitcoins are following the same path, as each new store of value is characterized by a rapidly appreciating price that slows down over time and an initially high but continuously declining volatility that leads to a long-term steady state. Gold has some use as an industrial metal and in jewelry making, but for those uses alone it would not trade at 1,900 US-Dollar an ounce. It has that value because that is what people are willing to pay for an asset that stores their wealth. This analogy can also be applied to the case of Bitcoins, where the coin prices go beyond the expected utilization of the payment technology provided and move toward the consideration as a potential store of value.

Historically, considering money as a store of value implied the essential function of protecting it from being stolen, either by hiding it physically or depositing it in a bank. Bitcoin has certain advantages when compared to gold as a store of value. With Bitcoin, an individual seeking to store a substantial sum of money can carry and transfer it with him anywhere as opposed to gold, which is weighty and expensive to transport. In addition, the verifiability, divisibility and scarcity of Bitcoin are greater than those of gold. The private key enables Bitcoin to easily prove its originality and ownership in a verifiable manner. In addition, the Bitcoin protocol is designed so that only 21 million BTCs will ever exist. On the other hand, there is only a marginal scarcity of gold, as approximately 32,000 metric tons are mined each year, which represents 1.7% of the total amount of gold supply each year (Hawle, 2018). However, in the case of Bitcoins, the storage is maintained through digital computer accounts, the crypto wallets, and the security of these wallets has become a significant concern for the Bitcoin industry, as a considerable number of Bitcoins users have lost their digital credits through online frauds (Yermack, 2015, p. 40). In fact, even Bitcoin's exchange platforms have been subject to frequent cyber-attacks and hacking. One of the most notable cases is the crash of the major Bitcoin exchange, MtGox, in February 2014, which reportedly resulted in the loss of 850,000 Bitcoins (Ciaian *et al.*, 2016).[26]

A critical element that adds to the ongoing discourse on Bitcoin as a store of value is the consideration of government access to traditional currencies and the underlying motivations that drive individuals to hold Bitcoin (Baldwin, 2018). Traditional fiat currency systems typically allow governments to exercise significant regulatory power, raising concerns about individual financial autonomy and data privacy. Bitcoin, on the other hand, operates on a decentralized network based on blockchain technology, effectively offering an alternative monetary system that is completely independent of direct government control. For instance, it has been argued that the decentralized nature of cryptocurrencies and their pseudonymous transactions may allow for a certain degree of privacy and security with respect to government surveillance, a concern among individuals who prioritize financial privacy and distrust government control over monetary systems (Narayanan *et al.*, 2016). In addition, the transparency and immutability of blockchain transactions may also provide a degree of trust to those users who perceive the system to be more transparent and tamper-

[26] The case of QuadrigaCX is a similar example to the Mt. Gox scam. QuadrigaCX was a Canadian cryptocurrency exchange, which made headlines in 2019 following the accidental death of its CEO, Gerald Cotten. According to the report, the incident resulted in the loss of approximately $190 million worth of cryptocurrencies, mostly belonging to QuadrigaCX customers. Upon the incident, it was revealed that the CEO had exclusive access to the exchange's cold wallets, in which the majority of customer funds were stored. The exchange was unable to meet withdrawal demands without access to the wallets (Alexander, 2020).

resistant than traditional financial institutions (Swan, 2015). All of this may contribute to the perception of Bitcoin as a store of value for individuals seeking alternative financial systems with less oversight and more transactional autonomy.

However, it is important to note the counterargument regarding Bitcoin's potential as a store of value. As Bitcoin becomes more widely accepted, governments may respond by tightening regulations in this area. The growing popularity of Bitcoin and its ability to disrupt existing monetary and regulatory frameworks may be perceived as a direct challenge to the monetary sovereignty of governments. As a result, authorities may be reluctant to accept cryptocurrencies as an alternative form of payment in the future and seek to regain control over this emerging financial space. Because cryptocurrencies, unlike traditional remittance methods, are processed through a purely electronic medium that bypasses national borders, this can create potential drawbacks for governments. These include the loss of seigniorage revenues associated with the creation and distribution of physical currency, increased difficulty in controlling the money supply and interest rates through monetary policy, and the inability to implement effective fiscal policies and tax systems. Therefore, these factors could affect government finances and hinder the ability to deal with inflationary or deflationary periods (Hairudin *et al.*, 2022).

However, when assessing the potential of Bitcoin's utilization as a store of value, it is crucial to consider the patterns of Bitcoin supply and demand. While the supply of Bitcoins is entirely anticipated and is expected to continue to grow until 2040 and maintain at that level, the demand for Bitcoin is unpredictable both in the short-term as well as after 2040. Therefore, it remains challenging to anticipate the future value and utilization of Bitcoin. However, the deflationary mechanism inherent in the system makes it more likely that Bitcoins will be utilized as a store of value and as an investment asset, rather than as a medium of exchange (Baur *et al.*, 2015).

2.3.5 Bitcoin as an Asset Class

The line between money, currency and financial assets cannot always be categorically differentiated. In a certain way, money is a financial asset – an asset that is highly liquid and therefore used for the purpose of making payments but generally yields only little or no interest-income. Most other financial assets are less liquid; however, they have the inherent potential to generate income. Individuals often buy stocks or bonds, for instance, in their anticipation that they will earn interest, receive dividends or sell the assets at a later date for a higher price. Hence, the anticipated monetary or non-monetary returns of the investment asset are typically the key determinant for investment. In this context, financial indicators such as dividends, yields, expected returns, financial stability, interest rates or future price expectation are often used in the assessment of a particular investment. Besides the monetary factors, a variety of non-monetary indicators such as ethical and social aspects can influence investments decisions. However, even among socially responsible investments, individuals still consider the financial yield to be just as important as among non-socially responsible investments. Thus, investigations indicate that for instance, despite valuing ethics and social responsibility, the anticipated financial payoff clearly represents the key incentive for investment decisions (McLachlan and Gardner, 2004). In this context, the high valuation of Bitcoin indicates that market participants either see a non-monetary value in the possession of the crypto-asset that exceeds the cash payments (accordingly, they are prepared to hold the asset despite a lower expected future return), or they believe that the price will continue to rise forever, so that the price appreciation in itself provides a competitive return. The former phenomenon is referred to as the "*convenience yield*" [27], the latter as a "*rational bubble*"[28] (Cochrane, 2018).

[27] The term "*convenience yield*" refers to the non-monetary benefits associated with ownership of the physical asset, such as the availability to use or consume it, or the reduced risk of supply shortages or quality problems. It does not include any appreciation of the good and is used only to describe the benefits or advantages associated with owning a physical asset, such as a commodity, rather than a financial instrument that represents ownership of the asset, such as a forward contract (Chiou Wei and Zhu, 2006). The term *"convenience yield"* was introduced by economist Nicholas Kaldor to explore the theory of storage in the context of financial markets (Kaldor, 1939).

[28] The concept of a "*rational bubble*" is a controversial and often complex approach in economics that refers to a circumstance in which asset prices rise to unsustainable levels because of the assumption that others will continue to buy the asset, rather than because of underlying economic fundamentals. A *"rational bubble"* occurs when traders are ready to accept higher prices for an equity than what may be warranted by the discounted flow of future dividends. When traders assess the potential returns arising from equity price appreciation as justification for a shift from the fundamental value of the equity, a self-enhancing mechanism of price appreciation may occur, which is however compatible with rational expectations (Clive Jones, 2015). One of the early references to the concept of a rational bubble can be found in the work of Hyman Minsky, who advocated that financial markets are inherently unstable and prone to bubbles. In his 1982 book "Can It Happen Again? Essays on Instability and Finance," Minsky explores the idea that bubbles can be rational to the extent that they are based on expectations of future price increases (Minsky, 2016).

Although Bitcoin was initially designed to serve as a currency, a general consensus within the economic research discourse regarding a characteristic categorization of cryptocurrencies is still not reached. While certain features of cryptocurrencies entail them to be classified as currency, some features lead them to be regarded as a commodity (Yermarck, 2018; Baur *et al*., 2018; Ram, 2019). Recent studies show that the analogies between cryptocurrencies and gold in particular are strong and suggest that it is more appropriate to consider cryptocurrencies as an asset rather than a currency (Baur *et al.,* 2018). As such, cryptocurrencies are accepted as a new investment vehicle that is not only a means of payment, but also seen as a new investment tool that investors can add to their portfolios alongside traditional assets such as equities, bonds and gold (Glaser *et al.*, 2014). In this context, Dyhrberg (2016) and Baur *et al.* (2018) indicate that cryptocurrencies emerge as an investment instrument particularly in cases of market negative shocks, as well as for risk management purposes. Due to lower correlation with the other asset classes, cryptocurrencies might represent an alternative form of investment that can be used by investors within a diversification strategy to minimize the overall risk of a portfolio (Kamisli, 2019, pp. 334-337). Indeed, Bitcoins have increasingly attracted the interest of diverse institutional and cooperate investors. As of 2020 there are more than 150 active crypto hedge funds (PwC, 2020, p. 6). In October 2021, the first exchange traded fund (ETF) for crypto assets was launched and initiated trading on the New York Stock Exchange. The *ProShares* Bitcoin futures ETF (ticker BITO) drew over $1 billion in investments in its first two trading days, the most rapid mark ever reached by an ETF (Financial Stability Board G20, 2022, pp. 4-5; Greifeld, 2021). A recent example of the adoption of Bitcoin as an investment vehicle by the corporate sector is the engagement of Tesla in the crypto-market and the use of Bitcoins to achieve the company's financial target in 2021 (Ossinger, 2021). Moreover, in 2017, as Bitcoins became one of the most traded assets globally, CBOE and CME, the world's largest futures exchanges, launched Bitcoin futures, stating that these contracts, analogous to other futures, could deliver more price transparency, value tracking and a risk management instrument for Bitcoin (Sebastião and Godinho, 2020).

2.3.6 Further Financial Applications

Furthermore, Bitcoin triggered an impulse for the establishment of other cryptocurrencies. The feasibility of using such encrypted assets for electronic monetary transactions led to the emergence of a parallel financial system that aims to recreate traditional financial activities in a decentralized, open, and autonomous manner. In this context, the so-called "decentralized finance" or *Defi* has emerged offering decentralized banking services based on the applications of the blockchain technology and the implementation of cryptocurrencies. The majority of *DeFi* applications are built on the Ethereum protocol, which allows the creation of smart contracts[29] (OECD, 2022). One of the most popular types of applications that are part of the *DeFi* system are open credit protocols, also known as decentralized credit protocols. The primary goal of open credit protocols is to provide individuals and businesses with direct access to credit services, eliminating the need for traditional financial intermediaries such as banks. By facilitating peer-to-peer lending, borrowing, and other credit-related activities on the blockchain, these protocols enable participants to engage directly in credit transactions. In addition to increasing accessibility and potentially reducing costs for both borrowers and lenders, this decentralized approach provides the security of cryptographic verification methods. Other potential benefits include instant transaction processing, the ability to collateralize digital assets, the absence of credit assessment requirements, and the potential for standardization (Born *et al.*, 2022). Start-ups such as *Compound* and *Aave* gained attention in the crypto ecosystem by enabling users to borrow cryptocurrencies or lend their crypto holdings and collect interest (Schueffel, 2021). Credit marketplaces on the blockchain promise to reduce counterparty risk, make borrowing and lending cheaper, faster and available to more people. However, the focus of many traders is to invest their cryptocurrencies at the highest possible interest rates. The term *yield farming*[30] is used to describe this trend. In the DeFi system, investors

[29] A smart contract is a self-executing agreement written in code that automatically executes and enforces its terms and conditions when a pre-determined set of conditions is met. Smart contracts operate on blockchain platforms such as Ethereum, eliminating the role of intermediaries and allowing for transparency and immutability. They offer efficiencies and cost savings, and can be applied across multiple industries (Frankenfield, 2023a).

[30] Yield farming, or liquidity mining, refers to a practice in the world of cryptos where participants earn premiums by providing liquidity to decentralized finance (*DeFi*) platforms. It consists of lending or staking cryptocurrencies in exchange for receiving additional tokens or rewards. Through participation, users contribute to the platform's liquidity and obtain tokens as

have the opportunity to generate two kinds of profits. First, they can earn interest on their deposits. Second, they obtain tokens of the service provider's own cryptocurrency as an additional benefit.[31] Borrowers in the *DeFi* system, on the other hand, face certain limits on the amount of funds they can request. These limits are determined by various parameters such as the amount of collateral they have accumulated, the assets they have deposited, or even community ratings (Ramos and Zank, 2020). Moreover, the use of *DeFi* application might reduce underwriting and legal fees of the mortgage process and lower insurance premiums, due to eliminating the need for intermediaries and allowing risk to be spread across many participants (Makarov and Schoar, 2022).

DeFi differs from traditional finance primarily in its approach to service operation rather than in the types of services it offers. As shown in Table 1, specific services are classified into trading, lending, and investment functions to emphasize that *DeFi* encompasses these core service areas just as traditional finance does (Aramonte *et al.*, 2021).

incentives. However, there are risks associated with yield farming, such as market volatility and smart contract vulnerabilities (OECD, 2022).

[31] For instance, the value of Aave token, a *DeFi* application's cryptocurrency, surged from 4 US Cents in 2017 to over 600 US Dollars in 2021 before falling to under 100 US Dollars by the end of 2022, demonstrating the volatile nature of such tokens (CoinMarketCap, 2023).

Table 1: Crypto vs. Traditional Financial System

Function	Service	Crypto financial system: Decentralised finance (DeFi)	Crypto financial system: Centralised finance (CeFi)	Traditional finance
Trading	Funds transfer	DeFi stablecoins (DAI)	CeFi stablecoins (USDT, USDC)	Traditional payment platforms
	Asset trading	Crypto asset DEX (Uniswap)	Crypto CEX (Binance, Coinbase)	Exchanges and OTC brokers
	Derivatives trading	Crypto derivatives DEX (Synthetix, dYdX)		
Lending	Secured lending	Crypto decentralised lending platforms (Aave, Compound)	Crypto centralised lending platforms (BlockFi, Celsius)	Broker-dealers active in repo and securities lending
	Unsecured lending	Crypto credit delegation (Aave)	Crypto banks (Silvergate)	Commercial banks and non-bank lenders
Investing	Investment vehicles	Crypto decentralised portfolios (yearn, Convex)	Crypto funds (Grayscale, Galaxy)	Investment funds

CEX = centralised exchanges; DEX = decentralised exchanges; OTC = over-the-counter; USDC = USD Coin; USDT = Tether.

Source: Aramonte *et al.* (2021, p. 23)

Among the most important *DeFi* applications are arguably decentralized exchanges (*DEXs*). These platforms have gained considerable attention and emerged as the fastest-growing sector within the *DeFi* ecosystem. A key advantage of *DEXs* over centralized exchanges is that users retain control of their private keys. In contrast, when users deposit their crypto tokens with centralized exchanges, they relinquish ownership and are exposed to exchange risk. *DEXs* allow users to trade digital assets without the need for a trusted intermediary (like an exchange) to manage their funds. Trading on *DEXs* operates through smart contracts, effectively eliminating counterparty risk for investors. Because they require much less maintenance, decentralized exchanges usually have lower trading fees than centralized exchanges. Additionally, transactions on DEXs settle instantly upon confirmation and inclusion on the blockchain, providing efficiency and transparency to participants (Makarov and Schoar, 2022, p. 23).

Moreover, *DEXs* can also be used to enable the issuance and ownership of a variety of conventional financial instruments. For instance, asset tokenization involves digitally replicating real-world assets on distributed ledgers or issuing traditional assets in a token form. This approach, which leverages DLT and smart contracts, promises benefits such as automation, transparency, improved liquidity, and faster clearing and settlement. Tokenization also enables fractional ownership, which makes assets more accessible to retail investors and allows global capital to reach previously inaccessible markets. Further schemes can enable the creation of derivatives, synthetic assets, decentralized prediction markets and much more (OECD, 2020a).

The rise of *DeFi* applications and the absence of central bank digital currency (*CBDC*)[32] have led to a significant demand for a new type of crypto-protocol-based assets, the so-called "*stablecoins.*"[33] Stablecoins are a category of cryptocurrency constructed to maintain a stable value by pegging their price to a specific asset, such as fiat currencies (e.g., US Dollar), or commodities (e.g., gold) (Makarov and Schoar, 2022, p. 20). They serve as a key part of the *DeFi* ecosystem, facilitating more effective asset transfers and acting as a bridge between the crypto and traditional financial systems. Issuers of stablecoins receive assets as collateral for issuing stablecoins, and the expansion of their balance sheets is primarily determined by the demand of investors. Stablecoins emulate banknotes, but lack public guarantees such as deposit insurance and rely solely on private collateral. Other types of *DeFi* stablecoins attempt to reduce price volatility with respect to a fiat currency by employing algorithmic mechanisms rather than relying on collateral. Such stablecoins adjust their supply of tokens based on market demand. In 2021, the circulation value of stablecoins have surged to approximately 120 billion US-Dollar, indicating their

[32] Central bank digital currency (*CBDC*) describes a digital form of a sovereign currency, issued and controlled by the central bank. The CBDC is a digital representation of the national currency that runs on a blockchain, or centralized digital ledger. The aim of *CBDCs* is to combine the benefits of Bitcoin with the trust and stability associated with traditional fiat currencies. *CBDCs* are considered a potential tool to increase financial inclusion, improve payment efficiency and address emerging challenges in the context of the emerging digital economy (Bank for International Settlements, 2018a; Auer *et al.*, 2022b).

[33] Stablecoins can be classified as centralized (CeFi), administered off-chain by intermediaries, or decentralized (DeFi), maintained on-chain. While DeFi stablecoins are backed by overcollateralized crypto assets recorded directly on-chain, CeFi stablecoins rely on reserves and assets managed by intermediaries (Aramonte *et al.*, 2021, pp. 23-25).

remarkable growth and increasing relevance in the crypto industry (Aramonte *et al.*, 2021, pp. 24-25).

Nevertheless, the crypto-based *decentralized financial* applications are considered to face several challenges and obstacles. The first are technical risks: *DeFi* depends strongly on the functionality of smart contracts and the underlying blockchain protocol. Therefore, false or inaccurate transactions on the blockchain are considered to be non-reversible. Second, there are suitability risks: The usability and user experience of *decentralized financial* protocols are often complicated, unintuitive and aimed primarily at target crypto-native users. As such, a large proportion of *DeFi* products demand that users manage multiple tokens across their own wallets, which leads to a certain degree of complexity for most ordinary investors. Third are centralization risks: Several *decentralized financial* applications have been introduced by a particular business unit or enterprise rather than being effectively decentralized, although once implemented, they typically work to decentralize governability and facilitate decentralized decisions. However, to the extent that an application is semi-centralized, there is counterparty risk and the intermediary in charge of the assets might make fraudulent use of the funds. Fourth are liquidity risks: Liquidity is essential for efficient price formation in any financial market. However, liquidity in *DeFi* protocols are presently being overtaken by centralized market making solutions involving many low-fee liquidity providers, which stabilize financial services in the traditional way. In periods of uncertainty, the Bitcoin network experiences massive overloads, so that arbitrageurs and liquidity providers are unable to maintain prices in equilibrium on the various trading platforms, leading to major disruptions on the individual exchanges, which in turn sparks uncertainty and causes the markets to collapse. Fifth are regulatory risks: In most jurisdictions, decentralized financial schemes operate effectively under no license, irrespective of the location of the end user. Moreover, in terms of taxation, the treatment of *DeFi* assets lacks clarity in the vast majority of territorial legal systems (Grigo *et al.*, 2020, pp. 15-19).

The vulnerabilities associated with the under-institutionalization of decentralized finance (*DeFi*) have been exposed by a series of events, ranging from the collapse of the Terra/Luna stablecoin ecosystem to the bankruptcy of FTX. This meltdown has followed a typical pattern seen in financial crises, where an asset bubble bursts, causing the downfall of highly leveraged market participants, which leads to a cascade of defaults. Such events emphasize the importance of institutions and their structure, regulation, and decision-making mechanisms (Judge *et al.*, 2023, p. 4).

The collapse of the Terra/Luna[34] stablecoin ecosystem set off a chain reaction that unfolded as follows: The Terra ecosystem featured the Anchor Protocol and offered high-yield farming opportunities that attracted significant levels of investment. However, due to the unsustainability of the 20% interest rate offered by the protocol, a run occurred in May 2022, and the value of Terra/Luna plummeted to zero. As a result, the founder of Terra Labs, Do Kwon, was charged with securities fraud (Viswanath-Natraj and Chaudhary, 2022; Briola *et al.*, 2023; Judge *et al.*, 2023). The subsequent event that intensified the meltdown involved the crypto hedge fund Three Arrows Capital (3AC), which was exposed to approximately $500 million in losses on Terra/Luna investments. 3AC's default triggered a chain reaction of defaults among its counterparties, as it was unable to meet margin calls. As a result, 3AC filed for bankruptcy in July 2022, with its founders reportedly fleeing to Dubai (Sigalos, 2022; Wieczne, 2022; Judge *et al.*, 2023).

This wave of financial distress then quickly expanded to other crypto lending platforms and exchanges. Voyager, a cryptocurrency broker, declared bankruptcy after 3AC defaulted on a $650 million margin loan (Goswami, 2022). Celsius, a fellow crypto lending platform, similarly filed for bankruptcy, uncovering an unsustainable business model and suspicious operating practices (Oliver and Shubber, 2023). Meanwhile, a report released by the Financial Stability Oversight Council (FSOC) (2022) highlighted the significant interconnectedness between crypto asset firms and companies with high-risk profiles as well as non-transparent capital and liquidity exposures. In November 2022, high-profile crypto exchange platform FTX filed for bankruptcy, triggering significant losses and leading to one of the largest single exchanges failures in history. FTX's uncollateralized creditors included crypto lending platforms such as BlockFi and Genesis, which suspended

[34] The Terra/Luna ecosystem describes a stablecoin framework within the cryptocurrency market, where TerraUSD (UST) serves as an algorithmic stablecoin. In tandem with its associated cryptographic asset, Luna, algorithmic stablecoins rely on algorithmic protocols to manage the circulation of the stablecoin and maintain a predetermined target value, typically pegged at $1. Participants in the Terra/Luna ecosystem have the ability to convert 1 UST into an equivalent value of Luna and vice versa, leveraging an arbitrage mechanism to maintain the stability of the pegged exchange rate (Judge *et al.*, 2023, p. 4; Briola *et al.*, 2023; Viswanath-Natraj and Chaudhary, 2022).

their withdrawals and ultimately ended up filing for bankruptcy (Yaffe-Bellany, 2023; Judge *et al.*, 2023, pp. 4-5). In summary, although often presented as a reaction to the excesses of the traditional financial system exemplified by the 2008 crisis, *DeFi* has not fully addressed the problems it seeks to overcome. Rather, over the past decade, decentralized finance has revealed certain risks and vulnerabilities within its ecosystem. In particular, it has inherited some of the negative aspects of the system it sought to replace, such as lack of transparency, self-dealing, manipulation, fraud, corruption, and favoritism of insiders over retail investors (Judge *et al.*, 2023, p. 7).

Furthermore, another topic of debate and concern in this context is the issue of independence from government authorities surrounding Bitcoin and other cryptocurrencies. Supporters of cryptocurrencies claim that they provide a means to store value and conduct transactions independent of government intervention, as they are not subject to traditional banking regulations. This has led to the perception that cryptocurrencies, such as Bitcoin, may offer a potential vehicle to bypass government control over traditional forms of money, and are thus seen as a feasible alternative to fiat currencies issued by central banks (Gans and Halaburda, 2018). For example, it has been advocated that the decentralized nature of cryptocurrencies and their pseudonymous transactions may allow for a certain degree of privacy and security with respect to government surveillance, a concern among individuals prioritizing financial privacy and distrusting government control over monetary systems (Narayanan *et al.*, 2016). Additionally, the transparency and immutability of blockchain transactions may also provide a degree of trust and reliability to those users who perceive the system to be more transparent and tamper-proof than conventional financial institutions (Swan, 2015). This perspective, however, is subject to counter-arguments. Some authors argue that increased regulation of cryptocurrencies, including Bitcoin, does not necessarily indicate government control or exposure, but rather a measure to guarantee the adherence to current laws and regulations, such as anti-money laundering (AML) and know-your-customer (KYC) regulations (Böhme *et al.*, 2015). Such regulations are designed to prevent illegal activities, like money laundering or the financing of illegal activities, and are implemented in order to safeguard the interests of the public and to maintain the stability of the financial system. Nevertheless, the emerging regulatory framework around cryptocurrencies remains a subject of ongoing research and debate, and additional considerations are required in order to better comprehend the dynamics between cryptocurrencies and authorities.

2.4 Conclusion

The emergence of cryptocurrency has been a notable financial innovation in recent times, driven by blockchain technology's decentralized operation and its potential to digitize the financial industry. However, cryptocurrencies, including Bitcoin, still lack certain standard monetary characteristics needed to be on a par with traditional currencies. On one hand, the cryptographic framework behind cryptocurrencies aims to prevent manipulation of money and currency, reducing the risk of monetary shocks associated with fiat currency systems. Additionally, the consensus mechanism in Bitcoin promotes financial democratization. On the other hand, challenges such as cyber-attacks, energy consumption in mining, and potential misuse for illicit activities hinder the mainstream adoption of cryptocurrencies. Nonetheless, the transformative potential of cryptocurrencies and blockchain technology in reshaping the financial landscape remains significant. In this regard, Bitcoin cannot be considered as a currency in the traditional economic sense. Rather, it is regarded as an innovative technological financial asset that can function as a medium for investment, as an asset class for wealth diversification or as a tool for financial speculation. Thus, cryptocurrencies are defined in the context of this study as a digital-based alternative investment instrument that can be employed by investors either as a portfolio component alongside traditional assets such as stocks, bonds and gold, or as a purely speculative investment vehicle with the aim of promptly achieving individual financial goals. This perspective acknowledges Bitcoin's unique characteristics and its potential applications within the financial domain, while recognizing that it does not possess all the essential attributes typically associated with a conventional currency.

There has been a remarkable and widespread surge in the popularity of cryptocurrencies over recent years, capturing the interest of both individual and institutional actors. The increasing interest in utilizing cryptocurrencies can be attributed to a diverse array of motivations. At the individual level, these incentives encompass wealth accumulation, financial speculation, and ideological beliefs among retail investors. Within the institutional sphere, portfolio diversification has emerged as a driving force in the realm of financial management. It is noteworthy that even monetary authorities have contemplated the integration of blockchain technology into conventional monetary policies, with discussions underway regarding the potential introduction of central bank-based cryptocurrencies.

Thus, the adoption dynamics of cryptocurrencies as a technology-based financial innovation among different user groups is a complex phenomenon that demands comprehensive investigation. In order to gain insights into the reasons for the widespread diffusion of cryptocurrencies, in the case of this study the adoption of Bitcoin in Korea, the following chapter presents the necessary theoretical framework for conducting an in-depth analysis. This framework includes the exploration of different drivers among users and the examination of socio-economic variables that shape their decision-making processes. This allows for a deeper theoretical understanding of technology acceptance in general and cryptocurrencies adoption in particular.

3 Theories of Technology Acceptance and Diffusion

This study focuses not only on the economic and institutional factors contributing to the distribution of the Bitcoin technology in Korea, but also and especially on the social and socioeconomic components in order to better understand the complexities of the behavior of Bitcoin users in Korea with respect to the adoption and acceptance of this new technology. For this purpose, theories of technology acceptance and diffusion are used as methodological foundation, as they provide important additional information that extends beyond the macroeconomic framework conditions for the use and success of technological innovations. After a definition of the most relevant terms “acceptance” and “technological innovation”, this chapter presents the development of diffusion theory and technological acceptance models in order to then develop a comprehensive research method for examining the adoption and use of the Bitcoin technology in Korea that also takes into account current transformation processes of the digital change.

3.1 Conceptual Framework

For the implementation of a technological innovation, in the case of this study the use of Bitcoin technology in Korea, user acceptance is an essential prerequisite. In research, different approaches and theories have been developed to find tools to measure the different influences, which is why users decide to adopt and use a technological innovation. Before these theories are presented and discussed in detail, a general definitional explanation of the terms “acceptance” and “technological innovation” will be provided.

The economic approach to the concept of acceptance derives primarily from social analysis (Lucke, 1995). In sociology, the term “social acceptance” is usually defined as a “process of learning about, accepting, and adapting to an innovation” (Bell, 2014). Within the field of economics, the concept of technology acceptance was developed primarily in the context of sales strategies for products (Wilhelm, 2012, p. 15). There is no unified definition of the concept of technology acceptance in economic research literature due to the different areas and contexts of use and perspectives. Nevertheless, it can be stated that in the different approaches of technology acceptance models the term acceptance is either defined as adoption and use of a technology, the intention to use a technology or the actual use of a technology (Leps, 2016, pp. 17–18; Rogers, 2003, p.168). Daniel B. Wilhelm, who focused in his study on the user acceptance of web-based applications, defined the acceptance of a user towards IT applications as a condition that expresses itself through the acceptance and use of these applications. According to Wilhelm, this state can be both intrinsically and extrinsically motivated and can take on different forms over the course of a period of time (Wilhelm, 2012, p. 17). Technology acceptance research thus defines acceptance not only as a positive attitude toward a technological innovation, but also as an intention and action to use. However, this intention or action to use may fluctuate over time. A measurable indicator of acceptance can be the intensity of use, which by definition does not always correspond to the intention to act.

From a technological-economic perspective, innovation is usually understood according to the OECD definition as follows:

> "Technological product and process (TPP) innovations comprise implemented technologically new products and processes and significant technological improvements in products and processes. A TPP innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation). TPP innovations involve a series of scientific, technological, organizational, financial and commercial activities." (OECD, 2017, p. 31)

The OECD definition is being applied in order to make the factor innovation quantifiable by means of the above-mentioned indicators and thus to be able to statistically measure the innovation rate of an economy and compare it with other economies. The OECD differentiates between product innovations, which include goods and services, and process innovations, which arise from the use of new technologies and the reorganization of operational procedures and production processes (OECD, 2017, pp. 31-32). In this definition, the introduction of Bitcoin technology is a product innovation as well as a process innovation since it has the potential to transform an existing market - the financial market - in the long-term by means of a digital technological innovation. Contrary to a societal innovation, in this technological-economic perspective of the OECD phases of an innovation process - from research to the discovery of a phenomenon or invention of a technology up to the development into a distributable product or process - are only considered as stages of an innovation process when the respective product reaches the market or the respective process is applied in the economy (Braun-Thürmann, 2005, p. 18). The process of introducing and distributing innovations in the market is examined at the micro and the macro level by the diffusion theory, which originates from the fields of sociology, communication sciences and business administration.

3.2 Diffusion of Innovations

Diffusion theory has its bases in social sciences and addresses the analysis of the diffusion and adoption of innovations, whether they are information, processes or products. In this theory-based sociological perspective, diffusion is initially understood primarily as the result of a social process, in the course of which informers or users of new products or processes inform and influence other potential adopters. The evolution of diffusion theory goes back a long way, starting as early as the turn of the twentieth century. In 1890, the French sociologist Gabriel Tarde brought the interrelation of invention and imitation into the focus of his theory of social development and already noted some of the phenomena that are still essential for diffusion research today, such as the important role of opinion leaders and the development of successive increases of imitation or adoption of an innovation, which culminates in the typical S-shaped curve of diffusion (Tarde, 1890). Further origins of diffusion theory can be traced back to cultural anthropology, medical sociology and geography (Simmel, 1905; Coleman *et al.*, 1957; Hägerstrand, 1952).

Empirical studies on diffusion theory, however, did not take place until decades later. In 1943, the agricultural sociologists Bryce Ryan and Neal C. Gross published their study on the diffusion of hybrid seed corn, thus forming the methodological research framework for analyzing diffusion in wide geographical areas and within extensive social structures (Ryan and Gross, 1943). According to Gary Meyer, one can summarize their methodology as follows: "1. quantitative data, 2. concerning a single innovation, 3. collected from adopters, 4. at a single point in time, 5. after widespread diffusion had already taken place" (Meyer, 2004, p. 59). Furthermore, behavioral theories from social psychology have developed models to empirically analyze the factors that determine individual adoption decisions.[35]

[35] For instance, the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB); see: Fishbein (1975); Ajzen (1985).

Since the 1970s, the position has become increasingly accepted that diffusion cannot be explained as a mere result of communication and social interaction of users, but that the essential influence of marketing measures and other factors must be taken into account. Furthermore, it is essential to integrate the digital change in communication technologies that has taken place in recent decades as an influencing parameter in the analysis.

Diffusion processes of technological innovations arise because not all potential users adopt an innovation, such as a new technological product or a new technological process, immediately after its market launch, but rather different users adopt the innovation only gradually, i.e., distributed over time. The classical diffusion model, which methodically analyzes the diffusion process, i.e., the temporal distribution of the adoption, was developed by the sociologist Everett M. Rogers. His seminal publication "Diffusion of Innovations" (1962) consolidated the diverse threads of diffusion theory and established important principles for further diffusion research. Rogers describes the decision process of adopting or rejecting a technological innovation as a social process:

> "*Diffusion* is the process in which an innovation is communicated through certain channels over time among the members of a social system. […] Diffusion is a kind of *social change*, defined as the process by which alteration occurs in the structure and function of a social system. When new ideas are invented, diffused, and adopted or rejected, leading to certain consequences, social change occurs" (Rogers, 2003, pp. 5-6).

Based on the theoretical foundation and comprehensive overview of numerous publications on diffusion studies, Rogers provides an inductive generalization of existing approaches, which as a theoretical foundation refers to an analogy of the so-called S-M-C-R-E formula by political scientist and communications theorist Harold Dwight Lasswell, describing communication processes as follows: Who [*Source*] says what [*Message*] in which *Channel* to whom [*Receiver*] with what *Effects*? (Lasswell, 1948). By defining diffusion as a parallel to the communication process as formulated by Lasswell, the inventor replaces the source, the innovation the message, diffusion channels the channels, the adopter the receiver and adoption the effects (Rogers and Shoemaker, 1971, p. 20). In addition to this analogy with communication theory, it must of course also be stressed that communication channels –

especially mass media – play an essential role in the diffusion of technological innovations within society. It is important to define communication not as a linear, one-way sender-receiver model, but as a two-way model of convergence (Rogers, 2003, p. 6). Even if the linear communication model is able to depict certain forms of diffusion, e.g., authority innovation-decisions, this model is not sufficient when it comes to other decision processes such as optional innovation-decisions or collective innovation-decisions.[36] In addition, one must consider the great influence that new mass media communication channels of the digital age have on these decision-making processes. Participatory forms of media communication channels, such as digital social networks, are a priori configured as a two-way – or rather multiple ways – communication process model. This is especially true for technological innovations that are themselves digital products or processes, as it is the case with Bitcoin technology.

In general, the process of adopting an innovation can be identified at two levels: at the micro level through the decision-making process of a single individual, and at the macro level of the respective social system. According to Rogers, the innovation decision-making process at the micro level can be divided into five phases for analytical purposes. In the first phase of the process – *Knowledge* – an individual learns about a specific innovation and how it works, whereby this knowledge can be categorized in three stages: Awareness-knowledge defines the mere knowledge about the existence of an innovation, whereas how-to-knowledge also includes knowledge about the correct application of an innovation, and at a further stage, principles-knowledge contains general underlying knowledge about the respective innovation (Rogers, 2003, pp. 171-173).

In principle the innovation-decision process can be defined as "an information-seeking and information-processing activity in which an individual is motivated to reduce uncertainty

[36] Rogers differentiates between the adoption or rejection of an innovation by an individual member of a social system independent from the decisions of the other members of the social system (optional innovation-decisions) and by the social system as a whole. The latter can be achieved most rapidly through authority innovation-decisions, as they do not grant individuals the freedom to make their own choice. In the opposite case are collective innovation-decisions, in which the acceptance or rejection of an innovation is based on a common consensus among the individual members. However, optional innovation-decisions are also influenced by the respective social system, be it by social norms or by communication through interpersonal networks (Rogers, 2003, pp. 28-29).

about the advantages and disadvantages of an innovation" (Rogers, 2003, p. 172). This leads to the second phase of the decision-making process – *Persuasion* – in which an individual thinks through the pros and cons of a possible adoption, examines the potential consequences of a positive or negative attitude towards the innovation and seeks support from the social system to confirm his or her decision (Rogers, 2003, pp. 174-177). In addition to an individual's experience, his or her respective needs and his or her willingness to take risks respectively general tendency to adopt innovations, the social system is an important factor that significantly influences the individual's decision. Thus, these factors affect the third phase - *Decision* - which implements a concrete active action, i.e., the adoption or rejection of an innovation. This process may lead to discontinuity, meaning that an individual decides to reject an innovation even though it was previously accepted. This would be an active rejection, because the individual first accepted the innovation, but then decided to reject it, e.g., after an initial trial and error. On the other hand, there is passive rejection, which occurs when the individual has never seriously considered an actual adoption of an innovation (Rogers, 2003, pp. 177-179).

If the innovation is adopted, however, this leads to the fourth phase, the *Implementation*. Now the innovation is actually and continuously used by the individual, he or she changes his or her behavior in a sustainable way and integrates the innovation into his or her general actions. The institutionalization of an innovation may also lead to its re-invention during the process of implementation. For instance, users may like to change or modify an innovation while using it in order to make it more suitable for a respective use (Rogers, 2003, pp. 179-181). At the same time, users always try to avoid or at least reduce dissonance, which is why they look for information to support their decision in the fifth stage of *Confirmation*. This can – if the user does not find any confirmation – lead to a change in behavior and discontinuance of the adoption. In the replacement process, the innovation may be replaced by the adoption of a new, superior innovation, or the user may become disillusioned and abandon the adoption due to disenchantment with the benefits of the innovation (Rogers, 2003, pp. 189-191).

In addition to the social or individual factors already mentioned with regard to the individual user, the various characteristics of an innovation itself play a decisive role in the diffusion process. Innovations can generate relative advantages, e.g., in terms of economic factors, time-savings or social reputation. If an innovation is highly compatible with the values and attitudes of the potential user, adoption is more likely. Likewise, the trialability as well as the possibility of observing the results of the innovation among other users increases this probability of adoption. The complexity of an innovation has the exact opposite effect if potential users find it difficult to understand and use an innovation. However, the above-mentioned characteristics of an innovation are not static and can change during the diffusion process for various reasons. In general, it is less relevant whether innovations actually have certain advantages or disadvantages in an objective sense. What is more decisive is how these advantages and disadvantages are perceived by potential users. According to Rogers, relative advantage and compatibility are the most important attributes for explaining an innovation's rate of adoption even though they are evidently not the only influencing factors (Rogers, 2003, pp. 15–17).

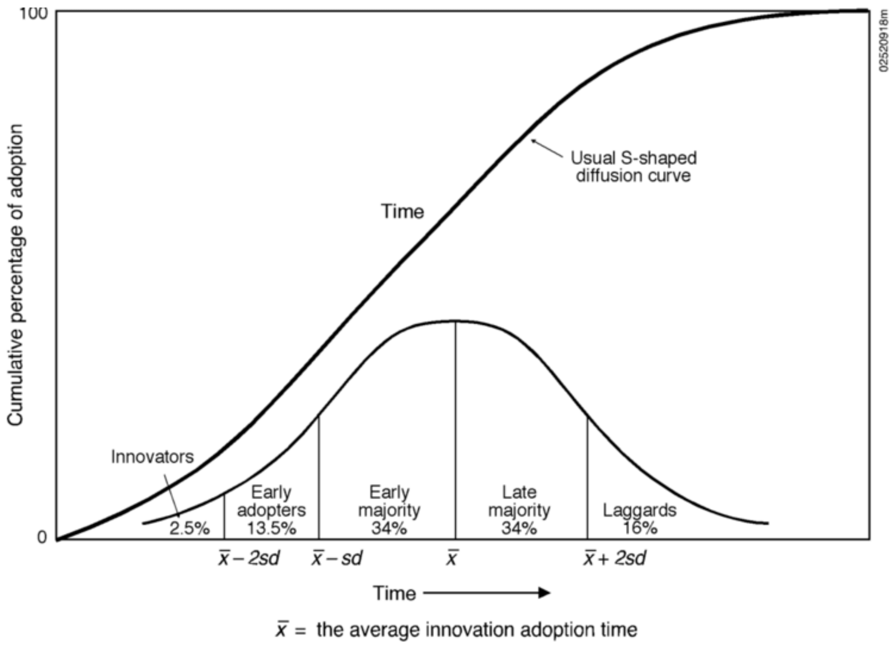
In summary, diffusion on the micro level can be described as a process "by which (1) an *innovation* (2) is *communicated* through certain *channels* (3) *over time* (4) among the members of a *social system*" (Rogers, 2003, p. 11). The description and analysis of the innovation-decision process on the macro level within a social system is more complex due to the different actors involved. Thereby, the exchange of information on a specific technological innovation can take place on several levels. When it comes to the mere announcement of a new technological innovation, mass media are the most efficient and rapid channels of information dissemination. In general, it can be stated that traditional mass media such as newspapers, radio and television are becoming less and less important in the light of digitalization and the extensive spread of the Internet - especially via mobile devices. Digital social networks render obsolete the former distinction between mass media, which allow few individuals to reach an audience of many, and interpersonal face-to-face channels. The potentiality and influence of interactive communication channels through the Internet must therefore be taken into account in the examination of the diffusion of a technological innovation (Rogers, 2003, p. 18). In diffusion theory, the impact of the digital media change has not yet been sufficiently analyzed in its specific influencing factors, so that empirical results, such as the influence of online social networks on the diffusion process, are still not available. Especially with regard to technological innovations, which are themselves based on digital innovations, as is the case with Bitcoin technology, however, this consideration is essential in order to be able to attain valid results in the analysis.

The diffusion of a technological innovation within a social system at the macro level can be visualized in relation to time by means of a characteristic S-shaped curve. While the gradient of the curve is still relatively low at the beginning of the diffusion process and thus only a few successively adopt the innovation, the curve increases rapidly at the point of the so-called critical mass, since here the early adopters begin to adopt the innovation and at the same time, as opinion leaders, spread the innovation further by means of their extensive social networking.[37] Once the last adopters take over the innovation, the curve gradually flattens out. The course of this cumulative adoption rate over time has been empirically proven in numerous studies, with reference to technological innovations i.a. for consumer goods (Hall and Khan, 2003) or information technologies (Teng *et al*., 2002). On the other hand, considering the course on a non-cumulative basis, i.e., the number of adopters per time unit, a bell-shaped curve emerges. This can be mathematically described by the normal frequency distribution and, on this basis, various types of adopters can be distinguished according to their respective adoption points.

In the graph the adopters are distributed over the entire length of a common diffusion process. One characteristic or parameter is the mean *(x)* that marks the average adoption time. Another parameter of a distribution is its mathematical standard deviation *(sd)*, a measure of dispersion or variation about the mean. Rogers uses these two statistics, the mean *(x)* and the standard deviation *(sd)*, in order to divide a normal adopter distribution into five categories of ideal types, which classify the members of a system on the basis of their innovativeness, the degree to which an individual is relatively earlier in adopting an innovation.

[37] The term "critical mass" derives from game theory and means that it is not necessary to convince an entire group about a certain strategy, but that it is sufficient to convince only a certain number of participants of this strategy. If this threshold is exceeded, i.e., if the critical mass is reached, the strategy will become self-supporting (Ball, 2005).

Figure 7: The Bell-Shaped Frequency Curve and the S-Shaped Cumulative Curve for an Adopter Distribution



Source: Farhar *et al.,* (2000, p. 4), adapted from Rogers (1995).

The first adopters of an innovation are the innovators, who are characterized primarily by a high willingness to take risks and a high degree of uncertainty tolerance, supported by sufficient financial resources. Innovators are well connected on an international level, yet according to Rogers they represent the smallest group of adopters with an ideal typical share of about 2.5 percent of all adopters. As a second group, early adopters play a decisive role in the diffusion process, since they act as very well-connected opinion leaders, that are integrated and highly respected within a social system, and thus influence other adopters to adopt the innovation. With a share of approximately 13.5 percent, they help the innovation to reach a critical mass of adopters in the further process. Once the point of critical mass is exceeded, the innovation is taken over by the third group of the early majority – before the average member of a system. The members of this relatively large group (around 34 percent of the adopters) are socially well connected, but generally not opinion leaders. Usually, they need a certain time to deliberate before completely adopting an innovation. However, they are less skeptical than the fourth group of the late majority. The members of this group (also about 34 percent of the adopters) normally only react to an innovation when an economic necessity or strong social pressure urges them to adopt it. As the fifth and last group, the laggards, with a share of about 16 percent, are adopting the innovation. Due to limited resources, this group tends to be very distrustful of innovations, which is why they need the greatest possible security for an adoption. Within a social system, this group tends to be isolated, has only a small social network that includes merely members of the same group (Rogers, 2003, p. 280-285).

In order to empirically analyze the diffusion process of an innovation, the following factors, among others, are crucial: the reasons why some users adopt an innovation earlier than others; the extent to which the perceived attributes of an innovation influence the diffusion rate; and how the point of the so-called critical mass can be explained. Particularly with regard to digital technological innovations, such as the Bitcoin technology, it is important to empirically examine whether the often-assumed homogeneity of the users is adequate. This can be measured by means of the homophily, the degree to which individuals who interact are similar in certain attributes, such as education, socioeconomic status and belief; or in contrast by means of the heterophily, which measures the differences between interacting individuals (Rogers, 2003, pp. 305-308). Another important aspect in the analysis is the communication structure, which, in addition to the formal social structure within a social system, forms an informal structure: interpersonal networks that connect the members of a social system with each other and show who interacts with whom under which circumstances (Rogers, 2003, p. 24). The consideration and analysis of these structures can help in part to predict the diffusion of an innovation, which is of particular interest from a marketing perspective. In general, it can be noted that for a successful diffusion process of an innovation a certain degree of homophily as well as heterophily is necessary, since on the one hand it is more likely that a technological innovation will diffuse in a homophilic network where the actors have similar characteristics such as age, income and educational background, but on the other hand a certain heterophily is necessary for an innovation to enter this network.

Rogers' diffusion model is one of the most widely adopted models in innovation and acceptance research (Howaldt *et al*., 2021; Dearing, 2015; Rogers *et al.,* 2009). However, the theoretical framework of diffusion theory has been criticized for various reasons, which can be categorized into normative, epistemological as well as theoretical and methodological aspects. The first objection is the normative bias for innovation, which has been emphasized by Rogers himself in his overview of diffusion studies: The distinct innovation positivism of diffusion research considers an adoption of an innovation as quickly and extensively as possible to be positive and disregards potential negative consequences *(pro-innovation bias)* (Rogers, 2003, pp. 106-107). This is particularly due to the fact that organizations or institutions often conduct diffusion studies on the distribution and adoption of innovations in order to promote their own innovation, and thus a bias has to be a priori stated.

A second point of criticism concerns the inductive epistemology and the meta-theoretical, generalizing method with which Rogers consolidated the tradition of diffusion theory and whose basis is largely based on the meta-analysis of Rogers and Shoemaker (1971). This meta-research approach, in which Rogers has examined a maximum of studies to gain generalizations about the adoption of innovations, is problematic in that the data is accumulated according to a vote taking. This means that in this method it is counted how many studies support a certain assumption and how many do not, without considering the sample size, the size of effects or the actual operationalization of the constructs (Glass, 1976, p. 6; Downs and Mohr, 1976). From the perspective of critical rationalism, this method is questionable, since as soon as it becomes evident that a generalized assumption does not apply to all innovations, it must either be limited in its validity or revised and tested again (Pape, 2009, pp. 274–282). Third, critics denounce the theoretical and methodological stagnation of diffusion theory (Katz, 1999, p. 145; Meyer, 2004, p. 69).

A further point of criticism is the linear conception of the diffusion process from the inventor to the adopter, which simultaneously forces a static concept of innovation and a merely passive role of the adopter, who can only choose between two options, acceptance or rejection. This linear diffusion process was developed in analogy to the Lasswell (1948) formula (Sender-Message-Channel-Receiver-Effects), which originated in communication theory, in order to structure the research results of diffusion studies. However, while communication theory now assigns a more active role to the recipient and moves away from the linear communication model given the media changes in communication technology (Maireder *et. al*, 2015), diffusion theory still retains a linear approach to the diffusion process (Karnowski *et al.*, 2011, pp. 57–75). The dichotomy between adoption and rejection in particular obscures the view of the active role of the adopter in the diffusion process. However, it is only this dichotomy that allows an aggregated view of the diffusion process at the macro level, such as the S-curve of diffusion. In order to solve this problem, Carolyn A. Lin proposes to extend the dichotomy of adoption and rejection by a third parameter of probable adoption (Lin, 1998, pp. 95–112).

As mentioned above, diffusion studies can be methodologically described as follows: They collect data with respect to a single innovation, as they were collected from adopters at a certain point in time, after the innovation has already been widely diffused (Meyer, 2004, p. 59). This means that only the correlative connections in the diffusion process can be examined and the process perspective of diffusion is not taken into account. One solution approach has already been mentioned by Rogers himself, which aims to work with several cross-sectional studies in the diffusion process (Rogers, 2003, pp. 112-113). Another solution option is network analysis. Dynamic models in particular make it possible to model the connections in the adoption behavior in a network over a period of time, whereby not only the network structure influences the adoption behavior, but also vice versa the adoption behavior influences the network structure (Marsden and Podolny, 1990, pp. 197–214; Strang and Tuma, 1993, pp. 614–639).

Despite these points of criticism, diffusion theory is an established field of research that provides a high level of applicability for examining the diffusion of an innovation within a society at both the micro and macro levels. In the recent past, new theoretical approaches have been developed to address the deficits of diffusion theory and the fact that, methodologically wise, this research tradition has developed only slightly in recent decades. If one looks at the objective of diffusion theory to explain certain effects of mass communication, the greatest methodological deficit lies in the still insufficient consideration of the technological media change for the influence ratio between interpersonal and mass media communication in the innovation decision-making process. In the following, these new theoretical approaches will be discussed, which address the above-mentioned deficits and points of criticism of diffusion theory in order to provide empirically tested conclusions in the analyses.

3.3 The Integration of Social Network Analysis (SNA)

Social network analysis (SNA) is an empirical research method for describing structures of interaction between individuals or actors, emphasizing the interrelations between actors as opposed to, for example, focusing on their personal characteristics. This is based on the assumption that these structured interaction dynamics shape the behavior of the members of a network. For diffusion theory, the main advantage of SNA is that it provides various qualitative and quantitative methods for collecting and analyzing the relevant data in order to predict interpersonal influence in the diffusion process.

Thomas W. Valente described the development of the concept of social networks in the diffusion theory in the following four steps (Valente, 2006, pp. 61–82). First, the influence of interpersonal relationships and the role of opinion leadership were identified as crucial factors in the adoption decision process (Rogers, 2003; Coleman *et al.*, 1957). Second, diffusion research in the 1970s turned to structural models in order to determine the possible channels through which innovations are diffused in a network and to define both the role of opinion leaders and of rather weak ties as bridges for innovation (Granovetter, 1973). Third, the implementation concentrated on critical points in the diffusion process, especially the tipping point when the critical mass of members of a social system had adopted the innovation (Markus, 1987). Fourth, diffusion theory focused on the dynamic interplay between network position and adoption by using event history analysis (Marsden and Podolny, 1990). In addition, the dynamic models were complemented by the construction of network-weighted indices over time (Strang and Tuma, 1993; Myers, 2000).

For the primary collection of data, empirical methods of SNA include interviewing, observation and content analysis. For the survey, there is the option of conducting standardized surveys, such as interviews based on questionnaires, or less standardized methods such as manual interviews or group and expert interviews. One of the most important methods used in SNA is the name generator, which is used to collect the so-called *Alteri. Alteris* are the actors with whom the interviewee is connected. With the name generator, which was developed by Roland Burt for the General Social Survey of the USA in 1984, the *Alteri* can not only be determined in a valid and reliable way, but also quickly and cost-effectively, because the interviewee is asked to name a maximum of 5 other actors with whom an actual interaction has taken place within a fixed time period (Jansen, 2006, pp. 80-81). From a methodological point of view, observation in the SNA is rather problematic due to the risks of selective perception or possible misinterpretation of the interactions. As a further option for data collection, content analysis includes a systematic collection and analysis of already existing texts, such as contracts or any other written documents.

The operationalization of data is relevant for the survey. The chosen classification should contain the following criteria: Unambiguousness, excludability and one-dimensionality. The scaling of the response categories can be binary, ordinal, or rational scaling, whereby these different scaling levels also allow different arithmetic operations. The relevant population can be empirically analyzed in the SNA as a total survey, partial survey or as an individual case study. The possible selection procedure depends on various factors such as the size of the population and the feasibility of implementation (Schätzl, 1994, p. 45).

When conducting a network analysis, various analysis methods can be implemented: By means of graph-theoretical analysis, networks are graphically visualized and analyzed in so-called sociograms, whereby the actors are represented as points or knots and the connections between them as lines. Different line shapes can visualize different connection types (Jansen 2006, p. 91). A second possibility is the use of sociomatrices and affiliation matrices. In the simplest case, a distinction can be made between the existence of network connections and their non-existence, whereby a zero or one represents this in the contact matrix accordingly. For unidirectional connections, incoming connections are displayed in the columns and outgoing connections in the rows (Jansen 2006, pp. 99-100). It must be stated that matrices are less suitable for the presentation of a network, but rather structure the data basis for the analysis of networks. This structuring of the database is used, for example, in the calculation of most of the measures, which are indicators for the structuring of the network. A distinction must be made between actor-related measures, which are calculated as outdegree (number of interactions emanating from the actor as a measure of expansiveness) and indegree (number of interactions directed at the actor as a measure of popularity) (Wasserman and Faust, 1994, p. 126); and network-related measures, such as network density (ratio of realized to possible interactions), multiplexity (overlapping of network interactions) and degree of cohesion (reciprocal advantage of network actors) (Jansen, 2000, pp. 46-49).

Using social network analysis, the interrelation between actors can be examined empirically in order to draw conclusions about interpersonal influences on the diffusion process. There are limitations to the SNA, however, such as a lack of representativeness of the results, limited objectivity in data collection and the possibility of a selective perception. In addition, network analysis has so far lacked instruments that can identify dynamic processes and temporal changes in a causal sense and make them verifiable. Thus, in the context of network analysis, only comparative-static observations for the development in the temporal process are principally possible (Jansen, 2006, pp. 275-276).

3.4 Attitude Behavior Theories on Individual Adoption Decisions

In order to determine the diffusion and adoption of a technological innovation within a social system and thus the technology acceptance, attitude-behavior theories are used in research, which represent the social psychological basis for the examination of individual acceptance behavior. The aim of attitude-behavioral theories is to explain the general behavior of an individual as an actor at the micro level, independent of any specificity of technology. There are two theoretical approaches: the Theory of Reasoned Action and the Theory of Planned Behavior. Both have been the most used models of attitude-behavior research in the last thirty years and form the basis for this research approach.

3.4.1 Theory of Reasoned Action (TRA)

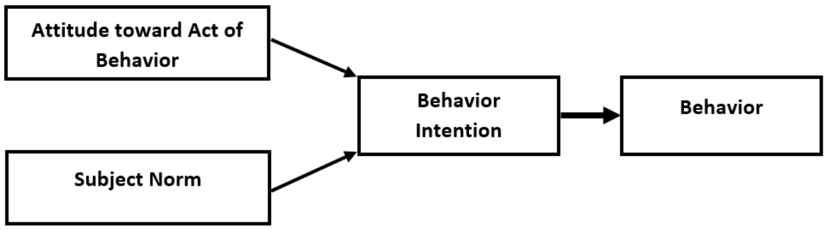
Martin Fishbein und Icek Ajzen introduced the Theory of Reasoned Action (TRA) in 1975. It is based on the Theory of Behavioral Prediction formulated by Fishbein in the late 1960s. This theory began with Fishbein's critical observations that, even after decades of research, attitude-behavioral research did not find consistent evidence of a correlation between attitude and behavior. He wanted to address this issue by considering a limited set of behavioral determinants and by examining the interconnections between these behavioral determinants and traditional attitudinal measurements (Fishbein, 1967, p. 491).

The Theory of Reasoned Action (TRA) forms a behavioral theory, which aims to explain the emergence of action intentions and constitutes the basis for the development of a model to determine the acceptance of innovations by potential users. The central assumption of this theory is the predictability of user behavior through two variables, attitude toward behavior and subjective norm. The sum of attitude and subjective norm gives the degree of user intention. The TRA distinguishes between the intention to use and the actual use and determines a positive correlation between these two components. Therefore, according to TRA, an individual's performance of a certain behavior "is determined by his or her behavioral intention (BI) to perform the behavior, and BI is jointly determined by the person's attitude (A) and subjective norm concerning the behavior in question, with relative weights typically estimated by regression: $BI = A + SN$" (Davis *et al.*, 1989, p. 983). The model does not define which of the two central determinants – attitude toward behavior or subjective norm – has a greater influence on behavioral intention and thus subsequently on the actual behavior. The differences from individual to individual and also in relation to the respective investigation subject are too different in terms of the behavioral decision (Ajzen and Fishbein, 1980, p. 54).

The TRA model is based on two general premises: On the one hand, the theory is modeled on individuals thinking and acting rationally, who consciously anticipate the meaning and consequences of their actions, while taking into account the information available to them, before they decide to perform or refrain from a certain behavior. On the other hand, it presupposes that social human behavior is in general under deliberate control (Ajzen and Fishbein, 1980, p. 5). If these general premises are not met, TRA reaches its limits. However, if these conditions are met, an advantage of the TRA is that the spectrum of its application is very broad and can offer explanatory models for different types of behavior.

With regard to the methodological approach, the objective of the model is behavior: It is assumed that the actual behavior of a person is determined by his or her behavioral intention. This behavioral intention results from the correlation of the constructs of normative belief or subjective norm and attitude. Although different and even contradictory definitions of the term attitude prevail in research, most definitions are consistent with the assumption that attitudes are intrinsically evaluative (Ajzen, 2005, p. 3). Accordingly, Ajzen defines the term attitude as follows: "An attitude is an individual's disposition to react with a certain degree of favorableness or unfavorableness to an object, behavior, person, institution, or event – or to any other discriminable aspect of the individual's world" (Ajzen, 1993, p. 41). However, it is important to note that in the context of TRA only attitudes towards behavior are considered and not attitudes towards objects, people, institutions or events (Ajzen, 1985, p. 12). The attitude towards a certain behavior is thereby substantially influenced by the determinant of the subjective norm, which finally results in the intention to perform a certain behavior. The four components – attitude, subjective norm, intention and behavior – form the basic principle of TRA, which is shown in Figure 8.

Figure 8: Framework of Theory of Reasoned Action (TRA)



Source: Designed by the author based on Fishbein and Ajzen (2009)

In the TRA, Ajzen and Fishbein presume that the intention of a person is the sole direct determinant of behavior (Ajzen and Fishbein, 1980, p. 5). The behavioral intention is defined as a measure of the probability with which a person will perform a certain behavior (Ajzen and Fishbein, 1980, p. 42). For the operationalization of attitude-behavioral contexts, Ajzen and Fishbein focus on intention and behavior in terms of four dimensions: target, action, context, and time (Ajzen and Fishbein, 1980, p. 42). In order to be able to anticipate behavior from the respective intention, there are two conditions that must be met: The first concerns the compatibility principle, i.e. that behavior and intention must correspond to each other, which means that their elements – target, action, context, time – are defined in the same way, because "the more similar the target, action, context, and time elements of one indicator to those of the other, the stronger the statistical relation between them" (Ajzen, 2005, p. 86).

The second condition concerns the temporal stability between the time the intention is registered and the behavior being performed, as the "accuracy of prediction will usually be an inverse function of the time interval between measurement of intention and observation of behavior" (Ajzen, 1985, p. 12). The longer the time interval, the more difficult it is to predict the intention due to unforeseen events or changes. However, if the conditions of compatibility and temporal stability are met, the behavior of a person can be predicted from their intention. With this, the first causal dimension of the TRA model is described, which can predict behavior on a statistical basis. However, since TRA also aims to provide an explanatory model for behavior, Ajzen and Fishbein determine in a second step which factors influence the intention. This is where the two determinants of intention as already mentioned come into play: the behavioral attitude on the one hand and the subjective norm on the other. The definition of behavioral attitudes is based on an evaluative character in that the actor determines whether a certain behavior is good or bad. In addition to subjective attitudes, the actor also draws his evaluation principles from social norms that he or she anticipates. Normative belief is composed of the subjective social and normative assumptions and intentions, which in their entirety affect the intention to act (Ajzen and Fishbein, 1980, p. 6; Ajzen, 1985, p. 12).

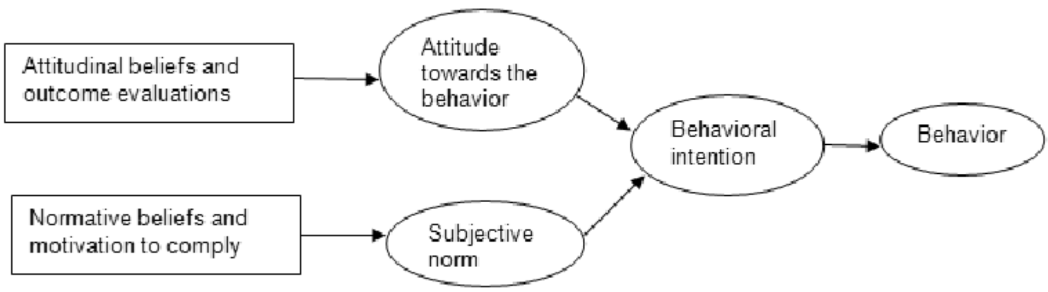
In general, individuals are more motivated to conform to the subjective social norms of reference groups. If an individual has the expectation that a certain behavior contradicts the social norm of a reference group, this usually has a negative effect on his or her behavioral intention. On the other hand, the individual’s own attitude towards the behavioral intention influences his or her behavior. Thus, intended or desired consequences of a behavior, such as a personal advantage, have a positive effect on the attitude towards the behavioral intention and vice versa. The own attitude towards the behavioral intention is thus composed of subjective assumptions and evaluations towards the positive and negative consequences of the action. Only when an individual evaluates a certain behavior as positive and assumes that other people important to him or her also evaluate this behavior as positive, he or she will carry out the behavior (Ajzen and Fishbein, 1980, p. 6).

The relevance of individual perceptions for attitudes depends both on the degree of evaluation of the perceived consequence of a certain behavior as well as on the strength of the respective perception. The degree of evaluation shows whether a person perceives a behavioral consequence as positive or negative. On the other hand, the strength of perception depends on the perceived probability with which a certain behavioral consequence will occur (Ajzen, 1985, p. 13). Ajzen describes this expectation-evaluation model in the following formula: $A_B \propto \sum b_i e_i$

In this respect A_B stands for the attitude towards behavior B, b_i for the perceived probability that behavior B will lead to consequence i, and e_i for the evaluation of this consequence. The behavior-related attitude thus results from the sum of the factors of probability of occurrence and evaluation in relation to the consequences of behavior (Ajzen, 1985, p. 13). The attitude can thus be described as a function of expectation and evaluation. In the same way, the subjective norm is also based on a person's expectations and can be described with the expectation-evaluation model. Ajzen refers to the beliefs that underlie subjective norms as normative beliefs. Normative beliefs are defined as an individual's perceptions of whether important reference persons or groups approve or disapprove of the performance of a certain behavior. Normative beliefs can exert social pressure that makes the individual tend to adopt or avoid a certain behavior (Ajzen and Fishbein, 2005, p. 124). The strength of the social pressure depends on the motivation of the individual to orientate him or herself towards the relevant reference persons or groups. Ajzen describes this correlation in the following formula: $SN \propto \sum n_i m_i$.

SN stands for the subjective norm, n_i for the normative belief in relation to the referent i, and m_i for the motivation to orientate oneself towards the reference person i (Ajzen, 2005, pp. 124-125). The subjective norm thus results from the imagination-motivation ratio in relation to reference persons and groups that are important for the actor. Thus, the basic model of TRA can be extended to include a person's perceptions as the basis of intention and behavior, as visualized in Figure 9.

Figure 9: Extended Model of Theory of Reasoned Action (TRA)



Source: Ajzen and Fishbein (1980, p. 8)

As mentioned at the beginning, TRA is based on two basic assumptions: One is that the theory assumes that people think and act rationally. On the other hand, the assumptions of TRA are only confirmed if the behavior to be explained is under deliberate control. For this reason, the Theory of Planned Behavior (TPB) takes up the limitation regarding deliberate control and extends the model assumptions of the TRA by this aspect.

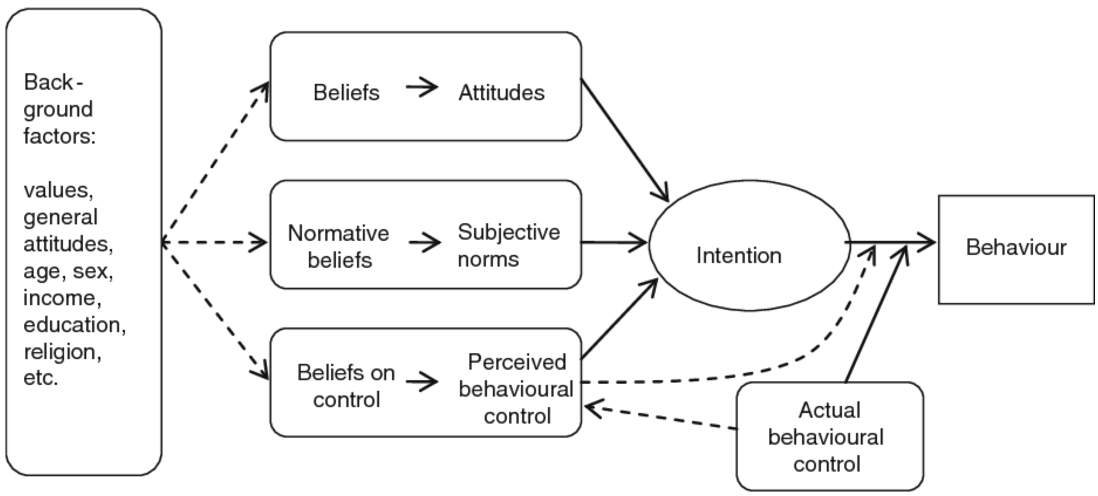
3.4.2 Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) represents one of the most influential and most cited models for the prediction and explanation of human behavior from attitudes (Sussman and Gifford, 2019, p. 920). As in TRA, it is methodologically assumed that the intention has a direct influence on the probability with which a certain behavior is performed. TPB differs from TRA, however, in the precise definition of intention, since whereas in TRA the behavioral intention is outlined more as a subjective probability of the performance of a certain behavior, the concept of behavioral intention in TPB implies more motivational aspects (Ajzen, 1991, p. 181). Moreover, the TPB extends the approaches of TRA with the addition of a further model component. Therefore, Ajzen postulates three independent determinants of intention for the TPB: the attitude towards the behavior and the subjective norm such as in TRA, as well as the perceived behavioral control (Ajzen, 1993, p. 49). Perceived behavioral control is defined as perceived ease or difficulty in performing a certain behavior (Ajzen, 1991, p. 183). Since a behavioral intention is not always followed by an actual behavior due to external circumstances, this component of TPB extends the theory of TRA to include non-volitional behaviors to predict behavioral intention and actual behavior. Even if the external circumstances cannot be measured or only to a very limited extent, the individual perception of people about the degree to which they can influence their behavior can be measured, whereby, according to Ajzen, this perceived behavior control can in turn be used to draw conclusions about the actual behavior control (Ajzen, 2005, pp. 110-111). The hypothesis that behavior can be directly influenced not only by a person’s intention but also by his or her perceived behavioral control depends on the assumption that the perceived behavioral control corresponds to the actual behavioral control to a certain degree (Ajzen, 1993, p. 49).

Perceived behavioral control is determined by the perceptions of an individual, the so-called *control beliefs.* These refer to a person's beliefs about which opportunities and resources are available to him or her to perform a certain behavior. These can be influenced by one's own experience of the behavior as well as by the experiences of others and other factors that reduce or enhance the perceived difficulty in performing a behavior. The perceived behavioral control is the greater the more resources and opportunities the individual believes he or she has and the fewer obstacles or hindrances he or she anticipates (Ajzen, 2005, p. 125). This can be visualized as follows: $PBC \propto \sum c_i p_i$

PBC stands for the perceived behavioral control, c_i for the control belief that a certain influencing factor i becomes effective, and p_i for the strength of the factor i to facilitate or hinder the performance of a certain behavior (Ajzen, 2005, p. 125). The TPB can therefore be summarized as follows: "According to the theory of planned behavior, the major determinants of intentions and behavior follow reasonably from – and can be understood in terms of – behavioral, normative, and control beliefs" (Ajzen, 2005, p. 134). These beliefs of an individual depend on various underlying factors and can be influenced by them. Examples of potential underlying factors include an individual's age, socioeconomic status, education, group membership, past experiences, access to information, social support etc. (Ajzen, 2005, p. 134).

Figure 10: Model of Theory of Planned Behavior (TPB)



Source: Ajzen and Fishbein (2005, p. 135)

In the TPB model (Figure 10), the background factors are separated into personal, social and informational factors. The dashed arrows between background factors and beliefs indicate that although these factors may have an influence on a person's beliefs, this is not necessarily always the case. However, the background factors play an essential role in improving the ability to explain human behavior. At the same time, the TPB stresses that these factors can only influence the intention or behavior indirectly via the beliefs of a person (Ajzen, 2005, pp. 134-135). The disadvantage of the TPB is that while the model extends the TRA, it cannot provide a complete variance explanation of behavioral intention. Ajzen states that the predictive power of intention through the variables of attitude, subjective norm and perceived behavioral control can range from 63 percent to 71 percent (Ajzen, 2005, p. 120).

3.5 Technology Acceptance Model (TAM)

Fred D. Davis originally developed the Technology Acceptance Model (TAM) in 1989 to model user acceptance of information technologies in order to understand why individuals accept or reject computers (Davis, 1989). It forms an adaptation of the Theory of Reasoned Action (TRA), since although the relevance of this model has been empirically proven, it is less suitable for technology-dependent decisions, since it explains the general behavior of an individual as an actor at the micro level independently of the technological specification of an innovation. This is where the TAM is applied.

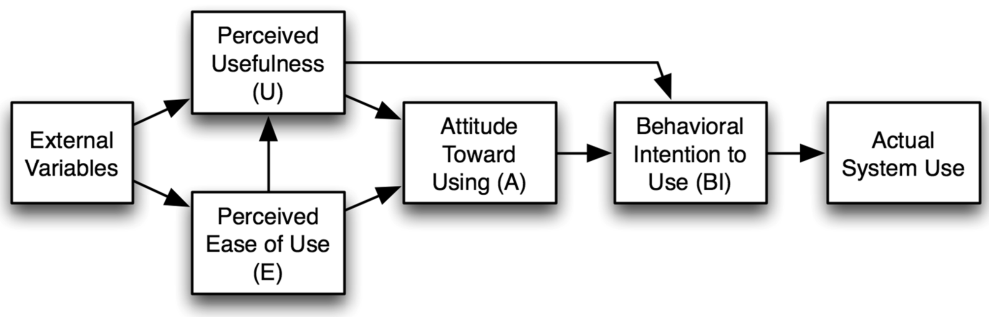
In accordance with the Fishbein-Ajzen theories, in TAM the intention is presented as the direct predictor of acceptance behavior. The intention thereby expresses the tendency of a person to use a technical innovation in the future. Whereas TRA is more generally conceptualized in order to explain human behavior, TAM is specifically designed to apply to computer usage behavior. The aim of TAM is to provide a generally valid and theoretically justified explanation of the determinants of acceptance of computer technology:

> "A key purpose of TAM, therefore, is to provide a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions. TAM was formulated in an attempt to achieve these goals by identifying a small number of fundamental variables suggested by previous research dealing with the cognitive and affective

> determinants of computer acceptance, and using TRA as a theoretical backdrop for modeling the theoretical relationships among these variables" (Davis *et al.*, 1989, p. 985).

For this reason, the basic TRA model was extended by two cognitive factors, which are firstly the perceived usefulness and secondly the perceived ease of use. According to the TAM, these two components are important for the acceptance of technologies. Davis defines perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance" and perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). These two determinants of behavioral intention are thus subjective perceptions that may differ from real characteristics. The model can therefore not be used to describe objective system characteristics, such as system utility or manageability (Davis, 1989, p. 320). The attitude towards the use of a technological innovation follows from the sum of these two components of technology acceptance – perceived usefulness and perceived ease of use – which are determined by external influencing variables. Variables that influence the perceived usefulness include, for example, improvement of user's productivity or better quality. Variables such as system features, training, documentation or user support consultants, on the other hand, affect the perceived ease of use (Davis *et al.,* 1989, pp. 987-988). In line with the TRA, the TAM distinguishes between the attitude, intention and actual use of a technology and assumes a positive correlation between these components. In this regard, TAM hypothesizes similarly with TRA that the use of computer technologies is determined by the behavioral intention to use a particular innovation (BI), but differs from TRA in that this intention is considered to be jointly determined by the person's attitude to the use of the system (A) and the perceived usefulness (U), the relative weights being estimated by regression: $BI = A + U$ (Davis *et al.*, 1989, p. 985) (Figure 11).

Figure 11: The Technology Acceptance Model (TAM)



Source: Davis *et al.* (1989, p. 985)

The perceived ease of use also has a direct influence on the perceived usefulness: A lower effort to use the technology enables the user to obtain a greater benefit with the same effort. The perceived ease of use thus also has an indirect positive effect on the attitude and intention to use the technology (Davis *et al.*, 1989, p. 987).

The TAM states that users then pursue the intention to perform a certain behavior toward which they have a positive effect, as formulated in the TRA. On the other hand, the approach of TAM, that a belief like perceived usefulness has a direct influence on the behavioral intention, is contrary to the model of TRA. However, Davis refers here to alternative intention models, which empirically demonstrate direct belief-intention relations.[38] Thus, TAM constitutes a direct relationship between perceived usefulness and behavioral intention, hypothesizing that individuals' intentions towards using a technological innovation (in the case of TAM computer software) are widely based on a cognitive assessment of how it will increase their job performance (Davis *et al.*, 1989, p. 986). The theoretical context for this hypothesis is based, among others, on the study of Robey (1979), which proposes a model of information systems use based on expectancy theories of job motivation. According to this perspective, individuals are motivated to improve their professional performance, as this is usually the basis for material compensation. This can take the form of a salary increase or payments from bonus systems.

[38] Examples of these models come from, among others, Bagozzi (1982); Brinberg (1979); Triandis (1977).

Accordingly, people will prefer precisely those technologies that satisfy this motivation (Robey, 1979, p. 537). Thus, the relationship between perceived usefulness and behavioral intention in the equation is formulated on the basis of this perspective that individuals develop intentions towards behavior that they presume will improve their work performance, beyond any positive or negative feelings that may be generated with regard to the behavior itself (Davis *et al.*, 1989, p. 986).

In acceptance research, the TAM is regarded as the best-operationalized and empirically most extensively tested model to explain the acceptance of technical systems. Various empirical studies have shown that the two factors of perceived usefulness and perceived ease of use as postulated by Davis are valid indicators for the acceptance and actual use of technical systems (Venkatesh and Davis, 1996; Arning and Ziefle, 2007). The application of TAM initially focused in the 1990s almost exclusively on the analysis of the system acceptance of employees in companies. In the meantime, however, current technology acceptance research is also increasingly turning to the use of new information and communication systems by individuals, as in the case of the acceptance analysis of mobile or virtual payment systems, for the investigation of purchasing behavior on the Internet, or the acceptance of online games (Schierz, 2008; Vijayasarathy, 2004; Hsu and Lu, 2004).

However, since empirical studies have found that the two factors postulated in TAM alone are insufficient to comprehensively explain the acceptance and use of technological innovations, the model has been modified and extended in more recent research approaches. This was done with the aim of increasing the explained variance of the model and at the same time contributing to a more comprehensive specification of technology acceptance. For example, the influence of external variables, such as personality characteristics of potential users, as well as the influence of subjective norms on the acceptance of technical systems, were taken into account in various model designs, as in the extended version of the technology acceptance model of Fred D. Davis and Viswanath Venkatesh (Venkatesh and Davis, 2000), TAM 2.

In their study, the authors examine the development and change of the acceptance of technical systems over a longer time period of use and conclude that, in addition to the two factors of perceived usefulness and perceived ease of use, social influence processes such as subjective norm, voluntariness and image, as well as cognitive instrumental processes such as job relevance, output quality and result demonstrability, significantly influence the acceptance of technical systems. It is important to note that the determination of the factor of perceived ease of use is not the focus of TAM 2. Venkatesh and Davis point out that previous empirical studies have identified this factor as being of secondary importance for comparison. In contrast, perceived usefulness has been shown to have a consistently high influence on the intention to use. Therefore, the main aim of TAM 2 is “to extend TAM to include additional key determinants of TAM’s perceived usefulness and usage intention constructs, and to understand how the effects of these determinants change with increasing user experience over time with the target system” (Venkatesh and Davis, 2000, p. 187).

The definition of the subjective norm in TAM 2 follows that of the TRA and the TPB. In this regard, subjective norm is defined as a “person’s perception that most people who are important to him think he should or should not perform the behavior in question” (Fishbein and Ajzen 1975, p. 302). In the process, the direct influence of subjective norm on the factors perceived usefulness and behavioral intention decreases over time and thus with increasing experience of use (Venkatesh and Davis, 2000, p. 190). Voluntariness is defined in TAM 2 as a moderating variable in the course of the influence of the subjective norm on the behavioral intention. Here, the authors refer to the research of Hartwick and Barki (1994), who showed that subjective norm has a significant effect on intention in mandatory contexts, but not in voluntary contexts (Venkatesh and Davis, 2000, p. 188).

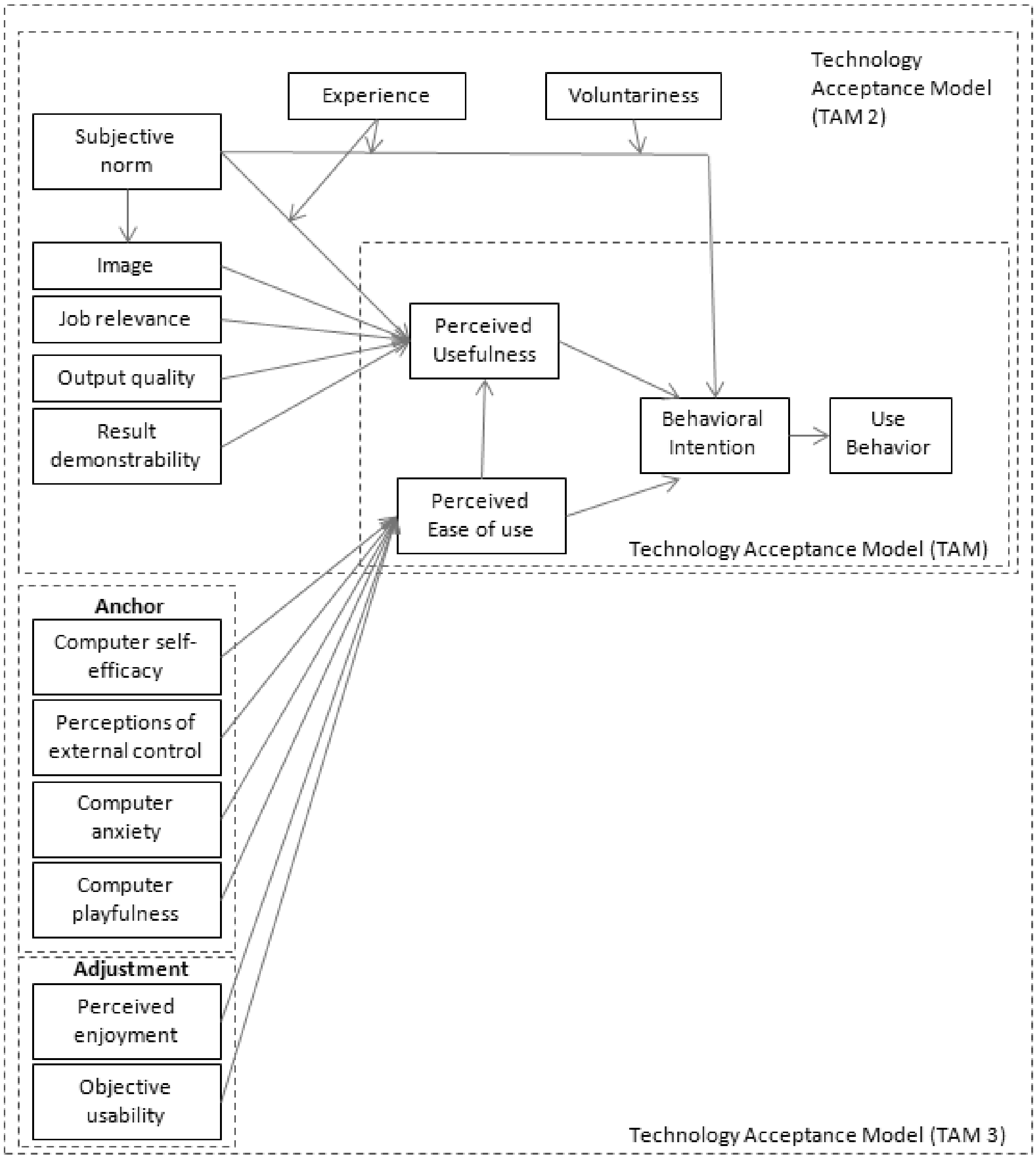
Image is defined as “the degree to which use of an innovation is perceived to enhance one’s image or status in one’s social system” (Moore and Benbasat, 1991, p. 195). It influences the behavioral intention indirectly via the perceived usefulness. The subjective norm, in turn, has a positive influence on the image factor, since the influence of the social system, such as advices from other adopters in the work field that the innovation should be used, and the implementation of these expectations increase the image within the social system. The improvement of the image positively influences the perceived usefulness of the individual, independently of the actual improvement in performance resulting from the use of the system. The image factor is independent of whether the use is voluntary or mandatory (Venkatesh and Davis, 2000, p. 189). Therefore, Venkatesh and Davis were able to demonstrate that the subjective norm influences the perceived usefulness both through the process of internalization and via the image factor through the process of identification. The indirect influence of the subjective norm on the perceived usefulness shows that individuals join a group opinion if this results in an increase in their group status. Furthermore, behavioral intention is directly influenced by the subjective norm. According to this, a person will use a system in the future if he or she expects to be rewarded by the group or if he or she can avoid negative consequences by the group (Venkatesh and Davis, 2000, pp. 188–189).

In contrast to the social influence processes, the cognitive instrumental determinants newly added in TAM 2 – job relevance, output quality and result demonstrability – only have a direct impact on the perceived usefulness (Venkatesh and Davis, 2000, p. 190). The job relevance factor refers to the individual perception that evaluates the innovation with regard to its applicability in the professional field. The output quality factor is used to summarize individual perceptions of the extent to which the innovation will actually deliver the promised performance. Finally, with the factor of result demonstrability, TAM 2 addresses the aspect that innovative systems do not gain acceptance if individuals have problems with the identification of benefits of use or of improvements in work performance. The more visible and presentable the increase in work performance through an innovative system is, the stronger the positive influence on the perceived usefulness (Venkatesh and Davis, 2000, pp. 191–192).

In 2008, Viswanath Venkatesh and Hillol Bala developed a further modification of the model, TAM 3, which in turn aims to provide a more detailed representation of the construct perceived ease of use. The development of TAM 3 is based on a combination of TAM 2 and the Model of Determinants of Perceived Ease of Use after Viswanath Venkatesh (Venkatesh, 2000). TAM 3 presents an integrated model of technology acceptance and a nomological network of determinants of the behavioral intentions of individuals with regard to the use or non-use of technological systems (Venkatesh and Bala, 2008, p. 275). TAM 3 draws on Venkatesh (2000) to add several anchors that determine early subjective perception and evaluation of the construct perceived ease of use: computer self- efficacy, perceptions of external control, computer anxiety, and computer playfulness. The anchors are based on comparable experiences through which these attitude factors are formed. Computer self-efficacy describes the degree to which an individual believes he or she can use the technology based on his or her own competencies, and perception of external control describes the degree to which an individual perceives organizational and technical support for the use of the system. While computer anxiety describes the degree of fear or rejection an individual experiences when faced with using a new technology, computer playfulness describes the degree of spontaneity an individual shows in interacting with the new technology. Through the actual experience of use, perceived ease of use may change by two adjustment factors – perceived enjoyment and objective usability, particularly with respect to computer anxiety and computer playfulness (Venkatesh, 2000; Venkatesh and Bala, 2008, p. 278).

The different factors and determinants of the three technology acceptance models – TAM 1, TAM 2 and TAM 3 – are visualized in the following graphic representation (Figure 12):

Figure 12: Technology acceptance models (TAM, TAM 2 vs. TAM 3)



Source: Boughzala (2014, p. 169)

In contrast to the TRA, it is not necessary for the TAM to determine relevant user beliefs in preliminary studies. Rather, the independent variables perceived usefulness and perceived ease of use are used to determine individual expectations of a technical system. Both characteristics are described in the TAM as cross-technological and across users. According to Venkatesh and Davis, the two variables are also not intended to detect situation-specific beliefs. The acceptance model merely provides an image of the beliefs existing for the acceptance object (Davis *et al.*, 1989, p. 988). In the first TAM version, the subjective norm was not adopted from TRA as an independent model factor. Davis explained that due to the time restriction and the novelty of a technical innovation, no influence from a person's social environment was to be expected: "In a user acceptance test, subjects will typically be seeing the target systems (generally new system prototypes) for the first time, and will therefore not have been able to receive cues from referents upon which to draw normative inferences" (Davis, 1986, pp. 36–37). Later, however, Davis *et al.* (1989) corrected this statement. Even if no influence of the subjective norm on behavior could be determined in the comparison of the TAM with the TRA, indications were nevertheless found that the influence of the social environment correlates with the object of examination; in other words, even if no connection between the subjective norm and system use can be demonstrated for individual applications, it can be expected that in multi-person applications the subjective norm can very well make a contribution to explaining behavioral acceptance (Davis *et al.*, 1989, pp. 998–999). Therefore, as mentioned above, Venkatesh and Davis included the subjective norm in TAM 2, referring to the research that showed that subjective norm has a significant effect on intention in mandatory contexts, but not in voluntary contexts (Venkatesh and Davis, 2000, p. 188).

Even though the different versions of technology acceptance models are among the most widely discussed and applied models for empirically investigating the acceptance of technological innovations by users, there are limits to their applicability and points of criticism. These are summarized by Richard Bagozzi as follows: "[…] the absence of a sound theory and method for identifying the determinants of PU and PEU, as well as other bases for decision making, […] the neglect of group, social, and cultural aspects of decision making, […] the reliance on naive and over-simplified notions of affect or emotions, and finally […] the over dependence on a purely deterministic framework without consideration of self-regulation processes" (Bagozzi, 2007, p. 245).

At the same time, the development of the TAM has been criticized for the fact that the large number of very different studies has led to a degree of adaptation and expansion that is very hard to overview. This is where another theory comes in, which attempts to develop a unified theory that explains the use and acceptance of technology, the Unified Theory of

Adoption and Use of Technology (UTAUT). UTAUT can therefore be described as a meta-model of previous acceptance models.

3.6 Unified Theory of Acceptance and Use of Technology (UTAUT)

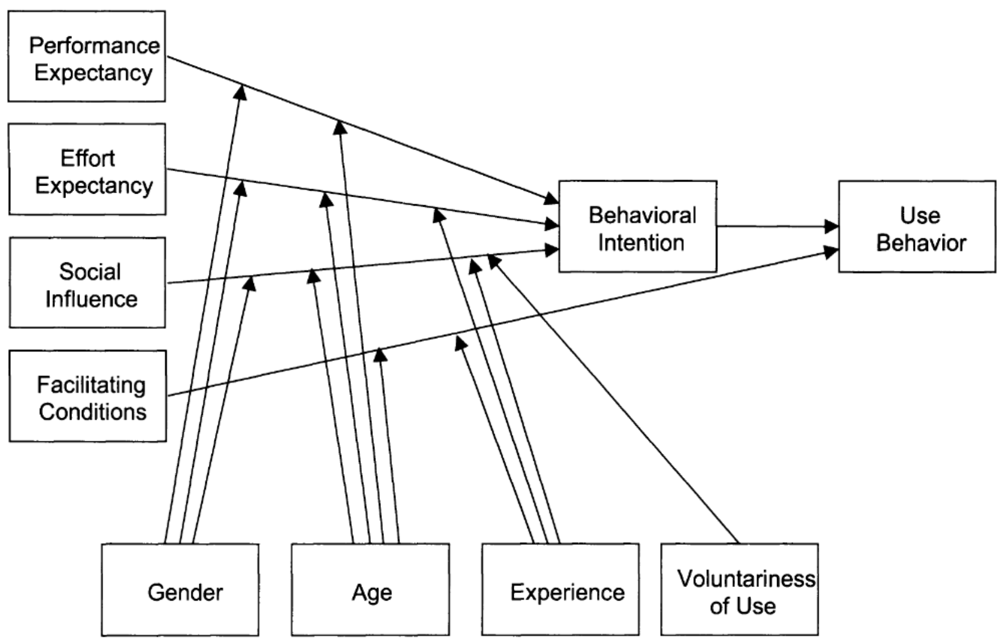
The Unified Theory of Acceptance and Use of Technology (UTAUT) intends to develop a unified theory that explores the use and acceptance of new computer and information technologies. Based on a comprehensive literature analysis on acceptance research related to the models described above, Venkatesh *et al.* (2003, p. 426) argued that when faced with a broad range of similar constructs proposed by multiple theories, researchers "pick and choose" constructs from the different models or select a "favored model", ending up widely ignoring the other models. Due to the proliferation of models and constructs used in research, it was necessary to synthesize them into a unified research model. Therefore, the authors harmonized the propositions of the diverse previous acceptance models and developed the Unified Theory of Acceptance and Use of Technology (UTAUT) in 2003. The UTAUT model is closely related to the TAM model in terms of its basic assumptions. As in the TAM, it is assumed that actual use is preceded by an intention to use and that this intention can be influenced positively or negatively by certain factors (Venkatesh *et al.*, 2003, p. 427). In their study, the authors make an empirical comparison of eight established theoretical models for explaining and predicting individual use behavior and establish with UTAUT a combination of individual elements of these models.[39]

As a result of their analysis they identify four determining constructs for user acceptance: First, performance expectancy, "defined as the degree to which an individual believes that using the system will help him or her to attain gains in job performance"; second, effort expectancy, "defined as the degree of ease associated with the use of the system"; third, social influence, "defined as the degree to which an individual perceives that important others believe he or she should use the new system"; and fourth, facilitating conditions,

[39] In addition to the models of TRA, TPB and TAM, the authors also include the following models in their study: *"Motivational Model (MM)"* according to Davis *et al.* (1992), *"Combined TAM and TPB (C-TAM-TPB)"* after Taylor and Todd (1995), *"Model of PC Utilization (MPCU)"* after Thompson *et al.* (1991), *"Social Cognitive Theory (SCT)"* after Compeau and Higgins (1995) and Compeau *et al.* (1999), and the influencing variables of the *"Innovation Diffusion Theory (IDT)"* in particular according to Rogers (2003). See Venkatesh *et al.* (2003, pp. 428–436).

"defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh *et al.*, 2003, pp. 447–453). The influence of these four determining constructs is moderated by four influencing variables – gender, age, experience and voluntariness of use – to further improve the predictability of the model. The inclusion of these moderating factors is one of the main differences between UTAUT and its predecessors (Dwivedi *et al.*, 2019, p. 721). The different moderating variables on the four determinants described above can be illustrated graphically as follows (Figure 13):

Figure 13: Model of UTAUT



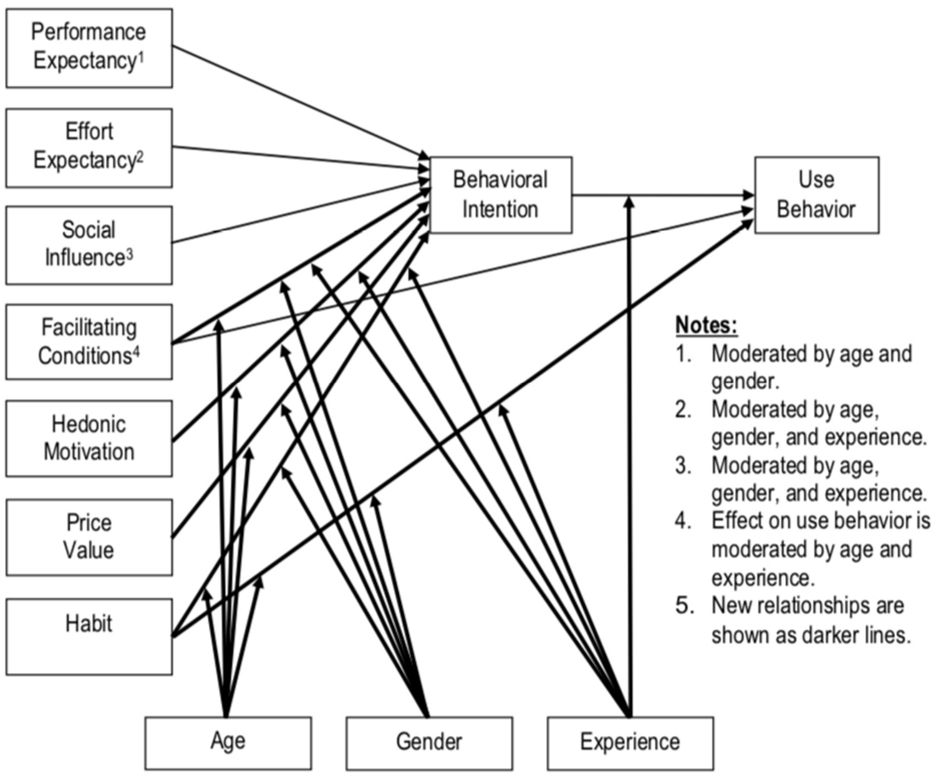
Source: Venkatesh *et al.* (2003, p. 447)

Throughout its origins, UTAUT has been used in an extensive way to explore the adoption of computer and information technologies by individuals. By means of an empirical investigation, Venkatesh *et al.* could show that the three determining factors performance expectancy, effort expectancy, and social influence have a significant influence on the intention of the individual to use a technical system in different organizational contexts. Furthermore, a positive influence of the behavioral intention as well as of the facilitating conditions on the actual use could empirically be confirmed. Also, the four moderating influences were confirmed as integral part of UTAUT (Venkatesh *et al.*, 2003, p. 467). Based on empirical findings, the UTAUT was found to provide an appropriate level of interpretation of 70% of the variance in the behavior intention toward using a new technical system. This value is significantly higher than the results of other analyzed models, for which the figures varied between 17% and 53% (Ramírez-Correa *et al.*, 2019, p. 87). However, the initial UTAUT model might be revisited in the context of a number of other constructs that may explain individuals' adoption and use behavior. Although they represent individuals' perceptions of a technical system, the four exogenous constructs in the UTAUT model may be also regarded as proxies for technology attributes (i.e. performance expectancy and effort expectancy) and contextual factors (i.e. facilitating conditions and social influence) (Dwivedi *et al.*, 2019, p. 721). Dwivedi *et al.* argued that even if the four determining constructs explain a significant part of the variance in adoption and use behavior, the UTAUT model still lacks an essential element, namely the inclusion of individual characteristics that describe user dispositions, such as attitude, computer self-efficacy and personal innovativeness (Dwivedi *et al.*, 2019, p. 721). Hence, the original model's constructs are more suitable to anticipate employee behavioral intension and less appropriate to measure consumer-focused innovations such as cryptocurrencies.

In 2012 the model of UTAUT was extended: UTAUT 2 examines technology acceptance and technology use especially from an end-customer perspective. Instead of solely focusing on the organizational professional framework, the UTAUT 2 attempts to explain on an aggregate basis why individuals use information technology (Venkatesh *et al.*, 2012, p. 157-158). UTAUT 2 follows the approach of the original model and subsumes results from other studies in an integrated meta-model. UTAUT 2 extends the four UTAUT model factors – performance expectancy, effort expectancy, social influence and facilitating conditions – by three additional influencing factors: Hedonic motivation "defined as the fun or pleasure derived from using a technology"; price value defined "as consumers' cognitive tradeoff between the perceived benefits of the applications and the monetary cost for using them"; and habit "defined as the extent to which people tend to perform behaviors automatically because of learning" and "measured as the extent to which an individual believes the behavior to be automatic" (Venkatesh *et al.*, 2012, p. 161). A rationale behind including the construct "hedonic motivation" was provided by the results of previous studies in information systems and marketing, whereby the observed hedonic nature of the experience such as perceived pleasure proved to be a significant determinant of individuals' use of technology. The argument for including "price value" in the new model relied on the potential impact of the component when considering the use of consumer products in comparison to the use of technology in work environments. When employees in organizations use information technology, they typically perceive no responsibility for the costs related to the use of the technology, as there is no direct financial consequence for them. On the contrary, using technology as a consumer implicates a greater perceived responsibility as a result of the direct costs incurred through using the technology. Therefore, the lower the costs, the higher the intensity of the technology use. A positive correlation that exists between perceived value and intention to use implies that an individual views a technology utilization as more valuable than the corresponding monetary expenditure (Marikyan *et al.,* 2021). The construct "habit" was initialized in line with previous research in which the automatism perspective is applied (Kim *et al.*, 2005). Unlike a reason-oriented approach postulated in social psychological research to the study of individual behavior, such as in TRA and TPB, which posits that the intention to use emerges from conscious evaluations, the automaticity perspective views the use of a certain technology as an automatic and therefore unconscious reaction (Limayem *et al.*, 2007, p. 709). Habit has been proposed to directly and indirectly influence actual use via behavioral intention. Either course's impact relies on the extent to which individuals adopt routine behaviors when using a certain technology (Venkatesh *et al.*, 2012, pp. 163-165). In addition, UTAUT 2 introduces a new link between facilitating conditions and intention to use. While in UTAUT facilitating conditions are postulated to directly influence technology use because in the organizational setting facilitating conditions are relatively the same for all users (e.g., via free available training), UTAUT 2 also links facilitating conditions to behavioral intention. This is because facilitating conditions can vary widely in a consumer environment, unlike in an organizational environment. Here, facilitating conditions act more like perceived behavioral control such as in TPB and influence both intention and actual behavior. Thus, an individual consumer with access to facilitating conditions is more likely to have the intention to use a technology (Venkatesh *et al.*, 2012, p. 162). As consumption in a consumer context is always on a voluntary basis, UTAUT 2 erases the voluntariness of use as a moderating factor and adds instead the variable experience as a moderator in the interaction between intention to use and use (Venkatesh *et al.*, 2012, p. 159; Palau-Saumell *et al.*, 2019, p. 3).

The extended UTAUT 2 model resulted in a series of substantial theoretical findings, which indicates high estimation validity on the application of adoption on the consumer level by providing explanations to 74% of the variance in behavioral intention and 52% of the variance in technology use (Venkatesh *et al.*, 2012, p. 171). Although its introduction took place on a rather recent basis in 2012, UTAUT 2 has already accumulated more than 6,000 references in Google Scholar with frequent citations in the research field of information systems and other fields of social science, highlighting its potential role explaining the individual's dynamic of technology acceptance (Tamilmani *et al.*, 2020, p. 988).

Figure 14: Model of UTAUT 2



Source: Venkatesh *et al.* (2012, p. 160)

The advantages of UTAUT and its extension UTAUT 2 lie in its ability to combine explanatory constructs from other models and to explicate a high percentage of the variance in behavioral intention with relatively few predictors. Since its inception, UTAUT 2 has been applied in a variety of technology acceptance research contexts, with other theories added to it depending on the context of the study object in order to increase the explanatory power of the results (Venkatesh *et al.*, 2016). In their meta-analysis of the UTAUT, Blut *et al.* (2022) specifically suggest for future research the addition of new endogenous factors from different theories as well as the addition of new moderating variables to examine the generalizability of the UTAUT in different contexts. For the study of the diffusion and adoption of Bitcoin in Korea, in addition to the influencing factors outlined in UTAUT 2, two extending factors are of significance for providing an explanation of the following phenomena specific to the context of the research subject: First, the intention to use Bitcoin despite its extreme volatility, and second, the reasons for the cryptocurrency's popularity in Korea in particular. For the analysis of the first phenomenon, the determinant herd behavior is included. To examine the specific framework of the Bitcoin hype in Korea, the UTAUT 2 model is further extended by moderating cultural variables. In the following, the theories related to these factors will be presented and discussed in order to integrate them into the analysis model.

3.7 Uncertainty, Informational Cascades and Herd Behavior

For the decision-making process to adopt a technological system, such as the cryptocurrency Bitcoin in the case of this study, not only an individual's own perception and information are relevant influencing factors, but also the behavior of individuals in his or her environment. This is especially the case when the technology is an innovation that has a high level of complexity, about which the individual does not yet have enough information to make a decision. In these uncertain circumstances, observing the decisions of other individuals can strongly influence the decision-making process. In research, this process is defined as herd behavior, i.e. "everyone doing what everyone else is doing, even when their private information suggests doing something quite different" (Banerjee, 1992, p. 798).[40] The ability to observe the decisions of other users with respect to the adoption of

[40]For instance, it is often argued in the literature on balloting behavior that polls encourage voters to vote as the polls predict. A similar degree of influence occurs when, for instance, academic researchers decide to work on a topic that is "en vogue" at the moment. This type of factor has also been suspected to influence the decision to adopt new technologies (Banerjee, 1992, pp. 797-798).

a technology has been accelerated in particular via the digital communication channels of social media. Technology acceptance models such as the UTAUT and UTAUT 2 focus on the influence of the individual's own beliefs on the adoption and use of a technology and are less suited to explain herd behavior, which is characterized precisely by the devaluation of these personal beliefs (Sun, 2013, p. 1035).

Herd behavior broadly derives from the general phenomenon of localized conformity in society, such as common practices in national settings. As a consequence, individuals sharing common characteristics in a local framework tend to take similar decisions that are driven by very limited information. The reason for this is that when one is faced with making a decision, rationally acting individuals who only have insufficient information about the consequences of a decision, tend to take into account the observed decisions of other individuals having previously made a decision in the same decision-making circumstances (Bikhchandani *et al.*, 1992, pp. 992-995). Herd behavior is of great importance in the field of information technology. For instance, IT managers often track each other in terms of investment decisions, and computer users frequently acquire favored software products, thereby increasing their popularity (Duan *et al.*, 2009, p. 24).

Initially, herd behavior may appear similar to the concept of *social influence* in the UTAUT models or generally to *subjective norm* in previous diffusion and adoption theories. However, it is important to emphasize that, despite some degree of conceptual aspects overlapping, herd behavior differs from social influence along several key dimensions. First, herding behavior and social influence are different regarding the source of information that leads to the individuals' choices, as social influence emerges from the reference group of an individual, which are the persons who are important to him or her. These "significant others" are typically smaller groups of familiar people, such as family members, close friends, colleagues or supervisors, whereas the herd is usually made up of unfamiliar outsiders. While the reference group may not actually use the technology themselves, they may however share an opinion that reflects the subjective norm. In contrast, herd behavior typically has a much larger source of information, which often includes many previous adopters or a sizable user base. Moreover, in the context of herd behavior, people tend to follow those individuals who have in fact adopted the behavior or technology (Sun, 2013, p. 1018; Vedadi and Warkentin, 2020, p. 431).

Second, herd behavior and social influence are different in terms of the type of information obtained and the motivation for obtaining it (Sun, 2013, p. 1018). With regard to social influence, individuals expect that their reference group might later judge the adoption behavior. Since social influence is reflected as reinforcement to oneself for appreciative and correct behavior that is perceived by the surrounding social environment, individuals consider how the use of a particular technology will affect their image in their social environment (Moore and Benbasat, 1991, p. 195). In the context of herd behavior, on the other hand, individuals gather information about the attributed value of a technology in order to avoid incurring potential costs or later blaming themselves over a bad decision. They do not mind in the decision-making process how other individuals might judge them for using the technology. Members of the large anonymous herd will actually not be aware of the individual decisions either (Sun, 2013, p. 1018; Vedadi and Warkentin, 2020, p. 431). Third, herd behavior and social influence are different in terms of how information is gathered. Herd behavior is based on observations of other individual's actions, while social influence generally depends on messages received from the reference group (Thompson *et al.*, 1991; Sun, 2013; Vedadi and Warkentin, 2020).

In research literature on the phenomenon of herd behavior, network effects are presented as one rationale, which can be described as a kind of beneficial externalities (Duan *et al.*, 2009, p. 24). Network effects generally address the fundamental principle that the perceived value of a given product increases with the size of its user basis, since the utility or surplus that one user draws from a product increases as the number of other users consuming the same type of product grows, such as it is the case with computer hardware and software (Katz and Shapiro, 1994, p. 94). With regard to the information technology sector, however, researchers have found that the significant network effects anticipated by academics occur only for some products and thus not in all cases. For different products that have network effects, a boundary often exists in terms of the extension of the network. For example, peer-to-peer networks in general tend to gain from having a large number of users, yet excessively large numbers of users may at some point overload the network and restrict network effects further down the line. Under such circumstances, for potential users, an extensive network does not automatically result in greater perceived value (Duan *et al.*, 2009, p. 24; Liebowitz, 2002, p. 13; Asvanund *et al.*, 2003).[41]

However, network externality can be differentiated from herding behavior in certain aspects. Sun (2013) summarizes the differences in the following five points: First, network externality is strongly linked to the rising utility value of a technological system or product as a result of gaining new users. The intentional adopter may be aware that by adopting a certain technology, it is likely to enhance the value of that technology to existing users (e.g., cellphones or digital social networks). In herding behavior, on the other hand, this value-enhancing effect does not exist. The rationales for herding behavior are rather to cope with uncertainness, to prevent the costs of obtaining information and to avoid the reproach of having chosen a particular course of action. Second, in herding behavior, individuals draw information from keeping track of the decision-making and adoption process of others. By contrast, network externality can typically be the outcome of regular exchanges of information across potential adopters and existing users. Third, in herd behavior, information is usually derived either from general members of the public or from precursors who are well-informed, whereas, network externality concentrates rather on information derived from individuals and groups who stand to gain the most from adopting the technology. Fourth, while adoption processes resulted from herd behavior are relatively volatile and vulnerable to inversion, network externality is able to function as a means of reinforcing the value of a technological system or product and reducing the fragility of the user basis (Sun, 2013, p. 1018). Ultimately, unlike herd behavior, where there is often a drastic rush of adopters, network externality may in fact act as a deceleration, as individuals can be motivated to postpone their decision to adopt a certain technology and await more early adopters to offer them higher benefits from network externality (Goldenberg *et al.*, 2010; Sun, 2013, p. 1018). Table 2 summarizes the differences between herd behavior, network externality, and social influence (as used in UTAUT models) respectively subjective norm (as used in earlier diffusion and adoption theories).

[41] For instance, the presence of a first bidder in the acquisition market often attracts competing bids, even though the arrival of the first bidder boosts the target's price. This indicates that the positive information transmitted by the fact that the first bidder appreciates the target company dominates the negative payoff externality of paying a higher price (Bikhchandani *et al.*, 1992, pp. 1012-1013). A further example of negative network effects is the decision of investors to participate in an IPO (Welch, 1992).

Table 2: Differences between Herd behavior, Network Externality and Subjective Norm

	Herd Behavior	Network Externality	Subjective Norm
Definition	A person follows others when adopting a technology.	The value of a technology increases as the number of its users increases.	A person's perception that most people who are important to him/her think he/she should or should not perform the behavior in question.
Information source	Prior adopters.	Those who can benefit from the new adoption of the technology.	People in an adopter's reference group (important to the adopter) who may or may not have adopted the technology.
What information is inferred from others	Estimated value of the technology.	Benefits from more adopters of the technology.	Others' opinions/norms about the adoption.
How information is inferred from others	Observation.	Observation and direct communications.	Perceptions of how others would think about the behavior.
The impact of the number of others	The more, the stronger influence of others. However, the informativeness of predecessors may be low.	In general, the more prior adopters, the stronger the influence of others, and the higher perceived value of the technology. However, network externality is subject to the chilling effect and network congestion.	No strong relationship. Limited to those who are important to the adopters.
Motivations	To overcome uncertainty and to avoid costs or blame for choice.	To enjoy the increased value associated with the enlarged user base.	To avoid being judged unfavorably or in the hope of being judged favorably.
Long-term impact	Herds are often fragile and later reversals of herd practices are expected. On the other hand, herding practice may also have reasonable staying power if the true value of the adopted practice is ultimately revealed.	Network externality can strengthen the perceived value of a technology and can thus reinforce the user base.	Subjective norms do not matter much after the technology is adopted.

Source: Sun (2013, p. 1017)

As argued by Banerjee and Bikhchandani *et al.,* so-called *informational cascades* are a significant driver of herd behavior (Banerjee, 1992; Bikhchandani *et al.*, 1992). An informational cascade is a scenario where each successive actor, relying on the interactions of others, adopts the same decision; irrespective of the actor's own personal information. Thus, informational cascades emerge "when it is optimal for an individual, having observed the actions of those ahead of him, to follow the behavior of the preceding individual without regard to his own information" (Bikhchandani *et al.*, 1992, p. 994). Prior to the advent of an information cascade, processes of adopting a technological system or product are shaped by both private information and the behavioral choices of precursors. However, in cases where actors lack sufficient information regarding the real utility of a technological system or product, they mainly derive its value based on the observation of the behavior of other actors who have already decided to adopt or reject the technological system or product. The impact of the behavior of other actors can be so significant that it outweighs the impact of the actor's private information. As a result, an individual might imitate the behavior of another actor irrespective of his or her personal sources of information (Duan *et al.*, 2009, p. 24). While the adoption process initially follows a gradual course, the occurrence of an information cascade leads to significant changes that can be described as a sudden jump in the adoption process, as potential users follow the behavior of their precursors regardless of their own information (Duan *et al.*, 2009, p. 28). Therefore, informational cascades provide an information-based framework to interpret herd behavior, a phenomenon that might contribute to a high degree of acceptance of a specific technological system or product or to the dominance of a certain technology, despite the availability of better alternatives (Abrahamson, 1991).

Bikhchandani *et al.* (1992) construct a basic model for herd behavior where individuals decide in a sequential manner between adopting or rejecting a particular behavior in an exogenous order known to all, presuming the following: Individuals experience equal costs of adoption and equal gains when making the correct decision. In addition, individuals make their decisions relying on two information sources: They observe the choices of other individuals who have already made them as well as privately obtain a conditionally independent signal regarding the acceptance or rejection of a particular behavior. In the second case, the signal is observed privately meaning that it is not transmitted to other individuals., The probability of obtaining a valid private signal is smaller than one, meaning that a few individuals obtain a private signal in favor of adoption, whereas others obtain a private signal in favor of rejection. Therefore, succeeding individuals are able to observe the choices of earlier individuals, but they are not able to observe their private signals. Since all individuals are aware that their private signal might be incorrect, they reach a rational decision in accordance with their private signal and the observed decisions of earlier users. At some point, however, the rational decision will be to pursue the decision of the major part of the preceding individuals, and to disregard the private signal of one's own, since it is assumed that the public information obtained by observing previous decisions will become more accurate over time. This creates an information cascade (Bikhchandani *et al.*, 1992, pp. 996-997). Some of the presumptions included in the basic model of herd behavior regarding the individual's behavior and the environment in which individuals act, were relaxed in later versions of the model to enable approaching similar constraints, such as the diffusion of innovations. Later approaches take into account, for example, variations in the cost of acquisition, multiple sources of information and variations in the extent to which private signals are precise (Bikhchandani *et al.*, 1992).

Since in an information cascade individuals make their decision based on the information obtained from previous observed decisions and ignore their own private information, little new information is gained. This implies that herd behavior is often marked by low informativeness: the herd does not entirely reflect the whole range of signals and preferences of the herd participants (Sun, 2013, pp. 1015-1016; Banerjee, 1992, p. 798; Bikhchandani *et al.*, 1992, p. 994). Therefore, the fact that a large number of individuals opt for a particular technology does not automatically imply that every user favors it over all alternatives.[42] The low information characteristic of herding lead to a general fragility at the individual as well as at the herd level. On the one hand, individuals exercising herding decisions due to informational cascades may undergo "post decision regret" (Rao *et al.*, 2001, p. 508). Through going along with the choices of others, a user is likely to misallocate his or her own desires and therefore falsely adopt a technology that is not appropriate for his or her personal needs (Abrahamson, 1991, pp. 606-608). Hence, when new information is subsequently disclosed, the user's opinion may change and cause him or her to abandon the herd (Sun, 2013, p. 1016). On the other hand, fragility at the herd level implies that when some users exit a certain herd, they may influence other users to abandon the herd as well, "starting a herd in the opposite direction" (Bikhchandani *et al.*, 2001, p. 281). Thus, a herd is characterized by a volatile nature, evidenced by its process of reaching conformity quickly and then dispersing in a form of "negative diffusion," resulting

[42] For example: In a given situation where two technologies with similar functionalities and qualities exist (technology α and technology β), three persons X, Y and Z are required to choose one of them. Individual X prefers technology α and therefore chooses it. Individual Y slightly favors technology β, but since Y has limited personal information about both technologies, Y discards his own preference and follows the choice of X. When individual Z observes the choices of X and Y, it is likely that Z will choose technology α as well. Thus, a herd is formed. All participants choose technology α, although some of them personally prefer technology β (Sun, 2013, p. 1015).

in a risk that the herd's current status quo will deteriorate (Rao *et al.*, 2001, p. 509; Sun, 2013, p. 1016). Moreover, there are even occasions when individuals go along with the herd and take decisions that they are aware to be wrong (Sun, 2013, p. 1016).[43]

In summary, literature on herding has generally proposed two prerequisites for the occurrence of herd behavior: uncertainty regarding the choice being made and observation of the actions of others (Sun, 2013, p. 1016; Bikhchandani *et al.*, 2001, p. 284; Rao *et al.*, 2001, p. 504-505). Uncertainty generally describes the perceived inability of an individual to accurately predict an event based on imperfect information (Loasby *et al.*, 1979; Milliken, 1987, p. 136). Uncertainty occurs when "a framework for interpreting a message is available, but there is a lack of information to process" (Dennis and Valacich, 1999, p. 1). As such, technology adoption uncertainty can be considered as the extent to which one is unable to correctly predict the associated concerns of adopting a technology due to insufficient information (Sun, 2013, p. 1020). In this context, Milliken categorize three forms of uncertainty: *State uncertainty,* or *perceived environmental uncertainty*, which is the perception that the organizational environment or a specific element of that environment is unpredictable; *effect uncertainty,* which involves the incapacity to anticipate the nature of the effect of a future state of the environment or a given environmental modification on the organization; and *response uncertainty*, which indicates the unawareness of response options and/or the incapacity to anticipate the probable outcomes of a given response choice (Milliken, 1987, pp. 136-138).

Sun (2013) emphasizes that each of the three forms of uncertainty can emerge in the framework of technology adoption. Individuals may, for instance, lack confidence about the purpose of a technology (*state uncertainty*). They may be unsure of what a technology will be able to provide for them (*effect uncertainty*) and whether they will be in a position to deal with potential technology changes, such as upgrades or requirements to download software to sustain the technology once adopted (*response uncertainty*) (Sun, 2013, p. 1020). Thus, the increasing sophistication of modern information technology systems and the associated information asymmetries that resulted from the complex nature of such systems lead to a valid degree of uncertainty with regard to the adoption process. For

[43] The collapse of the dotcom bubble in the early 2000s can be seen as an example for such behavior (Sun, 2013, p. 1016).

instance, a sufficient evaluation of a certain technological system might require from potential users to have adequate knowledge, previous experience or technical know-how. In some cases, the advantages of using specific technological systems might occur with a time lag which could create uncertainty to potential users, when making the decision whether to adopt or not. Examining which types of perceived uncertainty lead to herd behavior, Vedadi and Greer (2021) state that with regard to the adoption of a technology only *effect uncertainty* and *response uncertainty* lead individuals to disregard their own information and follow the decisions of previous users. In contrast, uncertainty about the purpose of a technology (*state uncertainty*) had no effect, possibly because in this case, individuals view the technology as too complex to understand and therefore tend not to discount their own information (Vedadi and Greer, 2021, p. 11).

Herd behavior is considered to have a significant influence on the adoption and diffusion of technological innovations and is applied, among others, to explain the rise and decline of technology trends (Duan *et al.*, 2009, Walden and Browne, 2009; Vedadi and Greer, 2021). It is based on the assumption of a potential user that those actors already using a certain technology have extensively evaluated its benefits as well as compared it with possible alternatives and that, consequently, it is a rational decision to adopt the technology. However, in addition to positive effects – such as accelerating the adoption process of technologies that are useful for society – herd behavior can also have negative effects, such as rash adoptions that are later regretted, misguided expectations, or manipulation of decision-making processes (Muchnik *et al.*, 2013).

3.8 The Role of Culture Values

In addition to the influencing factors mentioned in the UTAUT 2 model, the respective location context in which the diffusion of a technology takes place is also important for understanding the adoption process of technological innovations. Along with, for instance, economic status and competition parameters, the relevant location factors include in particular the factor of regional culture, leading studies on possible extensions of the UTAUT model to focus on the effects of cultural factors for the analysis of technology acceptance and to examine differences in UTAUT relationships in an international comparison (Al-Gahtani *et al*., 2007; Venkatesh and Zhang, 2010; Im *et al.,* 2011, Alshare and Mousa, 2014).

The necessity of extending the UTAUT and UTAUT 2 model was also stated by Blut *et al.* (2022) in their meta-analysis on UTAUT. They summarized that the substantial variants in the UTAUT relationships in the different conducted studies applying UTAUT theory point to the presence of further influencing moderating variables. This illustrates that there is not just one particular UTAUT model with a universally relevant set of influencing factors that can be applied to all contexts. Rather, the capability of the theory to determine the influencing factors for the technology acceptance process is significantly dependent on the specific context in which the particular study is undertaken. Thus, when conducting studies to investigate the adoption process of technological innovations, the consideration of moderators is essential (Blut *et al.*, 2022, p. 51-53). The authors suggested an extension of the theoretical framework of the UTAUT model to include additional contextual differences that characterize each specific context and assigned an important role as influencing moderating variables on the technology adoption process to national cultural factors.[44] Culture has an influence on the thinking and behavior of individuals, the degree of innovativeness and the readiness to accept uncertainties. It is generally perceived as a pattern of social behavior and norms that exist in certain populations. Being one of the key concepts in the field of human sciences, culture is a set of phenomena that are passed on through social interaction and acquisition (Huang *et al.*, 2019, pp. 4 and 9). It is thus understood as the common symbols, norms and values in a social construct such as a nation (Lee *et al.*, 2013, p. 22).

Blut *et al.* (2022) extended the UTAUT model to include cultural moderating factors by drawing on one of the most prominent cultural theories in the field of research on information systems and technology adoption, the cultural model of Geert Hofstede. Hofstede defined culture as "the collective programming of the mind that distinguishes the members of one group or category of people from others" (Hofstede *et al.*, 2010, p. 6). In

[44] Besides the national cultural variables, Blut *et al*. additionally list the user characteristics age, gender and experience already used in UTAUT 2 as well as technology types (e.g. mobile vs. non-mobile, online vs. offline) as further contextually differentiating moderating factors (Blut *et al*., 2022, p. 21-24). The latter are not relevant to the study of Bitcoin adoption in Korea, as the focus is only on one technological innovation as research object.

an empirical study of more than 110,000 IBM employees in the late 1960s, Hofstede used a factor analysis to develop the model of cultural dimensions. By statistically processing the IBM data, he identified four dimensions of national cultures, which he outlined in "Culture's Consequences" (1980) and further developed in "Cultures and Organizations. Software of the mind" (1991). Although Hofstede's cultural model has been criticized in research for its generalizing and essentializing tendency (McSweeney, 2002), its application to the examination of the adoption process of technological innovations has been found to be reasonable as the integration of this model has been widely used in technology acceptance research and the concept of cross-national differences has been shown to be useful in explaining regional variations (Blut *et al.*, 2022, p. 16 and 60).

The four classical dimensions of culture in Hofstede's model are as follows: First, *Individualism/Collectivism* is defined as the degree to which the individual prioritizes his or her own set of personal interests over group interests and therefore tends to act as an individual rather than as a collective group member. Individuals who have a low individualism index score (and a high score for collectivism) generally display a strong sense of belonging as a member of a group and tend to consider it important to obey group decisions. In contrast, individuals who exhibit a high degree of individualism are self-oriented in their minds and behavior and are incentivized to exercise initiative and seek to impose individual choices (Hofstede *et al.*, 2010, pp. 92-94; Lee *et al.,* 2013, p. 21). Markus and Kitayama applied the terms independence and interdependence as substitutes for the terms individualism and collectivism used by Hofstede in order to describe the different conceptions of the self associated with, or frequently resulting from, the two opposing cultural approaches (Markus and Kitayama, 1991). While the independent conception of the self is particularly premised on the precedence of the individual, with the self viewed as distinctive and autonomous, the interdependent conception is characterized by social unity and emphasizes the maintenance of harmony in a social construct. Therefore, in more collectivist cultures, choices and decision-making are driven by the norms and the beliefs of the group members. According to Hofstede, a high individualism index score points to a culture with comparatively weak ties between individuals since one is expected to put his or her needs and those of his or her immediate family first. In contrast, a low individualism index score refers to a more collectivist culture characterized by strong ties among individuals, since they are integrated into cohesive in-groups that protect them in exchange for unconditional loyalty (Kim, 2008, p. 18; Hofstede *et al.*, 2010, p. 92).

Second, *Power Distance* is defined as the extent to which significant imbalances in power and inequality are considered as normal and accepted by the individual. Power distance determines the scope to which an employee, for instance, accepts that his or her superiors possess more power. In a culture or society where its group members intuitively acknowledge power distance, individuals would most likely consider the group leader's norms and opinions as important to emulate (Hofstede and Bond 1988, p. 10; Lee, 2013, p. 21).

Third, *Uncertainty Avoidance* is defined as the extent of risk that is accepted by the individual. This may be indicated by his or her reliance on obeying rules and ritual behavior, for example. The scale of uncertainty avoidance explores the degree to which one is able to cope with ambiguous circumstances. Individuals with a high degree of uncertainty avoidance generally tend to oppose all divergent and uncertain thoughts and behaviors and attempt to explore means of reducing uncertainty. A low uncertainty avoidance score reflects lower concern about insecurity and ambiguity, and more tolerance for a wider range of perspectives (Hofstede and Bond 1988, p. 11; Lee, 2013, p. 21).

Fourth, *Gender Role Orientation* is defined as the extent to which gender inequalities are endorsed by an individual and as the degree of differentiation of traditional gender roles. This dimension explores the impact of practicing specific masculine or feminine believed values on emphasizing different social attitudes and behavior within the group (Hofstede *et al.*, 2010, p. 137-140). Furthermore, *Long-Term Orientation* was later included as a fifth dimension and defined as the extent to which a social group welcomes long-term commitment to traditional values. Culture groups that have a strong long-term orientation may assess schemes in regard to traditions, customs, or history. A high long-term orientation score reflects how the culture espouses the values of long-term commitments and respect for traditions and historically established norms. In such cultures, transitions may be less frequent in comparison to a culture with a low long-term orientation score, as long-term commitments often create obstacles to making such transitions. In cultures with a strong long-term orientation, it may take longer for a business to develop or a new innovation to diffuse, especially for an exogenous innovation, business or product (Kim, 2008, p. 18).

With respect to different communication forms between national cultures, one of the founders of cultural studies, Stuart Hall, distinguished between so-called “high context” and “low context” national cultures. This focus complements Hofstede's model, as the aspect of communication is an essential component of the innovation adoption process (Hall, 1960; Hall, 1976, pp. 105-116; Hall and Hall, 1990, pp. 6-10). Context addresses the way information and knowledge is acquired by individual members of a social group and their societies. Individuals belonging to high-context cultures (e.g. Japanese or Koreans) tend to receive their information from networks of interpersonal sources such as friends, relatives and business associates, while those belonging to low-context cultures (e.g. Swiss or Americans) tend to obtain their information regarding decision-making from direct channels such as visual media, reading, and databases (Kim, 2008, pp. 18-19).

To investigate the impact of national culture differences on technology adoption Kim (2008, p. 19) combined the national culture types from Hofstede’s model with the context dimension of national culture from Hall to identify two culture types (i.e., Type I and Type II). The main characteristics of the two different national culture types with cultural dimensions and some exemplary countries assigned to each type are summarized in table 3.

Table 3: The Main Characteristics of National Culture Types

Culture constructs	Type I	Type II
Individualism versus collectivism	High IDV score Goals, needs, values of collectives are subordinated to those of individuals Separate from social context, constant and stable Internal, private (abilities, thoughts, feelings) Independent view of self Loosely coupled social network Relative preference for short-term, "shallow" relationships Decisions are weakly influenced by the group norm and members' opinions	Low IDV score Goals, needs, values of individuals are subordinated to those of collectives Connected with social context, flexible, and variable External, public (status, roles, relations) Interdependent view of self Tightly coupled social network Relative preference for long-term, "deep" relationships Decisions are strongly influenced by the group norm and members' opinions
Weak uncertainty avoidance versus strong uncertainty avoidance	Low UAI score High tolerance for uncertainty and a variety of opinions People prefer informal arrangements of controlling risk	High UAI score Low tolerance for uncertainty and ambiguity People prefer structured arrangements of controlling risk
Low long-term versus high orientation	Low LTO score Less focus on traditions, customs or history Emphasizes values such as personal steadiness, stability	High LTO score Evaluate plans in term of traditions, customs or history Emphasizes values such as persistence, ordering, relationships, thrift, royal, trustworthiness
Low context versus high context	Low context scale score People seek information about decision from direct and formal information sources Interpretation of messages rests on the written or spoken word content	High context scale score People obtain information from personal information networks Interpretation of messages rests on contextual cues
Typical countries	USA, Canada, UK	South Korea, Japan, Taiwan

Source: Based on Kim (2008, pp. 21–22)

The cultural dimensions of Hofstede's model have been widely applied in several information systems related studies. These research papers indicate significant linkages between national culture and the structure of the national information infrastructure, the frequency of technology adoption, technology diffusion and the capacity for innovation at the personal level (Lee *et al.*, 2013; Thatcher *et al.*, 2003; Garfield and Watson, 1997). However, the majority of the research conducted on cultural factors in the field of information systems and technology adaption deals with the national or corporate dimension. Thus, a common practice has been to employ nationality as a substitute for culture, by making comparisons between analogous patterns of respondents drawn from either two or more nations and to explain potential discrepancies based on the presumed cultural dichotomies across the respective nations. As a result, this approach is considered to be questionable for a number of reasons. It is often based on historically formed prejudices about the cultural attributes of a given country or certain region. Moreover, in Hofstede's model cultural dichotomies covary across diverse nations. Hence, deducing the cultural factor causing the discrepancy observed across samples from diverse countries often proves to be complex. Consequently, finding samples that meaningfully separate out those critical cultural variables of interest might present a major obstacle. A related concern is that individuals from the same country can differ in terms of cultural dimensions. Indeed, national culture can be understood as a macro scale phenomenon, whereas user acceptance of technology is an individual scale issue. As such, it is problematic to use a national benchmark model in order to assess or predict individual behavior, since it would mean universalizing cultural attributes of individuals living in the same country, despite potential differences (Tarhini *et al.*, 2017, pp. 307-308). In addition, the national cultural dimension scores of Hofstede's model cannot be understood as an immutable entity, since cultures are subject to transformation processes and can change over time (McCoy *et al.,* 2005, p. 214).

For this reason, the inclusion of contemporary individual level measures is essential when integrating the influencing factor of national culture into technology acceptance research. In this context, Dorfman and Howell (1988) extended the measurement of culture, normally considered as a society-level attribute, to the individual level, manifested as the degree of individual belief in particular cultural values. Srite and Karahanna (2006) took this approach and argued that the influence of culture on the individual largely depends on the extent to which the individual is receptive to the values of his or her own culture and is willing to interact accordingly (Dorfman and Howell, 1988, p. 128; Srite and Karahanna, 2006, pp. 680-681). The authors employed scales derived from the approaches of Hofstede (1980) and Dorfmann and Howell (1988) in order to measure espoused national cultural values at the individual level. Accordingly, based on research in psychological anthropology and cultural psychology, the study of Srite and Karahanna (2006) showed that national culture can be treated as an individual difference variable. The authors integrated this conceptualization of national cultural values at the individual level into a TAM-derived model and demonstrated that espoused national cultural values can influence individual user behavior as moderating variables (Srite and Karahanna, 2006, pp. 697-699). Therefore, the inclusion of individual-level cultural values as influencing moderating variables for studying the diffusion and adoption of Bitcoin in Korea is appropriate for examining individual behavior.

3.9 Conclusion

Chapter 3 presented and discussed the different approaches of diffusion theory and technology acceptance research. While the diffusion of innovations theory focuses on the perceived characteristics of an innovation in relation to the adoption decision process, the attitude-behavior theories (TRA and TPB) examine the variables that influence the intention and behavior of decision makers. Both diffusion of innovation and attitude-behavior theories examine the perceptions of the decision maker (Weigel *et al.,* 2014, p. 621). Behavioral intention is defined in TRA and TPB as an essential variable that directly corresponds to an individual's actual behavior. The Technology Acceptance Model (TAM) adopts this approach and conceptualizes behavioral intention as an endogenous variable to understand technology acceptance in the context of information technology. According to the TAM, behavioral intention is directly influenced by perceived usefulness and actual use and indirectly influenced by perceived ease of use. On the one hand, the TAM has been recognized for its applicability and validity in explaining individuals' behavioral intentions regarding the use of a particular technology. On the other hand, it has been criticized for not taking into account external variables that could affect its main constructs, which led to the extension of the model (Teo *et al.,* 2018, p. 462). In this field of discourse, Venkatesh *et al.* (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT) to combine the approaches of different acceptance models into a unified research model.

While the advantages of the UTAUT and its extension UTAUT 2 lie in their ability to combine explanatory constructs from other models and to explain a high percentage of the variance in behavioral intention with relatively few predictors, recent technology acceptance research has expressed the need to add further endogenous factors from additional theories as well as new moderating variables into the model in order to increase the validity of the results. In this study, the UTAUT 2 model is applied and extended with the factors of herd behavior as well as with moderating cultural variables to explore the complexity of the behavior of Bitcoin users in Korea with regard to the adoption and acceptance of this new technology. Before presenting the hypothesis development and methodology of the study to examine the paradigms that influence the decision-making process, Chapter 4 outlines the specific socio-economic development of Korea, which provides the socio-historical context for the diffusion of Bitcoin in this country.

4 Cryptocurrencies in South Korea

In the international cryptocurrency market, South Korea is of particular importance: it forms the third largest crypto trading market, although it ranks only 28th in terms of population and 10th in terms of GDP (Low and Wu, 2019, p. 3; Jehn *et al.,* 2022).[45] The causes of the rise of cryptocurrencies in South Korea need to be examined in the context of the country's post-development and neoliberal transformation process, which marked the turning-point of the country's rapid economic development and enabled the liberalization of financial markets as well as a growing public interest in real estate, stocks and funds (Kim, 2017, pp. 612-613; Lee, 2020, p. 8). Therefore, Chapter 4 outlines the economic development in South Korea with its impact on wealth, education, and social mobility, and discusses the social and political responses to the rise of cryptocurrencies in order to provide the socioeconomic context for analyzing the adoption and diffusion of Bitcoin in this country.

4.1 South Korea's Socioeconomic Characteristics

4.1.1 From the "Miracle on the Han River" to the Asian Financial Crisis and its Aftermath

While Korea was one of the most impoverished regions in the world at the end of the Pacific War, South Korea has undergone a historically accelerated economic development since the end of the Korean War in 1953, leading to its membership in the OECD in 1996 and its participation in the formation of the G20 intergovernmental forum in 1999. During the period from the 1960s to the 1980s, South Korea registered an average GNP growth rate of 8.5% per year and was considered the world's fastest growing economy (Kim, 2004, p. 210). The so-called "Miracle on the Han River"[46] was the result of a state-controlled and export-oriented economic development, which initially focused on labor-intensive light industry and, from the 1970s, on capital-intensive heavy and chemical industries, until it was expanded in the 1980s to include technology-intensive sectors such as electronics and

[45] In 2022, the U.S. ranked first in Bitcoin trading volume at 69.8%, Japan ranked second at 11.3%, and Korea ranked third at 8.7% (Jehn *et al.*, 2022).

[46] The characterization of the East Asian economic development as a "miracle" was taken up and further consolidated by the World Bank in its 1993 publication "The East Asian Miracle: Economic Growth and Public Policy" (Word Bank 1993).

IT industries. The interventionist policies of the authoritarian military government were based, on the one hand, on controlling finance and regulating the flow of capital, and, on the other, on cooperating with large private business conglomerates, the so-called *chaebols*, by granting them certain privileges – such as "investment licenses", which gave them monopolies over certain products, better access to capital at subsidized interest rates, tax incentives, trade protection measures and tariff exemptions for the import of capital goods – and in return demanded compliance with state planning directives, which focused in particular on the rapid expansion of production (Kim 2018a, pp. 3-4; Yang, 2018, p. 48; Minns 2001, pp. 1026-1031). To ensure international competitiveness, the state pursued a low-wage policy and suppressed labor rights movements in a repressive manner (Suh 2018, p. 43). In public discourse, the military government propagated saving and frugality in domestic life as an essential means for the state development process and rigid working and living conditions as a necessity to achieve national and individual prosperity.[47] The personal savings rate of Korean households subsequently increased in the 1960s, reaching 22.2% in 1979 (Yang 2018, p. 37 and 45).

Despite these authoritarian state interventions to accelerate economic development, income inequality did not increase, as it was the case in other developing countries, but in fact decreased from the beginning. A distinctive characteristic of the so-called "Miracle on the Han River" was the observation that the decades of high growth rates apparently occurred in the absence of Kuznets' inverted-U hypothesis, which states that with rising per capita income, the inequality of income distribution first increases, then decreases again (Kanbur *et al.*, 2014, pp. 241-243; Kuznets, 1955). In contrast to the Kuznets curve, Korea's official Gini coefficient indicates that the level of income inequality did not change significantly during the period of 1965-1993 and that income distribution actually improved between the mid-1960s and the early 1970s and then improved again in the 1980s (Kanbur *et al.*, 2014, pp. 241-243). Researchers have pointed to the introduction of an authoritarian welfare system as one of the reasons for this development (Kim *et al.,* 2011). Thereby, the military government did not establish the welfare system as a state operated program, but rather delegated this task to an alliance between the state, business and industry, and the voluntary

[47] For instance, the state propagated the image of the Korean middle-class housewife as a strong advocate of domestic savings, frugal lifestyle, and rational consumption to promote national modernization (Yang 2018, pp. 43-45).

sector. This employment- and occupation-based welfare system, whose benefits applied only to regular employees, became established over the long term and was later adopted by the democratic government (Suh, 2018, p. 44). In addition, the educational and health care systems were expanded and improved during the period of rapid economic growth. The access to education for the population was pushed forward by means of various programs, so that universal education was achieved more rapidly and comprehensively during this period than in any other country. Also, the education programs showed other aspects of a new social policy, such as free childcare and school meals (Kim, 2020, p. 482). Although South Korea's rapid economic growth was often associated with corruption and favoritism due to the monopoly position of the *chaebol*[48], as well as with difficult working conditions for many ordinary workers, most Koreans benefited from the development as their living standards and wealth increased (Yang, 2018, pp. 130-131). The 1980s marked the beginning of the democratic movement in South Korea. In 1987, the authoritarian regime was overthrown by a civil uprising that spread throughout the country. Already before these events, steps were taken to transform the growth strategy from a government-led to a market-led one. The liberalization of imports and the gradual opening of capital markets to foreign investors followed. Consumerism increased, and for many Koreans it seemed that austerity and hard work had paid off. From 1963 to 1992, household disposable income, after adjusting for inflation, had increased ninefold (Korean National Statistics Office, 1993, p. 60).

On the other side, the rapid development has also generated a more critical perception of Korea's modernity in the academic discourse since the late 1990s, including the theory of *Compressed Modernity*, which is defined as "a civilizational condition in which economic, political, social, and/or cultural changes occur in an extremely condensed manner in respect to both time and space, and in which the dynamic coexistence of mutually disparate historical and social elements leads to the construction and reconstruction of a highly complex and fluid social system" (Chang, 2017, p. 33). As a critical theory of postcolonial change, the theory of *Compressed Modernity* refers to Korea's history of colonial

[48] By comparison, in South Korea the ten biggest companies contribute more than 76% of the country's total GDP, while in Japan more than 80% of GDP is generated by small and medium-sized enterprises. Large corporations such as Sony, Toyota and Panasonic contribute less than 20% of total GDP in Japan (Kim, 2018a, p. 3).

occupation and the influence of external forces in the postwar period that promoted nationalist developmentalism, and argues that economic development in South Korea was mainly a top-down project of elites, in which feudal social hierarchies were never completely removed and in which traditional and modern elements continuously interacted, competed, and conflicted. According to Chang (2017, p. 33), this has led to an environment of tension in which individuals must continually behave in a flexible and often conflicting manner in order to conform to the social norms.

The process of rapid economic development, however, was slowed by a series of setbacks and remaining systemic problems within its corporate and financial systems, culminating in 1997 with a devastating financial crisis in South Korea that prompted the IMF's largest bailout program to date to rescue the struggling economy (IMF, 1999). The reasons for the crisis included excessive borrowing and over-investment, which led to a series of corporate failures. When the financial crisis in Thailand and Indonesia spread to Korea, it resulted in a massive flight of capital, the crash of the stock price index, and the depletion of the foreign reserves, bringing South Korea to the brink of default (Im, 2018, p. 98).[49] The IMF reform package was based on comprehensive neoliberal reforms that affected the financial market, the labor market, the public sector and corporate governance (Shin, 2013, p. 336). The fundamental restructuring of the economy had an enormous impact on Korea's social and economic situation: The bankruptcy of many large industrial groups led to layoffs and unemployment, the middle class faced shrinkage, wealth polarization became more pronounced and problems of injustice began to increase (Kim, 2018a, p. 4; Kim, 2020, p. 482). Since the welfare system was mainly linked to employment, many Koreans lost their social security along with their jobs. Poverty re-emerged as an acute socioeconomic issue: Between 2000 and 2010, almost 10% of the population lived in poverty, and in 2008, about 12% of the total labor force belonged to the category of "working poor". Even though the IMF's demands included strengthening social welfare systems and government spending on social welfare increased constantly, it lagged behind in international comparison. In 2008,

[49] The effects of the Asian crisis in Korea were drastic: The South Korean Won crashed on the foreign exchange market, dropping from 844 to almost 2,000 Won in exchange for a US Dollar in 1997 (Shin, 2013, pp. 335-336). GDP per capita, which had reached 13,403 US Dollar in 1996, fell dramatically to 8,281.7 US Dollar in 1998 (World Bank Data, 2021, GDP per capita, current US Dollar).

South Korea spent 8.3% of GDP on public welfare, the lowest figure among OECD countries (Suh, 2018, pp. 47-48).

During the decades of rapid economic growth, the premise promoted by the state was that hard work and frugality would lead to prosperity and upward social mobility. In public discourse, the category of the rising middle class was linked to the country's economic development in order to promote national modernization and to mobilize the population as part of the development project (Yang, 2018, p. 33). "If you work hard and live frugally then you can buy a home and raise children" (noryeok/노력) was one of the maxims of South Korea's development agenda, gaining its ideological power not only through rough mobilization, but also by encouraging aspirations and desires. As this premise was realized for certain parts of the population during the period of rapid economic development, the concept of the middle-class based on hard work and austerity was further elaborated and promoted in public discourse (Kim, 2017, p. 617; Lee, 2020, p. 11). However, in the aftermath of the financial crisis, this concept has failed to materialize for ever larger segments of the population – particularly the younger generation.

The social consequences can be illustrated by the transformation of people's self-identification with the middle class. Whereas in a 1977 survey 86.8% of respondents attributed themselves to the middle class, although scholars estimated the proportion of the middle class to the total population at only 30% based on objective indicators, the ratio was reversed in 2005. Only 56.2% still stated that they considered themselves middle class, while official statistics identified 69.2% as middle class. In contrast, 42.4% responded that they identified themselves as lower class, while the statistics attributed only 11.9% of the population to the lower class. Since public statistics measure the share only in terms of income, and disregard other parameters such as wealth and liabilities, they may tend to overestimate the share of the middle class. In general, however, the size of the middle class has declined by both objective and subjective criteria since the 1997 financial crisis (Yang, 2018, pp. 58-59 and pp. 123-125). According to official statistics, 67% of Korean households were classified as middle class in 2010, compared to 75% in 1990 (Hyundai Research Institute 2011). Although financial stability was restored and the economy recovered, the financial crisis thus had long-term socioeconomic consequences for the

Korean population. The effects were particularly evident in the areas of wealth, education and social mobility.

4.1.2 Difficulty in Accumulating Wealth

The conditions of the IMF bailout program addressed, among others, the aspect of labor flexibility, and the Korean government implemented extensive labor reforms resulting in mass layoffs and extending the scope of using irregular labor. Hence, the unemployed figure more than doubled, from 658,000 in December 1997 to 1.7 million in December 1998, raising the unemployment rate from 2.6% in 1997 to 8% in 1998 (OECD Data, 1997-1998; Yang, 2018, p. 101). The reforms were not only directed at overcoming the economic crisis in the short term, but fundamentally transformed the labor market in the long term. Government and corporate actors often pointed to labor inflexibility as one of the reasons for the inefficiencies and burdens on the economy that ultimately led to the crisis. As a result of the reforms, the discontinuation of the employers' obligation to guarantee secure and permanent job opportunities to their employees led to an increase in temporary employment and lower wages (Yang, 2018, p. 101). While the profit rate of the corporate sector recovered after the crisis, precarious working conditions and low wages had now become the norm (Lee, 2020, pp. 11-12; Shin, 2013, p. 336).[50]

This trend toward an increasing number of non-regular workers living in precarious economic conditions has evolved into an enormous social problem. Since the early 2000s, non-regular employment has constituted more than half of total employment; in the service sector, this share is even estimated at 60% to 90% (Yang, 2018, p. 101). The pay gap between precariously employed workers and regular workers expanded from 33.9% in 2002 to 44.6% in 2011.[51] In this context, the term "social polarization" became a common expression to describe the growing economic inequality and the extent of social exclusion in South Korea (Korea Labor Institute, 2011; Shin, 2013, p. 336). In the media and in public discourse, this is referred to as the polarization between the "labor aristocracy"

[50] For instance, Korean households' real disposable income growth rate fell from ca. 6% in the 1990s to 0.8% in 2000-2004, whereas the corporate sector's growth rate rose from 4.8% to 58.3% (Lee, 2011).

[51] In addition to lower wages, non-regular labor has other disadvantages such as longer working hours and no entitlements for additional benefits such as retirement benefits, bonuses, overtime pay, or paid vacation (Yang, 2018, p. 102).

(*nodong gwijok/노동 귀족*) and irregular employment (*bijeonggyujik/비정규직*), with the former encompassing the 10% of regular skilled workers of large enterprises who benefit from higher wages, job security and state welfare provisions. While these benefits even extend to the so-called "employment inheritance" (*goyong seseup/고용세습*), which guarantees the children of retiring employees, who have completed more than 25 years of service, priority employment opportunities, these benefits do not apply to non-regular workers, even if they are employed by the same company (Kim, 2018b, pp. 119-120).

Another condition of the IMF program concerned the deregulation of the financial markets.[52] In order to facilitate foreign investment, the Korean government was required to significantly liberalize the financial markets, which led to an increase of foreign capital and a boost in the Korean financial markets. The government also deregulated consumer credit in an attempt to tackle the issue of declining domestic spending due to high unemployment, precarious labor conditions and lower wages. This measure led to a rise of local real estate and stock markets (Lee, 2011, pp. 38-39; Lee, 2020, p. 12). As the prospect of regular employment, and thus sustainable and prosperous personal economic well-being, diminished for many Koreans, a large number began to see the financial markets as a potential source of financial prosperity. Consequently, a surge of public interest in stocks, funds and real estate has been generated and expanded (Jang, 2011, p. 55). In this context, Korean local media discourses as well as the marketing of financial industries have led to promoting financial issues and hence encouraging private households to participate in the new developments in the financial markets. For instance, commercial banks have reoriented their main business priority from focusing on industrial loans to providing more profitable loans to private households (Lee, 2020, p. 12). Along with this, the media soon spread

[52] During the period of the Korean military government, banks were controlled by the state and financial resources were directed to the *chaebols* in order to promote industry and support export-oriented economic growth. At the same time, bank loans to the ordinary population were highly restricted. Despite the democratization of the political system and the processes of deregulation and liberalization in the economic sphere in the 1980s, this "state-banks-chaebol nexus" persisted until the mid-1990s (Kim, 2017, p. 616; Jang, 2011, p. 47).

reports about people who, by participating in the real estate market with the help of bank loans, achieved instant wealth (Kim, 2017, pp. 617-618).[53]

The expectation of improving steadily stagnating wages with financial gains has led many individuals to invest in real estate and stock markets. The greater the insecurity and uncertainty about the economic future, the higher the temptation to invest in financial assets (Lee, 2020, p. 12). Once interest rates dropped significantly and real estate as well as stock prices soared, the financial industry began advising people to invest in securities, real estate, mutual funds and insurance policies. The enormous transformation processes in the aftermath of the financial crisis thus had the effect of shifting the characteristic pattern of financial behavior among Koreans from ordinary saving to more calculated investment (Kim, 2017, p. 618).[54] The transformations were also reflected in the financial products: Due to the intensification of competitive structures between local and foreign financial companies, more flexible and high-risk products have been launched on the market, giving rise to more diverse and customized financial products, such as credit cards, short-term savings or venture capital products offering high interest yields or tax privileges as well as insurance policies (Song, 2014, p. 55). Irrespective of whether they could afford it, many Koreans from different economic backgrounds were now convinced that these wealth-creating financial methods had become accessible to all, for the sole reason that every individual could gain access to the necessary information to invest. At the same time, social pressure to create wealth from money, to use financial products in a smart way, and to leverage finances increased (Song, 2014, p. 56). The new economic opportunities promising more open access for individuals to financial markets created a community of interchange in which newcomers to the market and more established investors shared

[53] The dimension of the local media discourse on how to get rich in Korea has been described in the literature as exceptionally extensive. For instance, the major television commercial hit at that time can be translated as “Everybody, get rich!”. Moreover, a Korean translation of Robert Kiyosaki’s New York Times bestseller on speculation techniques “Rich Dad Poor Dad: What the Rich Teach Their Kids about Money That the Poor and Middle Class Do Not!” (1997) was published in 2000 and gained great popularity in the Korean market (Kim, 2017, p. 618).

[54] While Koreans were saving an average of 22.2% of their net household income in 1990, it was only 3.4% in 2012. According to another study, net household personal savings were 24.2% in 1991, but then fell sharply to 0.4% in 2002. In the 2000s, it maintained around 5%, widely substituted by financial investments (Kim, 2017, p. 630). For instance, the figure for individual mutual fund accounts has soared from 3.6 million in 2003 to 23.2 million in 2008 (Lee, 2020, p. 12).

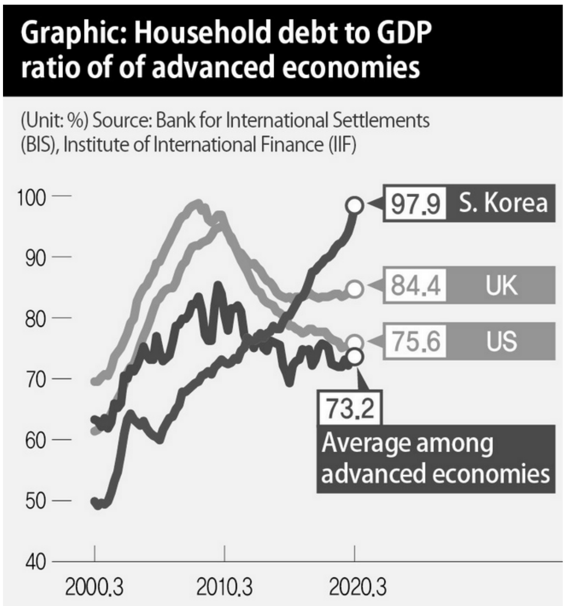
investment tips on social media, followed advice from already successful investors, and obtained best-selling books on trading strategies. These developments which mainly resulted from the post-crisis transition of the Korean society led to the rise of the so-called "mass investment culture" (Harmes, 2001).

In the Korean financial discourse, this includes the rise of the so-called *chaetekû* (*채 테큐,* "wealth-tech")[55] phenomenon, which began during the period of liberalization in the 1980s and flourished in the aftermath of the 1997 financial crisis. The neologism is a combination of the Korean word *"chaemu/채무"*, which means financial obligation or wealth related matters, with the English word "technology" (*tekû/테크*). It generally applies to the techniques of personal financial management used to accumulate wealth. "Wealth-tech" thus means dealing with financial investments and usually refers to investing in stocks, funds, real estate, or other financial products. While the term initially had negative associations in the media until the early 1990s – referring to the practices of speculative real estate investment by *chaebol* – the connotation changed to positive after the financial crisis and referred more to individual practices of personal sovereign financial management. Local press and media thereby increasingly promoted the topic of investing in an attempt to foster financial education among the population. The media presented "wealth tech" as simple to learn and practice, stressing that it was not a practice that could only be mastered by experts, but rather that anyone could achieve wealth. Interested Koreans could obtain the necessary information in numerous different seminars and education programs, both public and private (Kim 2017, pp. 612-618).

Thus, the emergence of mass investment culture has not only been accelerated by contemporary financial infrastructure but also by media coverage as well as through several social channels. These dynamics of investment and borrowing have been reflected, for instance, in the rise of the ratio of South Korea's household debt to GDP, which is estimated to be one of the highest among global economies (Park, 2020) (Figure 15).

[55] The study follows with "wealth-tech" the translation of Kim (2017), since the term *chaetekû* encompasses the ability to generate wealth with financial investments. Previously, Song (2014) translated the term as "financial know-how" or "financial techniques", however, this translation is less able to express the comprehensive definition of the term.

Figure 15: Household debt to GDP ratio of advanced economies



Source: Based on Park (2020)

Moreover, the ratio of household debt to disposable income has also steadily been expanding. The ratio rose from 147,5% in 2010 to 206,5% in 2021 (Yoon, 2022; Kim and Chun, 2018). Speculative housing investment as well as mortgages for home-buying fueled by the real estate boom have been considered as a main driver behind the rise of Korean household debt.[56]

Therefore, while the economic reforms following the financial crisis in 1997 resulted in the economic precarization of large segments of the Korean population due to the enhancement of labor market flexibility, the transformations enabled at the same time more Koreans to participate in the global financial market. Through the public discourse of the media, which promoted investment in various financial products as a reasonable means of generating wealth, many Koreans were encouraged to follow this path and change their behavior from ordinary saving to investing.

[56] For instance, the widespread practice in Korea of *jeonse/전세*, a unique rental deposit system, generally facilitates the acquisition of real estate for the purpose of investment by means of so-called gap investments. The system enables homebuyers to obtain a certain share of the purchase price in the form of security deposits, which they get in exchange for renting out the property. The deposit rate is commonly known as *jeonse* fare (Shin and Yi, 2019, p. 186).

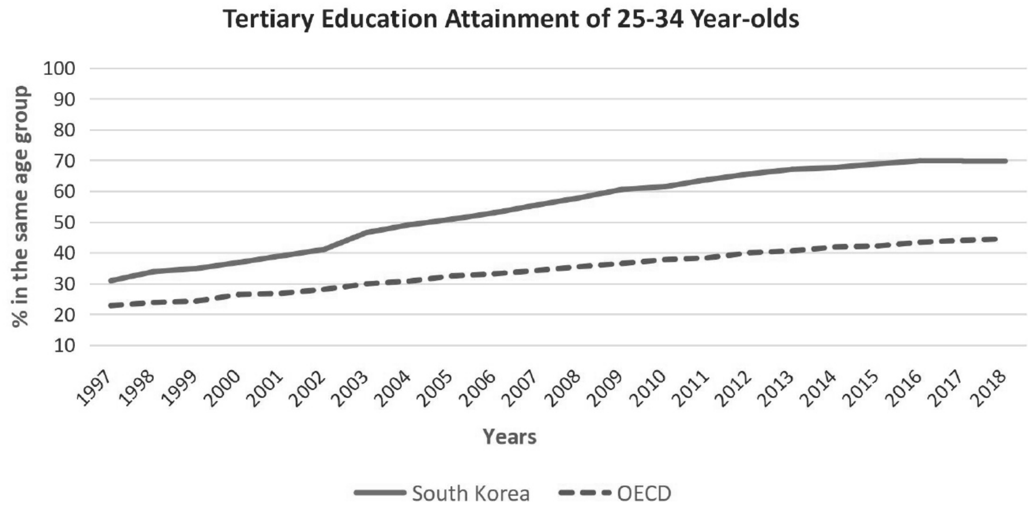
4.1.3 Overeducation, Competition and Youth Perspectives

The socioeconomic developments in Korea also had a major impact on the education system. During the period of rapid economic growth, education served as a key factor for upward mobility and as an impetus for growth and economic prosperity by enhancing workforce skills, innovativeness and productivity. Thus, education was closely linked to the concept of modernization. At the same time, a highly competitive orientation developed in the education system (Chang, 2010, p. 31-36). As a possible cause for this phenomenon of overreaching competition, academic discourse has pointed to the socio-psychological consequences resulting from the conjunction of turbo-capitalism and neo-Confucian attitudes and values. In this context, the concept of individual economic competition, as pursued by capitalism, was combined with the concept of a meritocratic career path, as fostered by Confucianism, that seeks to identify and support new intellectual elites from an early age through specific educational measures (Schlottmann, 2019, p. 18).[57]

The high significance of education and the extreme competition in the area of education have led to the phenomenon of "educational fever" (*gyoyug-yeol/교육열*) of Korean society. In Korea, the share of the population between 25 and 34 years old with tertiary attainment increased by 32% over the last twenty years. In 2021, the share of 25–34 year-olds with a tertiary qualification was 69%, well above the OECD average of 47% (OECD, 2022).

[57] In research, the phenomenon of "educational fever" has been particularly attributed to the influence of Confucianism on attitudes toward learning and status in Korean society (Seth 2002; Lee, 2006).

Figure 16: Percentage of the 25-34 Age Group Enrolled in Tertiary Education in South Korea



Source: OECD Statistics (2019)

Access to a prestigious university is generally seen in Korea as a key to professional success, prosperity and social advancement. While the educational system pursued egalitarian aspirations during the period of rapid economic growth, the addition of private out-of-school services has increasingly become the norm. To enhance educational opportunities, wealthy families began providing their children with private tutors and cram schools until most Korean families followed suit, so that the majority of the population is now involved in some form of extracurricular education (Koo, 2007, pp. 11-12). To understand the high relevance of competitiveness in the Korean educational sector, the examination system with its selective entrance examinations of secondary schools and universities is of central importance. Admission to a university depends largely on the results of these annual examinations. In addition to regular school classes, students prepare for these entrance exams on evenings and weekends at cram classes and expensive private tutoring sessions. This characteristic of the Korean education system, colloquially referred to as "examination hell" (*sihôm chiok*/시험 지옥), not only generates a high level of social pressure, but also places an immense financial burden on families (Seth, 2002, p. 140). While the Korean education system has always been competitive, it has intensified with the expansion of the private education market since the 1990s and the increasing polarization of society after the 1997 financial crisis. Meanwhile, exam preparation at a private tutoring school has virtually become a prerequisite for obtaining the highest scores on university entrance exams. Spending on private extracurricular education is enormous: according to a study, it amounts to ca. 25% of the average monthly expenditures (Yang, 2018, pp. 118-119; Hyundai Research Institute 2007). However, the rise of irregular work with low wages has left many families unable to pay the high cost of private tutoring, and access to prestigious universities has increasingly become a matter of wealth, undermining upward mobility (Kim, 2018a, p. 8).

Another obstacle to upward mobility is the shortage of qualified employment positions. Highly educated young Koreans are entering a labor market that does not provide enough adequate job offers for the high demand. This problem is described as over-education (*gwaining gyoyuk / 과잉 교육*), referring "to the phenomenon whereby workers are in jobs for which they hold an educational qualification at a level that exceeds the educational requirements of the job" (Delaney *et al.*, 2020, p. 11). The over-education dilemma is exacerbated by the circumstance that the Korean market is dominated by ten large conglomerates that have achieved growth largely without increasing the number of new hires (Yang and Kim, 2019). Many graduates therefore have to accept jobs that are below their educational level in order to avoid unemployment. A study of 16,266 participants found that 17.4% accepted a job that did not match their academic qualification level, with the probability of over-qualification decreasing as educational attainment increased (Kim *et al.,* 2016). Moreover, Korean youth are more likely to be unemployed as compared to the rest of the population. For instance, in May 2020, the total unemployment rate was 4.5%, while the youth unemployment rate reached 10.2%, being more than twice as high. In general, the percentage of NEETs[58] in the 15-29 age group is high in Korea. In 2017, Korea's youth NEETs ratio was 18.4%, marking the seventh highest among OECD nations. College-educated youth often experience long periods of unemployment when trying to find a good employment that corresponds to their education. As of May 2020, young Korean, across all academic backgrounds, spent an average of ten months waiting for their first job after graduation. Those with a high school diploma or less spent ca. 14 months

[58] An NEET is an acronym for "Not currently engaged in Education, Employment, or Training". It refers to a young person who is no longer in the educational system and who is not working or being trained for work (Cho and Lee, 2020, p. 67).

looking for a job, and those with a college degree or higher spent an average of 7.3 months without an employment (Cho and Lee, 2020, p. 69).

Maintaining the status of belonging to the middle class largely depends on how successfully one passes through the competitive processes in school, university and work. The high pressure of constant competitiveness and diminishing opportunities has led to frustration among an increasing number of young Koreans. Whereas for many Koreans of Generation X (born between 1965-1980) job security enabled social progress, this is often no longer the case for the subsequent generation of Millennials (born between 1981-1996). In public discourse, the acronym "*N-Po Generation" (N 포 세대)* has become widely established to describe the complex of problems, meaning that certain factors, N number of factors, such as home ownership are being given up in the planning for the future (Kim, 2020, p. 483). Many Korean Millennials designate themselves as the so-called "generation of three giving-ups" (sampo seda / 삼포세) alluding to the three things they have given up: dating, marriage and starting a family.[59] As limited employment opportunities and rising cost of living become the norm, many young people are deciding to forgo some of the things Generation X took for granted (Kim, 2020, p. 483). Koo (2015) summarizes the difficulties and problems of the young population in Korea as follows: "Having to sacrifice youth for interminable education, the state and a job one does not believe in; a narrow path to financial security and an even more narrowly defined path to success; growing inequality and hereditary privileges of the haves; lack of social welfare that might cushion the fall to poverty; and elite corruption." These socioeconomic transformation processes have had drastic social consequences. Various studies have shown that South Korea has seen the highest per capita suicide rate in the OECD in recent years, while maintaining some of the lowest levels for subjective happiness among youth, resulting in more than 25% of high school students having suicidal thoughts in 2016 (Jeong, 2016; OECD, 2018a).

[59] Furthermore, there is also the "*opo sedae/오포 세대*', or "five giving-ups," adding employment and home ownership. The "*chilpo sedae/칠포 세대*' ("seven giving-ups") extends the concept with interpersonal relationships and hope (Park, 2015).

4.1.4 Social Mobility

In general, South Korea has been regarded as a society with high social mobility. In more recent times, however, the situation has changed considerably – especially for Korean youth. In a 2015 report from Statistics Korea surveying the ability of social mobility, 95% of the respondents stated that "the inheritance hierarchy in our society is severe", an increase by 21% compared to the same survey conducted in 2006. Another survey in 2017 showed a growing proportion of individuals sharing negative attitudes concerning social mobility. The share of respondents aged 19 or older with the opinion that social mobility in Korea is difficult was 46.7% in 2006, 58.1% in 2009 and 65% in 2017 (Kim, 2020, p. 486).

Skeptical attitudes toward potential opportunities for upward mobility have been supported by data on middle class development, which indicate a "crisis of the middle class" since the late 1990s (Yang, 2018, pp. 96-97).[60] The reasons for this crisis, which caused a growing polarization of society, are, on the one hand, the increasing precariat of labor. Work flexibilization and mass layoffs due to the reforms of the late 1990s have led to insecurity and high unemployment. As a result of the layoffs and "voluntary" early retirements (*myŏngye t'oejik/명예 퇴직*), many older Koreans in particular have become self-employed. The rate of self-employment is about 30% of the working population, the fourth highest among OECD countries, with more than half of the self-employed being in their 50s and 60s. However, the investment required for self-employment, which often involved using one's entire savings, retirement severance pay, and, if available, one's home as collateral, as well as borrowing, have posed a financial risk that resulted in high bankruptcy rates and debt, especially for small retail stores and restaurants with low value added (Yang, 2018, pp. 101-106). On the other hand, rising housing costs are a major cause of growing inequality. Due to increasing real estate prices, home ownership has become unaffordable for many Koreans. As a result, the homeownership rate fell from 72% in 1970 to 55.6% in 2005 (Son, 2008, p. 188). At the same time, rental prices have increased even

[60] Both the Wolfson polarization Index and the Esteban and Ray Index (ER Index) measuring income polarization indicate that the middle class in South Korea has shrunk. The Wolfson index, which had fallen from 0.28 in 1984 to 0.25 in 1993, jumped to 0.29 in 1999 after the financial crisis. The ER index also fell from 0.020 in 1984 to 0.018 in 1993, but rose to 0.021 in 1999. Income polarization led to the reduction of the middle class (Im, 2018, p. 28).

more. In the period between 1986 and 2008, housing prices increased by 125%, while rental prices increased by as much as 263% (Son, 2008, p. 94).

Overall, the obstacles to social mobility are precarious working conditions with the increase in irregular labor and at the same time high financial burdens due to rising housing costs and costs for private tutoring. An analysis of labor income data from 2001 to 2011 hereby points to the "double crisis" of the middle class: The unemployment crisis of the young generation in their twenties and thirties coincided with the economic crisis of their parents' generation in their fifties and sixties. Of the incomes studied, only 26.8% of the workers who belonged to the middle class in their fifties still belonged to the middle class in their sixties. At the same time, of those who had fallen out of the middle class, only 56.4% of their children had full-time middle-class jobs, making them largely unable to financially support their parents (Jin, 2015).

As Myungji Yan (2018) demonstrated in his study of the Korean middle class, the decline of the middle class and upward mobility in South Korea can be seen not only as a result of neoliberal economic policies, but also as a consequence of the speculative and exclusionary ways in which it was shaped during the period of rapid economic growth. The author referred in particular to the state's favoritism toward *chaebols* and speculation in the real estate market. Upward mobility depended not only on whether one could afford to buy a property, but also on the location of the property and the time of purchase, due to the extreme differences in price increases. Many Koreans regretted postponing the purchase of real estate in order to save enough first, and thus not taking on risk and debt, when real estate was still affordable. The development that smart real estate investments have made parts of Korean society prosperous, while other parts of society struggle with irregular work, high rental costs and expensive private tuition, contradicted the state's promise of prosperity through hard work. This speculative path to the middle class perpetuated the belief among many Koreans that social mobility is the result of well-timed investments and luck (Yang, 2018, p. 114 and 137).

Serving as an expression of despair about the current situation, the term "*Hell Joseon*" (헬조선) is widely used in colloquial language among young Koreans as a rhetorical phrase to criticize the socioeconomic situation in the country.[61] It has become a popular term used by a variety of actors, rising from being widely circulated online to being used regularly in the media. The term unites the English word “hell” with “Joseon” which refers to the class-based Joseon dynasty (1392-1910) that is often used by Koreans as a derogatory term for South Korea in general. The term criticizes the prevailing socio-economic circumstances for South Korean youth by comparing today’s social structure to the feudal system of the Joseon Dynasty, built on strong class hierarchies, and thereby denounces the polarization of economic distribution in contemporary Korean society (Kim, 2018a, pp. 1-2). Thus, the term serves as a condensed means of expression for the younger Korean generation to publicly complain about the government’s policies, which are seen as the cause of increasing economic inequality that is driving more and more Koreans into poverty and leading to a deterioration of the middle class.[62]

The wide popularity of the term “Hell Joseon” in public discourse is reflected in the controversial media debates in which various public figures from business and politics have commented on the issue. For instance, during a speech on the occasion of the 71st *Gwangbokjeo*[63] *(광복절)*, former President Park Geun-hye made a statement on this topic by criticizing the negative, condemnatory implication of the term: “Newly coined words that deny our glorious modern history and words disparaging our country are spreading, while the world is envying our nation” (Phark, 2016). In the wake of the Park Choi scandal[64], however, the popularity of the term has been intensified even more to capture the

[61] The roots of the term “Hell Joseon” can be attributed to the best-selling novel “Because I Hate Korea” (2015) by Korean author Chang Kang-Myoung, in which the Korean society is described as “hell”. Although the plot around the protagonist Gye-na, who dreams of leaving Korea because of the poor working conditions in a dehumanized corporate culture, is fictional, many Korean millennials saw it as reflecting their own reality and everyday struggles in life (Epstein *et al.*, 2018).

[62] In a survey of 1,800 employees and 1,300 university students conducted by the job-seeking portal Job Korea, working people in their twenties sympathize most with the term “Hell Joseon”, with 90.7% of respondents, narrowly followed by people in their thirties with 90.6% and college students with 90.5%. The poll indicates that people in their fifties are the least likely to relate to the term, with only 24.1% approving it at all (Choi, 2016).

[63] Gwangbokjeol or National Liberation Day of Korea is a Korean national holiday commemorating the liberation from Japanese colonial rule on August 15, 1945.

[64] A major scandal involving cases of bribery, abuse of power and illegal leaking of official documents revolved around Park Geun-hye’s relationship with her close friend Choi Soon-sil. The Park-Choi scandal resulted in the impeachment of former President Park Geun-hye on allegations of

problem areas of corruption and favoritism, lack of upward mobility, and misconceptions of fully realized social justice (Schlottmann, 2019, p. 10). Another popular public phase is the so-called "spoon class theory" (*sujeogyegeublon/수저계급론*), which is based on the assumption that individuals within the country can be categorized into different socio-economic classes – "Gold Spoon (*geum sujeo/금 수저*)" and "Dirt Spoon (*heulgsujeo/흙수저*)" – depending on the wealth and income level of their parents, and that consequently success in life is highly dependent on whether or not one is born into a wealthy family (Kim, 2020, p. 486). Social polarization has also been addressed in the media and films, such as in the first non-English-language Academy Award winning film "*Parasite*" (2019), which has been perceived as emblematic of rampant class inequalities and general frustration with the lack of social mobility in Korea, or in the series "*Squid Game*" (2021), a dystopian social satire in which the highly indebted protagonists literally try anything for social advancement in a game of survival. The success of the film and the series has been attributed to its depiction of marginalized groups that are otherwise rarely featured in Korean film and television, and its illustration of the difficult realities faced by many Koreans in the form of parables.

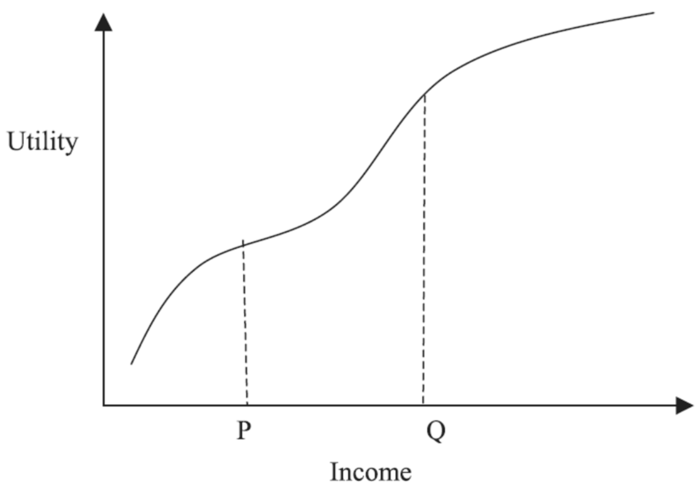
Since upward social mobility can decreasingly be achieved through wage labor and a frugal lifestyle, investing has gained in importance. In this context, investments should also be examined as a socially framed activity that is often used as an instrument for belonging to a social class. The aim is either to catch up with people who have reached a certain level of wealth or to move up into higher socioeconomic classes (Konana and Balasubramanian, 2005, p. 32). The connection between social-class-driven aspirations and investment behavior was first observed by Friedman and Savage (1948).[65] In general, an individual is sensitive to changes in social classes. An individual's utility – as a function of income – shows the usual risk-averse concave shape within each social class. Yet, improvements in

corruption in 2017. As a result, Park was sentenced to 22 years in prison and a large fine for corruption and other crimes in several court cases starting in 2018.

[65] This argument was introduced by Friedman and Savage (1948) to explain the empirical evidence that individuals who bought insurance for risk protection were also often willing to purchase lotteries or engaging in other financial activities with uncertain outcomes (Konana and Balasubramanian, 2005, pp. 32-33).

income that move an individual into a class with higher social and economic status lead to rising marginal utility (Friedman and Savage, 1948; Konana and Balasubramanian, 2005, pp. 32-33). This assumption is illustrated in figure 17 based on the Friedman-Savage utility function. On the left side of the point *P*, an income increase will raise the utility, but maintain the individual as a member of the lower socio-economic class. Therefore, within this area of income, people usually perform standard, risk-averse behavior. Yet, increasing income in the scope between *P* and *Q* raises the individual to a higher socio-economic class and thus results in increasing marginal utility. Within this income area, people are especially inclined to gamble if it provides a chance for income gains big enough to move them into the higher socioeconomic class. Beyond Q, by contrast, people resume the usual risk-averse behavior, having already reached the target socioeconomic class, and improvements in income once again result in decreasing marginal utility (Konana and Balasubramanian, 2005, p. 33).

Figure 17: Friedman–Savage Utility Curve



Source: Konana and Balasubramanian (2005, p. 34)

The dimensions of the Friedman-Savage paradigm have been empirically explored on the macro level as well as on the individual level of the economy. It can be stated that societies experiencing high levels of social inequality are more likely to participate in gambling and taking risks, and individuals facing the pressure of upward social mobility are more likely to engage in gambling-wise investment behavior (Brunk, 1981). In this context, Konana and Balasubramanian (2005, p. 35) showed that this is particularly the case for online investments, indicating that individuals tend to employ riskier trading strategies when engaging in online financial activities. Thus, it can be concluded that Koreans may see the new opportunities for online investment – such as buying and trading cryptocurrencies like Bitcoins – as an opportunity for social upward mobility, as prosperity is often no longer attainable through conventional means, such as wage labor.

4.2 Bitcoin in South Korea

4.2.1 The Emergence of Cryptocurrencies in South Korea and the Korean Bitcoin Premium (*Kimchi Premium*)

The East Asian region plays an increasingly important role with respect to the international cryptocurrency market. Not only the mining sector, but also the staking, the adjusted trading volume as well as innovations in this field are increasingly dominated by the region (Ong, 2023). Since their emergence, South Korea has seen a strong rise in the diffusion of cryptocurrencies. The massive adoption of crypto began in the country in 2017. Previously, the cryptocurrency market was mainly dominated by China. In the second half of 2016, between 85 and 98% of the global Bitcoin trading volume was in Chinese Yuan, and Chinese mining pools controlled over 70% of the network's hash rate (Low and Wu, 2019, pp. 1-2). Although the Chinese government has tightened its regulations in September 2017 by banning both ICOs[66] and the exchange of crypto coins, more than two thirds of new Bitcoins have still been extracted from Chinese mining pools (Wildau, 2017; Li and Marchi, 2017). At the same time, a cryptocurrency boom was emerging in Japan and South Korea (Lewis and Dunkley, 2017). While the rise in trading activity in Japan and South Korea can be attributed in part to the shift in Chinese trading activity following the government regulations, at the same time there has been significant demand from local traders, attracted by the boom in Bitcoin prices. Moreover, investors' strong demand for

[66] The term Initial Coin Offering (ICO) is derived from the stock market term IPO, the initial public offering of a company. An IPO involves the sale of company shares, while an ICO involves the sale of so-called tokens (which can also correspond to company shares). A crypto token is a digitized representation of assets stored decentrally on a blockchain. Thus, ICO represents a method of raising capital using tokens. It is often used by startups as a tool to raise venture capital in the form of cryptocurrencies. See, for instance, Hönig (2020).

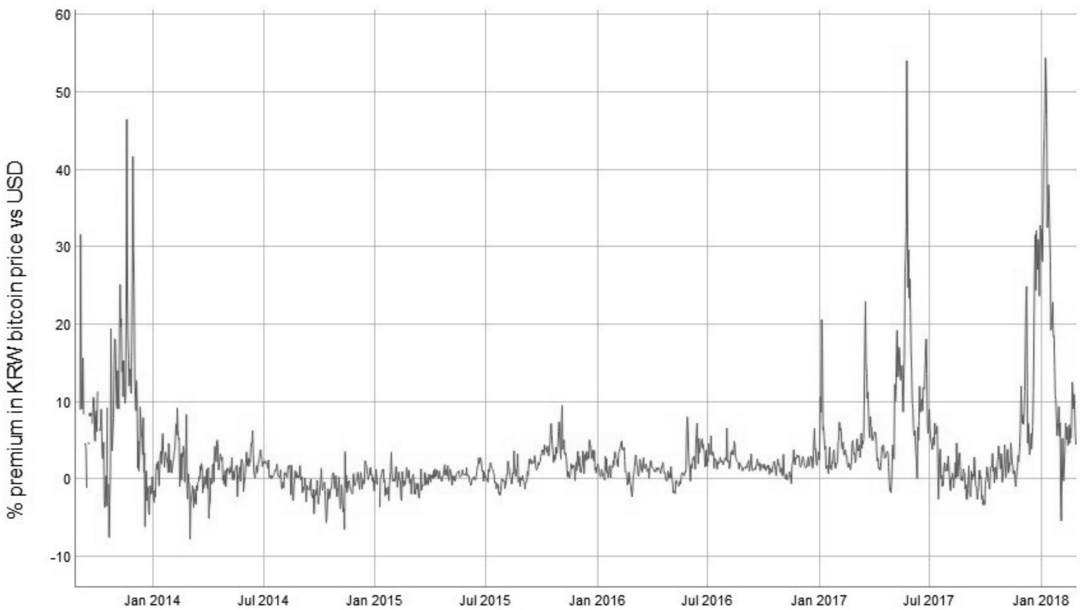
leverage in Asia certainly had an implication on the rapid expansion of market share in East Asia (Low and Wu, 2019, p. 2). Shortly after the regulatory interventions in China in 2017, Japan, where the regulating authority granted licenses to eleven Bitcoin exchanges operating there, has become the market leader in Bitcoin trading (Wong, 2017). At the end of 2017, South Korea generated up to 20% of global Bitcoin trades. Although this represents a much smaller share than the 40% that comprised Japan's trade, it is nonetheless a remarkable number considering that Japan's economy is four times the size of South Korea's and larger in terms of both financial investment and population. After Japan and the United States, South Korea became the third largest crypto trade market in the world (Low and Wu, 2019, p. 3). In 2018, two of the top three exchanges of the world were Korean exchanges.[67]

It can be stated that the enormous demand for cryptocurrencies in Korea has not only been discussed in the field of economics, but has also widely been understood as a socio-cultural phenomenon that has increasingly defined the daily lives of many Koreans. It is estimated that about 10% of the Korean population invested in cryptocurrencies during the Bitcoin boom in the first half of 2021, an increase of more than 50% since 2017, when the hype around cryptocurrencies first peaked in the country (Yoon, 2023a). Among salaried workers, the percentage of those who have experience with cryptocurrencies is even higher. In a survey of employees in Korea conducted in 2017, about 30 percent reported that they have invested in crypto currencies with an average investment of ca. 5,000 US-Dollar (Jo, 2017). In general, it can be stated that cryptocurrencies have become a mainstream phenomenon in the Korean society, and considerable numbers of Koreans already regard cryptocurrencies as a broadly accepted investment instrument that can provide an alternative to conventional forms of securities (Yim *et al.*, 2018, p. 30). Whereas the main group of Bitcoin users in South Korea have been young people in their twenties and thirties, the increasing interest in using Bitcoins appeared to be encompass all segments of the population regardless of age and gender. Internet forums saw an enormous rise in posts, articles and threads sharing information and experiences about Bitcoin investments. Furthermore, an increasing number of Bitcoin trading clubs appeared. Even a series of

[67] In 2023, South Korean exchanges are still playing a significant role among the top 10 cryptocurrencies exchanges by volumes worldwide. See: https://coinranking.com/exchanges.

offline Bitcoin exchanges were established, particularly for elderly people who were not experienced in dealing with the Internet or smartphones. Activity increased to the point that high school students were forbidden to use school computers for mining or trading Bitcoins (Lee, 2020, p. 7).[68]

Figure 18: Bitcoin Korean Price Premium (Kimichi Premium)[69]



Source: Choi *et al.* (2018, p. 3)

In terms of the international cryptocurrency market, Korea holds a particular position due to the above-average demand for cryptocurrencies, as this local development has led to higher prices than in the rest of the world. This phenomenon is often referred to as the "Kimchi

[68] Meanwhile, cryptocurrencies have become an even wider cultural phenomenon in the country. For example, coffee shops started printing their own digital coins and the introduction of new digital coins were launched during festive events. In addition, a national broadcaster produced a game show called "Block Battle" (블록 배틀) in which candidates competed to establish a business based on crypto technology (Stevenson and Lee, 2019).

[69] "The premium for purchasing Bitcoin with Korean Won (KRW) versus US Dollars (USD) is calculated: (KRW-BTC price in USD) / (USD-BTC price) -1, where the Bitcoin price in USD is the mean price of all USD transactions on the Bitstamp exchange for that day. The Bitcoin price in KRW is similarly defined from the Korbit exchange. Conversion from KRW to USD is done using the OANDA daily average rate" (Choi *et al.*, 2018, p. 3).

premium"[70]. In the period between January 2016 and February 2018, the average "Kimchi premium" was 4.73%, but reached a level of 54.48% in January 2018 (Choi *et al.*, 2018, p. 1) (Figure 18).

During the peak of the price premium for Korean cryptocurrencies, price tracking platform CoinMarketCap.com[71] excluded trading prices in Korea several times in its daily average prices for various cryptocurrencies, as these led to a misrepresentation of global average prices (Yim *et al*., 2018, p. 30). It is important to note that in frictionless financial markets, however, such a price difference would not be able to persist, since it would be instantly arbitraged away (Choi *et al.,* 2018, p. 1). A foreign arbitrage trader would theoretically have taken advantage if he had followed this simplified trading model: (1) buying the cryptocurrency outside Korea; (2) transferring the crypto currency to a Korean exchange; (3) selling the cryptocurrency on the Korean exchange for Korean Won; (4) transferring funds from the revenues of the sale of the crypto currency from Korea to overseas; and (5) repeating steps (1) through (4) until the price premium for the cryptocurrency has been eliminated (Yim *et al*., 2018, pp. 30-31).[72]

However, this form of arbitrage trading is technically not applicable in South Korea. Reasons for this are in particular the restrictions imposed on the transfer of fiat currencies from Korea out of the arbitrage gains in step (4) of the arbitrage model (Yim *et al*., 2018, p. 31). The transfer of money from Korea to an offshore account is subject to the Foreign Exchange Transactions Act (FETA) as well as the subsidiary bodies of the FETA, the

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[70] The term was likely first used in the media by CNN on 12th December 2017 to describe the phenomenon of the gap in cryptocurrency prices in South Korean exchanges compared to foreign exchanges (Kwon, 2017).

[71] CoinMarketCap is a platform for tracking the capitalization of a wide range of cryptocurrencies, the number of trades in which they are used, and the current price converted into fiat currencies. It has become the primary reference point for prices of cryptocurrencies, https://www.coinmarketcap.com.

[72] This can be further illustrated with the following numerical example: An US individual might purchase one unit of Bitcoin for 10,000 US-Dollar on a US crypto exchange. The user notes that one Bitcoin is traded in Korea for 15,000,000 Won (ca. 14,000 US Dollar). Presuming that the US trader holds an account on a Korean crypto exchange, he or she will simply transmit the purchased Bitcoin to his or her account on the Korean exchange and then sell it for 15,000,000 Won on the Korean exchange. The US trader then returns the 15,000,000 Won back to the US and after converting the Won into US-Dollars, deposits 14,000 US-Dollar into his or her US bank account. Therefore, he or she gains 4,000 US-Dollar from this arbitrage trade. In this simplistic approach, the US individual would need to carry out the Korea arbitrage model in Korea and replicate this process until the price premium is erased from the Korean cryptocurrency market (Yim *et al*., 2018, p. 31).

Foreign Exchange Transactions Regulations (FETR). Being a basic rule under the FETA, there must be a "legal basis" such as payment of sales proceeds, dividend payments or loan repayment together with evidence of repatriation of funds from overseas, as required by the FETA. The FETA defines a set of instructions and required documents for each category of financial transactions listed in the FETA, both for the sender of funds from abroad and for the bank processing the transfer. The procedures for transferring funds overseas differ depending on the type of transaction. However, there are no guidelines for cryptocurrency transactions within the FETA. In the absence of any guidelines for transactions in cryptocurrency for the transfer of funds from sales proceeds, the foreign exchange bank is not authorized to transfer the money abroad. This has been a major reason for the absence of cryptocurrency arbitrage trading in Korea, enabling the price premium of Korean crypto currency to be maintained for so long (Yim *et al.*, 2018, p. 31).[73] While the "Kimchi premium" vanished in early 2018 after the government announced regulatory measures, it returned in the first half of 2021 and exceeded 20% in April and May 2021 (Yoon, 2021).

4.2.2 Cryptocurrency Regulations in South Korea

The enormous hype around cryptocurrencies in South Korea led to the introduction of a number of government measures in order to combat the use of these currencies for illicit activities, protecting users from fraud, and maintaining the integrity of both markets and payment systems. The regulations initially served to give cryptocurrencies such as Bitcoin a legal basis. Even though cryptocurrencies are not considered legal money in Korea, cryptocurrency exchanges are legal within a regulatory framework. In July 2017, the Korean government legalized Bitcoin as a remittance method, permitting fintech companies to process up to 20,000 US-Dollar worth of Bitcoin in South Korean Won for users (O'Neal, 2018). Subsequently, traders or other business entities involved in cryptocurrency transactions were required to obtain approval from the *Financial Services Commission (FSC)*. The requirements included the retention of capital of at least 500 million Won (436,300 US-Dollar), as well as data processing facilities for the purposes of customer identification and anti-money laundering (Ji-hyoung, 2017). Besides this legalization, there

[73] A foreign arbitrage trader who conducts an unauthorized foreign wire transfer associated with a cryptocurrency transaction is subject to sanctions and heavy penalties. Similarly, sanctions can be applied to a foreign exchange bank if it makes an unauthorized foreign transfer for a cryptocurrency activity (Yim *et al.,* 2018, p. 31).

have also been a number of prohibitions related to the usage of cryptocurrencies in order to protect users from potential risks in transactions. In September 2017, the government announced a ban on ICOs in order to protect investors. The objective of the announcement was to contain ICO fraud. However, it is important to note that the government never voted to ban ICOs and thus there is no official government policy and law against ICOs. The announcement nevertheless had its intentional impact, as Korean blockchain companies decided to incorporate abroad and discontinue offering ICOs in Korea to prevent potential closure risks (Ghoshal, 2018).[74]

The discussion about the overheated cryptocurrency market became more present in the public discourse in the second half of 2017. For instance, the inflated demand for cryptocurrencies in Korea has led to the widespread use of the term "Bitcoin zombie" (*비트코인 좀비*) in local media to describe individuals who constantly monitor the cryptocurrency's price trend (Lee, 2017). In this context, the country's former prime minister, Lee Nak-yeon, has even expressed worries about Korea's Bitcoin mania, cautioning that it could lead to "serious distortion or social pathological phenomena, if left unaddressed" and to encourage young people to engage in illegal activities (Kharpal, 2017). Furthermore, Korean psychologists have recorded a rise in patients with so-called "Bitcoin blues" and counselors have noted a rising number of divorces due to failed investments (Premack, 2018). The various impacts led the government to signal plans to implement a range of measures after convening an emergency meeting in late December 2017 to discuss methods to curb speculation in cryptocurrencies (Lockett and Song, 2017). This resulted in unrest within the crypto community. The debate over the appropriate handling of the crypto craze escalated when the head of the Ministry of Justice, Park Sang-ki, issued a statement on January 11, 2018, announcing plans for a law that would ban cryptocurrency trading in the country (Jenkinson, 2018). Cryptocurrency users reacted with broad resistance and massive protests against the announced ban. The protest was expressed in various forms

[74] In August 2022, however, the Bank of Korea called for regulating the trading of ICOs rather than banning it, arguing that the ban is ineffective. Korean companies such as Terra circumvented the prohibition by issuing new digital tokens through foreign-based companies and listing these tokens on local exchanges. By May 2022, Terra had suffered a devastating collapse in which investors lost millions. An arrest warrant was issued for Terra's founder in September 2022 for capital market law violations (Handagama, 2022).

and activities, including the launch of numerous petitions. One of the petitions demanding "Reverse Virtual Currency," which received a high degree of public attention, was able to generate more than 280,000 signatures within one month of publication, obligating the government to respond to the petition (Jeong, 2018).[75] The contextual wording of the petition can also be read symptomatically for the socioeconomic demands of many Koreans:

> "Korean people can dream a happy dream that we've never been able to in South Korea, thanks to cryptocurrencies. I might be able to buy a house in a country where it's very hard to buy a house. I might be able to live a life doing something I want to do. I might be able to take a breath. Please don't take away our happiness and dreams that we could have for the first time living in South Korea. When I voted for the Moon Jae-in government, I was filled with the anticipation that finally I would be able to live like a human being. However, nothing has changed. Nothing has been improved. The economic downturn we feel is still the same."[76] (Huang, 2018)

The argumentative nature of the broadly supported petition draws attention to the socio-economic significance that the Korean Bitcoin community associates with its activities. However, as it turned out, the government was not planning to ban cryptocurrencies. Following the Justice Ministry's statement, the Ministry of Strategy and Finance stressed that it did not support the mentioned plans to ban cryptocurrency trading, and that the Justice Ministry had released the statement without the approval of the Ministry of Strategy and Justice and other government agencies that participated in South Korea's cryptocurrency regulation task force. Rather, as opposed to a total ban, it was planning various measures to regulate cryptocurrency exchanges as legitimate financial service providers (Young, 2018; Jenkinson, 2018). These measures included a ban on minors and foreigners from trading cryptocurrencies. The government cited the goal of preventing uninformed and inexperienced users from suffering financial losses by participating in investments in highly volatile digital currencies. Even before, traders had to hold Korean

[75] According to the laws in South Korea the government is obliged to respond to a petition that gathers over 200,000 signatures within 30 days.

[76] For the original version, see: www.president.go.kr/petitions/76020?navigation=best-petitions.

savings books in order to be able to deposit and withdraw cash. Thus, there was already a measure in advance that excluded many foreign traders (Hyung-jo *et al*., 2017). In March 2018, civil servants were prohibited from possessing and trading cryptocurrencies under the civil servants conduct law (Partz, 2018). In 2021, this was followed by a ban on employees of crypto exchanges from trading on their own platforms, whereby the large Korean exchanges had already introduced corporate policies restricting their own employees from trading (Im, 2021a).

Furthermore, the government issued additional regulations to combat the use of cryptocurrencies for illegal activities. In January 2018, after the *Korea Financial Intelligence Unit (KoFIU)* and the *Financial Supervisory Service (FSS)* inspected six commercial banks that provided trading accounts for cryptocurrency exchanges in order to uncover possible cases of money laundering, as well as after police and tax authorities conducted raids on Korea's major cryptocurrency exchanges for alleged tax evasion, the government released a cryptocurrency-based anti-money laundering guideline. The measures included allowing cryptocurrency trading only through real-name bank accounts linked to cryptocurrency exchanges. Under this guideline, users intending to conduct cryptocurrency transactions have been required to hold a bank account under their real name at the same bank with cryptocurrency exchanges. Users who did not have an account under their real name at the same bank have only been allowed to withdraw funds from their existing bank account. For new deposits, they would have to open a new bank account under their real name at the same bank with the exchanges. This measure should ensure that banks identify their customers (Financial Services Commission, 2018a).

In June 2018, the *FSS* published an adjustment to the regulations that affected the following changes: While the enhanced due diligence of financial institutions towards their customers previously only affected cryptocurrency exchanges' bank accounts used for collecting customer money for cryptocurrency trading, the due diligence has under the new regulation also been subject to bank accounts used for parking their operational expenses, i.e., non-trading accounts. This was to prevent cryptocurrency exchanges from using their non-trading accounts for collecting money or other illegal activities. Further, the modified guideline required financial firms to share a list of cryptocurrency exchanges abroad and domestically, and to strengthen monitoring of money transfers to exchanges abroad to prevent tax evasion and money laundering (Financial Services Commission, 2018b). Thus, the Financial Services Commission established a direct supervision and control over the cryptocurrency sector. The regulations should also serve to legitimize cryptocurrencies in Korea as a valid form of investment and payment.

In March 2020, the *Korean National Assembly* passed a new law further paving the way for the regulation and legalization of cryptocurrencies and crypto exchanges. This amendment was intended to harmonize Korea's legal framework for crypto-assets with the international standards of the *Financial Action Task Force (FATF)*. According to the law, crypto-asset operators must report their transactions to the *Korea Financial Intelligence Unit (KoFIU)*, and comply with basic anti-money laundering requirements. Further, financial institutions engaging with crypto-asset business operators are responsible for complying with their due diligence on crypto-asset business operators and verifying that they report their transactions to the *KoFIU* (Financial Services Commission, 2020).

After the cryptocurrency market cooled down following the 2018 crash, the value of Bitcoin rose again significantly in 2021. Another important regulation of crypto exchanges, amendments to the *Act on Reporting and Use of Certain Financial Transaction Information*, also known as the *Financial Transaction Reports Act (FTRA)*, took effect in March 2021. According to this act, trading platforms receive an information security management system (ISMS) certification and must enter into contracts with local banks to provide deposit and withdrawal accounts for users under their real names. To receive the certification, all cryptocurrency exchanges are required to register with the *Financial Intelligence Unit (FIU)* of the *Financial Services Commission (FSC)*. This regulation thus prevents anonymous crypto-to-fiat money transactions to reduce the potential for money laundering or fraud. For some small to medium-sized exchanges, however, implementation was not possible due to bureaucratic and administrative complications as well as due to the associated costs, with the result that they had to close down (Park, 2021). While the four largest Korean cryptocurrency exchanges have already partnered with commercial banks, banks are more hesitant to partner with smaller exchanges due to risk aversion, which means they prefer the larger actors compared to them. This strategy of regulations has been criticized with regard to the point that the advantages of the largest cryptocurrency exchanges reflect the entire Korean economy, where a small number of conglomerates – the so-called *chaebols* – account for a large part of the economic productivity. On the other hand, users could benefit from institutionalization, as regulations are also likely to make services more accessible (Im, 2021b).

In general, the political decisions of recent years show that, although there is not yet a unified political strategy, the Korean government does not aim to fundamentally oust the cryptocurrency system, but to officially legitimize it through regulation. Another step is the planned taxation and the creation of a legal framework for the definition of cryptocurrencies and the classification of virtual assets (Park, 2021).

4.3 Conclusion

As the phenomenon of the Kimchi premium demonstrates, the popularity of cryptocurrencies such as Bitcoins in Korea is far above average by international standards. After Japan and the USA, Korea is the third largest cryptocurrency market; with a simultaneous share of less than 2% in the global economy (The Global Economy, 2020). While the difficulties of applying the Korea arbitrage model could be explained by the special features of the Korean financial regulation system and the legal framework, the widespread popularity that allowed the emergent rise of such price premium and the dynamics behind the diffusion of Bitcoin in Korea still present a phenomenon worth investigating in more detail.

Along with the affinity for cryptocurrencies, a general affinity for digital technology can be noted for the Korean population. For instance, it is estimated that 99% of Koreans use the Internet at least occasionally (Pew Research Center, 2022).[77] In addition, the Korean population is generally very open to new technologies, especially in communications technology, which is also evident in the area of research and development.[78] At the same time, the socioeconomic developments have resulted in a high-risk propensity for financial investments, as social prosperity via traditional means such as income from regular employment is no longer possible for many Koreans as it was in the decades before the financial crisis. The above-mentioned problem areas such as difficulties in accumulating

[77] In comparison, it is estimated that 93% of Germans use the Internet at least occasionally (Pew Research Center, 2022).

[78] For instance, the Global Innovation Index 2021 ranked Korea 5th out of 132 countries (Global Innovation Index 2021).

wealth, overeducation, overreaching competition, and the declining degree of social mobility seem to have led many Koreans to turn to newly emerging, often high-risk investment opportunities because they seem to perceive them as an opportunity for social advancement that can otherwise no longer be achieved. This correlation between high technology and digital affinity and socioeconomically driven high-risk tolerance in financial investments can be used as a possible causal basis for the immense popularity and hype surrounding cryptocurrencies such as Bitcoin, making Korea an ideal research subject from a methodological point of view to empirically investigate the adoption and diffusion of cryptocurrencies – in this study using Bitcoins as an example. It is thereby important to emphasize that this hype around cryptocurrencies in Korea can be described not only as an economic phenomenon based on rational, calculated investment decisions by individuals, but also, and more specifically, as a sociocultural phenomenon whose origins lie in the country's social, political, and financial developments (Lee, 2020, p. 8).

In the following, these socioeconomic aspects behind cryptocurrency adoption and diffusion in Korea are empirically examined in order to explore the paradigms that influence the decision to adopt or use a financial technology-based product, in this case the cryptocurrency Bitcoin. The study uses technology adoption research models to clarify and rationalize the ways in which Korean users derive benefits from adopting the new technology of the cryptocurrency Bitcoin.

5 Methodological Framework

The aim of this chapter is to outline the methodological framework of the study. In order to establish an introductory basis for the methodology, section 5.1 systematically reviews existing empirical studies in the literature on the diffusion and adoption of cryptocurrencies. Section 5.2 develops the research hypothesis and situates it within the relevant theoretical framework. The empirical model is presented in section 5.3, along with an explanation of the methodological approach and the analytical techniques that are applied. Section 5.4 concludes with a summary of the key insights derived from the chapter.

5.1 Cryptocurrencies in the Diffusion Research

Although there has been a rise in academic and non-academic interest in cryptocurrencies, and a growing body of literature dedicated to the topic, research on the socioeconomic implications and adoption dynamics of cryptocurrencies is still in its early stages (Al-Amri *et al.*, 2019). To provide a comprehensive overview of the existing literature on cryptocurrency adoption and the models used in previous analyses, a systematic review was conducted, revealing the following schematic outline of the current state of research.

5.1.1 Qualitative Research

The first methodological category of technology diffusion and acceptance research related to cryptocurrencies refers to qualitative research. In this framework, the authors have used interviews as the method of conducting research. While qualitative studies on the adoption of cryptocurrencies are still limited, researchers have demonstrated variation in the adoption and acceptance theories they employ. For example, in their study on end-user adoption of Bitcoin, Presthus and O'Malley (2017) sought to understand the motivations and barriers associated with the adoption of Bitcoin as a digital currency. To this end, the authors conducted a small survey in the summer of 2016, collecting 135 responses. They drew on concepts from diffusion of innovation theory to explore why some individuals choose to use Bitcoin, while others do not. The survey results reveal that Bitcoin users are motivated by technological curiosity and individual goals. On the other hand, non-users express concerns about the value and security issues of Bitcoin. The paper suggests that there may be a deadlock where everyone waits for others to start using Bitcoin, leading to a slower adoption rate. However, due to the exploratory and descriptive nature of their study, the authors conclude that additional research is needed in this area to gain a full understanding of the dynamics influencing Bitcoin adoption (Al-Amri *et al.,* 2019, p. 296).

With regard to user applicability, Kazerani *et al.* (2017) focused in their research on cryptocurrency usability and user experience. The authors examined the factors that influence the use of Bitcoin and whether ease of use influences the acceptance of Bitcoin by new users. For this purpose, the researchers asked the participants to complete certain tasks using the cryptcurrency and observed them as they complete those tasks. These observations where then complemented with interview-style probing to better assess how participants felt while performing the tasks assigned to them in the study. The results of the research contribute to explaining how the conceptual map of Bitcoin, financial literacy and usability contribute to individuals' overall experience of the tasks performed (Al-Amri *et al.,* 2019, p. 296). However, the study also points out a number of limitations. First, it is critical to broaden the participant pool to include individuals of different ages, technical backgrounds, and levels of financial literacy. Such an approach would provide a more comprehensive understanding of the relationship between financial and technical literacy and the adoption of Bitcoin. Second, with respect to future studies, the research script is encouraged to be modified by incorporating a quantitative survey to assess users' financial and technical literacy. In addition, it would be beneficial to develop a taxonomy of tasks specifically focused on entry-level Bitcoin use and design a series of tasks for participants to assess their skills (Kazerani *et al.*, 2017, p. 4).

Exploring the adoption of cryptocurrency as a payment method, Baur *et al.* (2015) adopted an inductive and exploratory approach by conducting interviews with 13 users in three distinct groups (end-consumers, e-commerce merchants, and employees of Bitcoin exchanges). The study focused on assessing the effects of the determinants usability, usefulness, and subjective norm on individual's intention to adopt Bitcoin. The researchers applied the Technology Acceptance Model (TAM), which takes into account the perceived ease of use, the perceived usefulness, and the subjective norm. The results showed that most of the stakeholders considered the perceived ease of use to be low, while the perceived usefulness varied among the users depending on their group. The basic rationale of cryptocurrency as a potential future payment method was confirmed by all respondents in the study. Furthermore, the study indicated that the imapct of subjective norm is divided to some extent. The application of Bitcoin in terms of innovation and the creation of competitive advantages is of significant importance for all groups. Peer influence, being on-trend or off-trend, and lifestyle issues have less of an impact on the subjective norm of using Bitcoin (Al-Amri *et al.,* 2019, p. 296). However, there are some limitations in the context of this study. The limited number of individuals beeing interviewed makes it rather complicated to draw a generalized conclusion of the study. To enable such generalization, the authors recommended hypothesizing based on the interview results and then testing those hypotheses in a comprehensive quantitative survey in a deductive research framework. In addition, the findings may be biased because almost a third of the respondents were involved in professional activities related to Bitcoin exchanges. Therefore, they could have an interest in seeing cryptocurrencies in an overly positive light. Moreover, the authors state that "comparing developments in different parts of the world could debunk differences due to risk-aversion (e.g., very high in Germany), methods of payment (e.g., widespread credit card use in the US), or technical availability (e.g., lack of traditional banking infrastructure in developing countries)" (Baur *et al.*, 2015, p. 77).

Based on the application of a value-sensitive design (VSD) approach, another qualitative research was employed by Cousins *et al.* (2019) in order to identify the values associated with Bitcoin use. The study included three phases of data collection, consisting of focus group studies, email interviews with MBA students, and email interviews with selected stakeholders in the broader cryptocurrency network. Applying the values expressed by the respondents as a basis, the study categorized them into three user groups (innovators, conventional users, and sensitive transaction users) and two non-user groups (potential adopters, non-adopters), and found that individuals hold different values about Bitcoin that exceed its original design values. The findings highlight the complex relationship between usability and human values in the Bitcoin ecosystem, considering the pros and cons as well as the challenges of cryptocurrencies and suggest further research to explore the implications of these manifested values. However, the study also acknowledged some limitations, including the potential lack of well-founded knowledge among some respondents and the narrow scope of the study.

Khairuddin *et al.* (2016) examined the motivations for holding Bitcoins and identified three motivations: Bitcoin's role in a monetary revolution, user empowerment, and perceived value. Sas and Khairuddin (2017) examined user motivations and perceptions, highlighting trust challenges. Both studies have limitations, such as small sample sizes and narrow theoretical frameworks. Their findings contribute to understanding cryptocurrency acceptance and trust but require cautious interpretation due to these limitations.

Shifting the reserach focus from individual adopters to the adoption at the organizational level, the study by Connolly and Kick (2015) investigated the question of what differentiates organizational Bitcoin adopters from non-adopters by examining their IT readiness, innovativeness and social media presence. As emphasized by the study team, adoption of cryptocurrencies by organisations is considered more significant than adoption by consumers, as consumers are not in a position to make use of cryptocurrency if organisations do not accept it as a means of payment. The researchers used the Theory of Diffusion of Innovation (DOI) to perform the analysis and to measure the degree of innovation diffusion. In this context, the authors noted that organizations can use these results to benchmark themselves against Bitcoin acceptors and non-acceptors in order to determine their own degree of willingness to accept Bitcoins. Furthermore, regarding the limitations of the study, the authors pointed out that future research related to the diffusion of cryptocurrencies should directly interview organizations about why they adopted cryptocurrencies in order to contribute to a better understanding of the dynamics of an innovation's diffusion (Al-Amri *et al.,* 2019, p. 296).

Another qualtitive framework addressed users' perceptions of global stablecoins. Kimmerl (2020) investgated the impact of these perceptions on the users' intentions to adopt stablecoins using the Libra case as an example. For this purpose, in-depth interviews were conducted with 32 participants. The interviews covered topics such as knowledge and experience with cryptocurrencies, views on global stablecoins, potential requirements for stablecoin features and regulations, and personal assessments of stablecoin adoption. From the interviews, seven main themes and forty-three sub-themes emerged that influenced users' intentions to use global stablecoins. These themes were categorized into five factor groups: User Specific Factors, Satisfaction with Current Payment Infrastructure, Perceived Fulfillment of General Properties Requirements, Perceived Fulfillment of Regulatory

Requirements, and Perceived Data Protection. Thus, the findings show users' attitudes towards technology adoption and their satisfaction with the existing payment infrastructure. Nonetheless, it is important to exercise caution when interpreting the outcomes of the study, as they are constrained by certain limitations. These include the small sample size, potential bias in participant selection, and the focus on Libra as a specific stablecoin.

5.1.2 Quantitative Research

The second methodological category of technology diffusion and acceptance research related to cryptocurrencies refers to quantitative research. Within this category, researchers primarily utilized surveys as their chosen method of investigation. Most of the studies presented in this section are based on partial least squares structural equation modeling (PLS-SEM). For instance, Glaser *et al.* (2014b) examined the question of whether consumers' interest in cryptocurrencies is driven by their desirability as an asset or as a means of everyday payment, and more specifically on consumers' perceptions of replacing fiat currencies with cryptocurrencies. The outcomes of their study suggest that especially uninformed individuals adopting cryptocurrencies are not primarily interested in using them as an alternative payment method; rather they are trying to take advantage of an alternative investment opportunity (Al-Amri *et al.,* 2019, p. 299). With regard to future research, Glaser *et al.* (2014b) proposed to investigate whether key features of financial markets also apply to the markets of cryptocurrencies. In addition, they suggested taking the analysis a step further by exploring the existence of possible arbitrage opportunities between exchanges and determining the extent to which behavioral patterns, such as herd behavior, guide the decision-making process of Bitcoin users.

In order to address the issue of measuring consumer acceptance and use of virtual currencies for payment applications, Schuh and Shy (2016) undertook an exploratory approach by conducting a survey designed to detect individuals' payment preferences based on the annual (2008-2015) Survey of Consumer Payment Choice (SCPC) from the Federal Reserve Bank of Boston's data. The primary scope of the research was to provide preliminary empirical and econometric insights that identify US consumers' experiences with Bitcoin along with other virtual currencies. The outcomes underline that consumer awareness, adoption, and use of virtual currencies are linked to different demographic and economic characteristics. The findings suggest that a typical Bitcoin holder is more likely to be a young, non-white male with less education, who expects Bitcoin to increase in value, has adopted other payment mechanisms, and is most responsible for household purchases (Al-Amri *et al.,* 2019, p. 299). However, the study suggested that the claim that cryptocurrencies are solely a speculative investment should be further explored, more so given the limited choice of payment acceptance offered by retailers.

Another study that examined the perception of cryptocurrencies compared to fiat currencies was conducted by Hur *et al.* (2015). They found that Bitcoin's lack of competitiveness as a currency can be attributed to its low network effects. The study emphasized the need for Bitcoin and other cryptocurrencies to actively engage consumers and build a strong network in order to outperform fiat currencies. Similarly, Shehhi *et al.* (2015) investigated the determinants underlying the choice of cryptocurrencies. Their study revealed that factors such as the cryptocurrency's brand name, logo, ease of mining, anonymity, privacy, value, popularity, and technology influence individuals' decisions to use or mine a particular cryptocurrency. The findings highlight the importance of these factors in shaping the adoption and use of cryptocurrencies (Al-Amri *et al.,* 2019, pp. 298-299). However, both studies concluded that future research needs to generalize the underlying outcomes and to add more questionnaires in order to gain a more comprehensive understanding of cryptocurrencies.

In their study of Bitcoin adoption, Anser *et al.* (2020) applied the extended Theory of Planned Behavior (TPB) to construct and test a theoretical model to examine the relationship between social media usage and individuals' intentions to adopt Bitcoin. The proposed model was tested based on survey data collected from 443 respondents in China. The results of the study indicate a positive relationship between social media usage and individuals' intentions to adopt Bitcoin through attitudes, subjective norms, and perceived behavioral control. The research emphasized the relevance of taking into account the perceived risk associated with Bitcoin, as individuals with higher risk perceptions were less likely to adopt the cryptocurrency, despite demonstrating strong intentions to adopt. Among the limitations of the study is the cross-sectional nature of the data, which may be subject to common methodological variance (CMV). In addition, the generalizability of the findings is limited to the Chinese context, which calls for future research in different countries and cultures.

By utilizing an expectation confirmation model, Nadeem *et al.* (2020) investigated the repurchase intention of Bitcoin in China. The findings show that expectation has a positive influence on perceived enjoyment and perceived ease of use. Furthermore, expectation, perceived enjoyment, and perceived ease of use were found to significantly influence satisfaction. In addition, perceived enjoyment, perceived ease of use, and satisfaction were found to significantly influence the intention to repurchase Bitcoin. However, the following limitations were addressed: First, the sample size of 143 respondents is not representative of the entire population, which may compromise the generalizability of the findings. Therefore, the study recommends that future exploratory research be conducted to gain more comprehensive insights, and to examine other possible predictors of repurchase intentions, as well as potential negative effects of Bitcoin.

In their study of Bitcoin diffusion, Wood *et al.* (2017) examined the factors involved in choosing Bitcoin as a means of financial exchange. They used TAM and Innovation Diffusion Theory (IDT) to conduct their research. By adopting structural equation modeling and the partial least squares method, the researchers designed an international study in which 121 respondents were questioned worldwide. The results of the study suggest that relative advantage and ease of use have been shown to have a significant positive influence on the intention to use Bitcoin, while visibility and compatibility have also a statistically positive influence. Although the survey reveals a considerable degree of relevant content, a series of limitations associated with the study still remain and require addressing. These limitations cover among others the sampling method used and the size of the sample. Regarding the approach for future research, the authors proposed to study the factors and the model in different environments worldwide and to explore the similarities and differences that may exist in the research outcomes (Al-Amri *et al.*, 2019, pp. 297-298).

Through the integration of various benefits and risks linked to the utilization of Bitcoin, Abramova and Böhme (2016b) applied the TAM model and a literature review in order to design the multidimensional constructs perceived benefit and perceived risk. They suggested an empirically tested theoretical framework that explores the potential of Bitcoin as an electronic payment method for legitimate purchases and money transfers. In that context, the study aimed to establish a conceptual and methodological framework that could be integrated into technology acceptance theories in the field of decentralized and sharing economic systems. This approach is reported to be effective in highlighting key factors and obstacles for consumer adoption of Bitcoin (Al-Amri *et al.*, 2019, pp. 297-298). However, Abramova and Böhme (2016b) concluded that certain constraints of their study persist and need to be overcome in future research: "First, the small convenience sample restricts the robustness and generalization of our findings among Bitcoin users and the larger population of non-users. Secondly, our pioneering model ignores other important factors such as hedonic benefits, social factors, facilitating conditions, or trust, which may have substantial impact on individuals' decisions to adopt Bitcoin" (Abramova and Böhme, 2016b, p. 14).

By extending the TAM model to include the constructs of social commerce, hedonic motivation, and utilitarian motivation, Paschalie and Santoso (2020) sought to gain insight into the developments of cryptocurrency adoption. Their study employed a quantitative research methodology and collected data from 54 respondents who currently lived in Indonesia using a non-probability, snowball sampling method. Respondents were selected based on their previous experience in using mobile financial technology applications and their knowledge of cryptocurrency investing. The results show that hedonic motivation and utilitarian motivation, represented by subscription-based online services, have a significant effect on perceived usefulness. Yet, perceived usefulness does not significantly impact behavioral intention to use cryptocurrencies as an investment vehicle. On the other hand, social commerce, which represents social interaction, has a significant influence on behavioral intention to adopt, which is mediated by perceived trust. Limitations of the study include a relatively small sample size and a narrow demographic sample, with respondents primarily between the ages of 17 and 35. Consequently, the generalizability of the findings of the study is limited. In addition, the study only addresses the impact of social commerce, hedonic motivations, and utilitarian motivations, and excludes other factors that may influence cryptocurrency adoption.

A further study employing the TAM model as a framework to test the research hypotheses was conducted by Nadeem *et al.* (2021) in order to examine the factors that influence the adoption of Bitcoin in China. The researchers used a survey questionnaire to collect data from 385 Chinese participants. The findings reveal that perceived ease of use and perceived usefulness have a substantial impact on the intention to use Bitcoin. Thereby, perceived usefulness acts as a mediator between perceived ease of use and intention to use Bitcoin. Transaction processing and perceived ease of use were also found to have a positive influence on perceived usefulness, suggesting that the benefits of Bitcoin's transaction-processing-related features enhance its perceived usefulness. On the other hand, the study reported an insignificant relationship between security and control and perceived usefulness, indicating that security concerns may not significantly affect users' perceptions of Bitcoin's utility. However, the authors point out the following limitations of the study. First, the data were obtained from only one city in China, which may limit the generalizability of the findings to the broader Chinese population. Second, the study focused only on the positive aspects of Bitcoin adoption and did not fully explore the negative aspects associated with its use. In addition, the study did not take into account other factors such as trust, hedonic motivation, and social factors that may play a role in users' intention to use Bitcoin.

Focusing on the use of Bitcoins in the specific context of the financial crisis, Zamani and Babatsikos (2017) performed a research using a survey in Greek to examine whether the use of Bitcoins is widespread enough to lead to a partial or complete disintermediation of monetary transactions, and whether users are aware of the features and risks of this alternative payment method. The results indicate that while Bitcoin adopters are worried to some extent about security concerns, they are however enthusiastic about using the cryptocurrency as a potential business opportunity and to circumvent restrictions and barriers such as capital controls. For future research, the authors propose more detailed examination of consumers' perceptions of trust and risk, and whether these are similar to or fundamentally different from their perceptions of fiat currencies (Al-Amri *et al.,* 2019, p. 299).

The study of Gagarina *et al.* (2019) took a broader perspective, encompassing general aspects, while focusing particularly on young participants. The purpose of the study was to validate the attitudes toward cryptocurrencies questionnaire and to identify predictors of attitudes toward Bitcoin among young participants. The research involved 262 participants between the ages of 17 and 30. The researchers used several scales and questionnaires, including the Value Scale, the Moral Foundations Questionnaire, the Money Beliefs and Behaviors Scale, and the Baseline Confidence Scale. The sample consisted of students from various universities in Moscow. The data showed that the intention to adopt cryptocurrency as a payment instrument is directly linked to the aspiration for financial autonomy and the lack of trust in social institutions. Attitudes toward cryptocurrencies were also found to be influenced by age and gender. The main limitation of the study is the reliance on a sample of young participants, in particular, bachelor and master students from different universities in Moscow as well as the focus on attitudes rather than behaviors related to the cryptocurrency.

In order to assess the intention to use cryptocurrencies and identify the different factors that influence it, Gil-Cordero *et al.* (2020) designed a convenience sampling model in which the target population were individuals residing in Spain, aged 18 years or older, with previous knowledge of cryptocurrencies. The data was obtained through an anonymous online form, and a total of 411 forms were received for analysis. The study employed Partial Least Squares (PLS) analysis to evaluate the model and to provide insights into the adoption of cryptocurrencies as a financial tool. According to the study, trust has the greatest influence on behavioral intention, followed by performance expectancy. Variables such as e-Wom (electronic word of mouth), perceived risk and web quality were found to effectively influence trust. One of the limitations of the study was the unbalanced socio-demographic sample, which consisted mainly of cryptocurrency users in Spain. Therefore, the authors advocated for obtaining a larger and more balanced sample for future research. In addition, the study recommended investigating the influence of other variables on cryptocurrencies, such as volatility, ease of use, and facilitating conditions.

Taking the UTAUT2 model and modifying it with trust and personal innovativeness, Abbasi *et al.* (2021) examined the factors influencing cryptocurrency adoption in Malaysia. The study explored the role of personal innovativeness as a moderator between price value and performance expectancy, with a sample of 314 participants. The results indicate that performance expectancy and price value positively influence users' behavioral intention to adopt cryptocurrency. Effort expectancy also shows a positive influence, while social influence, facilitating condition, and hedonic motivation are found to have insignificant relationships. Furthermore, the study identifies trust as the most significant predictor of adoption, and personal innovativeness as a moderator between performance expectancy and price value. There are several limitations of the study, including the cross-sectional approach, restricted generalizability, and the lack of post-adoption behavioral analysis. In terms of future research, longitudinal studies and cross-cultural comparisons were recommended.

In a comparable context, Tamphakdiphanit and Laokulrach (2020) identified the regulatory development of cryptocurrency and determined the influencing factors on the intention to use cryptocurrency in Thailand. The researchers utilized the UTAUT model and surveyed two groups of participants: individuals with no previous experience with investment tools and individuals with previous experience in dealing with financial assets. The data were analyzed by using reliability, descriptive and regression techniques. The study concluded that social influence was found to have the highest impact on the intention to use cryptocurrency, followed by facilitating condition, effort expectancy, and performance expectancy. The limitation of the study included the application of a non-probability sampling method, potentially affecting the generalizability of the findings.

5.1.3 Mixed Methods Studies

The third methodological classification consists of mixed methods studies, where researchers used a combination of quantitative and qualitative techniques, as well as other approaches such as SWOT (strengths, weaknesses, opportunities, and threats) analysis, theoretical analysis, and contemporaneous. For instance, Lustig and Nardi (2015) introduced in their study the term “algorithmic authority” to help explaining the role of algorithms in people’s everyday lives. They defined “algorithmic authority” as the legitimate power of algorithms to guide human actions and to decide which information is considered true. The research deployed a hybrid methodology of both interview and survey data to collect the information and derive the conclusions. The results show that Bitcoin users favor algorithmic authority over the authority of conventional institutions, which they perceive as untrustworthy. However, in order to gain a clearer understanding of how algorithmic authority can optimally be utilized to empower users, the authors addressed the need for future research to explore the relationship between the centralized institutions that many cryptocurrency users oppose, and the decentralized algorithmic authority of Bitcoin (Al-Amri *et al.,* 2019, p. 300).

By providing an argument based on network effects and the mechanism of exchange costs, Luther (2016) addressed the prevailing state of technology and attitudes about the future purchasing power of existing currencies, and explained the reasons for the failure of cryptocurrencies to gain broader acceptance. In this context, the author applied a simple model of currency acceptance developed by Dowd and Greenaway (1993), in order to examine currency competition, monetary unionization and currency substitution. The study stated that besides the lack of key monetary stability or government support, cryptocurrencies face limited chances of achieving widespread adoption. The simple model of currency acceptance showed that the failure of cryptocurrencies to gain widespread acceptance does not necessarily imply that existing cryptocurrencies are inferior to incumbent monies. However, even if they are superior to the status quo, network effects might eliminate cryptocurrencies from gaining acceptance.

In the context of analyzing blockchain technology and its adoption barriers, Mthethwa (2016) highlighted that although blockchain technology has gained interest, the adoption of cryptocurrencies, in particular, remains low due to limited knowledge about their benefits. The potential of blockchain is seen more in non-financial applications, but the main barrier to adoption is the lack of awareness and understanding of the technology. DeVries (2016) conducted a SWOT analysis of Bitcoin and recognized its potential to transform the economic discourse, predicting a significant role for cryptocurrencies in the future as an alternative means of payment. However, their mainstream adoption is uncertain, and cryptocurrencies are viewed more as a financial investment. Bruijl (2017) discussed the acceptance of Bitcoin as an independent digital currency, noting limited adoption due to its perceived investment value and vendors' limited acceptance. Athey *et al*. (2016) developed a theoretical model of Bitcoin acceptance, emphasizing the role of frictions and the influence of other users' adoption. The study revealed localized adoption trends and the need to explore the network structure of Bitcoin.

Looking at the influence of social media on Bitcoin performance, Mai *et al.* (2015) analyzed in their study the predictive relationships between social media consisting of mixed signals from different users and systems, and Bitcoin returns. The finding indicates that social media is a significant indicator of future Bitcoin returns. However, social media content can have varying impacts. Moreover, the results highlight the influence of the silent majority, as their sentiments may be the more important measure in predicting future price movements. Future research should therefore develop appropriate methods to measure the most influential social media users, who are not necessarily the most active.

By applying a multimethod approach of qualitative and quantitative data collection and analysis method, Esmaeilzadeh *et al.* (2020) identified five main factors predicting Bitcoin adoption behavior. The authors showed that perceived benefits of Bitcoin, such as investment opportunities and improved financial transactions, positively influence users' attitudes and willingness to adopt and use Bitcoin. In contrast, regulation issues and concerns about security were identified as significant barriers to adoption. Social effects and facilitating conditions, such as social image and merchant support, also play a role in shaping users' intention to adopt Bitcoin. The study's limitations however include a small sample size, potential bias in the selection of participants, and the dynamic nature of Bitcoin's development, which may have influenced participants' perceptions. In order to validate and generalize the findings, further research using a larger and more diverse sample is needed.

In order to assess the variables that influence the adoption of cryptocurrencies in households, Arias-Oliva *et al.* (2021) employed a consumer behavior focus and used fuzzy set Qualitative Comparative Analysis (fsQCA) as an analytical tool. The study found that performance expectancy is the most significant factor in explaining the intention to use cryptocurrencies and that effort expectancy and facilitating conditions are also significant factors. On the other hand, the fsQCA showed that social influence, perceived risk, and financial literacy only affect cryptocurrency adoption when they interact with the other factors. Social influence acts as an accelerator for the other explanatory variables, positively influencing the intention to use cryptocurrencies. Financial literacy is important in this regard, as its absence is usually a sufficient condition for non-acceptance. Perceived risk influences the intention to use cryptocurrencies, but can have positive or negative effects depending on the circumstances. However, the study is subject to several limitations. First, it addresses only one population segment, namely college-educated adults with Internet skills, and it is limited to Spain. These findings may therefore vary across different populations and between countries.

In summary, the findings presented above constitute a very general overview of the current state of research on the topics discussed. Most studies have not yet been able to provide a comprehensive assessment of the dynamics and factors leading to the observed rapid diffusion of cryptocurrencies in general and Bitcoin in particular. The limitation of the above discussed findings encompasses among others the sampling method used, the homogeneous selection of the survey's participants and the size of the sample as well as the boundaries of a narrowly defined theoretical framework focusing mostly only on a single issue and undermining other multidimensional socio-economical aspects that can be witnessed within a specific geographic, cultural, or socioeconomic context such as the example of Bitcoin's diffusion in South Korea. The methodological scope of the present study involves addressing and eliminating these limitations through the following steps.

5.2 Hypothesis and Research Design

The subsequent section outlines the rationale for selecting the relevant theoretical background to develop the hypotheses, followed by presenting and formulating the research hypotheses for Bitcoin acceptance and adoption in Korea.

5.2.1 UTAUT 2 Model Hypothesis

Due to its comprehensive framework and its ability to explain individuals' behavioral intentions toward technology adoption, the Unified Theory of Acceptance and Use of Technology 2 (UTAUT 2) model has gained recognition and popularity in the research field of technology diffusion and acceptance.[79] The model represents an extension of the UTAUT model developed by Venkatesh *et al.* (2003) that expands the focus of examining the behavioral intention to use a certain technology from the organizational context to the consumer context (Venkatesh *et al.,* 2012). Although the UTAUT 2 model was only introduced in 2012, it has obtained over 6,000 citations in Google Scholar highlighting its predictive power in the field of information systems and technology acceptance. Thus, researchers are given the tools of using UTAUT 2 as a theoretical framework for exploring

[79] For a comprehensive discussion about the advantage of the selection and application of the UTAUT 2 model see a detailed overview in chapter 3.

issues related to technology adoption in a multitude of contexts, either on its own or integrated with other theories, or by adding further variables that are external to the theory (Tamilmani *et al.*, 2021). In literature, extensions to the UTAUT 2 model mainly related to the addition of new exogenous mechanisms that refer to the influence of external predictors on the exogenous variables of UTAUT 2; the addition of new endogenous mechanisms influencing the endogenous variables – behavioral intention and technology use; and the addition of new moderating mechanisms complementing the moderating variables already present in UTAUT 2 – age, gender, and experience (Venkatesh *et al.,* 2016, pp. 335-337). As discussed in Chapter 3, the present study of Bitcoin diffusion in Korea extends the UTAUT 2 model by introducing the factor *herd behavior*, conceptualized as an additional exogenous construct, as well as by adding moderating cultural variables derived from the national cultural dimensions of Hofstede (1980) and conceived as individual difference variables.

The UTAUT 2 model and its extensions are often referred to as being one of the most appropriate models for conducting research on the diffusion and adoption of cryptocurrencies (Abbasi *et al.*, 2021, pp. 19-20; Tamphakdiphanit and Laokulrach, 2020, p. 525). In this context, the following arguments support the utilization of UTAUT 2 for the study: First, the UTAUT 2 model relies on well-established theoretical foundations, including the Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB), and the Technology Acceptance Model (TAM). This basis allows for an in-depth approach to thoroughly and robustly examine the complex elements that influence an individual's adoption behavior. Second, the UTAUT 2 model provides a wide spectrum of constructs that shape technology adoption, such as performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, and price value, which can be extended according to the particular context. Due to its multi-dimensional nature, the model extended for this study provides a comprehensive perspective on the factors that determine cryptocurrency adoption. Third, with regard to the generalizability of the model, the UTAUT 2 has proven to be adaptable to various contextual and technological settings. The model has been effectively applied in multiple fields, including mobile applications (Alazzam *et al.,* 2018; Hilal and Varela-Neira, 2022), social commerce (Shoheib and Abu-Shanab, 2022), and information systems (Aswani *et al.,* 2018). Given its adaptability, it is well suited for studying the adoption of cryptocurrencies, an area of technology that is characterized by its evolving nature. Fourth, concerning the validation of the model, the UTAUT 2 has been subjected to substantial empirical verification in various research studies conducted under several conditions (Khechine *et al.*, 2020; Zamzami, 2020; Jung *et al.*, 2020; Albashrawi *et al.*, 2017). Such validation ensures the reliability of the model for predicting technology adoption behavior, including for the context of cryptocurrency diffusion and adoption.

As a meta-framework that combines the features of several traditional technology acceptance models, the UTAUT 2 model identifies the following determinants of behavioral intention, which will be used as a basis for hypothesis construction in the context of this study:

a) Performance Expectancy (PE)

The term *Performance Expectancy (PE)* [80] reflects in what extents the use of a new innovation would provide benefits for individual users and is defined as the perceived utility associated with the use of a specific technology (Venkatesh *et al.*, 2003, p. 447; Venkatesh *et al.*, 2012, p. 159). In the context of financial and monetary technology, such as adopting a cryptocurrency, performance expectancy measures the degree to which individuals believe that using Bitcoins would help them to achieve their financial goals. Individuals with confidence that the technology is expected to deliver positive outcomes are likely to adopt it. Several studies indicate that performance expectations generate a positive impact on behavioral intention. Park *et al.* (2007) study the adoption of mobile technologies based on survey data collected from Chinese consumers and state that performance expectations play a positive role in influencing the individual behavior intention to use the technology. In their research on factors influencing the adoption of internet and mobile banking in Pakistan, Mazhar *et al.* (2011) report a positive intention to using mobile banking application when customers perceive a number of expected advantages associated with the technology. In their analysis of the factors influencing the adoption of Internet

[80] *PE* conceived as expectations toward performance integrates the constructs of perceived usefulness in TAM, TAM2, C-TAM, TPB models, external incentives in MM models, job matching in MPU models, comparative advantage in IDT and outcome expectations in SCT (Zhang, 2020, p. 27; Venkatesh *et al.*, 2003, pp. 447-449).

banking in Jordan, AbuShanab and Pearson (2007) highlight the importance of performance expectations as a significant determinant of an individual's intention. Khechine *et al.* (2016, p. 147) conclude in their meta-analysis of the UTAUT model that individuals are willing to adopt an information system, as they perceive a potential increase of the expected return in productivity, efficiency and effectiveness. This is consistent with the results of other studies that demonstrate that performance expectancy significantly shapes behavioral intention of adopting a certain technology, a specific product or an innovative system, for instance, mobile banking (Oliveira *et al.*, 2014); mobile payment service (Jung *et al.*, 2020); mobile learning (Chao, 2019); investment applications (Zamzami, 2020) and social learning systems (Khechine *et al.*, 2020). Therefore, the following hypothesis is formulated to stress the connection between performance expectations and behavioral intention toward the adoption of cryptocurrencies in Korea:

Hypothesis 1. *Performance expectancy positively affects individual's intention to use Bitcoins.*

b) Effort Expectancy (EE)

The effort required to acquire the knowledge in order to be able to use a technology influences the user's acceptance and adoption of the technology. Venkatesh *et al.* (2003, p. 450) define *Effort Expectancy (EE)* as "the degree of ease associated with the use of the system." The perception of ease in using the system depends on how much effort the users expect to spend on understanding the functions of the system and how easy it appears to use the system from users' perspective. The construct was developed from *perceived ease of use* as conceptualized by TAM, *complexity* from the Model of Personal Computer Utilization (MPCU) and *ease of use* from Innovation Diffusion Theory (IDT) (Venkatesh *et al.,* 2003, pp. 450-451; Wei *et al.*, 2021, p. 620). Several studies have stated that *effort expectancy* significantly affects individuals' intention to adopt a certain technology. In the Internet banking adoption context, for instance, Rahi *et al.* (2018) find that the easier bank clients perceive an Internet banking application to be, the higher their intention to use the application. Bhatiasevi (2016) drew similar conclusions in his research to determine the factors driving the adoption of mobile banking in Asia. This interconnection was also confirmed by Albashrawi *et al.* (2017) in their analysis of adopting mobile banking applications by U.S. bank clients. In the context of online-based investment applications, Wang and Yang (2005) indicate that effort expectations significantly influence investors' intention toward adopting online-stocking investment services. Numerous further studies highlight the role of *effort expectancy* within financial and non-financial information systems, such as social learning systems (Khechine *et al.*, 2020); investment applications (Zamzami, 2020); mobile communication systems (Zhang, 2020); and digital learning systems (Park, 2009). Based on these findings, it can be anticipated that there is a potential link between *effort expectancy* and behavioral intention, also in the context of cryptocurrencies adoption. Accordingly, this is expressed by the following hypothesis:

Hypothesis 2. *Effort expectancy positively affects individual's intention to use Bitcoins.*

c) Social Influence (SI)

Social influence (SI) is defined as the perception of the value others attribute to the use of the system by the user and refers to the degree to which an individual's reference groups (namely, people that are perceived by the individual as important and trusted such as friends, colleagues, peers or family members) influence a person's intention to use a particular technology or to engage in a certain activity (Venkatesh *et al.*, 2003, p. 451). This construct was developed and integrated in the UTAUT model by Venkatesh *et al.* (2003) based on observed elements driven from previous diffusion and adoption theories, which can be divided in: *subjective norms* developed from TRA, TAM2, TPB, and TAM-TPB combination; *social factors* from the MPCU theory; as well as the *impression (image)* of the IDT (Zamzami, 2020, p. 99). In this context, *subjective norms* refer to the social pressure perceived by individuals to perform or not perform a certain behavior (Ajzen, 1991, p. 188). *Social factors* outline how an individual's internalization stems from the subjective culture of the group to which they belong, along with the consensus on interpersonal patterns that individuals have established with other individuals in certain social circumstances (Thompson *et al.*, 1991, pp. 126-127). Furthermore, *impression (image)* concerns the degree to which an innovation is considered to enhance a person's image or social status (Moore and Benbasat, 1996, p. 137; Zamzami, 2020, p. 99).

The effect of social influences is expected to be stronger at the early stages of adopting new innovation systems, when most individuals still have not accumulated sufficient personal experience in using a specific technology, and therefore rely on views of others (Marinkovic and Kalinic, 2017, p. 141). Several empirical studies have confirmed that social influence is a significant determinant of the intention of an individual to use a specific technology (Palau-Saumell *et al.*, 2019; Venkatesh *et al.*, 2012). This is particularly applicable to the use of financial technology applications. For instance, Hong *et al.* (2008) indicate that the opinions of friends and relatives have a significant impact on using mobile data services in Asia. Similar results are represented by Püschel *et al.* (2010), where *social influence* is identified as one of the most important factors in determining the dynamics behind the diffusion of mobile banking applications in Brazil. In the context of mobile banking acceptance, Riquelme and Rios (2010) show, based on a sample of more than 600 users of electronic banking in Singapore, that social norms and the need of affiliation affect the behavior of users involving in online banking activities. Furthermore, Zamzami (2020, p. 99) stress that the higher the level of social backing the individual obtains from well-trusted people and the higher their social status, the greater the impact on the individual's behavioral intention to use online investment applications. Therefore, the assumption of a significant relationship between social influence and behavior intentions to cryptocurrencies applications in Korea is made to test the following hypothesis:

Hypothesis 3. *Social influence positively affects individual's intention to use Bitcoins.*

d) Facilitating Conditions (FC)

Facilitating conditions (FC) is defined as the perception of the availability of sufficient resources and the existence of technical infrastructure to support a certain behavior or the use of a specific technology (Venkatesh *et al.*, 2003, p. 543). The construct is developed by Venkatesh *et al.* (2003) based on the following elements from previous diffusion and adoption theories: *perceived behavioral control* obtained from the TPB and the TAM-TPB combination; *facilitating conditions* of the MPCU theory; and *compatibility* derives from IDT (Zamzami, 2020, p. 99). *Perceived behavioral control* refers to individual's perception of the ease or difficulty of performing a certain behavior and includes self-efficacy, resources and equipment as well as the technical provision conditions (Ajzen, 1991, pp.

183-184). In the context of MPCU, *facilitating conditions* refer to the objective elements within a surrounding that multiple actors agree facilitate the performance of an action, such as the availability of hardware, software or technical assistance (Thompson *et al.*, 1991, p. 129), while *compatibility* addresses the level to which the innovation is perceived to be consistent with the existing values and experiences of potential users (Moore and Benbasat, 1996, p. 136).

Several studies demonstrate that *facilitating conditions* have a significant impact on the behavioral intention to use a particular technology or an innovation (Oliveira *et al.*, 2014; Venkatesh *et al.*, 2012; Palau-Saumell *et al.*, 2019). For instance, Zhou *et al.* (2010) find in their empirical study of user adoption of mobile banking, that the factor of *facilitating conditions* has a significant effect in shaping clients' intention to adopt mobile banking applications, as the use of mobile banking services requires the availability of appropriate resources (e.g. mobile phones), knowledge (e.g. know-how of using mobile phone applications), and technology infrastructure (e.g. accessibility of reliable mobile Internet connection). The better the *facilitating conditions* accessible to the individuals, the greater will be their acceptance level regarding the technology. These outcomes are correspondingly supported by the findings of further studies of the adoption of mobile payment services (Gupta *et al.*, 2019; Patil *et al.*, 2020; Mensah *et al.*, 2020). Overall, individuals acting in an environment that is characterized with the needed infrastructure for adopting a specific financial technology, such as using online investment applications, develop higher intention toward trying and accepting new innovations compared to individuals acting in an environment lacking the access to the sufficient infrastructure (Zamzami, 2020). In the context of cryptocurrencies, the participation in the Bitcoin network as an end-user does not require specific cryptographic expertise or special hardware (unlike e.g., involving in mining activities). However, using Bitcoin demands the accessibility to certain digital and analog infrastructure as well as skills and affinity for using digital-based systems. The higher the access to such digital and analog infrastructure facilities, the stronger the intention to accept and use the cryptosystem, especially during the early adoption stages. Therefore, the following hypothesis is formulated:

Hypothesis 4. *Facilitating Conditions positively affect individual's intention to use Bitcoins.*

e) Hedonic Motivation (HM)

The construct *Hedonic Motivation (HM)* refers to the feeling or emotion (e.g. fun or pleasure) stimulated by using a specific technology or innovation (Venkatesh *et al.*, 2012, p. 158). Hedonic motivation is achieved through the experiences and sensations attributed to the multisensory and entertainment features associated with the experience of using a particular product or involving in a particular activity (Yang and Forney, 2013, p. 337). In this context, Septiani *et al.* (2017, p. 507) state that "enjoyment is an intrinsic reward derived from the use of technology that has been learned. Enjoyment is used to capture the hedonism dimension towards user consumption and measure how far users find the service fun, convenient, and entertaining to be used."

The role of *hedonic motivation* in determining the individual behavior intention toward participating in a new technological system or involving an innovative activity has been empirically highlighted in numerous research analyses. For instance, with reference to online retail shopping behavior, Childers *et al.* (2001, p. 526) point out that enjoyment of a certain technology provides a robust and effective predictor of acceptance by the individual. Herrero *et al.* (2017) indicate a significant positive link between hedonic motives and the attitude towards using social networking sites (SNS) for sharing user-generated content. Nguyen *et al.* (2014) find that *hedonic motivation* positively influences the acceptance of digital-based education systems and of e-learning. Also, Nikolopoulos and Likothanassis (2017) conclude that *hedonic motivation* correlates positively and significantly with the behavioral intention to adopt cloud computing. In addition, Dehghani *et al.* (2018) find that *hedonic motivation* is significantly identified as one of the main determinants of continuous intention and actual use of newly introduced innovations such as smartwatches. In the financial and investment context, Sekścińska *et al.* (2016) show that the individual motivational aspect plays an important role in people's decision to allocate their money not only between consuming, saving and investment but also within each single category (e.g. intention to consume a specific product, to save in a certain financial object or to use a particular investment vehicle). Hwang and Kim (2007) find that customers' perceived enjoyment, generated by the design and feature of web applications, has a significant impact on their intention to adopt e-commerce systems. This was confirmed by Malaquias and Hwang (2016) who find that using mobile financial applications is not only based on functional motivation, but also relies on a certain degree of hedonic needs and values. In the case of the cryptocurrency system, the perceived emotional satisfaction might differ among different types of users. Thus, the pleasure obtained from using the Bitcoin system could be financially driven for some participants (e.g., financial gains from trading), political for other users (e.g., because usage is not controlled by the state) or based solely on the fact that they are participating in an alternative system (e.g., hype effect or being "cool"). Accordingly, there is a general consensus that where people experience satisfaction when using a technology, they are likely to continue to use it. Therefore, the following hypothesis is formulated:

Hypothesis 5. *Hedonic Motivation positively affects individual's intention to use Bitcoins.*

f) Price Value (PV)

Price value refers to the individual cognitive trade-off between benefits and costs associated with using a technology (Venkatesh *et al.*, 2012, p. 161). Individuals generally prefer to adopt a favored technology with sufficient benefits to compensate for the monetary costs implied (Abbasi, 2021, p. 8). In terms of digital-based and technology driven financial services, price value can be stated by the trade-off between the cost of downloading, installing and using the service (Thusi and Maduku, 2020). Retail investors, for instance, may decide to adopt online broker systems instead of conventional banks when trading stocks, since these so-called "neo-brokers" often offers a higher price value for the same service (e.g., lower fees and commission) in comparison to classical bank brokers. Even within the same segment of service, some banks offer lower fees when using their mobile applications or online-based systems for trading rather than going the conventional way. However, using such services might be associated with several indirect costs such as having a modern smartphone or a personal computer, access to reliable high-speed Internet or purchasing certain antivirus software to protect the financial transaction from harmful interference of third parties.

Venkatesh *et al.* (2012) state that in contrast to technology adoption by employees in the organizational and business framework, end-users and consumers are personally affected by the monetary costs associated with the adoption process. The consumer would therefore weigh the value contained in the adoption of a new technology against the financial expenses that have to be invested in implementing such a technology. Thus, multiple studies have found that *price value* has a significant impact on individual behavioral intentions to implement or adopt a new technology. For instance, Shin (2009) studies the adoption dynamics of mobile commerce services applications (e.g. mobile TV) in South Korea and identifies price value as one of the significant variables determining the behavior intention of Korean consumers toward using such applications. Similar results are shown by Hong *et al.* (2008) in the context of mobile data services. Another empirical research on the determinants of adopting health and fitness apps by Yuan *et al.* (2015) indicates a significant and positive link between price value and user's intention to maintain their intention to use a health and fitness app. In the context of cryptocurrencies, there are some costs associated with the participation in the Bitcoin network. This can be non-monetary indirect costs such as installing the software or direct financial expenses in form of transactions fess. It is expected that users would weight such costs against the expected advantages and benefits of using the system in comparison to other alternatives. This can be, for instance by comparing the expected return on the investments of Bitcoins to other available investment alternatives or comparing the benefits of using the system for transactions in relation to the use of other available currencies. Therefore, the following hypothesis is formulated:

Hypothesis 6. *Price value positively affects individual's intention to use Bitcoins.*

g) Habit

Habit is defined as a perceptual construct that reflects the outcomes of previous experiences. Habits emerge as people automatically carry out certain activities through repeated behavior (Venkatesh *et al.*, 2012, p. 161). Past behaviors and habits tend to be automated factors that can significantly limit consumers' willingness to adopt new practices or technologies, as individuals tend to act on their past experiences when making certain decisions. Accordingly, habits play a significant role in shaping individual's behavior intention toward using and accepting new forms of technology (Venkatesh *et al.*, 2012, p. 165). This role has been empirically highlighted in numerous adoption research studies. Baudier *et al.* (2020) show that individuals are to a certain extent influenced by their habits either as a barrier or as an incentive toward accepting or rejecting innovations. Chopdar *et al.* (2018) present similar outcomes by analyzing the adoption of mobile shopping apps in a cross-country study. Kolodinsky *et al.* (2004) investigate the acceptance of electronic banking technologies by US clients and find that habits influence the individual decision to adopt the system. Similar results are reported by Eriksson *et al.* (2008) for the use of Internet banking in Estonia, by analyzing the adoption dynamics of commercial innovations in former Central and Eastern European markets. In their study, Baptista and Oliveira (2015) highlight the potential impact of automatically repeated human activities on mobile banking adoption patterns, finding that habits are considered by respondents to be the most important factor in usage behavior. Accordingly, it can be assumed that the individuals' previous behavior and habits influence their current actual references and intentions, also in the context of using cryptocurrencies. For instance, people who are already familiar with digital-based applications might find it easier to start using the Bitcoin system. Moreover, individuals who have participated in mining activities would suffer less barrier to engaging in Bitcoin's trading activities and users who already have used the coins for commercial transaction might have higher incentive to consider Bitcoin as investment object. Therefore, the following hypothesis is formulated:

Hypothesis 7. *Habits positively affect individual's intention to use Bitcoins.*

5.2.2 Herd Behavior Hypotheses

In recent research on cryptocurrency, the existence of herd behavior in the crypto market has been increasingly discussed (Bouri *et al.,* 2019; Vidal-Tomás *et al.,* 2019; Kaiser and Stöckl, 2020). Following this debate, the study of Bitcoin adoption in Korea extends the influencing variables conceptualized in UTAUT 2 with the factor of *herd behavior* in order to investigate the phenomenon of using Bitcoin despite its extreme volatility. In the context of technology adoption, herding is defined as "the phenomenon that a person follows others when adopting a technology, even when his/her private information suggests doing something else" (Sun, 2013, p. 1016). Herding can influence the preferences of which technology to adopt as well as the decision of whether to accept or reject a certain technology. Rao *et al.* (2001) and Bikhchandani *et al.* (1992) find in their analyses of *herd behavior* that the observed actions of others often influence the individual's decisions to invest or not to invest. Similar results are delivered by Bikhchandani and Sharma (2001) in their study of herd behavior in the financial markets, in terms of how financial analysts make their investment decisions. Users of a technology may take into account the observations of other people as well as their own impressions when deciding whether or not to adopt a certain technology. Observing that many users adopt a specific technology might signalize that the technology is popular and generally useful. However, in some cases the observations of others might contain mixed signals regarding adoption or rejection, while the own perception reflects the actual personal needs (Sun, 2013, p. 1016; Vedadi and Warkentin, 2020, p. 431).

It is important to note that *herd behavior* differs substantially from the construct of *social influence* as conceptualized in UTAUT 2. *Social influence* is a self-instruction regarding the expectation of a reference group and implies that the information is primarily from messages received from others and hence the decision-making is affected by their judgment. In contrast, *herd behavior* relies on observations of other people's actions and is not affected by what others think about the eventual decision (Sun, 2013, p. 1018; Bikhchandani *et al.*, 1992).[81] For the implementation of the concept of *herd behavior* in the context of technology adoption, Sun (2013, p. 1015) introduces two patterns of herding: *discounting own information (DOI)* and *imitating others (IMI)*. *Discounting own information (DOI)* refers to the extent to which one disregards one's own beliefs about a technology when making adoption decisions; while *imitating others (IMI)* points to the extent to which one follows prior adopters of a particular technology. The empirical outcomes of the longitudinal study of Sun (2013) indicate that the discounting of personal assumptions and the imitation of others in the adoption of a new technology are primarily driven by the observation of previous adoptions and the perception of high uncertainty about the adoption of a novel technology. A multiple of other empirical studies stress the substantial impact of *herd behavior* in adoption dynamics. For instance, Duan *et al.* (2009) find in their empirical investigation of informational cascades and software adoption on the Internet that software choices of Internet users vary substantially when the download score changes, suggesting that users are likely to follow the choices of previous users. The study

[81] For a detailed elaboration of the differences between *herd behavior* and *social influence*, see chapter 3.7. *Uncertainty, Informational Cascades and Herd Behavior*.

also indicates that users' dependence on the total number of downloads is likely to influence them towards selecting inferior technologies. Hong *et al.* (2017) conclude similar outcomes in the context of adopting mobile social applications.

In a situation of high uncertainty, there is a lower degree of likelihood that users sufficiently evaluate and properly comprehend the nature of the link that exists between the use of the technology and the outcomes of that use. On the basis of asymmetric or limited information and the associated uncertainty regarding the realization of undesirable consequences, individuals are likely to discount their own uncertain information and join a herd, where the popularity of a particular decision is observed, in order to overcome the uncertainty of their decisional process. In this context, recent studies conclude that uncertainty is a driver of herd-like behavior in technology adoption decisions (Lieberman and Asaba, 2006; Walden and Browne, 2009; Sun, 2013; Vedadi and Warkentin, 2020). Consequently, the increasing sophistication of modern information technology systems and the associated information asymmetries resulting from the complex nature of such systems lead to a high degree of uncertainty regarding the adoption process. For instance, a sufficient evaluation of the system might require from potential users to have adequate knowledge, previous experience or technical know-how. In some cases, the benefits of using specific technological systems might occur with a time lag which could create uncertainty to potential users, when making the decision whether to adopt or not. High uncertainty limits individuals' ability to analyze and understand the context of the adoption of a technology and its implications, which makes it difficult to accurately assess the potential benefits of the technology. As a consequence, it becomes a reasonable course of action for individuals to follow the decisions of others, discounting their own information and perceptions, as these are perceived as inadequate and incomplete (Sun, 2013, pp. 1020-1021). Accordingly, in the case of cryptocurrencies and the participation in the Bitcoin system, the decision of whether to participate depends to some degree on the uncertainty, that is either socioeconomically or financially shaped, regarding the outcomes of the participation, the "fear of missing out" in case of non-participation as well as regarding the outcomes of comparative alternative options. Therefore, the following hypothesis is formulated:

Hypothesis 8a. *Uncertainty positively affects discounting own information (DOI).*

Despite obtaining a certain degree of information regarding the features, risks and benefits of Bitcoins, individuals are likely to discount their obtained personal information, as their own information has been collected in an asymmetric informational environment under uncertainty driven from the early-stage characteristic of the technology. Hence, an alternative approach to minimize the cost of information tracking and knowledge gathering under uncertainty is abandoning one's own perception and assuming that the individuals already using the system have undertaken the required information search and experimentation. Therefore, the following hypothesis is formulated:

Hypothesis 8b. *Discounting own information (DOI) positively affects individuals to imitate others (IMI).*

Imitation of previous adopters is expected to have a significant influence on the individual's own decisions and choices. In their study of investors' herd behavior, Maug and Naik (1996) show that when investment return is evaluated in the context of a benchmark (e.g., other market participants or the broad market) and when their rewards diminish in the case of underperforming with compared to the benchmark, they are most likely to shift their investment toward the observed benchmark and hence passively imitating other investors. Thus, imitation in order to prevent potentially worst outcomes might be a valid approach in terms of achieving an average reward. In the context of financial technology adoption, concerns of missing potential opportunities and facing competitive disadvantage might dominate individual's decision making, if people reject a specific financial technology while observing others users gaining benefits from adopting the system. Accordingly, the fear of missing out would drive users to choose the technology adopted by "observed others" to access the same technical or financial benefits that the average "others" are gaining (Sun, 2013, p. 1021).

Scharfstein and Stein (2000) show that investment managers concerned about their reputations or fearing missing opportunities might choose to imitate the behavior of other managers and disregard their own information. Rao *et al.* (2001) find that financial analysts often update their assessment of companies when observing assessments of other analysts with regard of the same companies. In this term, many experienced individuals would favor following the average and even accepting being wrong, if everyone else is also wrong instead of relying purely on their own information and risking reputation damages by delivering an underperformance. Similarly, inexperienced individuals would prefer directly joining the herd, due to the lack of sufficient information. In other words, imitation indicates that "even if a technology adopted through herding turns out to be inefficient, it is still better than the situation where a person becomes the only one making the wrong decision of rejecting an efficient technology and then suffering damage to his/her reputation" (Sun, 2013, p. 1021). Based on these research results*, imitating others* is expected to play a significant role in the dynamics of accepting and using cryptocurrencies. As the functionality of the emerging crypto financial technology is rather novel and sophisticated, and a precise objective assessment of the usefulness of the technology and a potential reward on the participation requires a more extensive range of knowledge and research efforts, most users are likely to face difficulties making an adoption decision purely based on their own objective judgment and private information signals. Therefore, the following assumption is hypothesized:

Hypothesis 8c. *Imitating others (IMI) positively affects individual's intention to use Bitcoins.*

5.2.3 Moderating Variables and the Impact of Individual-Cultural Dimensions

A) Demographics and Experience

Several studies have addressed the implications of demographic variables when it comes to the adoption of emerging technologies. Traditional studies on innovation diffusion indicate that early adopters of technological innovations are characteristically better educated than later adopters, enjoy a higher income, and possess a higher social status (Rogers, 2003, pp. 251-252). In the context of technology acceptance research, the UTAUT and UTAUT 2 models include the factors of gender, age and experience as moderating effects between the independent variables and the dependent variable of behavioral intentions.[82] Venkatesh *et al.* (2003) analyze in the first model of UTAUT the moderating impact of those variables

[82] The first UTAUT model additionally included the moderating variable *voluntariness*, which was dropped in the UTAUT 2 model, as the focus was expanded from an organizational context to the consumer context, in which use is mostly voluntary (Venkatesh *et al*., 2012, p. 6).

and find significant outcomes on the relationship between performance expectancy, effort expectancy, social influence as well as facilitating conditions, and behavioral intentions. Later in the new interconnections added to the UTAUT 2 model, Venkatesh *et al.* (2012) find that gender and age moderate the relations between price value and behavioral intentions. Moreover, they point in their modified model that gender, age, and experience moderate the interaction between the variables of facilitating conditions and behavioral intentions as well as the link between hedonic motivation and behavioral intentions, and among habit and behavioral intentions.

However, empirical findings regarding the role of the moderating variables are to some extent inconsistent, depending on the context of the data collection. For instance, there is some evidence in the research on mobile banking adoption that typical electronic banking users are relatively young (Joshua and Koshy, 2011) as well as that older people tend to be more reluctant to use mobile banking services and have more negative attitudes towards adoption, e.g. due to concerns about incorrect operation or connection failures (Laukkanen, 2007). A few studies, by contrast, find that middle-aged clients are more likely to use electronic banking services (Laforet and Li, 2005, p. 376; Laukkanen and Pasanen, 2008, p. 90). In turn, Cruz *et al.* (2010) conclude their analysis of mobile banking rollout in Brazil that older individuals view mobile banking as more challenging to use than younger individuals, while Püschel *et al.* (2010) find that mobile banking adopters in Brazil are predominantly young males.

With regard to gender, study results suggest that the perceived usefulness of adopting technological innovations, such as mobile services, is greater for men than for women (Nysveen *et al.*, 2005). In addition, a number of empirical research studies have highlighted a statistical pattern in which female and male users behave differently in the context of mobile services and electronic banking; such as women perceive a greater amount of risk in making an online purchase than men, both in terms of probability and in terms of likelihood (Garbarino and Strahilevitz, 2004, p. 773); normative considerations such as peer opinions have a higher impact on women in terms of mobile services (Nysveen *et al.*, 2005); and males tend to be more likely to adopt mobile banking services than females (Laukkanen and Pasanen, 2008, p. 90). Riquelme and Rios (2010, p. 337) indicate in their study of mobile banking adoption in Singapore that the effect of social norms on intention to adopt and ease of use on perception of usefulness is greater among women than among men. Using gender as a moderating variable, Püschel *et al.* (2010) show that men are more likely to use mobile financial services than women. On the other hand, no significant effects for age or gender are found among social media adoption (Workman, 2014) and mobile banking acceptance (Oliveira *et al.*, 2014). Despite these different results, the following moderating hypotheses are integrated into the empirical model on the basis of the UTAUT-2 model:

Hypothesis 9a. *Age moderates the effect of facilitating conditions on individual's intention to use Bitcoins.*
Hypothesis 9b. *Age moderates the effect of hedonic motivation on individual's intention to use Bitcoins.*
Hypothesis 9c. *Age moderates the effect of price value on individual's intention to use Bitcoins.*
Hypothesis 9d. *Age moderates the effect of habits on individual's intention to use Bitcoins.*

Hypothesis 10a. *Gender moderates the effect of facilitating conditions on individual's intention to use Bitcoins.*
Hypothesis 10b. *Gender moderates the effect of hedonic motivation on individual's intention to use Bitcoins.*
Hypothesis 10c. *Gender moderates the effect of price value on individual's intention to use Bitcoins.*
Hypothesis 10d. *Gender moderates the effect of habits on individual's intention to use Bitcoins.*

Hypothesis 11a. *Experience moderates the effect of facilitating conditions on individual's intention to use Bitcoins.*
Hypothesis 11b. *Experience moderates the effect of hedonic motivation on individual's intention to use Bitcoins.*
Hypothesis 11c. *Experience moderates the effect of habits on individual's intention to use Bitcoins.*

Moreover, experience has also been identified as significant moderator, in terms of effects of social influence on behavior intention (Venkatesh, 2000; Venkatesh and Davis, 2000; Venkatesh *et al.*, 2003). Once users have acquired substantial experience, the impact of social norms is anticipated to become smaller, since users are more likely to look to their own previous experiences instead of the views of others to form their preferences. For instance, Karahanna *et al.* (1999) conclude in their research that non-experienced individuals are more guided by social norms than experienced adopters. This relation is likely to be more prominent for non-experienced individuals in the field of information technologies, as they are more sensitive to the information provided by their peers (Tarhini *et al.*, 2014, p. 156). Therefore:

Hypothesis 11c. *Experience moderates the effect of social influence on individuals' intention to use Bitcoins.*

B) The Role of Culture Influences

In addition to demographic moderating variables, multiple studies suggest that cultural factors should be considered in structuring technology acceptance models, as people's attitudes towards information systems are shaped by elements of individual culture and hence cultural values are an essential moderator of technology and innovation acceptance (Park *et al.*, 2007; Srite, 2006; Thatcher *et al.,* 2003; Baptista and Oliveira, 2015; Blut *et al.,* 2022). For this reason, this study on the diffusion and adoption of Bitcoin in Korea extends the moderating variables of the UTAUT 2 model, which refer to demographic factors, to include cultural moderating factors in order to take into account the specific location context in the analysis. For the conceptualization of the cultural moderating factors, the study makes use of the following cultural dimensions of Hofstede (1980): *individualism/collectivism, uncertainty avoidance*, and *power distance*.[83] In this context, it is important to stress that the present study departs from the essentialist tendencies of the

[83] Hofstede (1980) also integrated the factor *gender role orientation* as a fourth cultural dimension. Since *gender* is already taken into account in the influencing moderating variables of the UTAUT 2 model, Hofstede's definition of this factor is not included in the study. For a detailed presentation and discussion of the cultural dimensions in Hofstede's model, see chapter 3.8 The Role of Culture Values.

Hofstede model. Culture is measured in the analysis not at the national, societal level, but at the individual level, i.e., as the degree of individual belief in certain cultural values.

a) Individualism/collectivism (IC)

People from cultures with a high degree of individualism tend to be more self-centered than group-centered. Therefore, the beliefs of other group members might not be given importance in determining whether or not to adopt a new information technology. Inversely, individuals with collectivist cultural values would be more preoccupied in maintaining group cohesion. Therefore, they are expected to have greater exposure to the opinions of other group members about new innovations (Zakour, 2004, p. 159). Hence, numerous studies have hypothesized that the link between *social influence* and *behavior intention* is shaped by the degree to which the behaving individual is exposed to individualistic or collectivistic culture values (McCoy *et al.*, 2005; Li *et al.*, 2009; Dinev *et al.*, 2009). For instance, Srite (2006) highlights that collectivist values are an important moderating factor in the dynamical impact of social influence on behavior intention. Similar, Dinev *et al.* (2009, p. 405) find that this relationship is significant in shaping the social influence of South Korean user behavior towards protective information technologies. Moreover, since individualistic cultures tend to be affected by an individualistic objective focus, *performance expectation* emerges as a applicable consideration for technology adoption in such contexts, as it addresses technology as a tool to achieve desired outcomes. This interrelation is supported by Sánchez-Franco *et al.* (2009), McCoy *et al.* (2007), and Tarhini *et al.* (2017). Based on the above discussion, the following hypotheses are formulated and integrated into the model:

Hypothesis 12a. *Individualism/collectivism moderates the relationship between social influence and individual's behavior intention to use Bitcoins.*

Hypothesis 12b. *Individualism/collectivism moderates the relationship between performance expectancy and individual's behavior intention to use Bitcoins.*

b) Uncertainty Avoidance (UA)

Individuals with high uncertainty avoidance culture values are more likely to feel uncomfortable in situations that are unclear and uncertain, and therefore they tend to avoid decisions that might lead to such uncertainties. Consequently, those individuals of cultures with high uncertainty avoidance may be less influenced to use novel innovations and technologies compared to those with low uncertainty avoidance (Zakour, 2004, p. 158). Hence, multiple research studies emphasize the moderating effect of *uncertainty avoidance (UA)* in the context of new technology adoption (Li *et al.*, 2009; Zakour, 2004; Srite, 2006; Dinev *et al.*, 2009; Zhao and Pan, 2023). For instance, the *social influence* exercised by significant individuals is likely to become far more relevant for technology acceptance among individuals with uncertainty avoidance culture values than among those tolerating uncertainty, since the views of reference groups represent a valuable vehicle for reducing the uncertainty surrounding the introduction of a new technology (Tarhini *et al.*, 2017, p. 313). Moreover, in order to cope with uncertainties and ambiguity, individuals of strong uncertainty avoidance codes of practice tend to rely extensively on rule setting and compliance, so subjective norms as behavioral guidance become more prominent than for individuals of weak uncertainty avoidance codes, who rely more on their own competence to judge a situation (Zakour, 2004, p. 159). In addition, the tendency to avoid uncertainty might be reflected in the way how individuals outline the *performance expectations* of a particular technology or innovation, as individuals with low uncertainty avoidance cultural values might have a higher willingness of taking risks. This might lead to an overestimation of the expected performance or undervaluation of the associated performance risks affecting the individual's behavior intention toward accepting or rejecting the innovation. Accordingly, following hypotheses are included in the research model:

Hypothesis 13a. *Uncertainty avoidance moderates the relationship between social influence and individual's behavior intention to use Bitcoins.*

Hypothesis 13b. *Uncertainty avoidance moderates the relationship between performance expectancy and individual's behavior intention to use Bitcoins.*

c) Power Distance (PD)

Individuals of high power distance cultures, where disagreeing with superiors is not encouraged, tend to rely more closely on their superiors' opinions when evaluating the adoption of a new innovation than individuals with low power distance cultural values (Zakour, 2004, p. 159). Therefore, the level of *power distance* is anticipated to moderate the interaction between *social influence* and *behavior intention* (Li *et al.*, 2009; Dinev *et al.*, 2009; McCoy *et al.*, 2005; Srite, 2006). As users characterized by higher power distance values are more likely to rely on the power of reference persons to shape their decision making, they are more likely to be affected by "significant others" when deciding whether or not to accept and participate in a new technology. This prediction is for instance supported by Dinev *et al.* (2009) in their study of individual behavior regarding the utilization of security technologies applications in relation to South Korea. Furthermore, the tendency to be influenced by the power of reference persons and superiors in the surrounding associated with higher level of power distance may affect the nature of performance expectation formation, as at lower power distance scales, users may have the confidence to use their own intentional decisions based on utility, rather than being seen as relying on the views of those with higher perceived power (Tarhini *et al.*, 2017, pp. 311-312). Therefore, the following moderating hypotheses are supplemented to the model:

Hypothesis 14a. *Power Distance moderates the relationship between social influence and individual's behavior intention to use Bitcoins.*

Hypothesis 14b. *Power Distance moderates the relationship between performance expectancy and individual's behavior intention to use Bitcoins.*

5.3 Empirical Model

Following the formulation of the research hypotheses in the previous section, this section deals with the construction of the empirical analysis model. First, the foundations of the paradigm concept are discussed, and second, the choice of the empirical approach is defined. This is followed by a discussion of the surveys and data collection, as well as the analytical techniques employed.

5.3.1 Paradigm Conception

Research paradigms are generally referred to as a set of underlying beliefs and theoretical frames of reference. They are defined by the basic philosophical assumptions of ontology, epistemology, and methodology. While ontology refers to assumptions about the conditions of possibility of things and procedures in the world, and thus to the way we understand the world and perceive and classify the things in it, epistemology refers to the way we can transfer the things and procedures found in the world into a definable state of knowledge. Methodology is concerned with the question of which procedures, methods and instruments can best be used to collect, describe and verify bodies of knowledge (Guba and Lincoln 1994, p. 107). In this context, the main schools of thought that accentuate the key paradigms shaping social science research are categorized as: *positivism*, *post-positivism*, *critical theory* and *constructivism* or *interpretivism* (Guba and Lincoln, 1994, pp. 109-111). Table 4 presents the ontological, epistemological, and methodological differences of the alternative inquiry paradigms.

Table 4: Different Approaches to Research Inquiry

Item	**Positivism**	**Postpositivism**	**Critical Theory et al.**	**Constructivism**
Ontology	naive realism—"real" reality but apprehendable	critical realism—"real" reality but only imperfectly and probabilistically apprehendable	historical realism--virtual reality shaped by social, political, cultural, economic, ethnic, and gender value; crystalized over time	relativism—local specific constructed realities
Epistemology	dualist/objectivist; findings true	modified dualist/objectivist; critical tradition/community: findings probably true	transactional/ subjectivist; value-mediated findings	transactional/ subjectivist; created findings
Methodology	experimental/manipulative; verification of hypotheses; chiefly quantitative methods	modified excremental/manipulative; critical multiplism; falsification of hypotheses; many include qualitative methods	dialogic/dialectical	

Source: designed by the author, based on Guba and Lincoln (1994, p. 109)

The positivist research perspective assumes real, unidirectional cause-effect relations that can be detected and verified through hypothetic-deductive analysis. The epistemological approach of the positivist perspective thus refers to the empirical testability of theories; applied research methodologies for data analysis are, in particular, sample surveys and controlled experiments. In behavioral information systems research, the positivist approach is the dominant research perspective (Orlikowski and Baroudi, 1990, pp. 10-12).

Postpositivism differs from positivism in that it assumes that reality can only ever be captured imperfectly and that one cannot be absolutely positive about one's claims of knowledge when studying human behavior. While positivist approaches favor quantitative methods, postpositivist approaches view both quantitative and qualitative methods as valid approaches (Creswell and Creswell, 2018). Critical theory is based on the ontological assumption that social reality is historically constructed and shaped by various social, political, cultural, and economic factors. Because this perspective, unlike positivism, assumes that the researcher and the object of inquiry are interactively connected and that the researcher's values influence the inquiry, the results are value mediated. Thus, this perspective challenges the traditional distinction between ontology and epistemology. The methodological approach is dialogical and dialectical e.g. via interviews and observations (Guba and Lincoln, 1994, pp. 110). Constructivism is a qualitative research approach. This perspective posits that people construct reality on a social and experiential basis as individuals develop subjective meanings of their experiences in order to make sense of the world. Because of the multiplicity of meanings, the researcher looks for the complexity of views rather than limiting meanings to a few categories (Creswell and Creswell, 2018).

When considering each of these research paradigms in the context of the present research undertaking, the following conclusions can be drawn: Since the constructivist research paradigm is based on qualitative data collection, it is able to provide detailed insights into the respective research object, but the results cannot be quantified and generalized. Critical theory, on the other hand, has been criticized for the ambiguity of the status of epistemological interest and the lack of an agreed-upon theoretical foundation. Although the post-positivist approach shares certain similarities with the positivist school of thought, it is often criticized for its resource-intensive nature and inadequacy in explaining unpredictable behavior. In contrast, the dominance of positivism can be observed in socio-economic analysis, where the focus is on testing research hypotheses and quantifying measurable parameters (Tarhini, 2013, pp. 94-95).

Consequently, following the above distinctions between different types of research paradigms, the positivist approach is chosen as the most appropriate for the analytical approach of the present study. Since the study examines the socio-economic dynamics behind the intention to use cryptocurrencies, it addresses social issues where the behavioral patterns of users are empirically measured. For this purpose, hypotheses are generated based on validated adoption theories and acceptance models provided by the literature-based rationale in Chapter 3. The hypothesized relationships are measured quantitatively using the statistical method of structural equation modeling to test the research hypotheses. Both the quantitative method and the statistical application are encouraged by the positivist approach.

5.3.2 Methodological Inquiry and Quantitative Research Approach

In technology acceptance research, both qualitative and quantitative methods of data collection are used, as well as mixed approaches.[84] While qualitative research is mainly concerned with examining case studies and analyzing them interpretatively in order to explore means and underlying patterns, quantitative research focuses on collecting data in order to analyze them statistically. The qualitative approach involves the conceptualization of questions and procedures, data collection and analysis proceeding inductively from particular to general themes, and interpretation of the meaning of the data. In contrast, the quantitative approach is used to test objective theories deductively by examining the relationships between variables. These variables can be measured so that the empirical numbered data can be analyzed statistically. This approach is primarily associated with positivist epistemology (Creswell and Creswell, 2018). The key differences between both quantitative and qualitative research methods are presented in table 5.

[84] For an overview of the different research approaches used to study the adoption of cryptocurrencies, see Chapter 5.1. Cryptocurrencies in Diffusion Research.

Table 5: Comparison of Qualitative and Quantitative Research

	Qualitative Research	Quantitative Research
Ontology (i.e., nature of reality/truth)	Subjective, mental, personal, and constructed	Objective, material, structural, agreed-upon
Epistemology (i.e. theory of knowledge)	Relativism; individual and group justification; varying standards	Scientific realism; search for Truth; justification by empirical confirmation of hypotheses; universal scientific standards
Most common research objectives	Qualitative/subjective description, empathetic understanding, and exploration	Quantitative/numerical description, causal explanation, and prediction
Form of data collected	Collect qualitative data such as in-depth interviews, participant observations, field notes, and open-ended questions. The researcher is the primary data-collection instrument.	Collect quantitative data based on precise measurements using structured and validated data-collection instruments.
Nature of data	Words, images, categories	Variables
Data Analysis	Use descriptive data; search for patterns, themes, and holistic features; and appreciate difference/variation.	Identify statistical relationships among variables.
Results	Particular findings; provision of insider viewpoints	Generalizable findings providing representation of objective outsider viewpoint of populations
Form of final Report	Less formal narrative report with contextual description and direct quotations from research participants.	Formal statistical report (e.g. with correlations, comparisons of means, and reporting of statistical significance of findings)

Source: designed by the author based on Johnson and Christensen (2014)

Quantitative research methods are based on the ontology of positivism. Several scholars in the field of technology acceptance research have advocated their use in the study of human behavior (Nakamichi *et al*., 2006; Adikari *et al.,* 2015, Chapman and Rodden, 2023). As mentioned above, this study uses the quantitative approach. In this regard, the constructed model is compiled and processed into a numerical standard to measure and reflect the relationship between the variables dealt with within the model.

5.3.3 The Survey Approach, Population and Sampling

In their systematic literature review of the UTAUT 2 model, Castanha *et al.* (2021, p. 322) present the methods used to determine and obtain sample data, as well as the different statistical procedures used to analyze the sample data. In this context, the authors find that the majority of scholars employed exploratory research (66%), of which 50% were based on online surveys. Convenience sampling was highlighted to be common in the analyzed studies (25%). The utilized average sample size was estimated to be 201-400 (48%) and the Likert scale was commonly used to estimate the influencing factors of the behavior intention toward acceptance and adoption (Castanha *et al.* 2021, p. 322). Further studies have highlighted the significance of the survey approach as one of the frequently used research techniques in the field of technology acceptance and adoption (Bell *et al.*, 2019; Venkatesh *et al.*, 2012; Blut *et al.,* 2022). Moreover, a questionnaire as a data collection method is commonly linked to studies based on positivist-quantitative methodologies. As a sizable quantity of data can be captured through the application of the survey approach, the results can be validated across the general population (Tarhini, 2013, p. 100). In this sense, applying the survey approach as a means of collecting data is regarded to be adequate from an ontological, epistemological and methodological perspective (Tarhini *et al.*, 2017, p. 315).

Survey research uses a variety of collection methods, both digital (e.g. using email, web-based questionnaires, subscription emails or online interviews) and analog (e.g. at universities or other locations appropriate to the survey) (Quinlan *et al.*, 2015). In the context of the present study, an online-based self-administered questionnaire is utilized for the purpose of quantitative data collection. In order to obtain a convenient representative sample, the survey questionnaire was promoted on online forums, blogs and social networking platforms related to Bitcoin activities and popular among users' community. In this context, the Google survey tool was applied for the questionnaire distributions.

With reference to ethical approvals, the following measures were taken: a detailed information was provided to all participants with precise elaborations regarding the aim of the study and the procedure; there were no direct or indirect data related to the health of the subjects obtained and hence the Declaration of Helsinki was not referred to in general; the anonymity of the information obtained was guaranteed; no authorization from any panel or ethics committee was required in accordance to the applicable institutional and official guidelines and regulations; and the completion of the questionnaire on a voluntary basis was considered to be a permission for the utilization of the data within the research framework.

The significance of sampling data from respondents representing the population as a whole needs to be determined by the researcher in the context of efficiency and financial limitations. There is a range of choices that the researcher needs to address with regard to the sampling approach, depending on the aims, objectives, timetable and funding of the research. In this regard, probability and non-probability represent the two major forms of sampling approaches (Bell *et al.*, 2019). The principle of probability sampling is based on a random selection of the sample. By doing this, a monitored process is applied to verify that any individual within the population has a given probability of being selected. Probability sampling methods are simple random sampling, cluster sampling, stratified sampling, and systematic sampling (Groves *et al.*, 2004, pp. 93-121). On the other hand, unlike probability sampling, the approach of non-probability sampling relies on a non-random selection of the sample and therefore not all individuals within the population have an equal probability of being selected (Tarhini, 2013, p. 105). In general, the aim of non-probability sampling is not for the results to be representative of the entire target population, but rather for the sample to be selected on the basis of a particular characteristic of the subjects studied and for the results to apply only to a particular subset of the population. Non-probability sampling methods involve convenience (haphazard) sampling, purposive (judgment) sampling, expert choice, snowball sampling, and quota sampling (Ayhan, 2011; Fowler, 2002). Table 6 illustrates the advantages and disadvantages of applying each of those sampling techniques.

Table 6: Methods of Sample Selection

Technique	Advantages	Disadvantages
Probability sampling		
Simple random sample (SRS)	Easy to implement, analysis, and interpretation, results projectable.	Require a complete list of population, expensive, time-consuming, produces high error rate.
Systematic	Simpler, quicker, cheaper expensive than SRS. Sampling distribution of mean or proportion is easy to be determined.	Costly, lower representative than SRS, the results and sample may be skewed due to the periodicity within the population.
Stratified random	The sample size in strata is controlled by researcher. Include all important subgroups, decrease sampling error	Expensive, more complex, and also researcher should make a greater effort compared to simple random; the sample size in strata must be carefully defined
Cluster	Cost effective, quick, good for large population, easy to do without a list of population.	Imprecise, not easy to compute results, the fact that sub-groups (clusters) are being homogenous rather heterogeneous this will lead to lower statistical efficiency.
Non-probability sampling		
Convenience	The least expensive, least time-consuming and administration to ensure sufficient participants of a study, most convenient and common among other methods.	Selection bias, cautious when generalisation of findings as the sample is not a representative of the whole population.
Judgmental or Purposive	Low cost, not time-consuming, ensures balance of group sizes.	The subjectivity of the researcher may lead to bias and thus reliability and generalisability of the results may be questionable.
Quota	Low cost, and not time-consuming, the researcher select subgroups with controlled characteristics and number of participants of which is related to the study.	Results depends on the characteristics of the respondents within the sample and thus not easy to defensible the results as a representative of targeted population.
Snowball	It is very efficient where individuals are very rare. It is also possible to include participants even if there is no known list in advance.	Time-consuming, questionable to guarantee whether the sample is a representative of the entire population.

Source: Tarhini (2013, p. 106)

The present study uses convenience sampling as a non-probability sampling technique. The advantages of this approach are that it can be used to sample individuals from the intended population who are both willing and easily accessible to be actively selected for the study; as well as that it is the least expensive and least time-consuming of all the techniques. In general, the random sampling approach is the most widely applied technique in behavioral and social science studies (Tarhini, 2013, p. 107). Compared to the other approaches, convenience sampling is the most effective method to collect data for researching Bitcoin adoption behavior in Korea in order to draw empirically supported conclusions for the reasons behind the Korean Bitcoin hype.

With regard to the research subjects, there are four components defining the target population that consist of the overall set of individuals to be examined by the researcher in order to address the research aims: inclusion, exclusion, feasibility and expected effect (Quinlan *et al.*, 2015). Concerning the inclusion criteria, the present research focuses on individuals within the Korean socio-economic framework (e.g., being Korean nationals, living in Korea or identifying their personal behavior within the Korean cultural context) by exploring their behavioral intentions toward cryptocurrency activities in general and Bitcoin applications in particular. With regard to the feasibility criteria, the online-based self-administrated questionnaire seeks to obtain a convenient representative sample. The survey questionnaire was promoted on online forums, blogs and social networking platforms related to Bitcoin activities and popular among the user community. The choice of digital channels for data collection seems to be in line with the characteristics of the underlying objectives of the study, since participation in cryptocurrency networks requires a minimum level of technological affinity and digital routine. Therefore, the feasibility of reaching the target population through online surveys can be considered a reasonable choice. Regarding the exclusion norms, the obtained data that did not meet the pre-defined criteria in terms of the target population and the targeted subjects were excluded from the analysis. Eventually, the size of the sample is assessed according to the rules of thumb for the application of structural equation modeling in AMOS statistical software packages. These rules suggest a minimum size of 30 for each subgroup and category (Roscoe, 1975). Furthermore, in the context of multivariate data analysis, particularly in the case of the implantation of structural equation modeling, the chosen sample size must outweigh the total number of variables in the research approach by the factor of ten (Roscoe, 1975; Memon, 2020).

5.3.4 Questionnaire Design and Accessibility of Data

In order to obtain the data needed to address the research questions and meet the primary aims of the present study, a questionnaire format was designed. The elements of the survey questionnaire were primarily derived from a literature review of technology acceptance and diffusion models, according to the research framework and hypotheses presented in the previous chapters. According to Sekaran and Bougie (2010), Ghauri *et al.*, (2020) and Blumberg *et al.* (2008) the research questionnaire is formed and developed from the conceptualization of each construct and the operationalization of the constructs. In this regard, the questionnaire is comprised of an informative introduction, which outlines the aim of the survey and includes the indication that the anonymity of the data will be ensured, as well as the exploratory form. The questionnaire is divided into 4 sections. Section A contains the moderating demographic variables age, gender, and experience with or intention to use Bitcoins. Sections B and C include the direct determinants of behavioral intention as identified in the theoretical model of the present study, while section D encompasses the moderating cultural variables (see Appendix A). The constructs and variables employed in the questionnaire are quantified as follows:

Section A: This part covers the demographic characteristics of the target sample and consists of

- **Demographic Background**: addresses the respondents' nationality (respectively residency), age and gender. There are three questions related to these variables, all of which were measured on a nominal scale and served as influencing moderating variables within the framework of the designed model. As the demographic issues represent an important element, they were placed in the initial segment of the inquiry.

- **Experience**: as moderating variable is about an individual's experience in using cryptocurrencies and overall level of digital financial literacy. A nominal scale is used to measure this moderator and comprises four survey items (Q1-Q4).

- **Behavioral intention:** reports the willingness and intention of the individuals to use Bitcoins or to participate in Bitcoin networks in the near or foreseeable future. Users' intention is measured on a seven-point agree/disagree Likert scale and covered by four survey items (Q5-Q8).

Section B: This part contains the key elements of UTAUT 2 Model determinants and consists of

- **Performance expectations (PE):** reflects the extent to which the use of cryptocurrencies would provide benefits to individual users and is defined as the perceived utility associated with participating in the Bitcoin network or engaging in cryptocurrencies activities. This construct includes four nominally measured questionnaire items (Q9-Q12).

- **Effort expectancy (EE):** points to the effort required to acquire knowledge in order to be able to participate in cryptocurrency systems and use Bitcoins. The perception of the ease of use of the system depends on how much effort the users expect to spend on understanding the functions of the system and how easy the system appears to be to use from the users' perspective. Consisting of four questions (Q13-Q16), this construct is surveyed according to a seven-point Likert scale varying from 1 (strongly disagree) to 7 (strongly agree).

- **Social influence**: refers to the perception of the value others attribute to the use of the cryptocurrency systems by the user and refers to the degree to which an individual's reference groups (people that are perceived by the individual as important and trusted such as friends, colleagues, peers or family members) influence a person's intention to use Bitcoin or to engage in crypto trading activities. This element is surveyed based on four question items (Q17-Q20) that are measured on a seven-point Likert scale varying from 1 (strongly disagree) to 7 (strongly agree).

- **Facilitating conditions**: refers to the perception of the availability of sufficient resources and the existence of technical infrastructure that support the use of cryptocurrencies and engaging in Bitcoin activities. This construct is measured based on four survey questions (Q21-Q24) according to a seven-point Likert scale varying from 1 (strongly disagree) to 7 (strongly agree).

- **Hedonic motivation:** refers to the feeling or emotion (e.g., fun or pleasure) stimulated by using the cryptocurrency as well as the emotional and entertainment aspects associated with the experience of the participation in the Bitcoin system or involving in trading activities. This construct is addressed through four questions items (Q25-Q28).

- **Price value:** refers to the individual cognitive trade-off between benefits and cost associated with using cryptocurrencies such as the cost of downloading, installing and using the service, disregarding the service's perceived value. Price value is measured by applying a seven-point Likert scale (Q29-Q32).

- **Habit**: This construct is defined as consequence of previous experience due to the regularity of past behavior. Habits emerge as people automatically carry out certain activities through repeated behavior (Venkatesh *et al.*, 2012, pp. 161-162). Habit is nominally measured based on four quantitative survey items (Q33-Q36).

Section C: This part contains the key elements of herd behavior hypotheses and consists of

- **Perceived uncertainty (UNC):** describes the scale at which people are incapable of precisely anticipating the challenges associated with the implementation of a technology, as a result of imperfect information (Sun, 2013, p. 1020). This construct is measured based on four survey questions (Q37-Q40) according to a seven-point Likert scale varying from 1 (strongly disagree) to 7 (strongly agree).

- **Discounting own information (DOI):** refers to the extent to which a person ignores his or her own beliefs about a technology when taking an adoption decision (Sun, 2013, p. 1022). This element is surveyed based on four question items (Q41-Q44) that are measured on a seven-point Likert scale varying from 1 (strongly disagree) to 7 (strongly agree).

- **Imitation (IMI):** describes the extent to which someone follows other predecessors in adopting a particular form of technology (Sun, 2013, p. 1021). This construct is measured based on three survey questions (Q45-Q48) according to a seven-point Likert scale varying from 1 (strongly disagree) to 7 (strongly agree).

Section D: This sector covers the role of culture influences on the target sample and consists of

- **Individualism/collectivism (IC):** addresses the degree to which an individual is integrated into a particular social group, i.e. whether the ties between individuals in a society tend to be loose or strong and cohesive (Hofstede *et al*., 2010, p. 92). This construct is composed of four questions (Q49-Q52) on a seven-point Likert scale that ranges from 1 (strongly disagree) to 7 (strongly agree).

- **Uncertainty Avoidance (UA):** involves the level of tolerating ambiguous or unknown situations (Hofstede *et al.,* 2010, p. 191). This construct is made up of four questions (Q53-Q56) assessed on a seven-point Likert scale varying from 1 (strongly disagree) to 7 (strongly agree).

- **Power Distance (PD):** addresses the degree to which individuals anticipate and accept the unequal distribution of power imbalances within populations (Hofstede *et al.,* 2010, p. 116). This construct is built on four questions (Q57-Q60) using a seven-point Likert scale with a scale from 1 (strongly disagree) to 7 (strongly agree).

5.3.5 Analysis Techniques

Structural equation modeling (SEM), also referred to as simultaneous equation modeling, path analysis, or covariance structure analysis, is adopted to conduct the process of testing and investigating the postulated relations between variables within the designed model framework given its extensive adoption among researchers in the fields of empirical social research such as technology acceptance studies (Blunch, 2008; Gefen *et al.,* 2000). The SEM method is regarded as an adequate instrument for this research for a number of reasons. Structural equation modelling (SEM) is capable of testing complex cause-effect linkages (Chin *et al.,* 2003; Reinartz *et al.,* 2009) and is notably helpful for examining the moderating effect of the hypothesized interrelationship among the independent and dependent variables (Chin *et al.*, 2003). The SEM allows a set of interrelated research questions to be addressed in a unified, consistent and comprehensive analytical approach, as the multivariate technique integrates characteristics of multiple regression and factor analysis as a means of estimating a variety of relationships between different types of observational data at the same time (Gefen *et al.,* 2000; Hair *et al.,* 2010). The SEM is mainly applied to develop theories and concepts, as it enables modeling theoretical constructs that are either complicated to measure directly or cannot be measured directly (Tabachnick and Fidell, 2007; Yuan, 2005, p. 115).

- Structural equation modelling (SEM) is shaped by the following characteristics: While traditional methods provide a standard model, the SEM relies on explicit specifications of a formal model for estimation and testing. SEM provides no standard model and imposes little restriction on the types of relationships that can be specified. Hence, specifying SEM models effectively means that researchers are expected to justify their hypotheses with theories or research findings, and to provide a priori specification of relationships (Suhr, 2006).

- Whereas traditional techniques only attempt to analyze measured variables, SEM involves, as multivariate technique, observed (measured) and unobserved variables (latent constructs). Multivariate, interrelated estimations are performed simultaneously in order to obtain parameter values using the SEM methodology (Suhr, 2006).

- Traditional methods tend to presume that there is no error involved in the measurements. SEM, on the other hand, does explicitly specify errors and hence enables researchers to acknowledge the imperfect nature of their measured variables (Suhr, 2006).

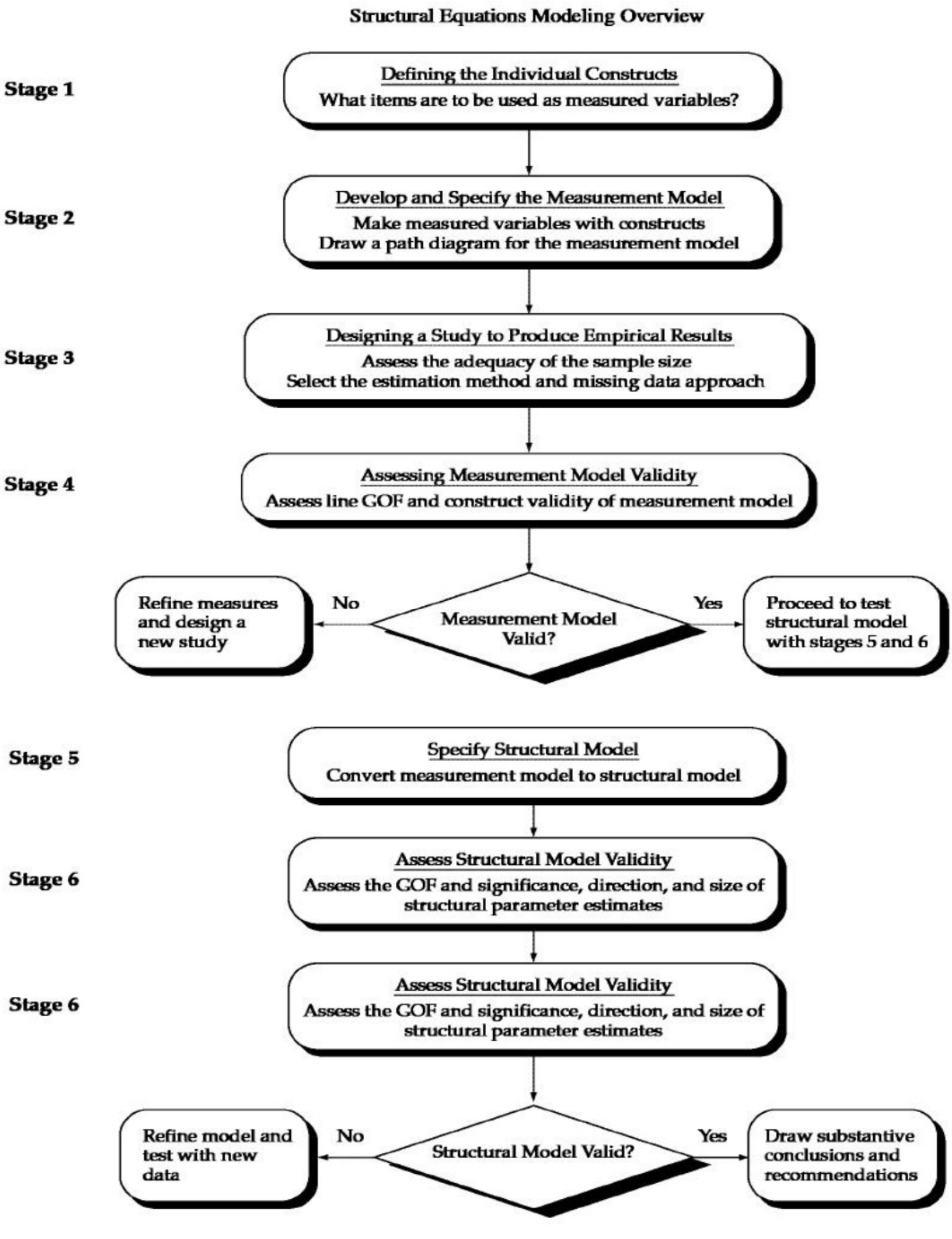
- While traditional analysis offers more straightforward tests of significance in order to identify group comparisons, correlations between variables or the extent of variance being explained, SEM does not offer straightforward tests to assess the fit of the model. Therefore, the most appropriate strategy for assessing model fit is to conduct multiple tests (e.g. Root Mean Squared Error of Approximation (RMSEA), Comparative Fit Index (CFI), Bentler-Bonett Nonnormed Fit Index (NNFI), Chi-Square) (Suhr, 2006).

- SEM overcomes problems of multicollinearity, since multiple measures are needed to capture a latent construct (unobserved variable). Multicollinearity simply cannot emerge as unobserved variables constitute various latent constructs (Suhr, 2006).

- SEM includes a diagrammatic framework that provides a convenient and efficient method of representing complex underlying interactions in the estimated model. The model definition implies the formulation of statements regarding a given set of variables. A diagram, a graphical illustration of a model, is converted into a set of equations. The equations are then simultaneously solved in order to test the fit of the model and estimate the parameters (Suhr, 2006).

The implementation of the SEM techniques can be framed in the following steps: first, the definition of the individual constructs; second, the development of the general measurement model; third, the design of a study in order to obtain empirical results; forth, the assessment of the validity of the measurement model; fifth, the specification of the structural model; sixth, the assessment of the validity of the structural model (Hair *et al.* 2010). The initial four steps are generally addressed by the measurement model, whereas the latter two steps are typically dealt with by the structural model (Tarhini, 2013, p. 122), see figure 19.

Figure 19: Structure Equation Modeling Steps



Source: Hair (2010, p. 654)

In this context, there are two different SEM techniques: Covariance-based modeling as well as variance-based modeling – partial least squares (PLS) (Gefen *et al.,* 2000). Whereas covariance-based SEM is more suitable in cases where the primary aim of the research is to verify and validate the theory, PLS-SEM is more applicable in cases where the primary aim of the research is to predict and develop the theory (Tarhini, 2013, p. 122). In the present research, a covariance-based SEM technique is employed to study and analyze the data in the context of the developed framework.

5.4 Conclustion

The main objective of this chapter was to present the methodological framework of the study. This included outlining the hypotheses and research design as well as providing a rationale for the conceptual paradigms, methodological frameworks and statistical analytical tools employed in this study in order to address the key aims of the research and formulate answers to the research questions.

In the present study, a quantitative method is applied to gain an in-depth comprehension of the conceptual framework in order to provide a validated basis for the research. Therefore, a survey approach relying on the positivism principle in conducting research is considered to be the most adequate method to be applied in this context. In this regard, a web-based survey is employed as a data collection technique for the research design, for which the development and scope of the questionnaire are detailed based on scientific evidence from academia as well as the characteristics of the potential respondents.

Furthermore, the sample size and the types of techniques employed were outlined in detail along with the explanation for the choice of the non-probability sampling method. Based on the conceptual model's degree of sophistication, the major statistical method of analyzing data implemented in this study relies on Structural Equation Modeling (SEM) by utilizing Analysis of Moment Structures (AMOS). Confirmatory Factor Analysis (CFA) and the structural model represent the two-stage based approach to SEM analysis used in the scope of the present research in order to explore and subsequently examine the nature of the relations between the independent and dependent categories of variables.

6 Model Testing

After Chapter 3 outlined the proposed theoretical framework for analyzing the dynamics behind technology adoption and diffusion, and Chapter 5 explained the research methodology underlying the study as well as provided the rationale for the decision of employing a survey methodology for hypothesis testing in order to address the study objectives, Chapter 6 first illustrates the initial data analysis of the information gathered from the participants, followed by an comprehensive examination of the relations between the constructs proposed in the conceptualized framework of the study.

6.1 Pilot Study Analysis

According to Creswell (2010), Cropley (2019) and Ghauri *et al.* (2020) it is crucial to undertake a questionnaire pilot test prior to its application within the context of the current study in order to check the validity and reliability of the items used as well as to optimize the survey questions, template size and rating dimensions.

In this regard, a pilot study was carried out in advance before circulating the main questionnaires. The pilot study was conducted in New Malden, London. The location was chosen due to the fact that the Royal Borough of Kingston upon Thames is home to one of the largest expatriate communities of South Koreans in Europe and is considered one of the most densely populated areas for Koreans outside of South Korea. Ethnic Koreans make up about one-third of the area's population (Parrish, 2014). New Malden hosts Korean-language churches and nursery schools, along with restaurants and stores serving multiple Korean clienteles, and acts as a shopping and cultural center for a predominantly Korean population (Fischer, 2015). Hence, locating the pilot study in New Malden provided a favorable environment in terms of the required demographic characteristics. The primary objective of undertaking the pilot study was to enhance the readability and comprehensibility of the survey questions and to determine whether the data collected address the underlying issues in a smaller representative sample before distributing the main surveys in South Korea on a larger scale.

The items (questions) employed in this study were all acquired on the basis of relevant literature, where reliability and validity in terms of capturing the constructs of the intended behaviors have been cited. As a matter of fact, the items have all been widely employed in research surveys designed to determine the way in which individual preferences impact how users perceive and behave with regard to technology and innovation adoption. Thus, the fact that the items were constructed and piloted within related and similar settings endorses the applicability of the items in the current study (see Appendix 1). Moreover, in order to ensure the validity of the content, the content and structure of the questionnaire were reviewed by statistical experts at the *Global School in Empirical Research Methods* at the University of St. Gallen.

According to Berg (2014), Neuman (2014), Ghauri *et al.* (2020), Kaplan and Maxwell (2005) as well as Creswell (2010), for conducting the pilot study, only a relatively small sample, $N \leq 100$, is required. However, the pilot sample has to be as representative to the population of interest as closely as possible. In this regard, 50 survey questionnaires were circulated in the district of New Malden. Out of the distributed questionnaires, and after excluding the non-representative responses, the number of the returned valid questionnaires was 35, which were evaluated. The process of filling out the questionnaire required 11 minutes on average, which is considered to be fairly adequate (Yin, 2009; Neuman, 2014).

In order to ensure that the data acquired by the measurements in the pilot study is internally consistent and unbiased, the reliability of the constructs in the survey was controlled by applying the *Cronbach's Alpha* test. *Cronbach's alpha* provides a reliable measure of how accurately a set of items captures a particular unidirectional latent variable. A test is regarded as reliable on the condition of obtaining consistent results by repeating the same study using different samples (Cronbach, 1951). The more the *Cronbach's Alpha* coefficient gets closer to 1, the higher the reliability of the employed constructs. For instance, Hair *et al.* (2010) suggest that for the reliability of internal consistency, *Cronbach's Alpha* should value between ≥ 0.7 and ≤ 0.95. In this context, the results of the pilot study show a general adequate reliability within the suggested *Cronbach's Alpha* coefficient values (see table 7).

Moreover, further internal consistency reliability indicators were controlled within the pilot study, by testing the inter-item correlation as well as item-to-total correlation. In the frame of this statistical analysis, test coefficient values of above 0.5 for the inter-item correlation and above 0.3 for item-to-total correlation are required to prove the corresponding reliability (Hair *et al.*, 2010). The results show a significant degree of reliability for most constructs employed in the pilot survey (see table 7).

Table 7: Cronbach's Alpha and Inter-Item Correlation for the Pilot Study

Construct	Nr. of Items	Cronbach Alpha	Inter-Item-Correlation	Item-to-Total Correlation
BI	4	.891	.559-.857	.664-.832
PE	4	.917	.618-.830	.717-.892
EE	4	.908	.614-.819	.752-.824
FC	4	.919	.660-.838	.775-.871
SI	4	.886	.505-.772	.684-.860
PV	4	.907	.591-.821	.667-.874
HA	4	.920	.652-.829	.745-.875
HM	4	.892	.560-.790	.716-.860
IMI	4	.917	.608-.822	.779-.889
DOI	4	.936	.712-.859	.809-.888
UNC	4	.943	.757-.873	.849-.898
EXP	4	.938	.705-.900	.784-.918
IC	4	.924	.574-.855	.753-.884
PD	4	.843	.506-.658	.641-.778
UA	4	.849	.450-.797	.546-.774

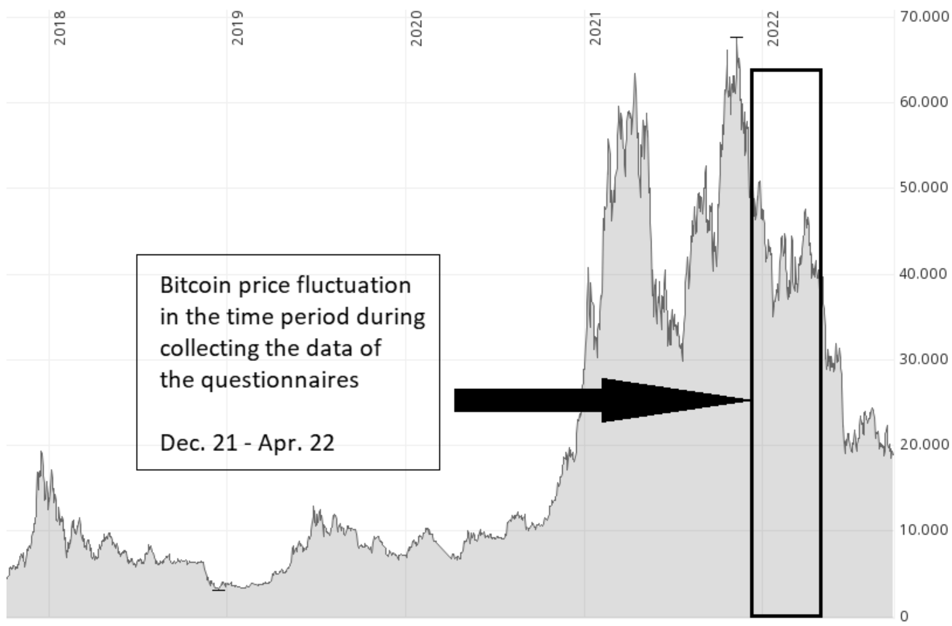
Furthermore, in order to eliminate specious responses and to verify the degree of the sincerity of the questionnaire respondents in giving adequate responses, a *Mann-Whitney U test* was conducted for the first construct *performance expectancy* (PE) on the questionnaire and was compared with the last construct *experience* (EXP) of the survey. According to this statistical method, the test was performed on categories pertaining to the equivalent group; therefore, gender was applied in this context (Mann and Whitney, 1947). The generated results show no statistically significant difference between the constructs on the gender base as well as no observed significant variation on the different construct's items. The significance level based on the asymptotic distribution, since $n > 30$, is higher than 0.05 (Pallant, 2010). Moreover, a comparison of the *Z-score* of the different constructs' items shows an overall survey size acceptance (Tarhini, 2013, pp. 130-131). Thus, the test results support the assumption that the structure and the length of the questionnaire were accepted by the participants (see table 8).

Table 8: Mann-Whitney U Test

	PE1	PE2	PE3	PE4
Mann-Whitney U	112.500	118.000	118.000	134.000
Wilcoxon W	283.500	289.000	289.000	305.500
Z	-1.366	-1.196	-1.183	-.632
Asymp. Sig. (2-tailed)	.172	.232	.237	.528
	EXP1	**EXP2**	**EXP3**	**EXP4**
Mann-Whitney U	145.000	143.500	134.500	146.000
Wilcoxon W	316.000	296.500	305.500	299.000
Z	-.271	-.321	-.626	-.236
Asymp. Sig. (2-tailed)	.787	.748	.531	.813

On the basis of the respondents' feedback and the outcomes of the performed statistical analysis, only minimal modifications of the questionnaire, such as adjusting formulation of the questions and the layout as well as optimizing the number of some construct's items, were required to enhance the validity of the survey. The final survey was then circulated in South Korea in the time period from December 2021 to April 2022. Figure 20 displays a chart of Bitcoin's price movement during the time period in which the surveys were circulated to retrospectively verify that this period has not been characterized by extraordinary price developments (e.g., a crash or a boom) that could possibly influence the responses to the questionnaires in one direction or the other. Beyond that, there is already a built-in construct in the empirical model that measures the influence of the price on the behavioral intention (see Chapter 5).

Figure 20: Bitcoin's Price (USD) Movement during the Survey



Source: designed by the author, based on Bloomberg.com

6.2 Preliminary Analysis of the Core Study

After discussing the results of the pilot study, the goal of the preliminary review of the collected data is to identify missing data, outliers, along with normality, multicollinearity, and homogeneity of the dataset using the *SPSS* statistical package and *AMOS 28.0*. Such analysis procedure is essential in order to prepare the collected data for the final statistical analysis.

6.2.1 Data Screening and Missing Data

Prior to data submission, a check for missing responses was performed on each questionnaire involved in the survey in order to ensure the accuracy of the data entry process. In addition, a review of the descriptive statistics for each item was performed to maintain the overall consistency of the data. In this context, responses with scores beyond the expected valid scale were verified by comparing the original questionnaires in order to increase accuracy. Furthermore, missing data poses a prevalent challenge in data analysis and can significantly impact the achievement of research goals and aims (Hair *et al.*, 2010). The effects of missing data are particularly pronounced when analyzing data using structural equation modeling in *AMOS* (Arbuckle, 2021, pp. 281-295). For instance, *Chi-Square* and other goodness-of-fit measures such as the *Goodness-of-Fit-Index*, as well as several modification indices, might not be calculated when the sample has missing data. Accordingly, in order to avoid such inconveniences resulting from potential missing data, the surveys had been structured in such a manner that all questions would be completed without missing answers. This was possible through the use of web-based and QR-circulated surveys. Therefore, the resulted sample does not contain any missing data.

6.2.2 Outliers

An outlier is typically described as "observations with a unique combination of characteristics that are markedly different from other observations" (Hair *et al.*, 2006, p. 73). Consequently, the detection and treatment of outliers is essential, as they can compromise the normality of the data and lead to significant bias in performing statistical tests. In this context, extreme outliers need to be deleted from the sample, while moderate outliers can be preserved (Tabachnick and Fidell, 2013, pp. 76-77; Tarhini, 2013, p. 133). In order to detect potential outliers, there are two relevant methods that can be applied: *Univariate Outliers* and *Multivariate Outliers* (Hair *et al.*, 2006).

A univariate outlier refers to a case exhibiting an extreme value that falls beyond the anticipated population estimates for a single variable and is therefore deviated from the majority of cases in the middle of the normal distribution for that same variable (Mowbray *et al.*, 2019). The univariate outliers in the sample are detected by estimating the frequency distributions of the *z-score* based on a *SPSS*-analysis. The *z-score* is the standardized value for a continuous variable in relation to the mean. Given a normally distributed dataset, 95% of cases would be between z-scores of ±1.96 and 99% of cases would range between z-scores of ±2.58 (Grove *et al.*, 2013). Z-scores are also consistent with standard deviations (SD), where a z-score of 0 indicates the mean. To facilitate data analysis and interpretation, data points are frequently converted to z-scores, in order to verify whether a suspected outlier case is an actual concern. In this context, a z-score absolute value of 3.29 constitutes a standard rating for identifying outliers (Tabachnick and Fidell, 2013; Polit, 2010). Therefore, any z-score above +3.29 or below -3.29 qualifies as an outlier case and is removed from the dataset. Table 9 shows that no problematic univariate outliers were identified for the sample.

Table 9: Z-score and Univariate Outliers

	(BI1)	**(BI2)**	**(BI3)**	**(BI4)**
Minimum	-2.19525	-2.18917	-2.16155	-2.21390
Maximum	1.72181	1.94213	1.67795	1.87570
	(PE1)	**(PE2)**	**(PE3)**	**(PE4)**
Minimum	-3.14528	-3.17577	-3.18688	-2.58470
Maximum	1.54801	1.61072	1.57074	1.84621
	(EE1)	**(EE2)**	**(EE3)**	**(EE4)**
Minimum	-2.81056	-2.72343	-2.69621	-2.56986
Maximum	1.75842	1.75017	1.67107	1.79044
	(FC1)	**(FC2)**	**(FC3)**	**(FC4)**
Minimum	-2.88959	-2.98670	-2.99305	-2.89223
Maximum	1.43242	1.59835	1.56834	1.90122
	(SI1)	**(SI2)**	**(SI3)**	**(SI4)**
Minimum	-1.90579	-2.22587	-1.91614	-1.93470
Maximum	1.88409	2.07803	1.91614	1.98709
	(PV1)	**(PV2)**	**(PV3)**	**(PV4)**
Minimum	-3.14188	-3.17288	-3.18443	-2.57409
Maximum	1.54856	1.61385	1.57858	1.80758
	(HA1)	**(HA2)**	**(HA3)**	**(HA4)**
Minimum	-2.89534	-2.98722	-2.98440	-2.88483
Maximum	1.43528	1.60087	1.57043	1.90140
	(HM1)	(HM2)	(HM3)	(HM4)
Minimum	-2.74057	-2.55315	-2.57026	-2.50105
Maximum	1.74712	1.72341	1.63854	1.77248
	(IMI1)	**(IMI2)**	**(IMI3)**	**(IMI4)**
Minimum	-2.12741	-2.21654	-2.04193	-2.08310
Maximum	1.99625	2.06142	1.91117	1.96967
	(DOI1)	**(DOI2)**	**(DOI3)**	**(DOI4)**
Minimum	-2.81674	-2.75705	-2.72889	-2.62995
Maximum	1.75519	1.74122	1.65743	1.78466
	(UNC1)	**(UNC2)**	**(UNC3)**	**(UNC4)**
Minimum	-2.82202	-2.75417	-2.72557	-2.63494
Maximum	1.76321	1.74640	1.66214	1.79277
	(IC1)	**(IC2)**	**(IC3)**	**(IC4)**
Minimum	-2.11522	-2.23272	-2.14565	-2.17419
Maximum	1.99749	2.06066	1.94279	1.99644
	(PD1)	**(PD2)**	**(PD3)**	**(PD4)**
Minimum	-1.77749	-2.46158	-2.29076	-2.41464
Maximum	15.88990	2.30688	1.99114	2.04840
	(UA1)	**(UA2)**	**(UA3)**	**(UA4)**

Minimum	-2.43277	-2.11291	-2.35950	-2.11795
Maximum	1.88605	2.11560	1.92109	1.77610
	(EXP1)	**(EXP2)**	**(EXP3)**	**(EXP4)**
Minimum	-2.43807	-2.53475	-2.46629	-2.49121
Maximum	1.73920	1.81528	1.73871	1.81229

The second category of outlier tests requires the observation and analysis of multiple statistical outcome variables simultaneously. This is in order to control for multivariate outliers, which are cases with an unusual combination of values on different variables (Hair *et al.*, 2006). A standard method for examining the multivariate outliers is the application of *Mahalanobis* D^2 measurement (Hair *et al.*, 2010). *Mahalanobis* D^2 is a multivariate distance metric that provides a composite measurement of the deviation of a specific case from the distribution of the surrounding cases (Tabachnick and Fidell, 2013, p. 74). *Mahalanobis* D^2 was calculated for the study sample by using *AMOS* statistical package version 28.0.[85] Accordingly, observations showing a p1 value < 0.05 are estimated to be significant outliers and the degree of correlation among the variables for this set of data is considered to be substantially distinct from the remainder of the sample (Tabachnick and Fidell, 2013, pp. 74-76). Consequently, these identified multivariate outliers were eventually deleted from the dataset. The outcomes of the multivariate outliers for the data set are presented in Table 10.

Table 10: Mahalanobis D^2 and Multivariate Outliers

Observation ID	Mahalanobis D^2	p1	p2
369	96,386	,000	,000
500	79,565	,000	,000
219	78,812	,000	,000
464	78,695	,000	,000
456	75,050	,000	,000
287	73,326	,000	,000
250	72,439	,000	,000
231	71,479	,000	,000

[85] The mathematical formula to calculate *Mahalanobis* D^2 is as follows: $D^2 = (x - m)^T . C^{-1} . (x - m)$; where D^2 is the square of the *Mahalanobi* distance, x is the vector of the observation, m is the vector of mean values of independent variables, C^{-1} is the inverse covariance matrix of independent variables (Polit, 2010; Arbuckle, 2021).

Observation ID	Mahalanobis D^2	p1	p2
468	70,896	,000	,000
195	70,849	,000	,000
279	70,677	,000	,000
122	69,420	,000	,000

6.2.3 Normality Assumption Tests

The assessment of normality is of fundamental importance in multivariate analysis. In particular, when the dataset deviates from a normal distribution, it can have implications for the validity and reliability of the outcomes (Hair *et al.*, 2010). One common way to verify the normality assumption is the application of *Jarque-Bera test* (*Skewness-Kurtosis*) in order to determine if the data are normally distributed or not (Polit, 2010). In this context, the *skewness* parameter is used to display the symmetry of the distribution. A positive *skewness* value displays a shift to the left, which means the right tail is longer and hence the mass of the distribution is concentrated on the left of the figure. On the other hand, a negative *skewness* value shows a shift to the right, which means the left tail is longer and hence the mass of the distribution is concentrated on the right of the figure (Kline, 2005, p. 74). Furthermore, the *kurtosis* parameter is used to display the distribution of the height of the data and describes the shape of the probability distribution. A positive *kurtosis* score points to a leptokurtic (peaked) distribution, while a negative score refers to a platykurtic (flatter) distribution (Polit, 2010). Therefore, a large dataset sample, N > 300, is assumed to be normally distributed when the absolute *skewness* value ranges between ± 2 and the absolute *kurtosis* value ranges between ±7 (Tabachnick and Fidell, 2013; Arbuckle, 2021). Accordingly, the results of the performed *Skewness-Kurtosis-Test* indicate that the variables in the sample*, N = 524*, are normally distributed as shown in table 11.

Table 11: Skewness-Kurtosis-Test and Normal Distribution

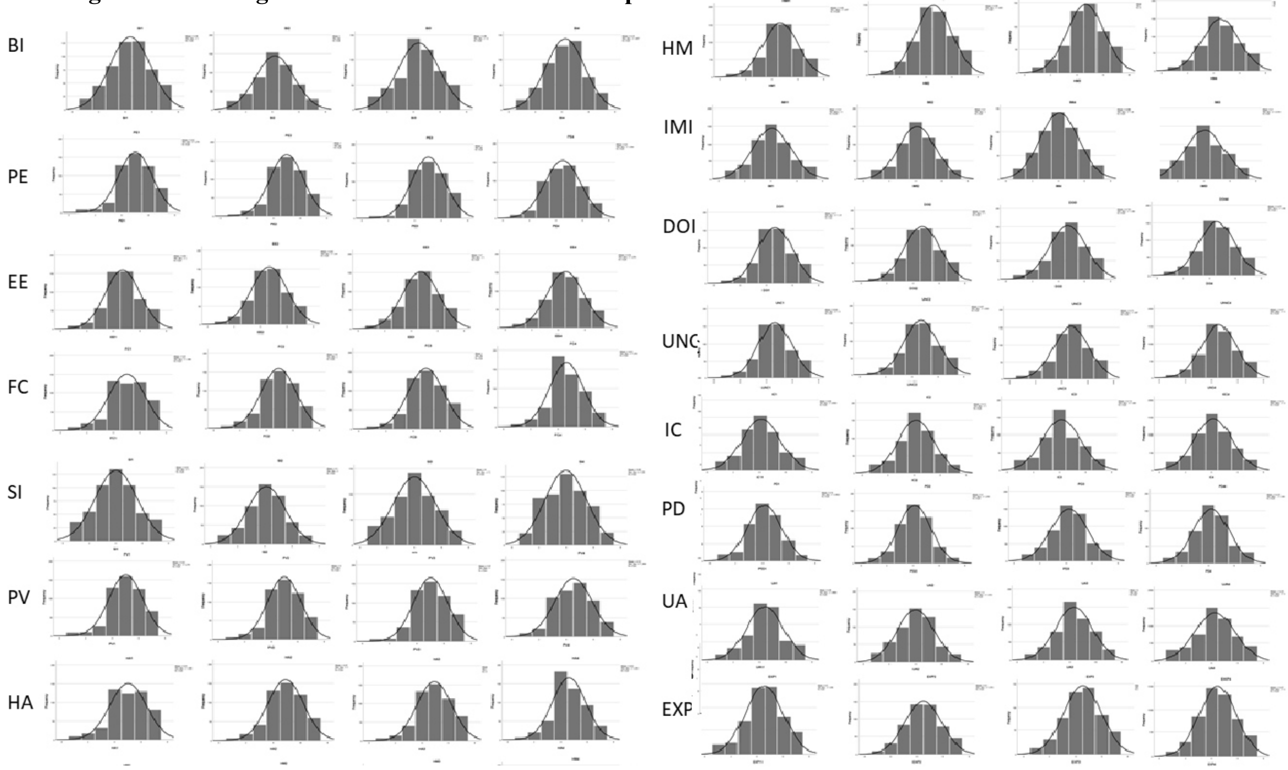
	Mean Statistic	Std. Deviation Statistic	Skewness Statistic	Kurtosis Statistic
BI1	4.36	1.532	-0.179	-0.529
BI2	4.18	1.452	-0.161	-0.336
BI3	4.38	1.563	-0.247	-0.450
BI4	4.25	1.467	-0.151	-0.432
PE1	5.02	1.278	-0.535	0.520
PE2	4.98	1.254	-0.408	0.176
PE3	5.02	1.261	-0.352	0.089

PE4	4.50	1.354	-0.102	-0.372
EE1	4.69	1.313	-0.183	-0.016
EE2	4.65	1.341	-0.197	-0.165
EE3	4.70	1.374	-0.273	-0.215
EE4	4.54	1.376	-0.142	-0.262
FC1	5.01	1.388	-0.503	0.011
FC2	4.91	1.309	-0.406	0.012
FC3	4.94	1.315	-0.379	0.040
FC4	4.62	1.252	-0.146	0.025
SI1	4.02	1.583	0.021	-0.557
SI2	4.10	1.394	-0.142	-0.223
SI3	4.00	1.566	-0.078	-0.596
SI4	3.96	1.530	0.032	-0.777
PV1	5.02	1.279	-0.531	0.509
PV2	4.98	1.253	-0.401	0.171
PV3	5.01	1.260	-0.338	0.093
PV4	4.52	1.369	-0.149	-0.462
HA1	5.01	1.385	-0.493	0.001
HA2	4.91	1.308	-0.393	-0.012
HA3	4.93	1.317	-0.372	0.024
HA4	4.62	1.254	-0.140	0.010
HM1	4.66	1.337	-0.202	-0.037
HM2	4.58	1.403	-0.154	-0.362
HM3	4.66	1.426	-0.324	-0.206
HM4	4.51	1.404	-0.140	-0.288
IMI1	4.10	1.455	0.054	-0.294
IMI2	4.11	1.403	-0.107	-0.158
IMI3	4.10	1.518	-0.063	-0.504
IMI4	4.08	1.480	-0.017	-0.512
DOI1	4.70	1.312	-0.191	-0.008
DOI2	4.68	1.334	-0.185	-0.175
DOI3	4.73	1.368	-0.346	-0.018
DOI4	4.57	1.359	-0.142	-0.207
UNC1	4.69	1.309	-0.163	-0.060
UNC2	4.67	1.333	-0.156	-0.243
UNC3	4.73	1.367	-0.318	-0.086
UNC4	4.57	1.355	-0.118	-0.242
IC1	4.09	1.459	0.051	-0.288
IC2	4.12	1.398	-0.148	-0.080
IC3	4.15	1.468	-0.088	-0.273
IC4	4.13	1.439	-0.047	-0.302
PD1	4.16	1.302	-0.173	0.008
PD2	4.10	1.258	-0.080	-0.016

PD3	4.21	1.401	-0.102	-0.146
PD4	4.25	1.344	-0.067	-0.036
UA1	4.38	1.389	-0.169	-0.023
UA2	4.00	1.419	-0.073	-0.300
UA3	4.31	1.402	-0.170	-0.259
UA4	4.26	1.541	-0.211	-0.367
EXP1	4.50	1.436	-0.315	-0.092
EXP2	4.50	1.379	-0.115	-0.334
EXP3	4.52	1.427	-0.227	-0.322
EXP4	4.47	1.394	-0.096	-0.365

Moreover, a histogram-based graphical presentation of the distribution of the items based on the parameters mean and standard deviation implies that the collected sample meets the normal distribution assumption as it is shown by figure 21 (and more detailed by the illustration in Appendix 2).

Figure 21: Testing the Normal Distribution Assumption



6.2.4 Homogeneity of Variance in the Dataset (Homoscedasticity)

Homogeneity is the normality assumption associated with the presumption that the dependent variables have equal variance across the number of independent variables

(Tabachnick and Fidell, 2013, p. 85). Assessing the homogeneity of variance in multivariate analysis is crucial as it can result in inaccurate estimates of standard errors (Hair *et al.*, 2010; Tarhini, 2013, p. 135). A common statistical procedure of identifying the presence homogeneity is the application of *Levene's Test*, an inferential statistic used to estimate the equality of variances for a variable calculated for two or more groups (Kline, 2005, p. 54). It tests the null hypothesis that the variances of the population are equal (*homoscedasticity*). Therefore, a *Levene's Test* was performed on the dataset using the *SPSS* statistical package 28.0, in order to detect the existence of homogeneity of variance in the sample. In this context, the element "*gender*" was applied as a non-metric construct in the t-test. The outcomes of the *p-value* of *Levene's Test* were beyond the significance level, $p > 0.05$, assuming that the differences in the variances of the samples are not significant and the null hypothesis of equality of variances cannot be rejected. Consequently, these outcomes support the homogeneity of variance, indicating that the variability for the constructs remained consistent among the groups (see table 12).

Table 12: Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
BI	Based on Mean	.797	1	522	.372
PE	Based on Mean	3.730	1	522	.054
EE	Based on Mean	.520	1	522	.471
FC	Based on Mean	.015	1	522	.902
SI	Based on Mean	.110	1	522	.741
PV	Based on Mean	.095	1	522	.758
HA	Based on Mean	.904	1	522	.342
HM	Based on Mean	.187	1	522	.665
IMI	Based on Mean	.000	1	522	.990
EXP	Based on Mean	.425	1	522	.515
PD	Based on Mean	.002	1	522	.960
IC	Based on Mean	3.618	1	522	.058
UA	Based on Mean	.019	1	522	.889
DOI	Based on Mean	.020	1	522	.888
UNC	Based on Mean	.129	1	522	.884

6.2.5 Multicollinearity Tests

Multicollinearity is a statistical phenomenon in which two or more of the independent variables show a linear relationship across them. In the case of multicollinearity, the regression coefficients are still coherent but may not be reliable as the standard errors are inflated. In other words, the predictive power of the model is not diminished, but the coefficients may not be statistically significant (Kline, 2005, p. 427). The existence of multicollinearity can be identified by two values: *Tolerance* and *Variance Inflation Factor (VIF)* (Polit, 2010). In this context, the *Tolerance* for an independent variable is calculated as 1 minus the proportion of variance it shares with the other independent variable in the analysis (1 - R_i^2).[86] This constitutes the fraction of the variance of each independent variable that is not associated with the other independent variables in the model. *The Variance Inflation Factor (VIF)* is the inverse of the *Tolerance*: 1/(1 - R_i^2). The *VIF* can be intuitively interpreted in terms of the effect of R_i^2 on the variance of the estimated regression coefficient for each independent variable (O'brien, 2007). Accordingly, a *VIF* above 4 or *Tolerance* below 0.25 indicates mostly that multicollinearity might exist (Arbuckle, 2021; Pallant, 2010). In this regard, the *VIF* and *Tolerance* values performed on the dataset indicate no significant presence of multicollinearity, as shown in table 13.

Table 13: Multicollinearity, Tolerance and VIF

Coefficients[a]			
Model		Collinearity Statistics	
		Tolerance	VIF
	PE	0.409	2.444
	EE	0.402	2.490
	FC	0.931	1.074
	SI	0.936	1.068
	PV	0.801	1.249
	HA	0.988	1.012
	HM	0.953	1.049
	IMI	0.562	1.779
a. Dependent Variable: BI			

[86] R_i^2 is commonly used to express the proportion of the variance in the independent variable that is associated with the other independent variables in the model. As such, it is an ideal indicator of the collinearity of each independent variable with the other independent variables in the model (O'brien, 2007).

6.2.6 Reliability Tests

Reliability refers to the general consistency of a measurement. A measurement has a high reliability if it provides similar results under standardized conditions (Pallant, 2010). The reliability of the constructs in the main study was tested, as in the pilot study, by applying the *Cronbach's Alpha* test (Cronbach, 1951). The outcomes of the test indicate that the constructs demonstrated reasonable reliability. This implies that the items addressing each construct used in the proposed model are found to be positively related to each other (Hair *et al.*, 2010). Moreover, table 14 also reports the outcomes of two further predictors of internal inconsistency with respect to reliability, which are inter-item correlation and item-to-total correlation. According to this statistical analysis, test coefficient values of above 0.5 for the inter-item correlation and above 0.3 for item-to-total correlation are required to prove the corresponding reliability (Hair *et al.*, 2010; Tarhini, 2013, p. 137). Consequently, the results show a significant degree of reliability for most constructs employed in the model.

Table 14: Reliability Tests

Construct	Nr. of Items	Cronbach Alpha	Inter-Item-Correlation	Item-to-Total Correlation
BI	4	.949	.793-.875	.871-.890
PE	4	.913	.643-.795	.741-.852
EE	4	.935	.752-.818	.832-.854
FC	4	.921	.651-.809	.730-.866
SI	4	.899	.623-.762	.743-.831
PV	4	.914	.649-.796	.744-.852
HA	4	.921	.651-.812	.731-.868
HM	4	.932	.742-.803	.826-.855
IMI	4	.941	.763-.828	.844-.876
DOI	4	.947	.795-.849	.857-.889
UNC	4	.947	.793-.850	.857-.889
EXP	4	.900	.657-.718	.761-.787
IC	4	.950	.781-.875	.852-.911
PD	4	.782	.341-.556	.510-.659
UA	4	.899	.619-.777	.731-.820

6.2.7 Data Descriptive Statistics

This study targeted general individuals in South Korea focusing on the applications of cryptocurrencies and particularly the use of Bitcoin. The data was collected based on digital-based questionnaires, which were circulated online on relevant forums and social media channels, as well as in various locations on-site by means of QR codes. Following the screening for missing data and duplicate responses, 524 completed questionnaires remain to form the study sample. There were 286 (54.6%) male and 238 (45.4%) female respondents within the sample. The ratio of male and female respondents is nearly equally distributed. In regard to the distribution of the age, 85 respondents (16,2%) were younger than 21 years old. 176 survey participants (33,6%) were in their twenties. 130 respondents (24,8%) were in their thirties. 81 participants (15,5%) were in the age group of 40-49 years. 31 respondents (5,9%) were 50-59 years old while 21 respondents (4%) stated that they are 60+ at the time of filling out the surveys. Further descriptive statistics for the sample are shown in table 15.

Table 15: Descriptive Statistics of Construct Items

	BI1	BI2	BI3	BI4
Mean	4.36	4.18	4.38	4.25
Std. Deviation	1.532	1.452	1.563	1.467
	PE1	**PE2**	**PE3**	**PE4**
Mean	5.02	4.98	5.02	4.50
Std. Deviation	1.278	1.254	1.261	1.354
	EE1	**EE2**	**EE3**	**EE4**
Mean	4.69	4.65	4.70	4.54
Std. Deviation	1.313	1.341	1.374	1.376
	FC1	**FC2**	**FC3**	**FC4**
Mean	5.01	4.91	4.94	4.62
Std. Deviation	1.388	1.309	1.315	1.252
	SI1	**SI2**	**SI3**	**SI4**
Mean	4.02	4.10	4.00	3.96
Std. Deviation	1.583	1.394	1.566	1.530
	PV1	**PV2**	**PV3**	**PV4**
Mean	5.02	4.98	5.01	4.52
Std. Deviation	1.279	1.253	1.260	1.369
	HA1	**HA2**	**HA3**	**HA4**
Mean	5.01	4.91	4.93	4.62
Std. Deviation	1.385	1.308	1.317	1.254
	HM1	**HM2**	**HM3**	**HM4**
Mean	4.66	4.58	4.66	4.51
Std. Deviation	1.337	1.403	1.426	1.404
	IMI1	**IMI2**	**IMI3**	**IMI4**
Mean	4.10	4.11	4.10	4.08

Std. Deviation		1.455	1.403	1.518	1.480
		DOI1	**DOI2**	**DOI3**	**DOI4**
Mean		4.70	4.68	4.73	4.57
Std. Deviation		1.312	1.334	1.368	1.359
		UNC1	**UNC2**	**UNC3**	**UNC4**
Mean		4.69	4.67	4.73	4.57
Std. Deviation		1.309	1.333	1.367	1.355
		IC1	**IC2**	**IC3**	**IC4**
Mean		4.09	4.12	4.15	4.13
Std. Deviation		1.459	1.398	1.468	1.439
		PD1	**PD2**	**PD3**	**PD4**
Mean		4.16	4.10	4.21	4.25
Std. Deviation		1.302	1.258	1.401	1.344
		UA1	**UA2**	**UA3**	**UA4**
Mean		4.38	4.00	4.31	4.26
Std. Deviation		1.389	1.419	1.402	1.541
		EXP1	**EXP2**	**EXP3**	**EXP4**
Mean		4.50	4.50	4.52	4.47
Std. Deviation		1.436	1.379	1.427	1.394

The descriptive statistics of the independent and dependent variables in the designed model, such as means and standard deviations, are consistent with the theoretical framework.

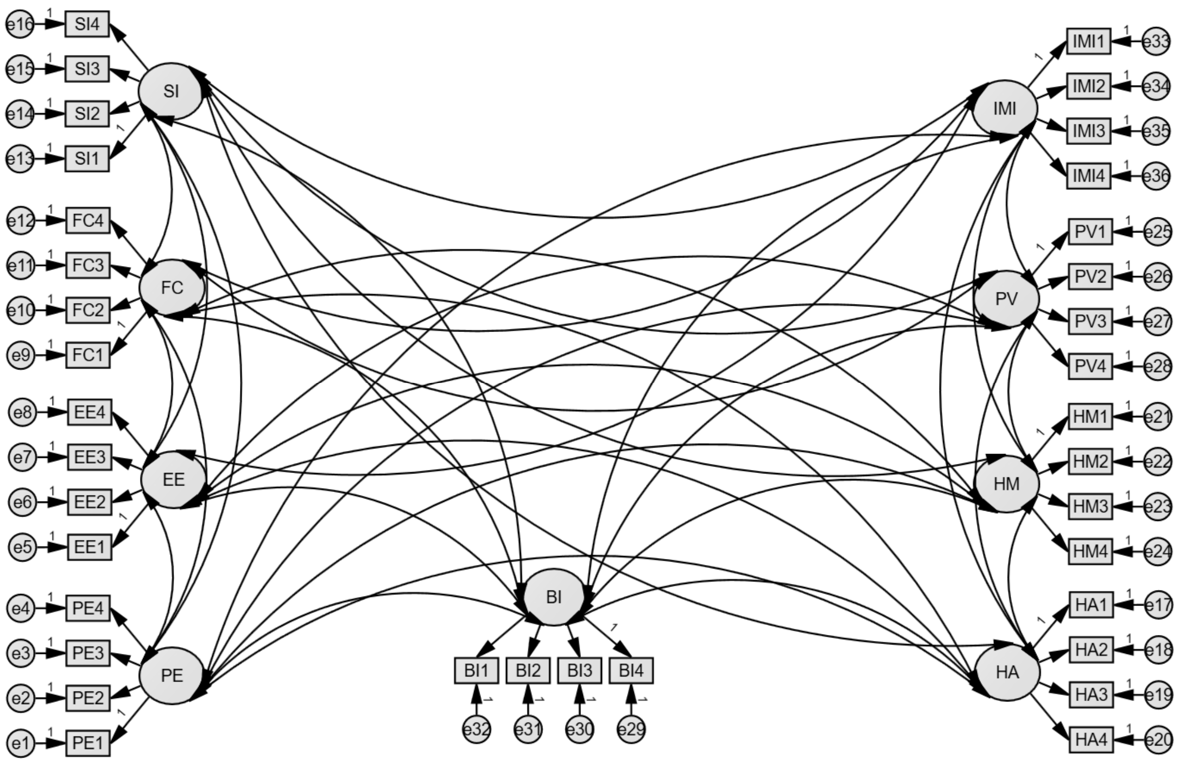
6.3 Model Testing

In the last section, the preliminary data analysis report was introduced. In this section, an in-depth examination of the interaction between the variables within the framework of the designed research study is conducted. The process of data analysis involves two steps. First, *Confirmatory Factor Analysis (CFA)* is applied to evaluate the validity of the constructs and to test the fit of the model. In the next step, the *Structural Equation Modeling (SEM)* technique is utilized to verify the hypothesized statistical relations between the independent and dependent variables. By employing a two-step approach, only constructs with robust measures in terms of validity and reliability are included in the structural model, ensuring their quality and suitability for analysis (Hair *et al.*, 2010; Tarhini, 2013).

6.3.1 The Confirmatory Factor Analysis (CFA)

In order to assess the relations and interactions between the diverse constructs across the designed model framework, the performance of a *Confirmatory Factor Analysis (CFA)* based on *AMOS 28.0* is essential (Arbuckle, 2021; Tarhini 2013). In this regard, the evaluation of the measurement model in *CFA* is conducted in two steps: examining the measurement model fit and evaluating the validity of the measurement model (Hair *et al.*, 2006). In *CFA*, no distinction between the dependent and independent variables is required, unlike in the model testing phase. Figure 22 shows that all variables are interrelated and construct items (measurement variables) are represented in rectangular shapes. In this context, covariance is typically represented by arrows with two heads, while a causal relationship between a construct and an indicator is represented by an arrow with one head (Tarhini, 2013, p. 161). A total of 33 items are applied in the *CFA*, which were derived from the previous exploratory factor analysis.

Figure 22: Confirmatory Factor Analysis (CFA)



6.3.2 Measurement Model Fit (Goodness of Fit Indices)

To estimate the parameters of the model, the maximum likelihood method is applied, and all analyses were performed on variance-covariance matrices (Hair *et al.*, 2010). In order to evaluate the goodness of fit of the model, the simultaneous implementation of several fit indices is considered to be of high relevance (Schreiber *et al.*, 2006; Kline, 2005; Hair *et al.*, 2010). For instance, the simple reliance on the fitting function χ^2 can lead to the rejection of an accurate certainty and in some cases extremely minor deviations between the observed model and the good model fit could be considered significant. This is due to the high sensitivity of the fitting function χ^2 for sample size >300 such as it is the case in the present study (Hair *et al.*, 2006; Kline, 2005). Therefore, to overcome this concern, the following goodness-of-fit measures are employed: the *ratio of the χ^2-statistic to its degree of freedom (χ^2/df)*; *Root Mean Square Residuals (RMSR)*; *Goodness of Fit Index (GFI)*; *Comparative Fit Index (CFI)*; *Normed Fit Index (NFI); Parsimony Normed Fit Index (PNFI); Adjusted Goodness-of-Fit Index (AGFI); the Root Mean Square Error of Approximation (RMSEA)* (Hair *et al.*, 2010; Tarhini, 2013, p. 163). Table 16 shows the level of fit with acceptability based on the survey data. The model run produced the following results for the sample [χ^2 =879.459; df= 558; χ^2/df= 1.576; *GFI* =.915; *AGFI*=.898; *CFI*=.981; *RMSR*=.055; *RMSEA*=.033, *NFI*=.945; *PNFI*=.841].

Table 16: Goodness of Fit Indices

Fit Index	Recommended Value (Kline, 2005; Hair *et al.*, 2006; Hair *et al.*, 2010)	Measurement Model
χ 2 /df	< 3.00	1.576
Goodness-of-fit index (GFI)	> 0.90	.915
Adjusted Goodness-of-fit index (AGFI)	> 0.80	.898
Comparative fit index (CFI)	> 0.90	.981
Root mean square residuals (RMSR)	< 0.10	.055
Root mean square error of approximation (RMSEA)	< 0.08	.033
Normed fit index (NFI)	> 0.90	.945
Parsimony normed fit index (PNFI)	> 0.60	.841

Furthermore, the *standardized RMR* indicates a very good value of .0280 that confirms the overall assumption of having a good measurement model fit. Further detailed statistics and tables in this regard are attached to Appendix 3.

6.3.3 Validity and Reliability of Model Constructs

Prior to testing the model hypotheses of the study, it is important to assess the validity and reliability of the measures employed, as this can influence the outcomes and in turn the overall goal of the research (Hair *et al.*, 2006). Despite the fact that both of these tests are independent and separate from each other, there are strong links between them. For instance, a measure can appear to possess high reliability (consistency) while being non-valid (accurate), at the same time, a measure can display high validity (accuracy) while being non-reliable (consistent) (Holmes-Smith, 2011; Arbuckle, 2021). In this context, validity is defined as the degree to which a composite of measured variables truly reflects the theoretical latent construct they are intended to capture (Hair *et al.*, 2010). This construct validity can be explored through convergent validity, discriminant validity, and nomological validity (Tarhini, 2013, p. 166).

Convergent validity simply describes the magnitude to which measurements of a given construct are supposed to converge, or be expected to have a high fraction of the variance in common. Whereas discriminant validity displays the degree to which constructs or concepts are not excessively related to other analogous though different constructs. In other words, it is the degree to which a construct differs from other constructs within the model (Hair *et al.*, 2010; Tarhini, 2013, p. 166). Finally, nomological validity is defined as the degree to which predictions in a given theoretical model can be confirmed (Hagger *et al.*, 2017, p. 1).

Reliability, on the other hand, is the extent to which the outcomes are capable of being reproduced when the research is repeated under the same conditions. High reliability means that the measurement system consistently generates similar results by using the same methods under the same circumstances (Schreiber *et al.*, 2006). In order to assess the validity and reliability of the proposed research model following tools can be applied: *Average Variance Extracted (AVE), Maximum Shared Squared Variance (MSV), Average Shared Squared Variance (ASV), and Composite Reliability (CR)* (Hair *et al.*, 2010).

The AVE measures the proportion of variance captured by the construct in relation to the proportion of variance due to measurement error (Fornell and Larcker, 1981). The AVE is calculated according to the following formula:

$$AVE = \frac{\sum_{i=1}^{k} \lambda_i^2}{\sum_{i=1}^{k} \lambda_i^2 + \sum_{i=1}^{k} Var(e_i)}$$

Where k is the number of items, λ_i represents the factor loading of item i and $Var(e_i)$ is the variance of the error of item *i.* In other words, AVE= (summation of squared factor loadings) / (summation of squared factor loadings) + (summation of error variances) (Fornell and Larcker, 1981; Tarhini 2013).

On the other hand, *Composite Reliability (CR)* is a measure of the internal consistency of scale items, similar to *Cronbach's Alpha*, and is calculated according to the following formula:

$$CR = \frac{(\sum_{i=1}^{k} \lambda_i)^2}{(\sum_{i=1}^{k} \lambda_i)^2 + (\sum_{i=1}^{k} \delta_i)}$$

Where k is the number of items, λ_i represents the factor loading of item i (standardized regression weights) and δi is the error variance term for every latent construct *i* respectively (Netemeyer *et al.*, 2003). In other words, *CR* = (square of summation of factor loadings) / (square of summation of factor loadings) + (summation of error variances).

Finally, in order to determine reliability, the *CR* has to be greater than 0.6 and ideally greater than 0.7 (Hair *et al.*, 2010). Moreover, in order to assess the convergent validity, AVE should be greater than 0.5 and *CR* is greater than AVE. In this context, the discriminant validity is supported when *Maximum Shared Squared Variance (MSV)* is less than AVE and *Average Shared Squared Variance (ASV)* is less than AVE (Tabachnick and Fidell, 2013). Table 17 shows all of these indicators that are manually calculated based on Amos output and according to the above discussed equations.

Table 17: Construct Validity and Reliability

	CR	AVE	MSV	MaxR(H)	BI	PE	EE	FC	SI	HA	HM	PV	IMI
BI	0,949	0,825	0,530	0,950	**0,908**								
PE	0,916	0,732	0,638	0,923	0,678	**0,855**							
EE	0,935	0,783	0,638	0,936	0,728	0,799	**0,885**						
FC	0,923	0,750	0,088	0,933	0,296	0,206	0,229	**0,866**					
SI	0,902	0,697	0,053	0,911	0,214	0,135	0,170	0,030	**0,835**				
HA	0,923	0,750	0,007	0,934	0,053	0,081	0,075	0,000	0,061	**0,866**			
HM	0,932	0,774	0,031	0,932	0,174	0,118	0,126	0,091	0,121	0,068	**0,880**		
PV	0,916	0,732	0,228	0,924	0,477	0,403	0,367	0,145	0,216	0,059	0,152	**0,855**	
IMI	0,942	0,802	0,500	0,942	0,707	0,603	0,635	0,235	0,230	0,051	0,175	0,396	**0,895**

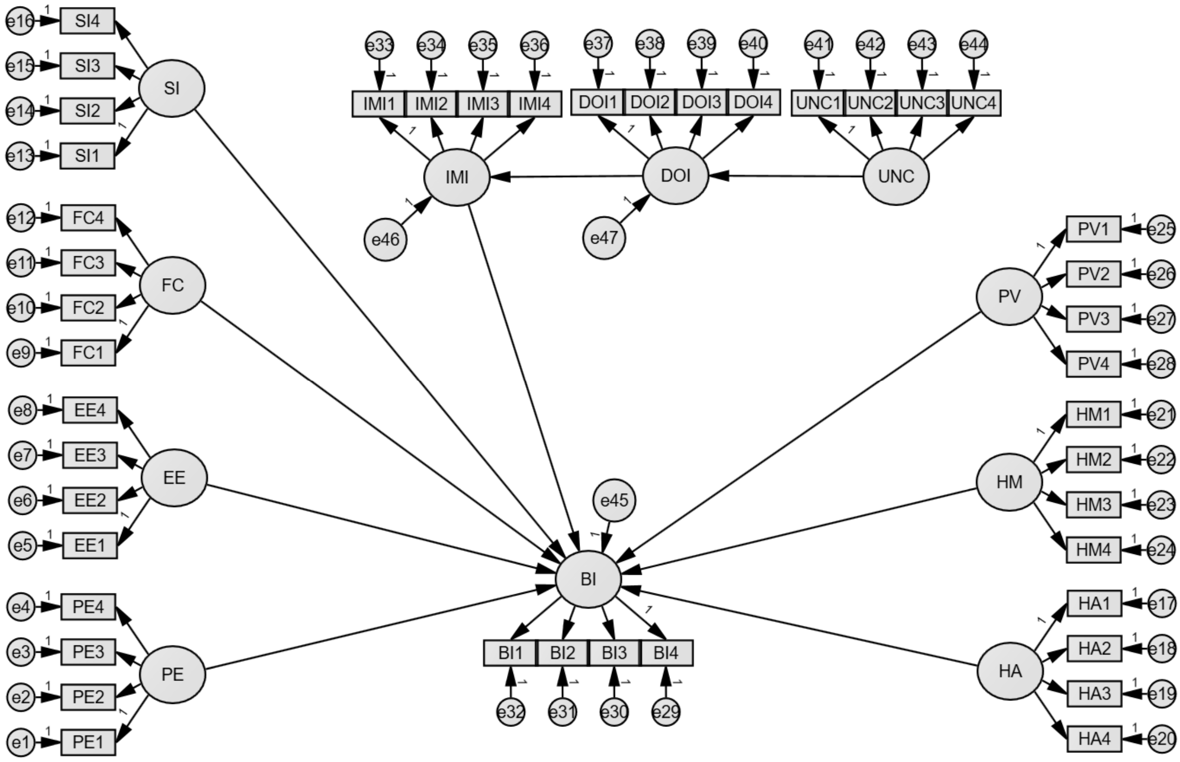
In accordance with the presented outcomes in table 17 all factors involved in the analysis highly satisfy all mentioned reliability and validity criteria of the model.

6.4 Structural Model Analysis and Hypotheses Testing

Once reliability, convergent validity, and discriminant validity have been determined, the subsequent stage involves testing the relationships between the exogenous and endogenous latent variables. This procedure is routinely performed in the context of the *Structural Equation Modeling (SEM)* (Arbuckle, 2021).

At this stage, in contrast to the *CFA* analysis, a distinction has to be made here between dependent and independent variables. The *SEM* approaches the covariance between the independent variables illustrated by two-headed arrows, while the causal relation between an independent variable and a dependent variable is indicated by an arrow. Consequently, the relationship among the constructs is stated in specification upon transitioning from the measurement model to the structural model, as it is shown in figure 23 (Tarhini, 2013, pp. 171-172; Hair *et al.*, 2010).

Figure 23: Model Testing



6.4.1 Assessing the Structural Model (Direct Effects)

The subsequent hypotheses are applied to empirically assess the direct statistical linkages between the exogenous (independent) and the endogenous (dependent) variables. As such, all of these interrelationships were previously determined in Chapter 5 throughout the model conceptualization phase. In this context, the exogenous constructs are *Performance Expectancy, Effort Expectancy, Facilitating Conditions, Social Influence, Price Value, Hedonic Motivation, Habit* and *Imitation (Herd Behavior)*, whereas the endogenous construct is *Behavioral Intention:*

H1. *Performance expectancy positively affects individual's behavior intention to use Bitcoins.*

H2. *Effort expectancy positively affects individual's behavior intention to use Bitcoins.*

H3. *Social influence positively affects individual's behavior intention to use Bitcoins.*

H4. *Facilitating Conditions positively affect individual's behavior intention to use Bitcoins.*

H5. *Hedonic Motivation positively affects individual's behavior intention to use Bitcoins.*

H6. *Price value positively affects individual's behavior intention to use Bitcoins.*

H7. *Habits positively affect individual's behavior intention to use Bitcoins.*

H8a. *Uncertainty positively affects discounting own information (DOI).*

H8b. *Discounting own information (DOI) positively affects individuals to imitate others (IMI).*

H8c. *Imitating others (IMI) positively affects individual's behavior intention to use Bitcoins.*

Relying on the same criteria applied to the measurement model for measuring the goodness-of-fit of the conceptualized model, the outcomes of the goodness-of-fit indices for the analysis are as follows: [*CMIN*=1969.278; df=866; *CMIN/DF*=2.274; *GFI*=.846; *AGFI*=.825; *CFI*=.948; *RMSEA*=.049, *NFI*=.911; *PNFI*=.834]. These outcomes indicate a strong goodness of fit of the model. Table 18 presents the path coefficients for the postulated interrelations observed within the framework of the designed empirical model.

Table 18: Test Results (Direct Effects)

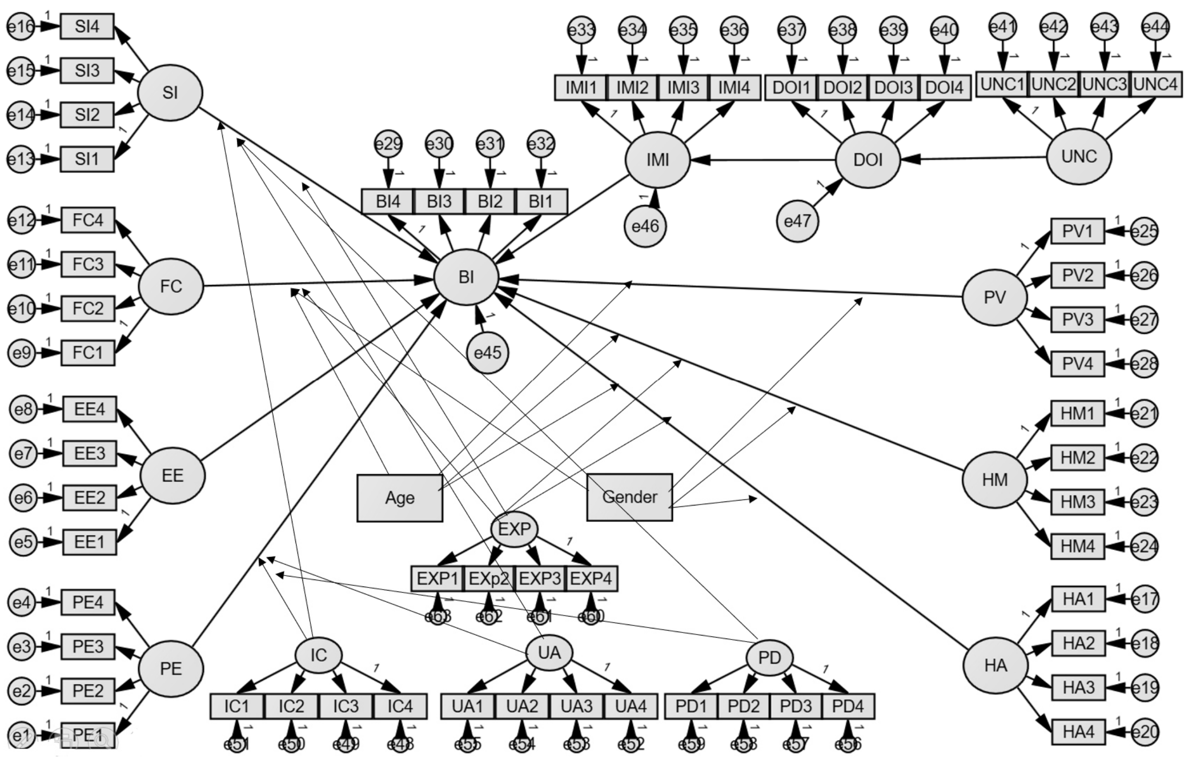
Hypothesis	Proposed Theoretical Relationship	Path Coefficient	P-Value	Test Outcomes
H1	$PE\ (+) \rightarrow BI$	0.198	***	Supported
H2	$EE\ (+) \rightarrow BI$	0.430	***	Supported
H3	$SI\ (+) \rightarrow BI$	0.061	0.080*	Limited Support (low Significance Level)
H4	$FC\ (+) \rightarrow BI$	0.136	***	Supported
H5	$HM\ (+) \rightarrow BI$	0.028	0.412	Rejected
H6	$PV\ (+) \rightarrow BI$	0.202	***	Supported
H7	$HA\ (+) \rightarrow BI$	0.002	0.963	Rejected
H8c	$IMI\ (+) \rightarrow BI$	0.384	***	Supported
H8b	$DOI\ (+) \rightarrow IMI$	0.681	***	Supported
H8a	$UNC\ (+) \rightarrow DOI$	0.328	***	Supported
Notes: * p<0.1; ** p<0.05; *** p<0.01				

The outcomes of the structure equation modeling analysis support *H1, H2, H4, H6, H8a, H8b, H8c* on high significance level with p-value < 0.01. H3 can only be supported at a lower significance level, p-value < 0.1 and H5 as well as H7 are rejected. Accordingly, the outcomes imply a positive correlation between the level of *Performance Expectancy, Effort*

Expectancy, Facilitating Conditions, Social Influence, Price Value, as well as *Herd Behavior,* and the likelihood of *Behavioral Intention* to use Bitcoin. In other words, as the observed extent of these constructs increases, so does the identified behavioral intention towards using the cryptocurrency. In this context, *Effort Expectancy* and *Herd Behavior* have the strongest impact on the behavior intention to adopt Bitcoin. The findings of *squared multiple correlations (SMC),* a measure of the model's ability to account for the variance observed in the dataset, show that these variables explain 44% (R^2 = 0.44) of the variance in *Behavioral Intention*. This R^2 value is more than adequate because the goal of the analysis is to explain the relationship between the predictors and the response variable rather than to predict the response variable. Moreover, the results indicate that *Hedonic Motivation* and *Habit* have no significant impact on the individual decision to use Bitcoin.

6.4.2 Testing the Moderating Effects

Figure 24: Moderating Effects



This section examines the moderating influence of the demographic variables gender, age and experience as derived from the UTAUT 2 model as well as the moderating influence of the individual-level cultural dimensions based on Hofstede (1980) on the interrelationships between the exogenous and endogenous constructs. The analysis is performed based on the following hypotheses addressing the moderating impact of individual demographic and cultural variables outlined in Chapter 5 within the framework of the conceptualized research model:

Age

H9a. *Age moderates the effect of facilitating conditions on individual's intention to use Bitcoins.*

H9b. *Age moderates the effect of hedonic motivation on individual's intention to use Bitcoins.*

H9c. *Age moderates the effect of price value on individual's intention to use Bitcoins.*

H9d. *Age moderates the effect of habits on individual's intention to use Bitcoins.*

Table 19: Moderating Effects Results (Age)

Hypo-thesis	Proposed Theoretical Relationship	Path Coefficient	P-Value	Test Outcomes	Model Fit		
					CMIN/DF	RMSEA	CFI
H9a	$Age \rightarrow (FC \rightarrow BI)$	-0.034	0.314	Rejected	2.310	.050	0.945
H9b	$Age \rightarrow (HM \rightarrow BI)$	-0.040	0.231	Rejected	2.383	.051	0.942
H9c	$Age \rightarrow (PV \rightarrow BI)$	-0.030	0.373	Rejected	2.347	.051	0.943
H9d	$Age \rightarrow (HA \rightarrow BI)$	-0.014	0.687	Rejected	2.342	.051	0.943
Notes: * p<0.1; ** p<0.05; *** p<0.01							

The results indicate that age does not impact the mechanism that influences the behavior intention to use Bitcoins, since all age-related hypotheses are rejected.

Gender

H10a. *Gender moderates the effect of facilitating conditions on individual's intention to use Bitcoins.*

H10b. *Gender moderates the effect of hedonic motivation on individual's intention to use Bitcoins.*

H10c. *Gender moderates the effect of price value on individual's intention to use Bitcoins.*

H10d. *Gender moderates the effect of habits on individual's intention to use Bitcoins.*

Table 20: Moderating Effects Results (Gender)

Hypo-thesis	Proposed Theoretical Relationship	Path Coefficient	P-Value	Test Outcomes	Model Fit		
					CMIN/DF	RMSEA	CFI
H10a	$Gender \rightarrow (FC \rightarrow BI)$	-0.057	0.087*	Supported at a low significance level	2.319	.050	0.944
H10b	$Gender \rightarrow (HM \rightarrow BI)$	-0.040	0.223	Rejected	2.373	.051	0.942
H10c	$Gender \rightarrow (PV \rightarrow BI)$	-0.038	0.248	Rejected	2.345	.051	0.944
H10d	$Gender \rightarrow (HA \rightarrow BI)$	0.007	0.830	Rejected	2.342	.051	0.943
Notes: * p<0.1; ** p<0.05; *** p<0.01							

The moderating effect of gender is negligible. Apart from a weak impact of gender on the influence of facilitating condition on the behavior intention to adopt the cryptocurrency Bitcoin, which can only be accepted at a very low significance level with P-value <0.1 but >0.05, all gender-based hypotheses are rejected.

<u>Experience</u>

H11a. *Experience moderates the effect of facilitating conditions on individual's intention to use Bitcoins.*

H11b. *Experience moderates the effect of hedonic motivation on individual's intention to use Bitcoins.*

H11c. *Experience moderates the effect of habits on individual's intention to use Bitcoins.*

H11d. *Experience moderates the effect of social influence on individuals' intention to use Bitcoins.*

Table 21: Moderating Effects Results (Experience)

Hypothesis	Proposed Theoretical Relationship	Path Coefficient	P-Value	Test Outcomes	Model Fit		
					CMIN/DF	RMSEA	CFI
H11a	$EXP \rightarrow (FC \rightarrow BI)$	0.024	0.482	Rejected	2.286	.050	0.947
H11b	$EXP \rightarrow (HM \rightarrow BI)$	-0.038	0.259	Rejected	2.770	.058	0.926
H11c	$EXP \rightarrow (HA \rightarrow BI)$	0.008	0.807	Rejected	2.731	.058	0.928
H11d	$EXP \rightarrow (SI \rightarrow BI)$	-0.030	0.372	Rejected	2.767	.058	0.928
Notes: * p<0.1; ** p<0.05; *** p<0.01							

Similar to age and gender, experience does not appear to have a significant impact on moderating the adoption of Bitcoin, since hypotheses H11a, H11, H11c and H11d are rejected.

<u>Individualism/Collectivism (IC</u>)

H12a. *Individualism/collectivism moderates the relationship between social influence and individual's behavior intention to use Bitcoins.*

H12b. *Individualism/collectivism moderates the relationship between performance expectancy and individual's behavior intention to use Bitcoins.*

Table 22:Moderating Effects Results (IC)

Hypothesis	Proposed Theoretical Relationship	Path Coefficient	P-Value	Test Outcomes	Model Fit		
					CMIN/DF	RMSEA	CFI
H12a	$IC \rightarrow (SI \rightarrow BI)$	0.004	0.909	Rejected	2.461	.053	0.940
H12b	$IC \rightarrow (PE \rightarrow BI)$	0.022	0.521	Rejected	2.265	.049	0.947
Notes: * p<0.1; ** p<0.05; *** p<0.01							

When it comes to the effect of the culture variable *Individualism/Collectivism (IC)*, the empirical analysis indicates that the level of individualism or collectivism of an individual does not impact the effect of the parameter social influence or performance expectancy on adopting Bitcoins. H12a and H12b are rejected.

<u>Uncertainty Avoidance (UA)</u>

H13a. *Uncertainty avoidance moderates the relationship between social influence and individual's behavior intention to use Bitcoins.*

H13b. *Uncertainty avoidance moderates the relationship between performance expectancy and individual's behavior intention to use Bitcoins.*

Table 23: Moderating Effects Results (UA)

Hypothesis	Proposed Theoretical Relationship	Path Coefficient	P-Value	Test Outcomes	Model Fit		
					CMIN/DF	RMSEA	CFI
H13a	$UA \rightarrow (SI \rightarrow BI)$	-0.027	0.416	Rejected	2.942	.061	0.922
H13b	$UA \rightarrow (PE \rightarrow BI)$	0.021	0.533	Rejected	2.507	.054	0.939
Notes: * p<0.1; ** p<0.05; *** p<0.01							

H13a and H13b are also rejected. Therefore, *Uncertainty Avoidance*, as a moderating culture variable, has no significant impact on the relationship between social influence or performance expectancy and the individual intention to adopt Bitcoins.

<u>Power Distance (PD)</u>

H14a. *Power Distance moderates the relationship between social influence and individual's behavior intention to use Bitcoins.*

H14b. *Power Distance moderates the relationship between performance expectancy and individual's behavior intention to use Bitcoins.*

Table 24: Moderating Effects Results (PD)

Hypothesis	Proposed Theoretical Relationship	Path Coefficient	P-Value	Test Outcomes	Model Fit		
					CMIN/DF	RMSEA	CFI
H14a	$PD \rightarrow (SI \rightarrow BI)$	-0.005	0.873	Rejected	2.764	.058	0.928
H14b	$PD \rightarrow (PE \rightarrow BI)$	0.044	0.214	Rejected	2.405	.052	0.942
Notes: * p<0.1; ** p<0.05; *** p<0.01							

The analysis leads to the rejection of H13a and H13b, indicating no significant impact of *Power Distance*, as a moderating culture variable, on how social influence and performance expectancy affect the individual's intention to use Bitcoin.

6.5 Conclusion

The pilot study carried out showed that the set-up of the questionnaires and the construction of the survey variables were very reliable. Subsequently, the surveys of the main study were conducted in South Korea in the period from December 2021 to April 2022. The collected data were subject to a preliminary examination, that has displayed a high degree of robustness of the data in terms of normality assumption, outliers, homogeneity of variance in the dataset (homoscedasticity), multicollinearity and reliability tests. The chapter has then addressed the model testing procedure. In this context, examinations were conducted to assess the discriminant validity, convergent validity, and reliability of all constructs encompassed in the conceptualized empirical model. Once the validity and reliability of the constructs were established, an assessment of the structural model followed, including confirmatory factor analysis (*CFA*), as an initial technique to analyze the postulated relationships among the constructs within the framework of the research model. The examination of the structural model and the evaluation of hypotheses demonstrated that performance expectancy, effort expectancy, facilitating conditions and price value have a significant influence on the dynamic behind the individual's behavior intention to use the applications of the cryptocurrency Bitcoin. Social influence has surprisingly a very weak impact on Bitcoin's adoption, that can only be identified at a very low significance of $p < 0.1$ and rejected at $p < 0.05$. In contrast to social influence, herd behavior mechanism appears to play a significant role in influencing the intention toward accepting Bitcoin. On the other hand, hedonic motivation and habits show no statistically significant impact on the decision to adopt or reject the use of Bitcoins. The chapter has eventually dealt with analyzing the moderating effects that included experience, demographic as well as individual's culture driven variables. Almost all of the moderating hypotheses were rejected. This outcome highlights that the dynamics behind the widespread popularity of cryptocurrencies in South Korea are socioeconomic in nature and less influenced by individual's experience, demographics, or cultural aspects.

7 Interpreting the Empirical Results

The aim of the model testing is to empirically investigate the socioeconomic aspects behind the adoption and diffusion of cryptocurrencies in Korea in order to explore the paradigms that influence the decision to adopt or use the cryptocurrency Bitcoin. The outcomes of the analysis of the interrelationships between the constructs within the proposed research model are presented and discussed in three parts. First, the findings of the tested hypotheses as derived from the *UTAUT 2* model are provided. The determinants of behavioral intention in this context are *performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price valu*e and *habit*. Second, in extension to the determinant *social influence* and in order to comprehend the reasons for the intention to use Bitcoin despite the extreme volatility of the cryptocurrency, the determinant herd behavior was included. To empirically test the influence of herd behavior, the constructs of *perceived uncertainty, discounting one's own information* and *imitation* were applied. The third part comprises the empirical analysis of the moderating demographic variables *age, gender*, and *experience* as well as of the moderating cultural variables *individualism/collectivism, uncertainty avoidan*ce and *power distance*.

7.1 UTAUT 2 Model's Empirical Findings

The hypothesis, which expected that *performance expectancy* would positively influence individual's intention to use Bitcoins (*H1*), is approved. Therefore, it can be confirmed that individual users see benefits in using Bitcoins to achieve their financial goals. Given the significant growth of the blockchain market in South Korea, expanding from around 20.1 billion won in 2016 to an estimated 356.2 billion won in 2022 (Statista, 2022a), this outcome was to be anticipated. The above-average investment in cryptocurrencies by international standards must also be seen in the context of the country's socioeconomic development: Despite economic growth unemployment has been rising – especially among the young population –, and oftentimes, incomes of even college-educated employees have no longer been sufficient to finance a home or to establish a family, a situation that might have driven many Korean investors toward adopting crypto speculation (Yoon, 2018). The gap separating the wealthiest and poorest segments of South Korea's population has been growing significantly in recent times. According to a recent bank's report based on a survey of 10,000 Koreans aged 20 to 64 and conducted from September to October 2021, average housing, property and land owned by the top 20 percent of the population is valued at 251 times as much as that of the bottom 20 percent. Koreans belonging to the top 20 percent of the country households averaged 1.2 billion won (990,000 US-Dollar) worth of real estate in 2021, while those in the bottom 20 percent owned 4.9 million won (4,000 US-Dollar) during the same period (Jung, 2022). There has been a sharp increase in the gap between the value of property owned by the richest and poorest people across the country in recent years, with the difference nearly doubling from 125 times in 2018 to 251 in 2021. This development has been accompanied by increasing income inequality as the average monthly income of the top 20 percent of households increased 5.9 percent to 9.48 million won (8,000 US-Dollar) in 2021, while the average income of the bottom 20 percent decreased slightly from 1.83 million won in 2020 to 1.81 million won (1,500 US-Dollar) in 2021. In addition, the Covid pandemic and the associated rise in inflation are currently reinforcing these trends (Jung, 2022).[87]

The positive assessment with regard to *performance expectancy* can be explained by the specific circumstances and regulations of investment opportunities in Korea. Local investment options have previously focused primarily on real estate and the domestic stock market. While both markets offer diminishing profit opportunities, many see cryptocurrencies as the new opportunity for wealth. The minimum sums required for investment in cryptocurrencies are low while the expected returns are high. In this context, even the inherent price volatility of Bitcoins provides another source of incentive to generate a rapid return on a small investment. As it is shown in table 25, the average returns

[87] The empirical investigation does not include a measure of the direct impact of wealth or income for several reasons. First, the previous chapters have shown that the adoption and diffusion of Bitcoin in Korea crosses income and wealth groups. It is not limited to any particular social or economic class. Second, the study acknowledges the relative nature of wealth accumulation and limited social mobility as social problems. For example, individuals often compare themselves to a higher social class to which they aspire. Therefore, focusing solely on income or wealth as control variables may overlook broader social and cultural dynamics that influence Bitcoin adoption. Rather than focusing solely on respondents' current levels of wealth and income, the research shifted its focus toward their expectations regarding Bitcoin's potential to help them achieve their economic and financial goals. Third, the study's theoretical framework is based on the recognition of the multifaceted nature of the phenomenon and the goal of providing a comprehensive analysis beyond narrow economic considerations. For more details see Chapter 3 and Chapter 4.

of Bitcoins since its introduction have outperformed those of most traditional asset classes, despite the high volatility associated with it and the several periods of bear markets and crashes that cryptocurrencies have gone through.

Table 25: Bitcoin Outperformances Traditional Asset Classes

Year	**Bitcoin USD**	**KOSPI Index**	**S&P 500**	**NIKKEI 225**	**US T. Bond**	**Gold USD**
2008	**................**	-40.73%	-38.49%	-42.12%	20.10%	3.41%
2009	228.95%	49.65%	23.45%	19.03%	-11.12%	27.63%
2010	11500.00%	21.88%	12.78%	-3.01%	8.46%	27.74%
2011	1355.17%	10.98%	-0.00%	-17.34%	16.04%	11.65%
2012	215.17%	9.38%	13.41%	22.95%	2.97%	12.57%
2013	5646.39%	0.72%	29.60%	56.72%	-9.10%	-0.19%
2014	-58.51%	-4.76%	11.39%	7.12%	10.75%	-11.59%
2015	35.80%	2.39%	-0.73%	9.07%	1.28%	-27.79%
2016	123.83%	3.32%	9.54%	0.42%	0.69%	8.63%
2017	1368.90%	21.76%	19.42%	19.10%	2.80%	12.57%
2018	-73.56%	-17.28%	-6.24%	-12.08%	-0.02%	-1.15%
2019	92.20%	7.67%	28.88%	18.20%	9.64%	18.83%
2020	303.16%	30.75%	16.26%	16.01%	11.33%	24.43%
2021	59.67%	3.63%	26.89%	4.91%	-4.42%	-3.51%
Source: calculated by the author, based on www.1stock1.com (2022), www.pages.stern.nyu.edu (2022) and www.macrotrends.net (2022)						

In contrast, the massive rise in prices on the real estate market, traditionally the most popular investment among Koreans making up around 77,9 percent of all households' assets in 2022, has made it impossible for many Koreans to finance an investment in this sector (Yoon, 2023b). The fact that the stock market is losing popularity in Korea is also due to the higher entry requirements in some fields. For example, since March 2017, those who want to invest in derivatives must complete 30 hours of training and perform 50 hours of simulated transactions in order to be certified as an investor (Ramirez, 2017a). According to the applicable regulations by South Korea's *Financial Services Commission (FSC)* a retail investor must deposit at least KRW 30 million (25,200 US-Dollar) to buy futures or options, and KRW 50 million to sell options (Regulation Asia, 2019). [88]

[88] New rules are currently being discussed to lower the required deposit for retail investors to KRW 10 million (purchase of futures or options) or KRW 20 million (sale of options). In addition, the mandatory minimum training that retail investors must complete before they are allowed to trade in the derivatives markets is to be reduced to one hour of training and three hours of test trading (Regulation Asia, 2019).

Excessively high entry barriers discourage small investments, and strict margin requirements constrain retail investor participation. According to the *FSC*, the share of retail investors in derivatives trading declined from 25.6 percent to 13.5 percent in 2018 (Regulation Asia, 2019).

These regulations have led to a change in investment behavior: As of 2021 the total amount of cryptocurrency transactions in Korea surpassed that of *KOSPI*, the Korean stock market (Chipolina, 2017). Also, the effect of the *kimchi premium*, a term used to describe the higher prices of cryptocurrencies such as Bitcoin in the Korean market compared to prices in foreign markets, came back into play in 2021 – with prices at times 21 percent higher compared to the international market (Cacioli, 2021). However, whether the *performance expectancy* of an individual participant is also met and cryptocurrencies such as Bitcoin represent profitable investment opportunities cannot yet be determined due to the high volatility and the still outstanding legally defined definition of cryptocurrencies. In general, the performance of most crypto assets demonstrates certain aspects that are present in any risk curve. During periods when market risk appetite increases, such as in the middle of a bull market, investors become more confident to move further up the risk curve of investment spectrums. Given their market size, cryptocurrencies tend to outperform in the period of universal bull markets. On the other hand, during risk-aversion periods, such as a bear market, riskier assets fall more than their less risky equivalents. Beyond that, one issue to mention is that with the cryptocurrency boom, debt has also highly increased: Of those over 30, debt has increased by 30 percent in recent years. There was an equally high increase in the number of applications for debt settlement among Koreans in their 20s (Dunne, 2022).

The hypothesis, which estimated that *effort expectancy* would positively affect individual's intention to use Bitcoins (*H2*), is accepted. Koreans obtain high competence and knowledge in information and communication technology (ICT), which makes it easier for them to adopt new digital technologies, such as cryptocurrencies. The foundations for educating ICT competence are already laid in the school system. Even before the Corona pandemic, 71 percent of Korean teachers were willing to support student learning through the use of digital technologies such as computers, tablets, and smartboards, which is well above the average for *OECD* countries (OECD, 2018b). Korea initiated various education reforms to provide skills and competence for the fourth industrial revolution. Examples are the *Free Semester Program* (*FSP*) starting 2013 to foster non-cognitive skills and creativity as well as the *SMART* Initiative starting 2011 to link the *ICT* field with the education sector by developing infrastructure, new pedagogies, and legal frameworks. The initiatives not only support digital infrastructure, but also implement new, holistic approaches to change the concept of education based on the respective learning paces of the students (Jeong, 2020). The curriculum in elementary and middle schools includes since the 1980s education in computer science (Neethipudi *et al.*, 2021, p. 4). For example, Korea ranked second among 12 participating countries in the 2018 *International Computer and Information Literacy Study* (*ICILS*) exam conducted by the *International Association for the Evaluation of Educational Achievement (IEA)*, which assessed computer literacy and computational thinking (ICILS, 2018).

One important reason that Korean users find Bitcoins easy to use is that they have been familiar with the concepts of microtransactions and digital tokens since before cryptocurrencies were introduced. Micropayments in this context are usually consisting of selling and buying in-game assets or content for a minimum small amount. The majority of online games, used in the 2000s especially in Internet cafes, have been free to play, but with additional payment options to improve certain elements or master the games. An important factor for the growth of the online gaming market has been a cost-effective system for billing, processing payments and collecting micro-payments. In Korea, the development of a mobile billing system capable of processing small payments has helped publishers monetize gaming operations for which players can choose from more than a dozen payment options, including mobile, landline, credit card and prepaid card payments (Carless, 2006). In 1996, there were the first online role-playing games by the video game studio *Nexon* that included microtransactions. In some marketplaces, the digital in-game credits could be exchanged for real currency: i.e., digital assets could be transferred (Skalex, 2018). The gaming industry holds an enormous position in Korea. For example, in 2001, the gaming company *Hangame* achieved revenues of 30,000 US-Dollar per day with micro contributions of 50 cents for services such as extend playing time, get power-ups, and host private group games, such as Battle Tetris, chess, blackjack, and pool. By the end of 2001, the company was earning 80,000 US-Dollar per day, and a few years later it had achieved annual sales of 93 million US-Dollar. The currency to buy in the game was named *Hancoin* (Moon, 2022). Through these games, many users had already adopted virtual currencies, so it was not such a big step to the later adoption of cryptocurrencies, as they were already used handling these digital assets, albeit in a different context, the online gaming world.

The hypothesis, which estimated that *social influence* positively affects individual's intention to use Bitcoins (*H3*), shows a very weak significance level, that can generally be rejected at $p < 0.05$ and only slightly adopted at the low significance level of $p < 0.1$. This implies that an individual's reference groups do not significantly influence the user's intention to use Bitcoins. The result is surprising in that it states, contrary as expected, that there is no direct meaningful influence from important and trusted people in the individual's immediate environment, such as family members, friends, and colleagues. One reason could be that reference persons no longer recommend the adoption of Bitcoins due to the loss experiences in the crypto markets caused by several crashes. Impression (*image*), the extent to which an innovation improves a person's image or social standing, is thus not a relevant factor.

However, there is a further influencing factor that goes beyond the social influence of direct, personal reference groups: the hyperconnectivity via social media. Korea belongs to the most hyperconnected societies. The development of social media has a long history in the country: some of the earliest social networks were launched here. The online platform and social network service *CyWorld* was founded as early as 1999, several years before *MySpace* (2003) and *Facebook* (2004). The country also pioneered the introduction of *Voice over Internet Protocol (VoIP)* technology for online phone calls with *Dialpad Communications*, founded in 1999 (Skalex, 2018). In 2022, Korea ranks third internationally with an active social network penetration rate of 91.2 percent, behind the United Arab Emirates and Malaysia. This is well above the international average of 58.4 percent (Statista, 2022b). In addition to the major U.S. corporations, the most notable are domestic social networks such as the instant messaging service *KakoTalk*, which is used by more than 43 million monthly active users (Statista, 2022c), and the mobile community application *BAND* from the search engine company *Naver*. The principles of cryptocurrencies as new financial products are based on decentralized network effects, so social networks are generally predestined to anonymously share information and experiences about them. Since the introduction of Bitcoin, social media has been the main communication channel through which new information has been exchanged. In addition to *Kakao* channels, *Telegram* channels are also often used to organize crypto communities. There is usually a fee to join the groups, which are mostly organized by anonymous admins, to guarantee that only serious traders share information with each other on how best to invest. While *social influen*ce is primarily about recognition within a reference group in the immediate environment, this factor does not appear to play a highly significant role in Bitcoin adoption. Rather, users look to the actions of other users merely to optimize their own investment options. This behavior can better be analyzed with the determinant of herd behavior, as it is used in the following after the results of the hypotheses testing as derived from the *UTAUT* 2 model.

The hypothesis, which stated that *facilitating conditions* positively affect individual's intention to use Bitcoins (*H4*), is adopted. The use of cryptocurrencies, in this case Bitcoin, requires the availability of appropriate resources and technology infrastructure. Korea has a well-developed ICT infrastructure. The government started building fast fiber-optic networks back in the 1990s. At 28.6 Mbps, the average broadband Internet connection in Korea is the fastest in the world (Frackiewicz, 2017). In addition, a well-developed telecommunications system facilitates both proximity and remote mobile payment systems. Already in 2002, the two biggest mobile operators, *SK Telecom* and *KTF* introduced the first post-pay mobile proximity payment programs. However, the programs, which were based on infrared technology, were not very successful due to impracticality, incompatibility with merchant point-of-sale readers and high costs. *BankOn*, the first IC chip-based mobile banking service, was launched in 2003 in cooperation with the third-largest mobile communications provider *LG Telecom* and *Kookmin Bank*, Korea's largest bank. The success of *BankOn* led other mobile operators and banks to offer mobile banking services with IC chips. Contactless solutions from *Visa (Wave)* and *MasterCard (PayPass)* have been available in Korea since 2006. These were still based on a SIM-sized credit card certified by the card organizations that had to be inserted into a mobile device. Then, starting in 2007, *SK Telecom* introduced a new service that downloaded applications to a SIM card over the air (Bradford *et al.*, 2007, pp. 2-3). This was followed from 2012 by the expansion of *Near Field Communication (NFC)* technology in smartphones, which is commonly deployed for contactless payments, money transfers, and information exchange (Shin *et al.*, 2014, p. 1616). An NFC-enabled device, such as a smartphone, has the ability to communicate with a terminal or other NFC-enabled device. In order to perform these transactions, users simply need to swipe or scan tags on terminals or similar devices with their NFC-enabled devices, such as smartphones or smartwatches. The NFC-enabled device is connected to the user's account or electronic wallet where the payment or banking information is stored (GlobalData, 2022; Paypers, 2022).

In recent years, mobile wallet payments have become increasingly common in Korea, with a successively growing share compared to traditional payment methods such as cash and cards. The most widely used mobile payment services are *Naver Pay*, *Kakao Pay*, and *Samsung Pay* (Statista, 2021a). The increase in the use of mobile payment options is primarily due to the high prevalence of smartphones in Korea. The country holds internationally the highest smartphone ownership rate: 97 percent of Korean adults own a smartphone (the remaining 3 percent own a mobile phone that is not a smartphone). Of the 34 countries surveyed, only Korea achieved a 100 percent mobile ownership rate.[89] It is estimated that 99 percent of the Korean population (older than 3 years old) go online at least once a week, spending an average 14.3 hours a week on the Internet. In this context, the country indicates, in international comparisons, a growing number of elderly (60s and older) as well as kids (younger than 10 years old) who are accessing the Internet on a regular base (Ramirez, 2017b).

Another point is the large amount of state and private investment in Research and Development (R&D), which has driven the availability of sufficient resources and the existence of technical infrastructure to support the use of technical innovations. This development has also fostered the high acceptance of technical innovations among the population. On the one hand, the engagement in R&D is evident with regard to the innovation index: Korea has consistently led Bloomberg's Innovation Index as the most innovative nation in recent years (with the exception of 2020, when it was surpassed by

[89] In contrast, the smartphone ownership rate in Germany, for example, is only 79 percent; 6 percent of adult Germans do not own a mobile phone at all (Pew Research Center, 2022).
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Germany) (Bloomberg Innovation Index, 2021). On the other hand, however, the government's strategy of encouraging the large industrial conglomerates, the so-called *chaebols*, to invest heavily while protecting them from competition has led to a concentration of a few large companies. This dependence, which has led to a social division in Korean society due to the resulting socioeconomic effects, has become increasingly problematic for the Korean economy and small and medium-sized companies. The Korean government has come under increasing criticism for pursuing economic growth that did not improve people's lives which also accounts for the increase in crypto speculation (Yang, 2018; Lee, 2020; Chang, 2017).

The hypothesis, which estimated that *hedonic motivation* positively affects individual's intention to use Bitcoins (H5), is rejected. This implies that the hedonic aspect, i.e., the aspect of feeling or emotion, such as fun or entertainment, is not a significant factor in the intention to use Bitcoins. In the main, financial reasons are what have driven the great popularity of cryptocurrencies in Korea. These reasons are not just about making the fastest and highest profits possible, as it is the case with gambling in the classical sense, but that due to a lack of alternative options – triggered by high unemployment and low wages combined with rising real estate prices – many Koreans see investing in cryptocurrencies as the only way to achieve their desired standard of living, such as buying a house. While in December 2017, the youth unemployment rate in Korea reached the highest rate since 2000 of 10 percent, cryptocurrency prices also reached their current highest level at the same time (Munro, 2018).

Even though the results show no significant relation between *hedonic motivation* and the intention to use Bitcoins, as with all financial speculation, there is a risk of gambling and addiction when investing in cryptocurrencies. The high volatility of cryptocurrencies has added another stress factor to an already highly stressed society. In general, there is a correlation between economic stress and physical and emotional well-being. Economic insecurities were particularly triggered by the 1997 Asian financial crisis. Fear of another crash led to increased stress both in the educational environment, with its day-long, demanding learning workload, and in professional life, with long working hours that extend into the night (Singh, 2017). While the profit opportunities were very high at the beginning of the crypto boom, the various crashes in recent years have led to "*bitcoin blues*", a kind of crypto-based depression with pathological symptoms such as headaches, as well as loss of sleep and appetite (Munro, 2018). Despite the heavy losses and debt associated with the collapse of the market, many continued to invest in cryptocurrencies because they remained convinced of the principle and saw no alternative option. News reports have also indicated a number of suicides due to cryptocurrency losses, although the number of reported crypto-related suicides is too small to express statistical significance (Ghosh, 2021). Korea is the country with the highest suicide rate among *OECD* countries (OECD, 2020b). Economic reasons form only a part of the possible triggering causes of depression leading to suicide; others can be seen in social reasons and in structural problems with regard to the health care system. Still, this points among others, to the issue of financial stress, which the volatility of the crypto market further compounds.

In general, *hedonic motivation* in form of the pleasure obtained from using the Bitcoin system could be by some participants financially driven (e.g., financial gains from trading), by other users politically (e.g., that usage is not controlled by the state) or only based on the fact of participating in an alternative system (e.g., hype effect or being “cool”). Since, as mentioned earlier, the majority of Bitcoin use in Korea is primarily for speculative financial investment, most aspects of enjoyment that come from using a fun digital system or user-friendly interface tend to be less relevant in this environment. Much more relevant in this case is probably the influence of endorphins that arise in connection with gambling, trading and financial speculation (Meyer, 1993). As many investors in Bitcoin are often relatively young and inexperienced, they lack the necessary time to digest past events and reconsider their decisions in the face of rapid gains or losses. Similar to classical gambling, when prices suddenly collapse, emotional releases and addiction potentials that are mostly associated with the volatile character of cryptocurrencies, lead many of the participants to believe that the lost money belongs to them and they must get it back by engaging in a new trade once again. On the other hand, when prices go up, the phenomenon of *Fear of Missing Out* (*FOMO*) results in investor’s fear of missing out on profit opportunities. In the case of investments in cryptocurrencies, this phenomenon is particularly noticeable. As large profits are usually openly articulated by investors and reported widely in the media, many people are eager to participate in these successes. Even if in cases where the initial investment expectations are met and the participants enjoy making book profits, a considerable portion of those who are misled by greed and overly optimistic market expectations as well as prophecies by pseudo-experts in the various crypto forums and social media channels keep assuming that the price will skyrocket even further. They accordingly choose to postpone the realization of profits with the expectation of achieving higher future profits until the price drops again and they instead suffer losses. For example, when the price of Bitcoin was rising in the course of the general market recovery after the beginning of the Covid-pandemic many of the so-called crypto experts have predicted a Bitcoin price of at least 100,000 US-Dollar within 2021. Instead, the recovery ended sooner and crypto prices crashed again (Bloomberg Intelligence, 2020).

Moreover, the lack of empirical significance of the influence of *hedonic motivation* enables strengthening the focus on the remaining social, structural and economic aspects, by excluding possible ideological or political drivers of adoption that might trigger *hedonic motivation*, which would influence behavioral intention.

The hypothesis, which stated that *price value* positively affects individual's intention to use Bitcoins (*H6*), is supported. Despite the high risk and extremely fluctuating exchange rate, Bitcoin users see the price as reasonable, also with regard to opportunity costs. The financial barriers to entry are comparatively low, as investments can already be made with small contributions, which lead to the subjective perception that the current price is favorable or more favorable than other investment opportunities. With regard to the influencing factor *price value*, it is relevant to investigate whether users also invest in Bitcoins for purposes other than with the intention of profit realization. In recent years, cryptocurrencies have increasingly established themselves as an alternative payment method for online transactions, making it easier for users to pay directly with cryptocurrencies without involving a third party. Therefore, cryptocurrencies such as Bitcoin can be an alternative to credit and debit cards, which charge higher fees for merchants (Yoo *et al.*, 2020, p. 8). For example, the e-commerce company *Qoo10*, the so-called "*Asian Amazon*," launched a cryptocurrency payment service together with the Korean crypto exchange *Bithumb* in 2018, though not based on Bitcoin, but on the new cryptocurrency *Q*Coin* (Lee, *et al.*, 2018, p. 54; Teh, 2018). Most essential to the adoption of cryptocurrency payments in Korea was the 2018 partnership between *Bithumb* and mobile payment services provider and gift card platform *Korea Pay Services (KPS)* to make cryptocurrency payments available at over 6,000 retail outlets nationwide for goods and services (Si-oo, 2018).

According to a survey conducted in March 2021, however, there were only seven offline stores in Seoul that accepted Bitcoin as payment; 43 other stores accepted Bitcoin in the past, but have since discontinued or closed their business (Statista, 2021b). There are also essential disadvantages for the use of cryptocurrencies as a general means of payment. For instance, unlike credit cards, payments with cryptocurrencies are not reversible, as the protocol does not provide for the possibility of reversing the purchase if the user does decide to cancel it. In addition, there are the general security concerns of opening up opportunities for fraud, as there is no intermediary, such as a financial institution, to verify a user's identity, and Bitcoin, unlike credit cards, for example, does not impose prohibitions on certain transactions that are illegal at the point of sale (Böhme *et al*., 2015, p. 219). Based on the results of several studies, it has been shown that users see the attractiveness of cryptocurrencies in their characteristics as asset and not as currency (Glaser *et al*., 2014; Lee, *et al.*, 2018). Users are generally less interested in an alternative transaction system than in an alternative investment instrument. In this context, price value expresses both the direct costs of an investment, such as transaction costs, information acquisition costs, brokerage costs, etc., and the indirect costs in terms of opportunity costs. As the direct costs of an investment in crypto assets are lower compared to traditional asset classes and most participants lack other investment opportunities, therefore, the price value appears to be appropriate for the majority of the respondents. Yet, they are usually aware of the high risks and do not use cryptocurrencies as a means of trading. Even in the event of losses and high opportunity costs, they are more likely to hold on to their position and hope that prices will rise again. It can therefore be argued that the perceived *price value* of Bitcoins as a technology-based alternative investment significantly influences the intention of individual Korean users to engage in Bitcoin activities, despite the high volatility associated with it, which users tend to perceive as an opportunity to make quick financial gains.

The hypothesis, which stated that *habits* positively affect individual's intention to use Bitcoins (H7), is rejected. This indicates that the intention to use Bitcoins is not an unconscious decision based on certain previous activities, experiences and habits, but rather a deliberate decision. This may be due to the fact that cryptocurrencies are a new technology that offers new speculative investment opportunities, where users are less likely to have prior experience, especially in terms of predictions regarding the risk assessment of the volatile investment. This outcome is contrary to the research findings stating that habits play a significant role in shaping individual's behavior intention toward using and accepting new forms of technology, such as electronic banking systems (Kolodinsky *et al.,* 2004; Eriksson *et al.,* 2008; Baptista and Oliveira, 2015). In Korea, payment habits have traditionally been dominated by card transactions. There are more than 100 million issued cards. That is an average of 4 cards per household. The total volume of annual purchases made with cards exceeds 600 billion US-Dollar. Around 76 percent of retail payments are made with cards, a much higher share than in the US (Paypers, 2022). Currently, payment habits are shifting towards mobile wallets, which are becoming the main payment method in South Korea and gradually replacing traditional payment methods such as cash and cards. As merchant acceptance of QR code-based payments expands and preference for contactless payment methods intensifies, nearly two-thirds of South Koreans currently use mobile wallets in stores (GlobalData, 2022). According to GlobalData's (2021) *Financial Services Consumer Survey*, which was conducted in the first and second quarters of 2021, 62.7 percent of individuals surveyed reported that they own a mobile wallet and use it for online transactions or in stores, while only fewer than 4 percent of the respondents said that they had actually never heard about such wallets. The COVID-19 pandemic has further strengthened Koreans' habit of using mobile wallets to make payments, as consumers have increasingly opted for contactless payments out of fear of contracting the virus when handling cash. As a result, many retailers, restaurants and public transportation systems are now accepting payments via mobile wallets. Most of these transactions are conducted via *Near Field Communication* (NFC) technology (GlobalData, 2022; Paypers, 2022).

All in all, the undetectable significance of the element *habit* on the behavioral intention to use Bitcoin despite these general observable habits in terms of digital payment systems among the Korean population again speaks to the fact that the adoption of cryptocurrency in Korea is purely speculative in nature and is less intended as a payment method.

7.2 Herd Behavior Empirical Findings

In the age of digitalization, the influence of social media forms an essential factor for the diffusion and adoption of a technological innovation, which must be taken into account in the analysis – especially since cryptocurrencies are themselves based on a digital technology, the blockchain technology. Social networks provide the most efficient and rapid means for the dissemination of information, but at the same time, can lead to the spread of misinformation that may provide false incentives for adoption and investment decisions. Therefore, as a complement to the influencing factors derived from the *UTAUT 2* model, the phenomenon of *herd behavior* was added to examine whether it has an influence on the intention to adopt Bitcoins. *Herd behavior* is to be distinguished from *social influence* as defined by the *UTAUT 2* model. While *social influence* represents self-instruction in relation to the expectations of a reference group and with the decision to accept Bitcoins one's aim is to achieve a positive standing within the reference group, *herd behavior*, in contrast, is based on observing the actions of other people and is not influenced by what others think about the possible decision.

Herd behavior manifests when a group of users acts based on the knowledge of a collective while disregarding their individual information, resulting in a cascade of potentially inaccurate information throughout the group. To trigger *herd behavior*, it requires a specific catalyst for that event. In the case of cryptocurrencies such as Bitcoin, websites and social media in particular can fuel the activity, as they can include potentially biased information designed to gain a financial advantage for those who share it (Boxer *et al.*, 2020). For the empirical analysis concerning the influence of *herd behavior* on the intention to use Bitcoins, the three influencing factors *uncertainty*, *discounting own information*, and *imitating others* were tested.

The hypothesis, which estimated that *uncertainty* positively affects *discounting own information* (H8a), is approved. The high fluctuations and several crashes in the cryptocurrency sector demonstrate immense uncertainty. The precise reasons for the large price fluctuations are difficult to quantify accurately. Some factors include the non-intrinsic value of cryptocurrencies, as they depend mainly on market sentiment, but also the lack of regulatory oversight, which can lead to market manipulation. Also, it is the herd mentality itself, when thousands invest or sell out of fear of losing money that leads to the large price fluctuations (Aggarwal *et al.*, 2019). This creates an impression of a highly emotional market, which is not only determined by facts and figures, but also by individual perceptions and beliefs. The result of testing the influencing factor *uncertainty* confirms that with regard to the development of the market uncertainty leads investors to disregard their own information and assume the actions of other users. Especially when prices fall abruptly, as it is the case in a crash, investors' anxiety will principally increase, forcing them to react quickly to market movements instead of using the information at their disposal and reflecting on the decision.

The hypothesis that estimated that *discounting own information* positively influences individuals to *imitate* others (*H8b*) is also adopted. If one discounts his or her own information, for example, because he or she has not yet had personal or conflicting experience with the introduction of a new technological innovation as well as not yet having had the time to consider the various advantages and disadvantages, he or she will look to others for how to respond in terms of adoption or rejection. Although considering one's own information would tend to lead one to reject an adoption of cryptocurrencies, the fear of missing out (*FOMO*) on potential opportunities and of experiencing competitive disadvantages may have the effect of making it more relevant to decision making to observe how other users are benefiting from the adoption. The huge return on cryptocurrency investment has burdened society with *FOMO*, which can lead to irrational decisions (Gazali *et al.*, 2019, p. 82; Ghoshal, 2018).

Ultimately, the hypothesis that stated that *imitating others* positively affects individual's intention to use Bitcoin (*H8c*) is also approved. Since cryptocurrencies are still a relatively new phenomenon, characterized in some cases by insufficient user information as well as a weak legal framework, investors tend to imitate the behavior of others. Imitating others to perform a certain action or adopt a new technological innovation can lead to *herd behavior*. Several studies on user trading behavior have already pointed out the significant role of *herd behavior* in influencing positive attitudes and subsequent behavior when purchasing crypto assets (Boxer *et al.*, 2020; Choi *et al.*, 2021). In their study of trading patterns in the crypto market in Korea for which they considered high-frequency trading data as well, Choi *et al.* (2021) show that herding behavior occurs only after a time interval of 10 hours or more, which means that users mimic other users' action decisions only after a certain period of time and thus do not retain their own information and beliefs in the long run. This effect appears to be stronger during periods of a down market, which generate an increase in fear of losing, so users feel compelled to react to market movements instead of using their own information. In contrast, during an up market, investors are supposed to be less likely to subordinate their entire own information to the market consensus (Choi *et al.,* 2021). However, in the case of booming markets, the fear of missing out (*FOMO*) on potential opportunities tends to intensify the tendency of discounting own information. The time frame in which the survey circulated for the statistical analysis of the conducted study (December 2021 - April 2022) showed retrospectively no extraordinary price developments. That the result of the analysis shows *imitating others* to be a significant factor for the intention to use Bitcoins, and thus *herd behavior* mechanisms were fundamentally present, may be due to users being insecure due to the previous crashes and fears of missing out opportunities of another potential boom period.

As mentioned before, the high price volatility can be attributed to *herd behavior*. As a means of explanation, the term of *herd behavior* is particularly used in cases with no other known or significant factor to describe the extreme peaks and troughs that occur in the cryptocurrency markets. Since social media serve as an important source of information for the development of cryptocurrencies, price fluctuations may in part even be predicted in advance via circulating news in social media that have triggered *herd behavior*. For instance, Mai *et al.* (2018) found in their study on the impact of social media on Bitcoin value that social media are an important predictor of the future value of Bitcoin, while distinguishing between the different social media platforms, as forums have shown to be better indicators than e.g., *tweets*. According to this study, there is a significant correlation between optimistic or pessimistic forum posts with a higher or lower Bitcoin market price the next day, with content from relatively inactive users having a greater effect than from active users (Mai *et al.*, 2018, p. 22). Since Bitcoin's blockchain algorithm guarantees that the supply of new Bitcoins is created at a known, geometrically decreasing rate, the demand for Bitcoins – and implicitly the intention to use them – represents the main driver of value (Mai *et al.*, 2018, p. 24). Therefore, positive social media coverage can be seen as a significant factor that encourages users to invest in Bitcoins.

Nevertheless, not only the sentiments of other users influence the individuals' intention to adopt cryptocurrencies, but also public news, such as announcements of regulations by government authorities, bank announcements about cryptocurrencies, or news from cryptocurrency exchanges. For instance, after a Bitcoin bubble emerged 2017 due to rising investor popularity, the value plummeted at the turn of 2017/2018 after profiting investors sold their Bitcoins and flooded the market. The Bitcoin crash was followed by almost all other cryptocurrencies. The extreme price drop of 30 percent in January 2018 had generated a loss of 44.2 billion US-Dollar internationally; a value that Bitcoin's total market capitalization had not come close to before the 2017 boom (Lam *et al.,* 2018). One of the potential reasons for the crash was an announcement by the *Korean Ministry of Justice* to ban cryptocurrency trading. The ministry did so without the approval of the *Ministry of Strategy and Finance* and other government agencies involved in South Korea's cryptocurrency regulation task force. This led to strong uncertainties and massive criticism of the decision. Shortly thereafter, the *Ministry of Strategy and Finance* spoke out against a ban (Young, 2018). After the government released the news of backing away from the announcement of a ban on January 12, 2018, when the cryptocurrency market was struggling, the price increased starting the next day (Aggarwal *et al.,* 2019).

However, the effects of this kind of news are difficult to measure, also because different users perceive regulations differently. Furthermore, since the Bitcoin market is a global market with international actors and has always been characterized by high price fluctuations, it cannot be stated exactly whether the Korean government's announcement was indeed one of the main causes of the crash, whether it did not trigger but amplified it, or whether it was just an incoherent coincidence. Other reasons for a crash can also be given. For instance, price volatility can be associated with hacks as occurred in the Japanese cryptocurrency market in January 2018 (Hu *et al.,* 2020). However, in the Korean cryptocurrency community, many Bitcoin users blamed the government for causing the price drop (Lee, 2020, pp. 21-22).

7.3 Moderating Effect Empirical Findings

7.3.1 Demographics and Experience

The analysis further examined the effects of *age, gender* and *experience* as moderating variables. First, the results show that *age* is not a significant moderating factor for the intention to use Bitcoins. Thus, there is no moderating influence of *age* on the interrelationships among the determinants *facilitating conditions, hedonic motivation, price value, habits* and behavioral intention. *H9a-9d* are therefore rejected. This may be due to the fact that while the majority of Bitcoin users are younger, interest in adopting Bitcoin spans across all age groups. About 60 percent of new crypto investors in Korea are in the age of 20-30, according to a study by the big data firm *IGA Works*. They typically invest smaller amounts of money in cryptocurrencies (Dunne, 2022). However, according to data from the *Financial Supervisory Service (FSS)* the largest share of money in cryptocurrencies is carried by 40-year-old investors, whose account balances reached 17.5 trillion won (ca. $14 billions) in 2021, which includes both the sum of their real money deposits and cryptocurrencies invested in exchange accounts, and which represents 33 percent of the total assets of cryptocurrency exchanges. In addition, seniors are also increasingly investing in cryptocurrencies (Min-hyung, 2022). While the percentage of older cryptocurrency users is low relative to other age groups – in 2021, of the 23.7 million new accounts on the four largest cryptocurrency exchanges, *Upbit*, *Bithumb*, *Coinone* and *Korbit*, 276,945 belong to people aged 50 and over – the total percentage of deposits for cryptocurrencies is above average compared to other age groups. Users in the age groups of 60 and above deposited 407 billion won (336 millions US-Dollar), which is an average of 71.1 million won (59,000 US-Dollar) per person. This is double the overall average of 35.4 million won (Young-won, 2021).

Although the percentage of young adopters of cryptocurrencies is the highest, the motivations to use Bitcoin are similar across generations. While *hedonic motivation* and *habits* have no influential effect on Bitcoin adoption, the determinants *facilitating conditions* and *price value* show a significant effect on the adoption of Bitcoin independent of user age. The digital infrastructure in Korea benefits the entire population. In general, the use of the Internet in Korea is relatively balanced demographically, showing an Internet usage rate of almost 100 percent up to the age group *50-59 years* and still 94.5 percent for the age group *60-69 years*. It is not until the age group *70 years and older* that the rate drops significantly to 49.7 percent (Statista, 2022d). The cryptocurrency hype in Korea has also generated the phenomenon that people, who are not digitally affine, such as the elderly, can acquire cryptocurrencies through offline trading clubs, thus facilitating access for all age groups (Lee, 2020, p.7.) The determinant *price value* has a significant impact on the intention to use Bitcoin, independent of the moderating variable *age* of the Bitcoin users. Regardless of demographics, individuals who use or intend to use Bitcoin see the price of Bitcoins as reasonable in comparation to other investment alternatives. Thus, for users, the benefits of Bitcoin – such as low transaction costs, low barriers to entry, and high returns options – appear to prevail over potential risks – such as opportunity costs and high volatility – as they believe the benefits cannot be achieved by any other investment (Abraham *et al.,* 2019, p. 9).

The results of the analysis with regard to the moderating variable *gender* showed no significant effect, as with regard to the moderating variable *age*. Thus, there is no moderating influence of *gender* on the interrelationship among the determinants *facilitating conditions, hedonic motivation, price value, habits* and *behavioral intention*. *H10a-10d* are therefore rejected.[90] In Korea, the proportion of women investing in cryptocurrencies is almost as high as that of men. This places the country in a distinctive position by international standards. While in every country more men than women invest in cryptocurrencies and in the global average 22 percent of men and 15 percent of women own cryptocurrencies, in Korea it is 24 percent of men and 23 percent of women. Thus, Korea has internationally the smallest cryptocurrency gender gap. This may be partly due to the significant role of women in Korea in managing household finances. With responsibilities that include budgeting, savings, and day-to-day financial decisions, Korean women’s financial expertise and contribution to the family's economic solidity likely played a role in their confident attitude toward cryptocurrencies (Finder Crypto Report, 2021). With regard to the government’s planned regulations, however, the opinions of cryptocurrency users differ depending on age and gender. According to a survey

[90] H10a can only be accepted at a very low significance level with P-value < 0.1 but > 0.05, however, the effect of H10a with a path coefficient of -0.057 is neglectable.

commissioned by the *Korean news channel YTN*, younger investors in cryptocurrencies are rather critical of the planned taxation on profits from cryptocurrency trading. Investors from older age groups are more open to the taxation. The largest percentage of supporters is found among citizens in their 40s (62.1%), followed by those in their 50s (57.2%) and 30s (55.4%). Women are also more likely to accept taxation than men (Tassev, 2021).

Similarly, the results of the analysis related to the moderating variable *experience* showed no significant effect on the determinants *facilitating conditions, hedonic motivation,* and *habits*. *H11a-11c* are therefore rejected. The reasons, similar to the moderating variables of *age* and *gender*, seem to be that the well-developed ICT infrastructure in Korea and the possible digital services such as online payment are used by individuals regardless of these moderating variables, and the motivations for investing in cryptocurrencies – achieving financial goals – are similarly shaped. As data on the trading volume of the Korean cryptocurrency exchange Korbit shows, cryptocurrencies became a mass phenomenon in South Korea at the latest in autumn 2017, when Koreans, regardless of age, gender, social background, and experience, became interested in adopting and investing in cryptocurrencies (Premack, 2018). The hypothesis that stated that *experience* moderates the effect of *social influence* on individuals' intention to use Bitcoins (*H11d*) is also rejected. As mentioned above, *social influence* does not appear to be a highly significant determinant for the intention to use Bitcoin independent from the individual experience background. The observed mass phenomenon of cryptocurrency adoption in Korea can better be explained by the determinant *herd behavior*, as has been discussed. *Herd behavior* is a phenomenon that can be observed in both inexperienced and experienced users as they discount their own information and imitate the decision of other users due to fear of missing out on potential opportunities and suffering competitive disadvantages.

7.3.2 Cultural Moderating Variables

To analyze the moderating effect of cultural variables on the linkage between *social influence* and individual's behavior intention to use Bitcoins as well as on the relation between *performance expectancy* and individual's behavior intention to use Bitcoins, the cultural dimensions derived from Hofstede's model of national-level cultural comparison were applied. The cultural dimensions are *individualism/collectivism*, *uncertainty* *avoidance* and *power distance*. In this regard, it is crucial to stress that the present study departs from the essentialist tendencies of Hofstede's model. Hofstede's model was criticized in particular for its equation of nation and culture and for its methodological approach of generalizing results from a study of organizational culture (*IBM*) to the entire culture of a nation (Myers *et al.,* 2002). For this reason, the dimensions are interpreted only in the context related to the adoption of Bitcoin and do not intend an essentialization of a Korean culture as a fixed entity.

The result of the cultural dimension *individualism/collectivism* showed that the individuals interviewed tended to think more in a collectivistic manner according to the recorded high mean values of the construct items. This is in accordance with the general theoretical expectations. However, the hypotheses, which estimated that *individualism/collectivism* moderates the relationship between *social influence* respectively *performance expectancy* and individual's behavior intention to use Bitcoins (*H12a* and *H12b*), are rejected. Accordingly, collectivism does not have a moderating effect on the aforementioned determinants of Bitcoin adoption, although one might draw this inference from the technological principle of cryptocurrency being based on a collective network. Thus, even individuals who have a more individual way of thinking tend to adopt a collective way of reasoning when participating or investing. At the same time, one has to point to the fact that even in a society based more on collective norms, there are variations in attitudes and generally collective driven individual users may tend more toward relative individualism, so that a generalizing statement is questionable.

The hypotheses, which estimated that *uncertainty avoidance* moderates the relationship between *social influence* respectively *performance expectancy* and individual's behavior intention to use Bitcoins (*H13a* and *H13b*), are rejected. Thus, the attitude of tolerating or avoiding uncertainty does not play a significant role as a moderating variable for Bitcoin usage. The assessments of the statements listed in the survey show that, on average, the respondents represent a culture with a high level of uncertainty avoidance. In this case, one would have assumed that high uncertainty avoidance as a moderating variable would tend to lead to Bitcoin usage being viewed more critically due to its high price volatility and the associated risks. Furthermore, one would have expected that individuals who tend to avoid uncertainty would take more into account social influence, i.e., the opinions of those they care about, when deciding to use Bitcoins. However, this influence as a moderating variable was not confirmed in the analysis. These findings demonstrate that individual cultural factors, such as the level of uncertainty avoidance, do not significantly influence the cryptocurrency adoption process. Instead, the impact of uncertainty becomes more pronounced when specific decisions are made in the absence of sufficient information or fundamental criteria for judging whether or not to adopt. This result undermines the role of cultural values and emphasizes the mechanisms of herd behavior, as discussed earlier.

The hypotheses, which estimated that *power distance* moderates the relationship between *social influence* respectively *performance expectancy* and individual's behavior intention to use Bitcoins (*H14a* and *H14b*), are also rejected. Power distance therefore has no influence as a moderating variable on Bitcoin usage. The theoretical framework proposes that, in a culture with low power distance, individuals are more likely to be seeking information on their own initiative from direct and formal sources as they consider themselves independent decision-makers who are to some extent disconnected from the social context. This is in contrast to the theoretically expected behavior of individuals with higher power distance culture characteristics. The data on the cultural dimension *power distance* showed that the individuals interviewed generally represent a culture with high power distance, which can be seen in the observed means of the construct items responses. This observation is in accordance with the theoretical expectations of the sample. However, similar to the other culture variables, power distance appears to have no statistically significant observable impact on moderating the adoption of Bitcoins in Korea, as the empirical findings suggests.

Overall, the results of the consideration of cultural aspects as moderating factors in the analysis have shown that, at least in the case of South Korea, the interaction of individual culture hardly plays any role in influencing the demand for cryptocurrencies on a national level. In fact, other factors are much more significant in influencing the adoption process, and their influence is equally strong regardless of individual cultural attitudes. Nevertheless, this result confirms the approach of the proposition of this study that socioeconomic reasons, rather than national-cultural ones, are better suited in explaining the dynamics behind the ongoing Bitcoin hype in Korea.

7.4 Conclusion

The empirical analysis has shown that the UTAUT2 model supplemented with the components of herd behavior is well suited to explain the phenomenon of cryptocurrencies in South Korea. In this context, the aspects of *Performance Expectancy*, *Effort Expectancy*, *Facilitating Conditions* and *Price Value* appear to be of greatest relevance, while the aspects of *Hedonic Motivations* and *Habit* show no significance. Surprisingly, the *Social Influence* aspect shows a negligible degree of significance. The influence of social factors is found to be stronger and significantly more observable in the elements of herd behavior. These dynamics are statistically observed across the sample spectrum, regardless of gender, age, experience, or cultural attitudes.

8 Conclusion, Outlook and Implications

8.1 Conclusion

With the introduction of cryptocurrencies based on blockchain technology, the global financial industry is undergoing a period of technological transformation. By providing technological opportunities for decentralization and transparency, cryptocurrencies are symptomatic of a departure from traditional, centralized financial system infrastructures. In the wake of the 2008 financial crisis and the resulting loss of trust in the financial system, this new type of currency gained increasing attention as an alternative concept for possible future currency systems.

The objective of this study was to examine the socioeconomic aspects behind the diffusion and adoption of Bitcoin in Korea in order to understand the paradigms that influence the decision to adopt and use cryptocurrencies, in this case Bitcoin. The study focused on South Korea, as the country has experienced massive growth in cryptocurrency users in recent years, which is above average by international standards, as indicated, for instance, by the phenomenon of the Kimchi Premium. As the subject of the research, the diffusion and adoption of the cryptocurrency Bitcoin was examined, as Bitcoin is the first cryptocurrency based on blockchain technology and the most widely used.

To provide a comprehensive understanding of the nature of cryptocurrencies and to present a working definition of the economic characteristics of Bitcoins, the financial technology features and technical functions of cryptocurrencies were first discussed in Chapter 2, with a particular focus on Bitcoin. In summary, the mechanisms of Bitcoin's operation can be described as follows: As a digital currency, Bitcoin is based on blockchain technology. Bitcoins are created without the involvement of central banks through the computation of blocks that contain transactions generated by cryptographic calculations in the course of so-called mining. The computers that perform the encryption calculations fastest within a defined period of time receive compensation for this in the Bitcoin currency and use it to create money. Cryptocurrencies such as Bitcoin are managed in a wallet, although they are not stored there directly. The actual contents of the wallet are the private and public keys that allow access to the addresses and thus to the user's holdings. Buying and selling cryptocurrencies is possible through cryptocurrency exchanges; these are systems that work on the basis of trading cryptocurrencies with other assets – similar to traditional financial exchanges. Furthermore, it was discussed whether Bitcoin can be defined as a medium of exchange, a unit of account, a store of value, or an asset. The analysis demonstrated that while cryptocurrencies, including Bitcoin, do not fully meet the conventional monetary characteristics necessary for them to be regarded as on par with traditional currencies, they have nevertheless been utilized to some extent as an alternative payment method. This study however, took the position that cryptocurrencies such as Bitcoin are generally viewed less as a currency and rather as an alternative asset class and an object of speculation. Thus, cryptocurrencies are defined in the context of this thesis as a digital-based alternative investment instrument that can be employed by investors either as a portfolio component alongside traditional assets such as stocks, bonds and gold, or as a purely speculative investment vehicle with the aim of promptly achieving individual financial goals.

The study showed that in order to understand the complexity of users' behavior in Korea in terms of Bitcoin technology adoption and acceptance, it is crucial to focus not only on the economic and institutional factors, but also and especially on the social and socioeconomic components that have led to the hype around cryptocurrencies. For this reason, in Chapter 3 of the study, theories of technology acceptance and diffusion were discussed in order to develop a comprehensive research method for studying the acceptance and use of Bitcoin technology in Korea, which also takes into account current transformation processes of the digital development.

The study adapted the *UTAUT2* model (Venkatesh *et al.,* 2012) and extended it by the factors *herd behavior* as well as cultural moderating variables. Advantages of the *UTAUT2* model are that as a meta-model it integrates various technology acceptance models and harmonizes the propositions of the diverse previous models; that it can be flexibly adapted to the particular research subject; and that it allows for a better understanding of interactions with external factors. As demonstrated, the *UTAUT* is closely related to the *Technology Acceptance Model TAM* (Davis, 1989), which is based on Ajzen and Fishbein's (1980) *Theory of Reasoned Action* and its further development, the *Theory of Planned Behavior* (Ajzen, 1985), but it is superior to them in predicting user acceptance (Legris *et al.,* 2003; Rahman et al., 2017). Advantage of the *TAM* model is that it does not rely on general attitudes toward technology, but measures behavioral intention toward a technology. According to *TAM*, intention is based on the primary construct of perceived usefulness and the secondary construct of perceived ease of use. The *UTAUT* and the *UTAUT2* extend this toward a universal theory that ultimately includes seven influencing factors: *performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, price valu*e and *habit*. These factors have the ability to affect intention to use and actual use. To investigate the information cascades around Bitcoin and the influence of social media as digital communication channels, the phenomenon of herd behavior and the constructs of *perceived uncertainty, discounting one's own information* and *imitation* were added as complementary influencing elements. Complementing the moderating demographic variables *age, gender,* and *experience* of UTAUT 2, the moderating cultural variables *individualism/collectivism, uncertainty avoidance* and *power distance* as derived from Hofstede (1980) were discussed and included in the model.

Before testing if these influential factors played a significant role in the intention to use Bitcoin in the Korean context by means of the formulated hypotheses, the historical socioeconomic developments in Korea were presented and discussed in Chapter 4. After a period of rapid economic growth, the financial crisis of 1997 had a far-reaching impact on all areas of Korean society, especially on the labor market. Youth unemployment in particular increased. The mentioned fields of problems such as over-education, excessive competition, difficulties in wealth accumulation, and decreasing social mobility were identified as possible causes that may have led many Koreans to turn to emerging and often high-risk investment opportunities such as cryptocurrencies. It was emphasized that the popularity of cryptocurrencies such as Bitcoin in Korea has to be described not only as an economic phenomenon based on rational, calculated investment decisions by individuals, but also and especially as a socioeconomic phenomenon whose origins lie in the country's social, political, and financial developments (Lee, 2020, p. 8).

After explaining the research methodology used in the study, providing a rationale for the choice of employing a survey approach, and formulating the hypotheses to be tested in Chapter 5, the results of the pilot study were discussed and the preliminary analysis of the data collected from the survey participants was presented in Chapter 6. Subsequently, a comprehensive examination was conducted to analyze the connections among the components in the conceptual framework of the research model. For this, a two-step approach was employed using confirmatory factor analysis (CFA) and structural equation modeling (SEM). The results of the structural equation modeling analysis supported the hypotheses that *Performance Expectancy, Effort Expectancy, Facilitating Conditions, Social Influence, Price Value,* and *Herd Behavior* influence the behavioral intention to use Bitcoin, with in contrast to expectation, *Social Influence* as construct has only a very low significance level. *Effort expectancy* and *Herd Behavior* were found to have the strongest influence on behavioral intention to adopt Bitcoin. In contrast, the results indicated that *Hedonic Motivation* and *Habit* have no significant impact on the individual decision to use Bitcoin. With respect to the moderating impact of the demographic variables of gender, age and experience as derived from the UTAUT 2 model as well as individual-level culture dimensions based on Hofstede (1980) on the interrelations between the exogenous and endogenous constructs, they were found to have no significant impact. The exception was Hypothesis 10a, which estimated that gender moderates the effect of facilitating conditions on individuals' intention to use Bitcoins. This was only supported at a very low significance level.

The outcome of the hypotheses testing was discussed in Chapter 7. As stated, the results indicate that the reasons for the extensive adoption and popularity of Bitcoin in Korea are based on the country's specific socioeconomic developments. High competence in information and communication technology (ICT) and experience with concepts of microtransactions and digital tokens prior to the introduction of cryptocurrencies have facilitated access to Bitcoin for Korean users, resulting in *Effort Expectancy* having with the strongest impact on behavioral intention to adopt Bitcoin. At the same time, the similarly strong impact of *Herd Behavior* shows that the decision to use Bitcoin is not, or not only, based on individuals' rational consideration, but that the social media-based hyperconnectivity of Korean society leads users to discount their own information and imitate others' behavior when intending to use Bitcoin. That the moderating demographic and cultural variables have no influential significance indicates that the reasons for Bitcoin adoption are similarly situated regardless of *age*, *gender*, and *experience*, and that the cultural factors *individualism/collectivism*, *uncertainty avoidance*, and *power distance* cannot be used as explanatory models for the dynamics of Bitcoin adoption in Korea.

In summary, the motivation to adopt Bitcoin, despite its speculative nature and the high risk associated with it, is due to the specific socioeconomic context in Korea. Considering the historical trajectory of this context, it can be stated that the interplay of two different developments in particular has paved the way for the popularity of cryptocurrencies in the country: on the one hand, the increasing social inequality within the Korean society and, on the other hand, the high affinity in the field of digitalization and financial speculation among the population.

The enormous economic growth since the mid-20th century, referred to as the *"Miracle of the Han River"*, which was initially characterized by a relatively even distribution of income, eventually resulted in a growing gap between wealthy and poor and a socioeconomic divide in society that has intensified after the financial crisis of 1997 and, currently, in the wake of the Corona pandemic (Kanbur *et al.,* 2014; Park, 2022a). In comparison with other *OECD* countries, Korea belongs to the industrialized nations with the greatest economic inequality. Apart from the USA, Korea is also the only *OECD* country in which the share of the top one percent in total national income has risen continuously since 2000 (World Inequality Database, 2018). As discussed, the reasons for this socioeconomic divide are based on both income inequality and wealth inequality. Income inequality was primarily caused by neoliberal economic policies and the economic reforms taken in the wake of the 1997 financial crisis, which led, among others, to precarious, nonregular employment, such as part-time or limited-term workers, high youth unemployment and forced early retirement in private companies. This situation has been exacerbated by inadequate public safety nets. Compared to other industrialized nations, public welfare in Korea is underdeveloped. In 2019, public social spending was 12.2 percent of GDP, compared to the OECD average of 20 percent (OECD, 2019). Wealth inequality has been generated especially by the housing market developments with rapidly rising real estate prices that more and more Koreans can no longer afford as well as by the general concentration of wealth through the *chaebols*. In terms of housing policy, the state failed to effectively manage the distribution of housing, which contributed to the increase in social inequality. While the housing lottery system has been a policy measure to provide affordable housing to middle-income people, the principle of the lottery contributed to the collective feeling in Korean society that social mobility cannot be achieved through hard work, as promised by the state, but is the result of speculation and luck (Yang, 2018, p. 63). In addition to lower income due to precarious work and higher expenses due to rising housing costs, high spending on education to keep up with the increasing competition for secure, permanent employment is another reason for the decline of the middle class and the intensification of economic inequality.

Simultaneously, the fact that Korea is one of the most innovative countries in the field of technologies – resulting in a well-developed information and communications technology (ICT) infrastructure and high digital literacy of Korean society regardless of age, gender, and social status – has facilitated access to cryptocurrencies, as Korean users are generally accustomed to technological innovations. In this respect, Korea holds a distinctive position. Even though it lags behind the U.S., China, Japan and Germany in a global comparison of total Research & Development (R&D) spending, it occupies a top position in terms of R&D intensity, i.e., total R&D spending as a percentage of gross domestic product (GDP). In this category, South Korea ranks second with 4.1 percent, behind Israel with 4.2 percent (UNESCO eAtlas of Research and Experimental Development). In addition, the deregulation of financial markets as one of the conditions of the IMF program after the financial crisis led many Koreans to see financial markets as a potential source of financial prosperity. One of the government's measures was to deregulate consumer credit to counter weak domestic spending caused by unemployment and low-paying jobs, which led to a boom in the real estate and stock markets. Public interest in asset investment was further promoted by the media and financial industry marketing, turning Korea into a mass investment society in the 2000s (Lee, 2020, pp. 12-13). The new economic opportunities, which promised more open access to financial markets for individuals, also paved the way for the popularity of cryptocurrencies such as Bitcoin.

The combination of these two different developments – the increase of social inequality and at the same time the high affinity and competence of society in terms of technological innovation and digitalization – has led to the fact that many Koreans began to speculate with cryptocurrencies such as Bitcoin as financial assets. What was initially seen as a new opportunity for wealth creation primarily by groups most affected by increasing social inequality – such as young, high-educated Koreans who could not find secure employment – has unfolded across Korean society regardless of demographic composition or social status. As the empirical analysis has shown, the hyperconnectivity of Korean society, where individuals are constantly online and engaging in exchanges through various platforms, and the resulting herd behavior as an important influencing factor on the intention to use Bitcoins, has led to the Bitcoin hype reaching all age and income groups in Korea and becoming a mass social phenomenon.

8.2 Theoretical Implications

The present study examined the various factors influencing the adoption and acceptance of Bitcoin among individual users in South Korea. Thus, the UTAUT 2 model was extended to incorporate the influencing factor *herd behavior* and the moderating cultural dimensions *individualism/collectivism, uncertainty avoidance* and *power distance*. The results of the study showed that the extended UTAUT 2 model is suitable and robust for analyzing individual user behavior in relation to Bitcoin adoption in Korea. While the influence of the moderating cultural variables was found to be insignificant, *herd behavior* – together with *effort expectancy* – was found to have the strongest influence on behavioral intention to use Bitcoin. This finding supports the current research perspective that the UTAUT 2 model should be extended, depending on the subject and context of the research, to form an accurate and comprehensive technology acceptance model (Blut *et al.,* 2022). A significant contribution of the present study thus lies in the extension of the model to include the determinant *herd behavior*, as it constitutes a significant correlation with regard to the intention to use Bitcoin, which has not yet or not sufficiently been considered in previous research on the acceptance of cryptocurrencies. By integrating the influence of *herd behavior* into the existing framework, this study has enhanced the overall comprehension of investment choice processes and shed light on the differential roles of herd behavior and social influence in technology adoption.

The empirical findings underscore the importance of considering herd behavior in making investment decisions, especially in situations characterized by uncertainty or limited information. The study showed that joining the herd tends to have a stronger impact than the social influence of peer groups. This suggests that individuals are more likely to orient their financial behavior to the actions and behaviors of the larger crowd, rather than relying solely on the recommendations or opinions of their immediate social circle. This highlights the importance of collective behavior and individuals' willingness to make decisions based on the observed actions and behaviors of a broader mass. In this context, social media plays an essential role in the occurrence of herd behavior, as it facilitates the possibility of observing other users, as exemplified by the hyperconnectivity of Korean society.

The theoretical contributions of this study also provide practical guidance. For example, the phenomenon of GameStop meme stock, which gained widespread attention during the COVID-19 crisis in 2021, serves as a notable case where the theoretical framework proposed in this study can be applied. The trading frenzy surrounding GameStop stock was initially fueled by discussions and recommendations within online communities, particularly on platforms such as Reddit. Early investors were likely influenced by the collective sentiment and enthusiasm generated by their peer groups within online communities, which underscore the role of social influence in investment decisions. Subsequent investors were drawn into the frenzy, motivated by news and prevailing market trends, aligning their investment decisions with the actions and beliefs of a large crowd of market participants. This case highlights the influence of herd behavior, triggered and amplified by social media platforms and online communities, in shaping investment trends.

8.3 Outlook

The future diffusion and adoption of cryptocurrencies, including Bitcoin, in Korea depends on various socio-economic, monetary and regulatory factors. These factors can play a crucial role in shaping the environment in which cryptocurrencies operate and may act as potential barriers or facilitators for their adoption. One factor is the further development of social inequality in Korea. It can be anticipated that the popularity of cryptocurrencies, such as Bitcoin, will persist as long as the complex socioeconomic problems remain unresolved. The perception of social inequality and social polarization has rarely changed in recent years. In a 45-country survey, 73 percent of young Koreans responded that wealth was "not fairly equally" or "not equally at all" distributed. This is above the average global level of 69 percent (Han, 2022, p. 3). The country's economic growth is largely decoupled from the well-being of the broad masses. In this context, Koreans will probably continue to see cryptocurrency investment as a way to achieve financial stability, which they do not see as achievable through other means. This has been manifested by the circumstance that in

Korea, despite its overall economic strength, there is a lack of sufficient alternative avenues for wealth accumulation and social mobility, leading many users to consider the adoption of cryptocurrencies as a path to prosperity.

As the high debt rate of Korean households demonstrates, speculation in cryptocurrencies such as Bitcoin, however, has not contributed to general prosperity and social mobility. The main risks of investing in cryptocurrencies as speculative financial assets are primarily the high price volatility and criminal activities such as hacks and Ponzi schemes. The future development of cryptocurrencies is thus also linked to whether certain price stability will be achieved in the long term or whether price fluctuations can be better predicted. Many users of cryptocurrencies, however, accept the risk of high price volatility, as this simultaneously generates the chance of high profits with minimal investment. In addition to high price volatility, there are also risks associated with criminal activities that can further impact the market. In this context, a differentiation has to be made between hacks and exit scams. While the latter is a simple fraud that can also occur in other sectors, hacks have the potential to undermine trust in the cryptocurrency system as a whole and thus generate price fluctuations. Therefore, they point to the problem of security of such digital currency systems. Of the hacks carried out so far, more than 90 percent involved thefts of the cryptocurrency Bitcoin (Hu *et al.,* 2020, p. 11). For instance, in 2021, North Korea allegedly stole up to $400 million in digital assets to fund its missile programs, as reported by the UN (BBC, 2022). In addition to criminal activities such as theft through hacks, fraud such as Ponzi schemes, money laundering or tax evasion, cryptocurrencies have also been used to fund and transact organized crimes of violence.[91] Although the scale of illegal activity enabled by cryptocurrencies remains relatively small compared to cash and other forms of illicit transactions, according to a *Europol* report, that scale has increased in recent years (Europol, 2022).

Another factor are the future regulatory measures that could influence the intention to use cryptocurrencies. In general, a unified public stance of the Korean government towards cryptocurrencies is not yet apparent. Government regulation, similar to other financial

[91] In 2019, for instance, the largest child pornography darknet website funded by Bitcoin was taken down. A Korean national and hundreds of others around the world were prosecuted (U.S. Department of Justice, 2019).

assets, can have the objective of combating the use of these currencies for illicit activities, protecting users from fraud, and maintaining the integrity of both markets and payment systems, as well as financial stability as a whole. In their statements on regulatory measures, Korean authorities have consistently referred to protecting users from criminal activity as one of the main reasons (Financial Services Commission, 2018a). For instance, the necessity for regulations is further highlighted by the current upheavals in the international cryptocurrency market following the crash of the crypto stable coin project Terra in May 2022, the insolvency of Celsius Network, a cryptocurrency lending company, in July 2022, and the insolvency of the second largest cryptocurrency exchange platform FTX in November 2022. The dissolution of the cryptocurrency exchange FTX has also revealed that the assumption of decentralization cannot be fully maintained and that the crypto industry is to some extent similarly intertwined as the conventional financial world.[92]

In order to provide a more comprehensive legal framework, the Korean government currently plans to enact the Digital Asset Basic Act, which contains regulations for trading in digital assets. With this, the Korean government is pursuing the view that digital assets will endure in the long run and therefore regulations for this new asset class are necessary. According to the announcement, the legislation will take into account crypto regulations from the U.S. and other countries in the process. In this context, cryptocurrencies are classified in two ways. First, as tokens that function like securities, such as digital assets, and are regulated accordingly under existing capital markets law. Second, as tokens that are not securities, or utility tokens, which have functions other than that of an investment instrument, and are regulated accordingly under the new Basic Act to provide greater protection to investors. The Act is intended to formalize standards for issuing, listing, and preventing unfair trading to provide clarity for investors as well as companies (Park, 2022b).

Moreover, so far, the taxation of cryptocurrencies has not been regulated, meaning that since they are neither defined as cash money nor financial assets, they are tax-free at the moment. Starting in 2020, however, the Korean government began preparations for the

[92] The ensuing market instability has been compared to the *Lehman Brothers* moment that caused the 2008 financial crisis (Chipolina, 2022).

taxation of crypto trading profits, which included a new income tax law that provides for the taxation of crypto income at a rate of 20 percent of the profit from crypto transactions above an amount of 2.5 million Korean won (2,000 US-Dollar). Originally scheduled for 2022, it is expected to take effect in 2025, by which time the legal framework for defining cryptocurrencies and classifying virtual assets shall be in place (Park, 2021). It remains to be seen how users will perceive the regulations and taxation plans in the long term.

8.4 Limitations and Further Research Directions

The study's findings, while providing valuable insights, have several limitations that should be considered. First, the generalizability of the findings may be limited due to the study's focus on a specific sample population and the unique socio-cultural background, economic conditions, as well as cryptocurrency awareness and adoption levels in South Korea. As a result, the external validity of the findings to other regions or populations with different characteristics could be constrained. Replicating the study in different countries or conducting cross-country analyses would enhance the generalizability of the findings.

Second, the study's focus on a single country, South Korea, may restrict the generalizability of the results to other countries or regions. Various country-specific factors, including regulatory frameworks, cultural norms, economic conditions, and technological infrastructure, can significantly influence cryptocurrency adoption patterns. Therefore, the findings may not fully capture the diverse dynamics observed in different countries. Conducting cross-country analyses and comparative studies in future research would help to provide a more comprehensive understanding of the factors influencing cryptocurrency adoption on a broader global scale.

Third, the study may be subject to self-selection bias, as participants who are already interested or involved in cryptocurrencies may be more likely to participate in the study, which could affect the representativeness of the sample. This bias may hinder the ability to generalize the findings to a broader population. Additionally, the study may rely on self-reported data, which can be influenced by biases like social desirability or recall bias. This reliance on self-reported information may impact the accuracy and reliability of the findings. Moreover, the study's reliance on cross-sectional data collected at a single point in time provides only a snapshot of cryptocurrency adoption behavior. Longitudinal data that tracks adoption trends over time would offer a more comprehensive understanding of the behavior and dynamics involved.

In addition to addressing the above-mentioned limitations, future research should also place emphasis on exploring the broader applications of blockchain technology. While the current study focused on the adoption of Bitcoin, blockchain has far-reaching potential beyond cryptocurrencies. In this context, there exists a wide range of blockchain-based innovations that provide ample opportunities for research. This includes the possibility of conducting individual analyses of user behavior with regard to specific blockchain technologies, as well as exploring cross-technology or transnational comparisons of factors that shape user behavior. Examples of the broad field of blockchain technology are, for instance, smart contracts, which can facilitate and conduct transfers and other operations digitally on the basis of pre-programmed contract terms. Once activated, a smart contract cannot be changed and must run according to its program (Collins, 2022, p. 12). Another example are non-fungible tokens (NFTs), i.e., tokens that certify ownership of real-world or digital assets, such as art, music, collectibles, in-game items, as well as real estate. By being stored on a blockchain, NFTs can only ever have one official owner, and a previous record of ownership cannot be changed. NFTs have experienced a significant surge in demand in recent years (Eun-ju et al., 2022). Another case of illustration are the decentralized autonomous organizations (DAOs), which are collectively owned and managed by their members through smart contracts. DAOs offer features such as pre-programmed treasuries that control access through group consensus and voting systems based on predefined statutes and rules. As a result, the need for traditional general or financial managers is eliminated (Collins, 2022, p. 13). [93]

In addition to the private sector, government authorities are also exploring the possibilities of distributed ledgers, particularly with regard to the fourth industrial revolution and the concept of *Web3*, an Internet based on blockchain that incorporates concepts such as decentralization and token-based economies. Moreover, in 2018, Korea began developing a blockchain-based voting system, managed with decentralized identification technology

[93] An example of a *DAO* in Korea is the "*BIZA M DAO*" platform, which researches, arranges, and digitizes lesser-known or unreleased songs to promote emerging artists and protect copyrights (So-hyun, 2022).

(DID), that was tested in 2021 in the wake of the Corona pandemic. Advantages extend beyond pandemic prevention and include, for example, less time required of citizens and thus potentially higher voter turnout, reduction in election costs, and potentially more efficient counting. Disadvantages include vulnerability to hacking (Ledger Insights, 2021). In 2020, a digital blockchain-based driver's license was introduced that works through South Korea's PASS smartphone network (Mapperson, 2020). By 2024, Korea plans to establish a blockchain-based identity system by means of decentralized identity (DID) solutions to replace the card-based ID system. The digital identifiers would be used in conjunction with smartphones, along with a range of other activities such as administrative and financial processes (Kim, 2022). In addition, there is an ongoing discussion by the Korean government regarding the potential introduction of a digital central bank currency (CBDC) (Collins, 2022, p. 17).

Furthermore, one of the main and most challenging issues of blockchain technology, which has been insufficiently addressed so far, is the immense energy consumption. Estimates of total global electricity consumption for crypto assets currently range from 120 to 240 billion kilowatt-hours per year. For comparison, this exceeds the total annual electricity consumption of many individual countries such as Argentina or Australia (The White House, 2022). The energy consumed for one Bitcoin transaction could be equated to 500,000 transactions with MasterCard or Visa (Abraham *et al.,* 2019). As a potential solution, the second-largest cryptocurrency after Bitcoin, Ethereum, launched an update in September 2022 called Merge, which aims to make the Ethereum blockchain on which the cryptocurrency is based faster, more secure and, in particular, more sustainable. The update is said to reduce energy consumption by 99.95 percent. This is possible because the Ethereum blockchain was changed from the energy-intensive *proof-of-work* mechanism to the more energy-efficient *proof-of-stake* mechanism.[94] The potential impact of such energy consumption trends on the adoption of cryptocurrencies by user groups with regard to environmental challenges and climate change concerns is an issue that requires further investigations.

[94] Unlike in the proof-of-work mechanism, in which a large number of servers compete against each other to confirm transactions, in the proof-of-stake mechanism, one user – the so-called validator – is selected for this purpose. A random selection is made from among those users who deposit a portion of their crypto assets as security (Frankenfield, 2023b).

Overall, the above-mentioned developments of blockchain-based innovations and applications represent a promising avenue for future research in the area of technology acceptance and diffusion, allowing scholars to explore individuals' perceptions and attitudes toward such innovative technological advancements.

Appendices

Appendix 1: Construct Definitions and Measurement Scales

Section	Construct	Item	
A	**Demographic Characteristics**	Age	
		Gender	
	Experience Measurement scale (1 = never, 2 = once a year or less, 3 = every 6 months, 4 = every 3 months, 5 = monthly,6 = weekly, 7 = daily) (Abramova and Böhme, 2016b)	Q-1. I use digital-based financial services regularly	EXP1
		Q-2. I trade stocks, securities and currencies online on a regular base	EXP2
		Q-3. I engage on digital-based investment opportunities	EXP3
		Q-4. I'm experienced with speculative investments	EXP4
	Behavioral Intention (BI) Measurement scale (7-point *agree/disagree* Likert scale) (Johnston & Warkentin, 2010) (Vedadi and Warkentin, 2020)	Q-5. I intend to continue using Bitcoin in the future	BI1
		Q-6. I plan to use Bitcoin soon	BI2
		Q-7. I will always try to use Bitcoin in my daily life	BI3
		Q-8. I expect to participate in Bitcoin activities soon	BI4
B	**Performance Expectancy (PE)** Measurement scale (7-point *agree/disagree* Likert scale) (Alalwan *et al.*, 2017) (Abbasi *et al.*, 2021) (Arias-Oliva *et al.*, 2019)	Q-9. Using cryptocurrencies will increase my standard of living	PE1
		Q-10. Using Bitcoins increases my chances of achieving things that are important to me	PE2
		Q-11. Using Bitcoins help me achieve targets more quickly	PE3
		Q-12. Using Bitcoins would increase my financial productivity	PE4
	Effort Expectancy (EE) Measurement scale (7-point *agree/disagree* Likert scale) (Alalwan *et al.*, 2017) (Abbasi *et al.*, 2021)	Q-13. Learning how to use Bitcoins is easy for me	EE1
		Q-14. My interaction with Bitcoins is clear and understandable	EE2
		Q-15. Engaging in Bitcoins activities is simple	EE3
		Q-16. It is easy for me to become skillful at using Bitcoins	EE4
	Social Influence (SI) Measurement scale (7-point *agree/disagree* Likert scale) (Alalwan *et al.*, 2017) (Abbasi *et al.*, 2021)	Q-17. People who are important to me think that I should use Bitcoins	SI1
		Q-18. People who influence my behavioral think that I should use Bitcoins	SI2
		Q-19. People whose opinions that I value prefer that I use Bitcoins	SI3
		Q-20. The reflections of my social peer group usually	SI4

<table>
<tr><td rowspan="21"></td><td></td><td>influence my behavior</td><td></td></tr>
<tr><td rowspan="4">Facilitating Conditions (FC)

Measurement scale (7-point agree/disagree Likert scale)

(Beza et al., 2018) (Abbasi et al., 2021)</td><td>Q-21. I have the necessary resources to use Bitcoins</td><td>FC1</td></tr>
<tr><td>Q-22. I have the necessary knowledge to use Bitcoins</td><td>FC2</td></tr>
<tr><td>Q-23. Bitcoins is compatible with other technologies I use</td><td>FC3</td></tr>
<tr><td>Q-24. I can get help from others when I have difficulties using Bitcoins</td><td>FC4</td></tr>
<tr><td rowspan="4">Hedonic Motivation (HM)

Measurement scale (7-point agree/disagree Likert scale)

(Beza et al., 2018) (Abbasi et al., 2021)</td><td>Q-25. Using Bitcoins is fun</td><td>HM1</td></tr>
<tr><td>Q-26. Using Bitcoins is enjoyable</td><td>HM2</td></tr>
<tr><td>Q-27. Using Bitcoins is very entertaining</td><td>HM3</td></tr>
<tr><td>Q-28. Investing in Bitcoins is exciting</td><td>HM4</td></tr>
<tr><td rowspan="4">Price Value (PV)

Measurement scale (7-point agree/disagree Likert scale)

(Beza et al., 2018) (Abbasi et al., 2021)</td><td>Q-29. Bitcoins are reasonably priced</td><td>PV1</td></tr>
<tr><td>Q-30. The costs of investments in Bitcoins are affordable</td><td>PV2</td></tr>
<tr><td>Q-31. The cost associated with participating in Bitcoin's activities are reasonable</td><td>PV3</td></tr>
<tr><td>Q-32. At the current price, Bitcoins provides a good value for investment</td><td>PV4</td></tr>
<tr><td rowspan="4">Habit (HT)

Measurement scale (7-point agree/disagree Likert scale)</td><td>Q-33. I tend to act in accordance with past experience more than cognitive reasoning</td><td>HT1</td></tr>
<tr><td>Q-34. I perform activities automatically after engaging in it for few times</td><td>HT2</td></tr>
<tr><td>Q-35. I tend to develop new habits quickly</td><td>HT3</td></tr>
<tr><td>Q-36. Making new habits is easy for my</td><td>HT4</td></tr>
<tr><td rowspan="8">C</td><td rowspan="4">Perceived uncertainty (UNC)

Measurement scale (7-point agree/disagree Likert scale)

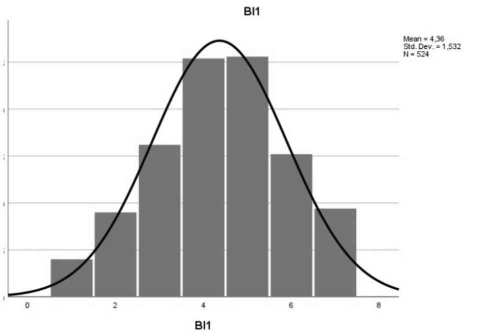
(Sun, 2013) (Vedadi and Warkentin, 2020)</td><td>Q-37. I am NOT sure what Bitcoins is about and what it can do for me</td><td>UNC1</td></tr>
<tr><td>Q-38. I feel uncertain whether my needs could be met by using Bitcoins</td><td>UNC2</td></tr>
<tr><td>Q-39. I feel uncertain whether I would be able to respond appropriately to any changes/upgrades of the Bitcoins system</td><td>UNC3</td></tr>
<tr><td>Q-40. I feel that using Bitcoin involves a high degree of uncertainty</td><td>UNC4</td></tr>
<tr><td rowspan="4">Discounting one's own information (DOI)

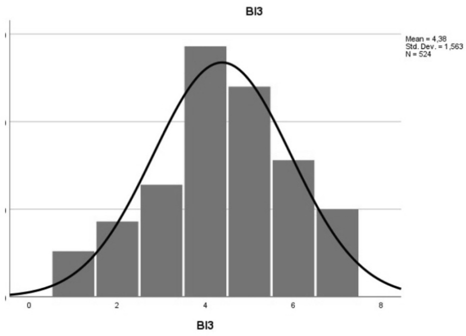
Measurement scale (7-point agree/disagree Likert scale)

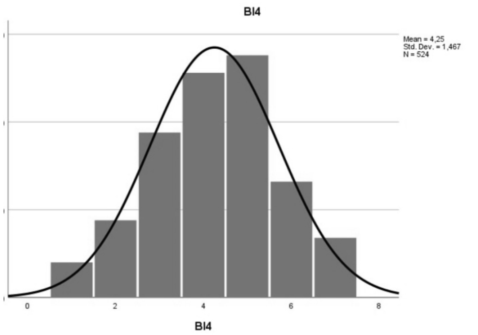
(Sun, 2013) (Vedadi and Warkentin, 2020)</td><td>Q-41. I do not fully trust my own thinking about how Bitcoins could work for me</td><td>DOI1</td></tr>
<tr><td>Q-42. I would not necessarily follow my own thoughts about Bitcoins' features</td><td>DOI2</td></tr>
<tr><td>Q-43. I would not rely only on my own information about how Bitcoins works</td><td>DOI3</td></tr>
<tr><td>Q- 44. My own information is usually not sufficient for investment decisions</td><td>DOI4</td></tr>
</table>

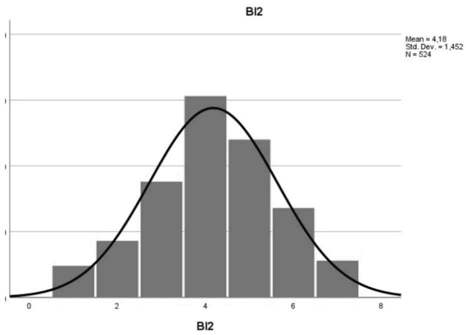
	Imitation (IMI) Measurement scale (7-point *agree/disagree* Likert scale) (Sun, 2013) (Vedadi and Warkentin, 2020)	Q-45. It seems that Bitcoin is widely-used, therefore I would like to use it too	IMI1
		Q-46. I follow others in deciding to use Bitcoins	IMI2
		Q-47. I would choose to use Bitcoins because many others are already using it	IMI3
		Q-48. My investment decision usually follows social media	IMI4
D	**Individualism/Collectivism (IC)** Measurement scale (7-point *agree/disagree* Likert scale) (Hofstede, 2011) (Huang *et al.*, 2019)	Q-49. Individuals should sacrifice their self-interest for the interest of the groups they belong to	IC1
		Q-50. Individuals should stick with the group even when facing difficulties	IC2
		Q-51. Group interest/welfare is more important than individual interest	IC3
		Q-52. Being accepted as a member of a group is more important than having autonomy and independence	IC4
	Uncertainty Avoidance (UA) Measurement scale (7-point *agree/disagree* Likert scale) (Hofstede, 2011) (Huang *et al.*, 2019)	Q-53. Specific rules or regulations are important to me	UA1
		Q-54. Detailed instructions are important to me.	UA2
		Q-55. Standardized operating procedures help me follow suit	UA3
		Q-56. The best option is to closely follow requirements, instructions and procedures	UA4
	Power Distance (PD) Measurement scale (7-point *agree/disagree* Likert scale) (Hofstede, 2011) (Huang *et al.*, 2019)	Q-57. People should make most of their decisions by consulting/discussing with administrators/superiors	PD1
		Q-58. Administrators/superiors should use authority and power when dealing with subordinate	PD2
		Q-59. Students should agree with administrators/superiors' decisions	PD3
		Q-60. Instructors should avoid social interaction with students	PD4

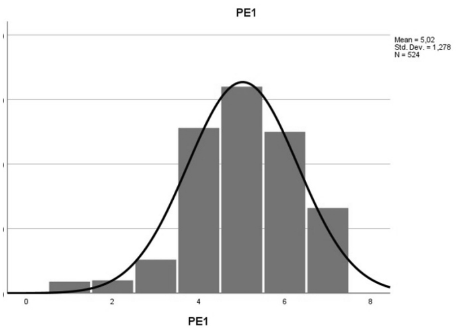
Appendix 2: Histograms and Descriptive Statistics

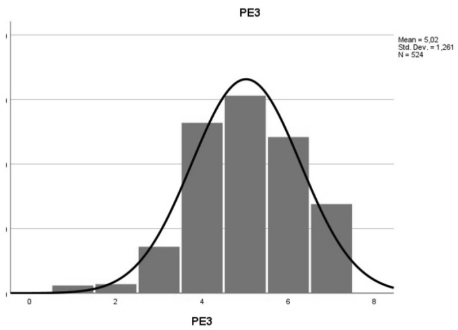


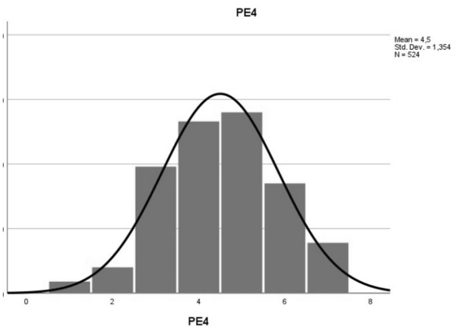


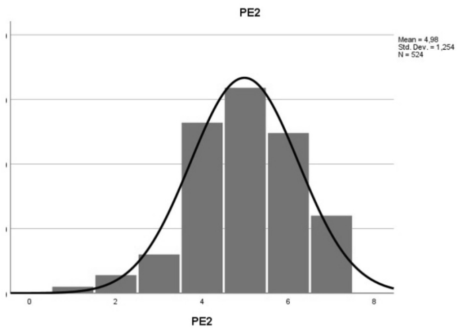


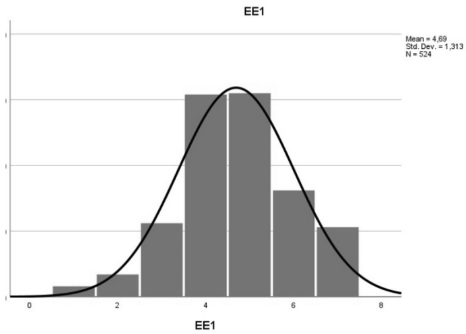








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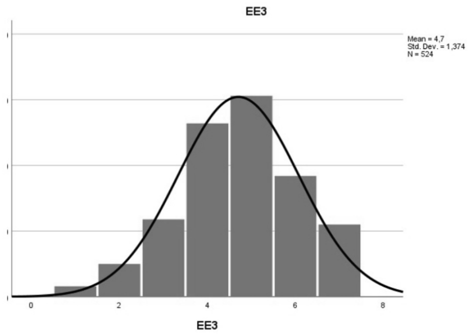
2
4
6
8
EE1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8
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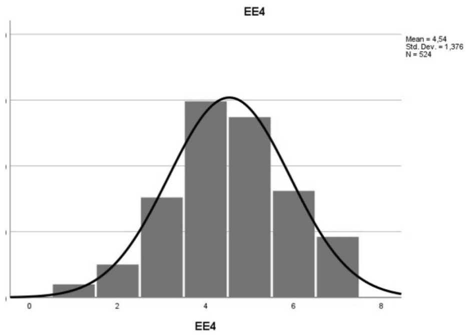
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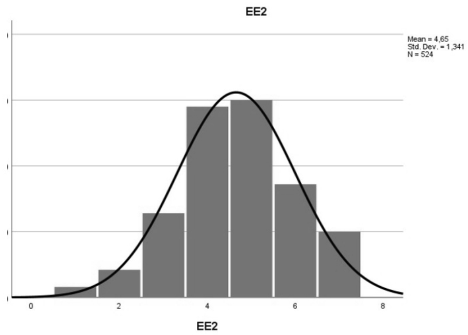
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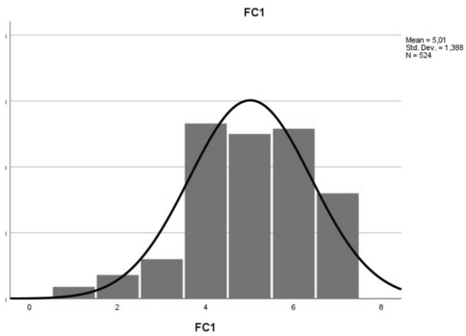
2
4
6
8
EE2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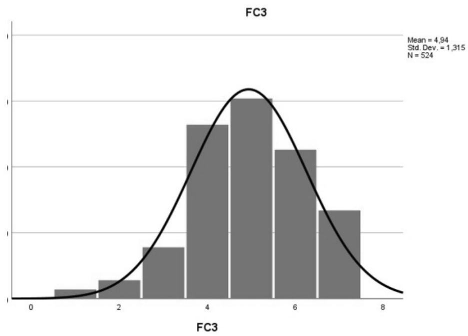
4
6
8
FC1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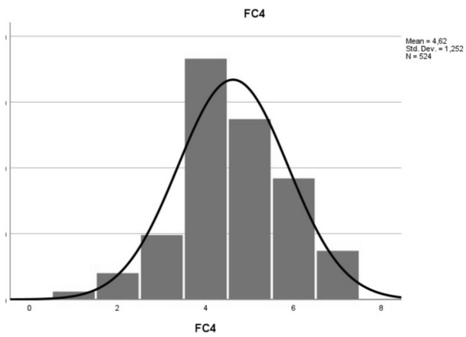
4
6
8
FC3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4
6
8
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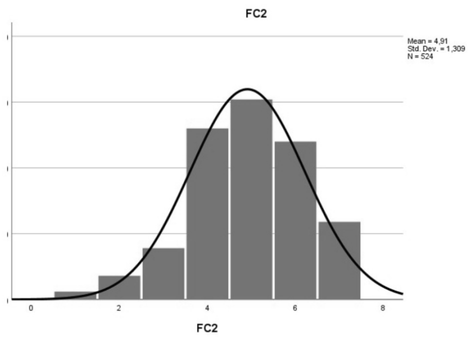
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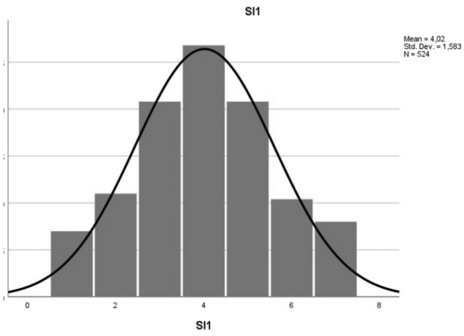
2
4
6
8
FC2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Std. Dev. = 1,583
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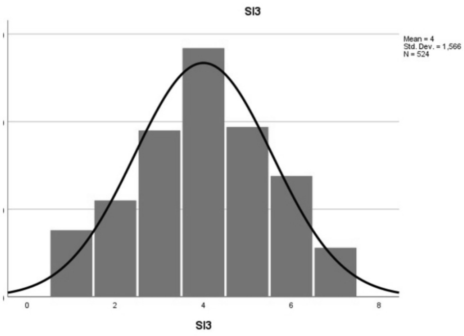
2
4
6
8
SI1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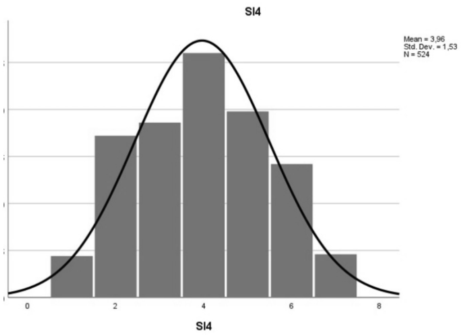
SI3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6
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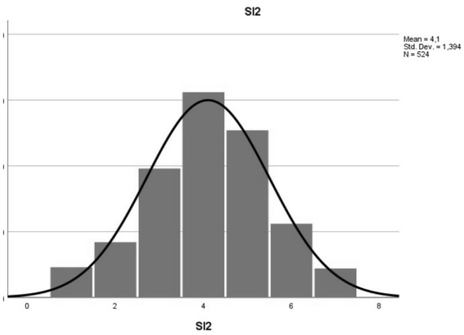
SI4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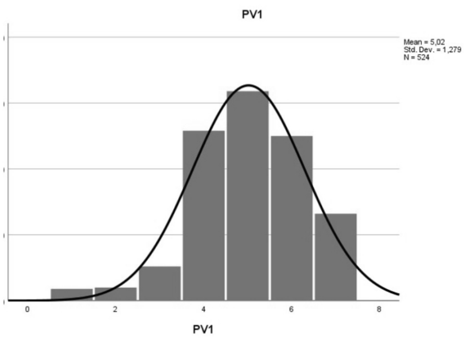
4
6
8
SI2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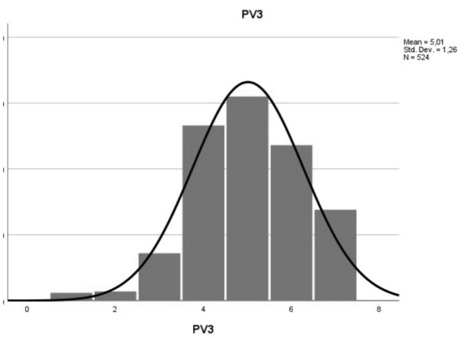
6
8
PV1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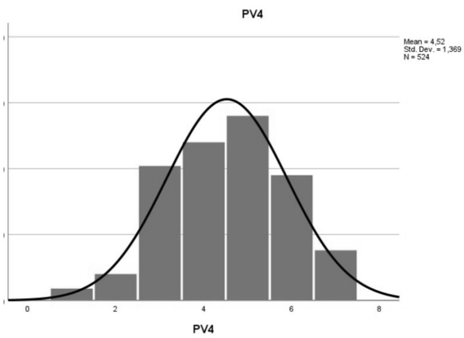
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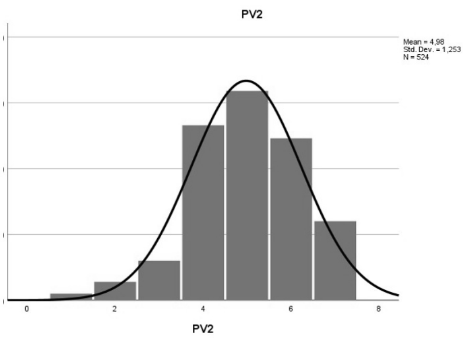
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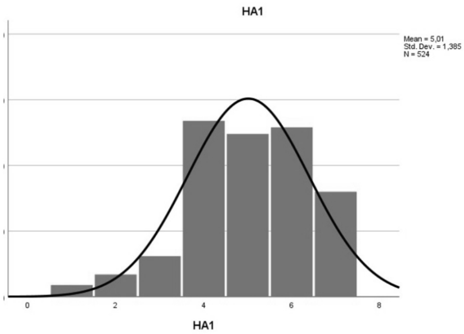
4
6
8
PV2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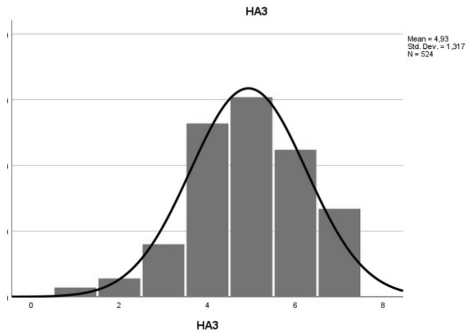
HA1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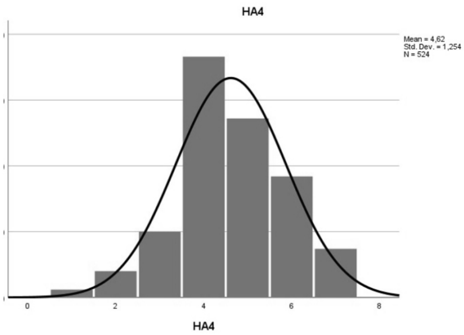
HA3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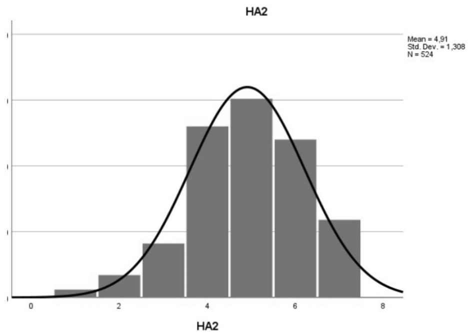
HA4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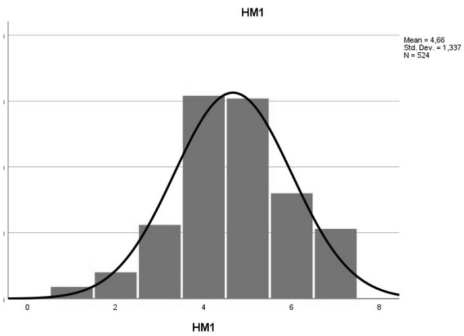
HA2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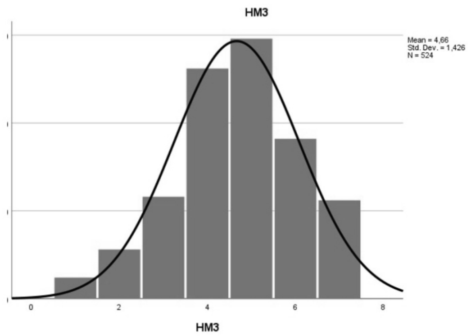
HM1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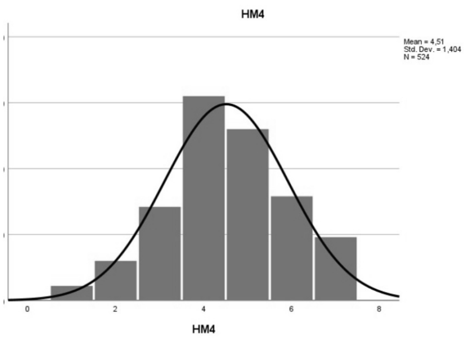
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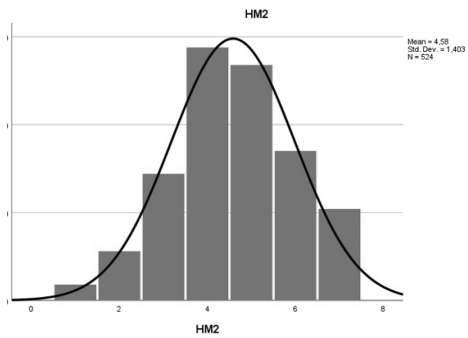
HM4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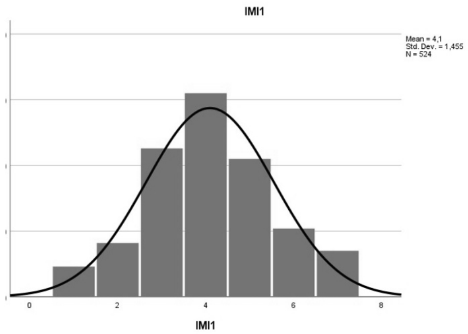
HM2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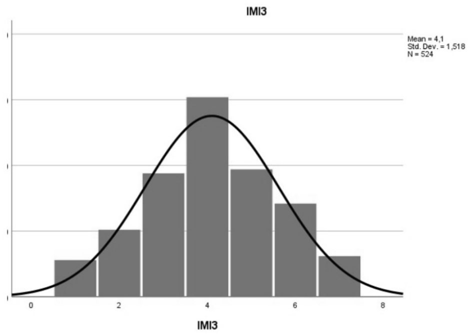
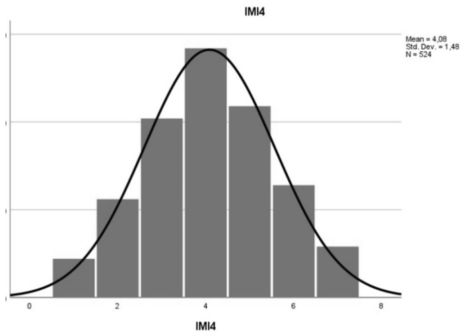
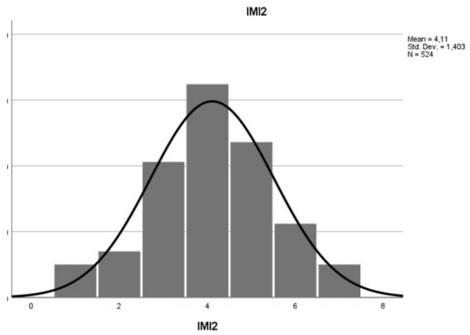
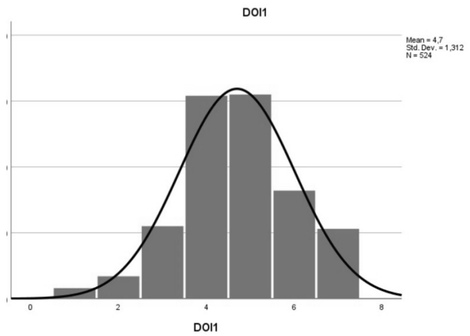
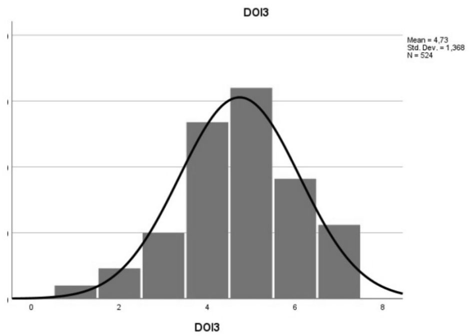
4
6
8
IMI1

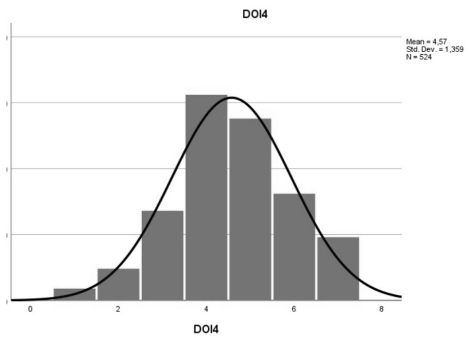

IMI3
Mean = 4,1
Std. Dev. = 1,518
N = 524
0
2
4
6
8
IMI3

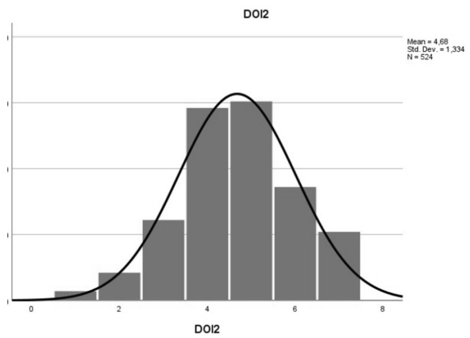

IMI4
Mean = 4,08
Std. Dev. = 1,48
N = 524
0
2
4
6
8
IMI4

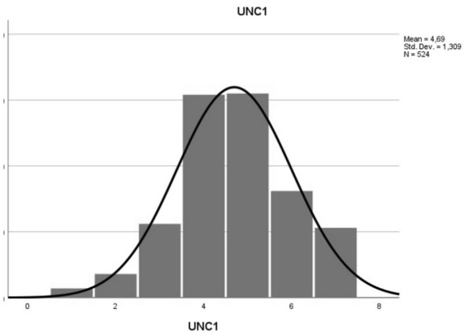

IMI2
Mean = 4,11
Std. Dev. = 1,403
N = 524
0
2
4
6
8
IMI2

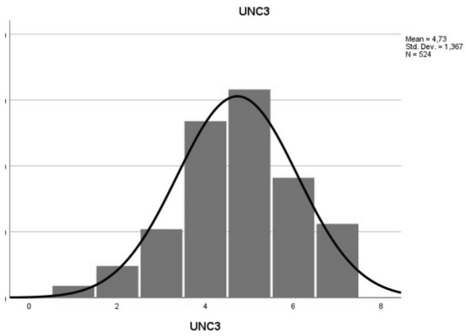

DOI1
Mean = 4,7
Std. Dev. = 1,312
N = 524
0
2
4
6
8
DOI1

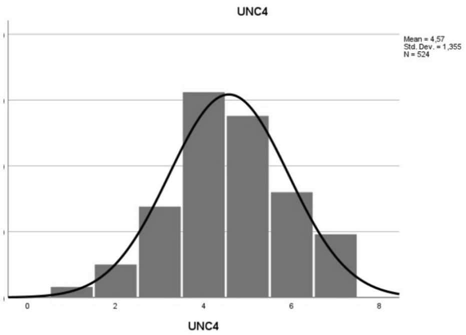

DOI3
Mean = 4,73
Std. Dev. = 1,368
N = 524
0
2
4
6
8
DOI3

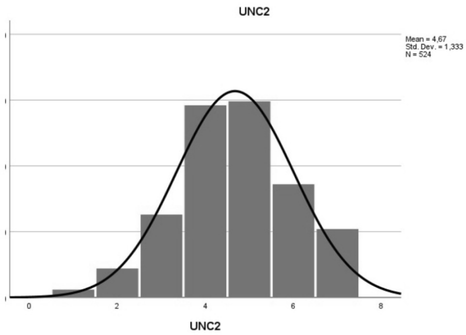

DOI4
Mean = 4,57
Std. Dev. = 1,359
N = 524
0
2
4
6
8
DOI4

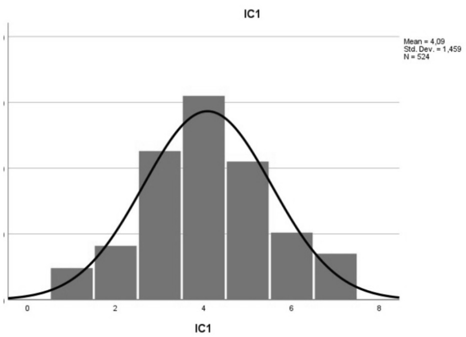

DOI2
Mean = 4,68
Std. Dev. = 1,334
N = 524
0
2
4
6
8
DOI2

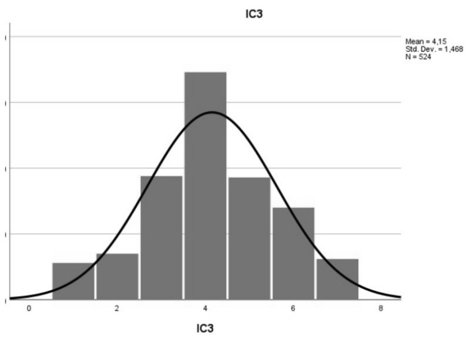

UNC1
Mean = 4,69
Std. Dev. = 1,309
N = 524
0 2 4 6 8
UNC1

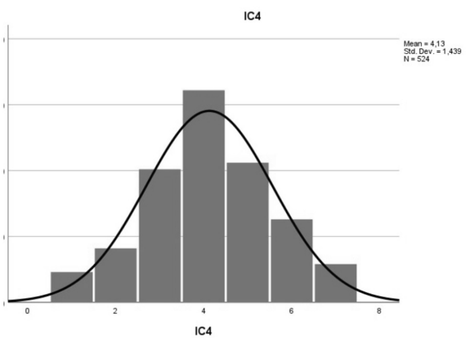

UNC3
Mean = 4,73
Std. Dev. = 1,367
N = 524
0 2 4 6 8
UNC3

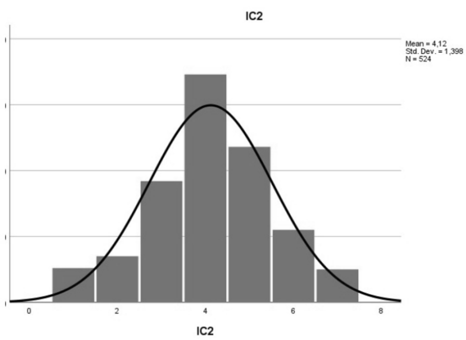

UNC4
Mean = 4,57
Std. Dev. = 1,355
N = 524
0 2 4 6 8
UNC4

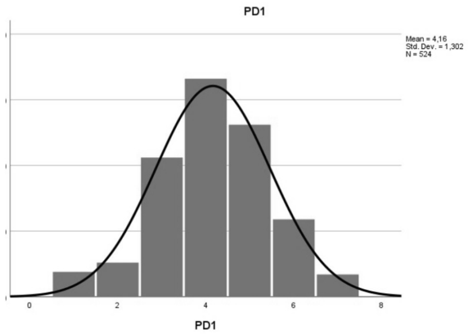

UNC2
Mean = 4,67
Std. Dev. = 1,333
N = 524
0 2 4 6 8
UNC2

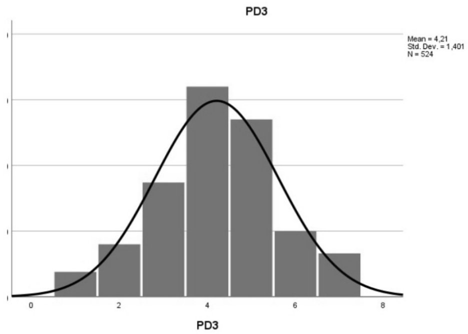

IC1
Mean = 4,09
Std. Dev. = 1,459
N = 524
0 2 4 6 8
IC1

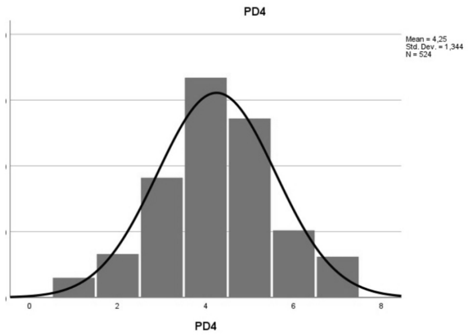

IC3
Mean = 4,15
Std. Dev. = 1,468
N = 524
0 2 4 6 8
IC3

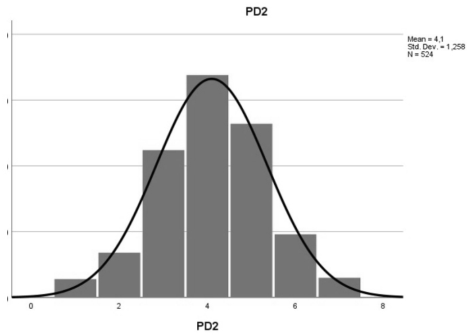

IC4
Mean = 4,13
Std. Dev. = 1,439
N = 524
0 2 4 6 8
IC4

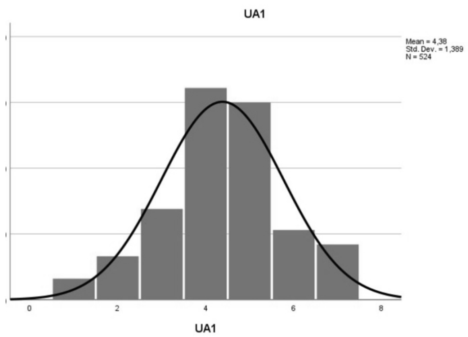

IC2
Mean = 4,12
Std. Dev. = 1,398
N = 524
0 2 4 6 8
IC2

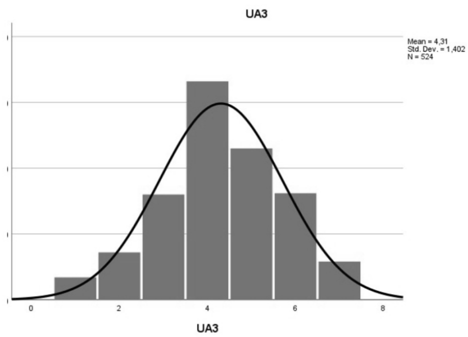

PD1
Mean = 4,16
Std. Dev. = 1,302
N = 524
PD1

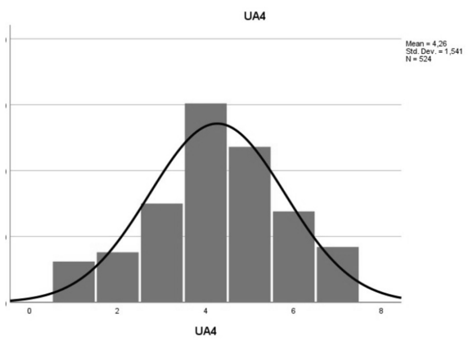

PD3
Mean = 4,21
Std. Dev. = 1,401
N = 524
PD3

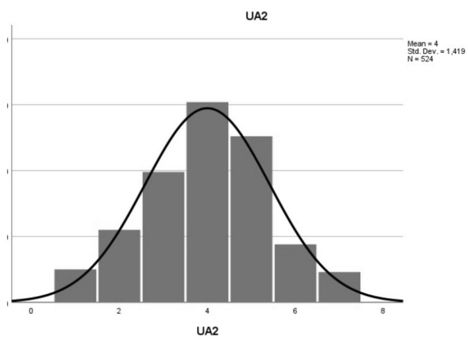

PD4
Mean = 4,25
Std. Dev. = 1,344
N = 524
PD4

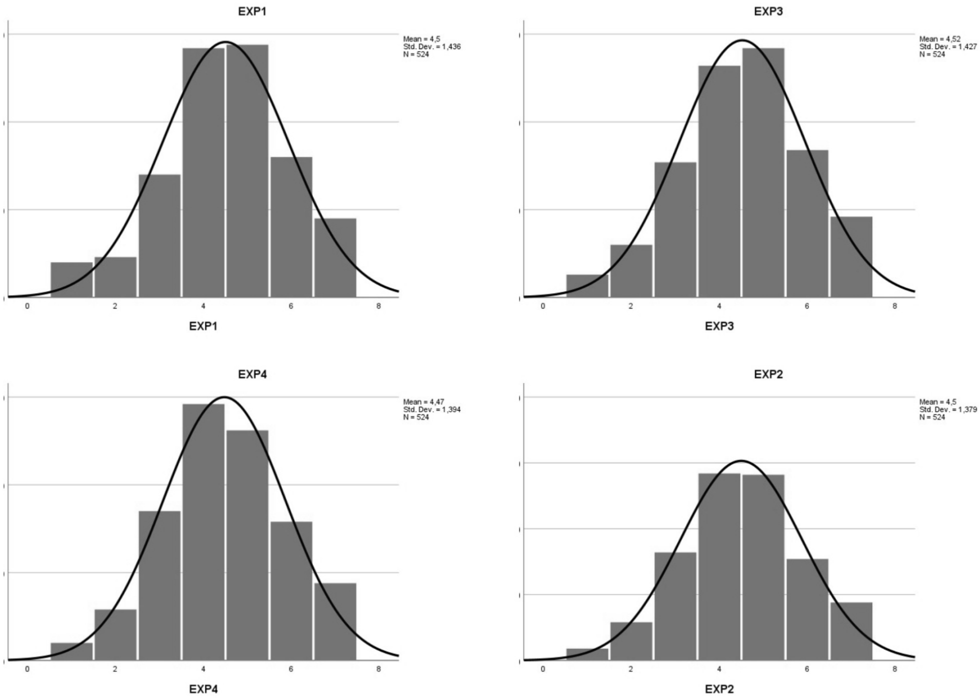

PD2
Mean = 4,1
Std. Dev. = 1,258
N = 524
PD2


UA1
Mean = 4,38
Std. Dev. = 1,389
N = 524
UA1


UA3
Mean = 4,31
Std. Dev. = 1,402
N = 524
UA3


UA4
Mean = 4,26
Std. Dev. = 1,541
N = 524
UA4


UA2
Mean = 4
Std. Dev. = 1,419
N = 524
UA2


EXP1
Mean = 4,5
Std. Dev. = 1,436
N = 524
0 2 4 6 8
EXP1
EXP3
Mean = 4,52
Std. Dev. = 1,427
N = 524
0 2 4 6 8
EXP3
EXP4
Mean = 4,47
Std. Dev. = 1,394
N = 524
0 2 4 6 8
EXP4
EXP2
Mean = 4,5
Std. Dev. = 1,379
N = 524
0 2 4 6 8
EXP2

Appendix 3: Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	108	879.459	558	.000	1.576
Saturated model	666	.000	0		
Independence model	36	17243.127	630	.000	27.370

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.055	.915	.898	.766
Saturated model	.000	1.000		
Independence model	.642	.198	.152	.187

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.949	.942	.981	.978	.981
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.886	.841	.869
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	321.459	244.781	406.064
Saturated model	.000	.000	.000
Independence model	16613.127	16188.294	17044.316

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	1.682	.615	.468	.776
Saturated model	.000	.000	.000	.000
Independence model	32.970	31.765	30.953	32.590

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.033	.029	.037	1.000
Independence model	.225	.222	.227	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	1095.459	1111.904	1555.700	1663.700
Saturated model	1332.000	1433.407	4170.153	4836.153
Independence model	17315.127	17320.608	17468.541	17504.541

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	2.095	1.948	2.256	2.126
Saturated model	2.547	2.547	2.547	2.741

Model	ECVI	LO 90	HI 90	MECVI
Independence model	33.107	32.295	33.932	33.118

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	366	380
Independence model	21	22

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