

Article

User Acceptance of Blockchain Technology in Financial Applications: Information Security, Technology Awareness and Privacy Aspects

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Abstract: Blockchain technology is now an advanced and innovative database technology and the attributes of blockchains are apparent in a variety of industries, especially in the financial industry. One of the most famous blockchain use cases, cryptocurrencies, has provoked much interest in social network users and customers. According to CoinMarketCap's information, the global crypto market capitalization has reached around USD 2.37 T and there are around 9975 different cryptocurrencies available in the market. Despite the fact that academia and industry have paid much attention towards the blockchain direction, there is not much research on the factors that influence customer acceptability. This paper studies blockchains from a different angle, probing the factors prompting customers to use financial applications that utilize blockchain technology. We established the model and sorted the individual factors of perceived information security, technology awareness and privacy and found that users' acceptance is significantly affected by information security and technology awareness, while privacy does not significantly influence users. According to the findings, we provide useful insights for application developers, conclude by presenting the limitations of the research and provide guidelines for future research.



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Keywords: blockchain; financial application; information security; privacy; technology awareness

1. Introduction

A blockchain is a distributed ledger that does not require a third-party intermediary [1] and consists of many lists of records securely linked together by cryptographic hashes, and each block contains a cryptographic hash, timestamp, and transaction data of the previous block [2]. In addition, blockchain technology has the characteristics of being tamper-proof, anonymous and consistent, they can effectively resist hacker intrusions like distributed denial-of-service (DDoS) attacks and they can also publicly track the address of the sender and receiver of the transaction to prevent fraud with fake names and addresses [3]. Dr. Adam Back, as a practical cryptographer, is best known for his invention of Hashcash, a proof-of-work system that can limit spam and denial-of-service attacks, which is widely used in the mining algorithms of Bitcoin and other cryptocurrencies [4].

A blockchain-like protocol was first proposed by cryptographer David Chaum in his 1982 paper [5]. Stuart Haber and W. Scott Stornetta [6] described further research into cryptographically secure blockchains about nine years later. Finally, the first decentralized blockchain was proposed in 2008 by a person or organization named Satoshi Nakamoto [7]. In the same year, the concept of cryptocurrency, electronic cash, emerged, based on the idea of blockchain and combining several other technological and computational concepts, and the most famous one was Bitcoin [8].

Blockchain uses innovative technology combined with an encryption algorithm and consensus mechanism to ensure the privacy and security of the financial industry and has been applied in many fields including digital currency, the Internet of Things, the smart

grid and supply blockchains [9]. However, it is difficult for certain properties of blockchain applications, such as their transparency, confidentiality and security, to coexist, and there is still a certain risk of privacy disclosure [10]. Monero protects users and their transactions from attacks by providing a high degree of anonymity; however, the new cryptocurrency “Traceable Monero” tends to further balance the anonymity of users with the responsibility of being ignored by the former [11].

To address this shortcoming, experts have also introduced encryption protocols such as zero-knowledge proof (ZKP) and secure multi-party computation (SMPC) and have also required blockchain code to run in a trusted execution environment (TEE) with isolated protection [3].

In this article, we further explore the factors that influence users’ acceptance of blockchain technology in financial applications by analyzing a large number of previous studies from the literature. Through the analysis of first-hand data collected from a questionnaire, we conducted targeted research on age and gender and concluded that age acceptance has a negative impact while gender is irrelevant. We revealed the significant impact of information security and privacy on the degree of blockchain links and drew some further conclusions in terms of risks. Unlike the previous literature, we believe that technical awareness has no significant impact. This study provides useful theoretical and practical insights into blockchain technology, making a key contribution to identifying the driving factors and barriers to blockchain technology in the financial sector.

The remaining paper is structured into six sections. In Section 2, we review the relevant literature and introduce the reference models. In Section 3, we elaborate on the research purpose, framework and methods, as well as the hypotheses. We analyze and process the data collected from the questionnaire in Section 4 and present the specific results of the empirical analysis in Section 5. In Section 6, we discuss our results and compare them with the previous literature and finally, we provide a conclusion and some future works in Section 7.

2. Literature Review

2.1. Blockchain Technology’s Application in the Financial Field

There are three main theories related to blockchain finance and economics. The first one is digital economy theory, which was proposed by Illing and Peitz in 2005 [12]. The theory promotes the combination of computer and communication technologies and ultimately realizes the complete digitization of goods and services in different fields such as manufacturing, sales and the supply chain. Secondly, Chen [13] proposed the free currency theory from Marx’s economic philosophy perspective, investigating the relationship between money and freedom. The paper points out that digital currencies can be freely exchanged in blockchain economy and iterate at a rapid rate. Last, Marcel et al. [14] adopted the information asymmetry theory. The theory examines the trust problem, providing methodological guidance for blockchain finance and economics. In recent years, blockchain technology has been increasingly used in the economic and financial fields, such as cross-border payment and digital asset registering and management. Some people further proposed that blockchain technology is a tool that can rebuild the credit system of financial markets [10]. Taking the first one as an example, blockchain technology will help improve the shortcomings of traditional cross-border payments like their time-consuming nature, high cost, high capital occupation, and low security, theoretically. In fact, many related companies around the world are already in contact and collaborate with blockchain operation companies, such as the American Express Foreign Exchange International Payment Company.

Currently, many people have conducted research on blockchain technology applied to the Internet of Things (IoT) and the supply chain. Alfandi et al. [15] provided an in-depth analysis of utilizing blockchain technology to address security and privacy issues in IoT systems. Some other research explores the integration of blockchain with emerging technologies such as artificial intelligence and secure multi-party computing and summarizes many cutting-edge solutions [16].

2.2. Opportunities and Challenges Faced by Blockchain Technology

Many researchers focus on the opportunities and broad development prospects of blockchain technology. Nærland, K. et al. [17] demonstrated how the use of blockchain technology may reduce transactional risk and uncertainty in decentralized environments and help to make information management operations in international trade more secure, effective, and reliable. Kaur, G. et al. [18] investigate potential new ways for involving innovation in blockchain technology and demonstrate how the use of blockchain reduces handling time for reports and exchange expenses and increases the level of transparency in exchange financing. Son, B. et al. [19] show that the Hashed Timelock Contract (HTLC), which is much faster than conventional settlement methods, is a representative technique for implementing atomic swaps in public blockchains. The findings suggest that the HTLC could improve not only the utilities of its participants but also social welfare.

More people are focusing on the challenges faced by blockchain technology, especially information security risks. Firstly, some information in the blockchain is public, which means everyone can read, receive and send it, making it easier for attackers to invade and obtain information. The disclosure of some addresses and transaction content also poses security issues. Some properties of blockchain applications struggle to co-exist, including their transparent, confidential and secure nature [3]. Secondly, blockchain technology is still in the research stage, and there is currently no mature regulatory standard. Vulnerabilities in smart contracts and service systems are often attacked by hackers [9]. Additionally, Li and Juma'h [1] showed that despite its innovativeness, the complexity of this technology, lack of clear value propositions and information security considerations may greatly prevent blockchain from becoming mainstream.

In terms of problem-solving, Zhang et al. [20] provide some state-of-the-art references on blockchain security and privacy, which may have a significant impact on future blockchain research and security engineering work. Zaghloul et al. [21] have established mathematical models on the success probability and profitability of dual expenditure attacks in blockchains, discussing network attacks, wallet security and privacy restrictions, which are crucial for improving the level of trust that blockchains may provide.

2.3. Consumers' Adoption Intention for Blockchain Technology in E-Commerce

Although blockchain technology has been hyped for over a decade, there is still little research on the factors that affect the willingness of blockchain adoption in the field of commercial e-commerce, and the existing literature tends to analyze it at the organizational level rather than investigating the behavior of individual participants [22,23].

Miyazaki and Fernandez [24] make an important contribution in unraveling the nuances of consumer risk perceptions. Felin and Lakhani [25] suggest that due to various concerns in the field of e-commerce, such as fraud, limited transparency, limited contact between buyers and sellers, and misuse of data privacy, customers still hold a strong skepticism towards blockchain technology.

A lack of understanding of blockchain technology is also considered a very important factor. One research study suggested that users did not pay attention and worry about security and privacy risks when using bank online services, which may be due to ignorance [26]. Grover et al. [27] investigated the fact that initial coin issuance (ICO) was widely discussed on Twitter, which may be considered as one of the signs that users are willing to accept blockchain technology, but it is also possible that users are simply not aware of the drawbacks of blockchain.

2.4. Introduction of Basic Models

The Technology Acceptance Model (TAM) [28,29], one of the most influential extensions of Theory of Reasoned Action (TRA) [30], is an information system theory that studies how a new technology can be accepted and used by users. Davis' Technology Acceptance Model [31] is regarded as the most widely used model in this area [32]. Davis proposed two new technical metrics: perceived ease-of-use and perceived usefulness, with the former

being defined as ‘the degree to which a person believes that using the specific system will be effortless’ and the latter defined as ‘the degree to which a person believes that using the specific system will improve their work performance’. The higher the degree of both, the easier it is for the system to be accepted. In recent years, the TAM has incorporated the impact of trust and perceived risk on system usage in order to fit the development of e-commerce [33].

Goodhue and Thompson conducted research on Task-Technology Fit (TTF) and Technology to Performance Chain (TPC) models in 1995, proposing that the TPC model is a comprehensive model based on attitude and behavior theories (such as TAM, UTAUT) and TTF to explain the relationship between information technology and individual performance [32]. They incorporated the impact of personal characteristics on technology and task adaptation into the model, attempting to study technology users from a personal, psychological perspective.

3. Methodology

3.1. Research Purposes and Significance

In recent years, blockchain technology has seen widespread adoption across the financial industry, such as banks and other financial institutions, for fraud prevention and international payments [34], and the development prospects in this field are very promising for the future [35,36]. Various articles focus on exploring consumer perceptions and acceptance of this technology in terms of the application of blockchain technology in the financial sector.

This study utilizes several theories (risk perception) to identify several factors that influence consumer acceptance and uses the Technology Acceptance Model (TAM) to study how those factors affect people’s acceptance.

With the widespread application of blockchain technology in various fields, its future development trends are also drawing much attention. However, the security issues that have appeared in financial applications, such as network attacks, private key leaks and smart contract vulnerabilities [10], may also affect consumers’ acceptance of blockchain, thus indirectly affecting the market size of this technology. For blockchain providers, it is necessary to study what influences consumers’ acceptance of blockchain technology in the financial field. Despite this, existing domestic and foreign research on blockchains is mainly focused on the application, security, development and prospects of blockchains, rather than consumer acceptance. Blockchain technology is increasingly valued by both individuals and organizations. However, there is a lack of research on consumer acceptance of it, and this article aims to address that gap and highlights the close connection between the application of blockchain technology in the financial sector and acceptance of it from the perspectives of information security, privacy and technology awareness.

Based on the Technology Acceptance Model (TAM) and the Technology-to-Performance Chain (TPC) Model from Goodhue and Thompson [37], this study explores the factors affecting consumer acceptance, which academically supplements the research of blockchains. At the same time, this study integrates theories and models which are commonly used in consumer acceptance research to explore the secure application of blockchain in the financial field, as well as to provide more opportunities for the development of certain fields. Finally, this study analyzes the main factors affecting consumer acceptance and provides corresponding improvement methods to facilitate blockchain developers to improve this technology and contribute to ensuring blockchain security. Furthermore, this study can support the managers of the business to better understand the attitudes of consumers in accepting blockchain technology and also find out how to improve and apply the technologies in different fields, thereby promoting wider usages.

3.2. Research Framework and Method

We start from the view of the literature to learn previous researchers’ perspectives and findings about blockchain technology. This paper studies the literature about the

opportunities and challenges of blockchain technology, its application in the financial field and the adoption intentions for blockchain technology in related areas. We discuss three parts of the literature review and provide further thinking toward our research direction, from which we can obtain appropriate factors and impacting mechanisms. Then, we construct our hypotheses and establish the model. The research model used is intended to analyze the factors that impede blockchain technology acceptance. Hence, this model expands the research by focusing on information security, privacy, technology awareness, along with age and gender relationship. Additionally, the research model is shown in Figure 1, and it combines these constructs and hypotheses. In addition, we conduct a survey to support the hypothesis testing. Finally, we use descriptive statistical analysis and measurement model analysis to analyze the implications from the survey results.

3.2.1. Survey Method

Surveys are one of the most commonly used basic methods in scientific research, aiming to collect materials about the reality or historical situation of the research object in a purposeful, planned and systematic way. A large number of data collected by the investigation are analyzed, integrated, compared and summarized, so as to find regular knowledge or summarize meaningful findings. This paper adopted the questionnaire method, set a series of related questions on the survey project and compiled them into a table, which was distributed by an online link and paper form to recipients who met our requirements. Then, the valid questionnaires obtained were collected, sorted, screened and counted for follow-up research.

3.2.2. Empirical Approach

The empirical analysis method is in accordance with the current social or scientific reality and relies on previous experience and examples. It combines theories, observations and the use of analytical tools to conduct experiments, provide explanations and finally draw a conclusion. This paper collected the above-described valid questionnaires and cleaned the data obtained from them, used Excel to check the validity and significance of the data, combined SAS and Python to study the data distribution, and analyzed the users' attitudes toward blockchain technology and the main factors affecting their acceptance of blockchains.

3.2.3. Functional Analysis

Functional analysis is usually used to explain a certain social phenomenon by analyzing the internal structural relations and the mutual influence of each element in terms of form and content. In addition, it also determines whether these effects are potential, obvious, positive or negative, and under what conditions. This paper divides the research objects according to gender and age and uses measurement model analysis (MMA) to discuss the correlation among information security, privacy, technology awareness and other factors that impact the acceptance of blockchain technology.

3.2.4. Empirical Analysis—Research Model and Hypotheses Building

Based on the literature review and theoretical basis of this research, a user's acceptance of blockchain technology or not is mainly influenced by related security concerns and related performance. In this paper, we take these factors into account for our model. Based on this, we also introduce age and gender as our independent variables. Furthermore, we go over each variable's underlying assumptions in more depth. The research model that analyzes the user's acceptance of blockchain technology in the financial industry is shown in Figure 1 below.

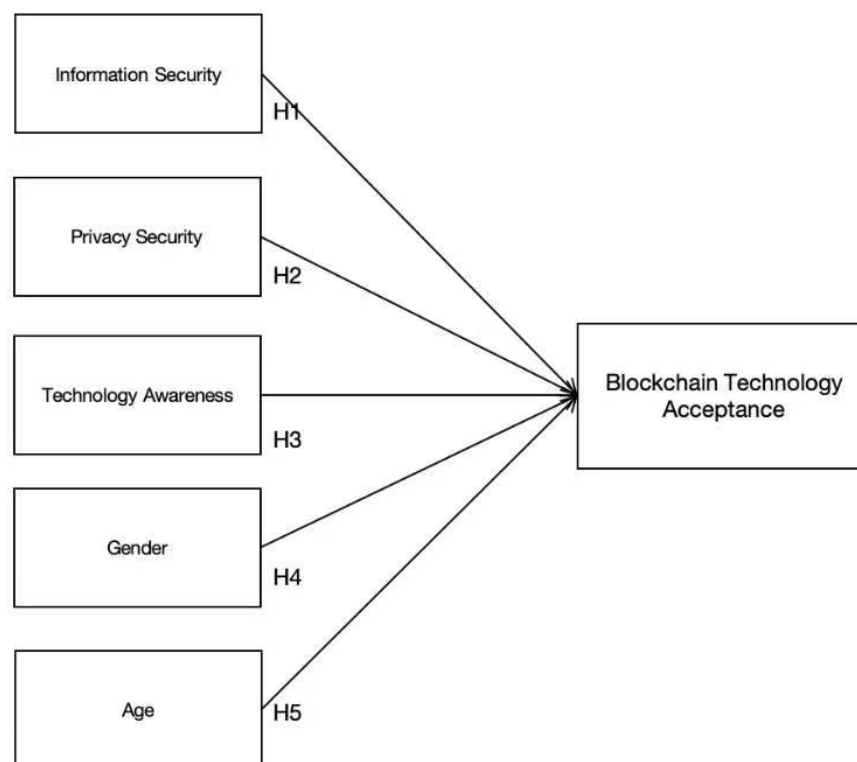


Figure 1. Research model.

Security Concerns: Users often associate blockchain technology with enhanced security due to its decentralized nature. However, concerns may arise regarding the safety of financial information on a blockchain. The perception that blockchain transactions are irreversible might lead users to worry about potential breaches or unauthorized access. In the TPC model, system reliability is crucial for technology acceptance. If users are doubtful about the security of their financial data due to blockchain's decentralized nature, it can lead to a negative impact on acceptance.

Instances of data breaches and security vulnerabilities in various blockchain applications may contribute to users' apprehension. High-profile cases, even if unrelated to financial blockchain applications, can create a general atmosphere of mistrust. Also, if users believe that the security features of blockchain may lead to performance issues, such as delays in transactions or system downtimes, it can contribute to concerns about information security and negatively influence acceptance. Therefore, the following hypothesis is derived:

H1. *Perceived information security has a negative impact on users' acceptance of blockchain technology in the financial industry.*

Enhanced Privacy Features: Blockchain's reputation for providing a transparent yet private ledger can be a double-edged sword. Users may view the technology positively, anticipating heightened privacy in financial transactions. Blockchain's decentralized nature can instill trust in users regarding the confidentiality of their financial dealings. The perception that transactions are secure and private, visible only to relevant parties, may positively impact acceptance.

If users perceive that blockchain's privacy measures lead to a more efficient and secure financial system, the positive impact on performance can contribute to a favorable stance regarding acceptance. Based on these reasons, the following hypothesis is proposed:

H2. *Perceived privacy has a positive impact on users' acceptance of blockchain technology in the financial industry.*

The TPC model considers performance expectancy as a determinant of technology acceptance. If users understand how blockchain can improve the efficiency, security and transparency of financial transactions, their positive performance expectations can contribute to higher acceptance. It underscores the fit between technology and tasks. Users with a better understanding about blockchain's features, such as its use of encryption and pseudonyms, understand how these contribute to enhanced financial transactions. Users who are well-versed in blockchain's principles are more likely to discern the technology's advantages, reducing uncertainty and fostering a positive stance regarding acceptance. They may perceive a stronger alignment between the technology and financial task, influencing their acceptance based on the perceived suitability for their needs. Therefore, users with a higher level of understanding of blockchain technology are likely to appreciate its benefits and potential, which can positively influence their acceptance. Therefore, the following hypothesis is derived:

H3. *The level of understanding of blockchain has a positive impact on users' acceptance of blockchain technology in the financial industry.*

All genders, in contemporary society, have similar exposure to digital technologies. With the widespread use of smartphones and online platforms, gender-based differences in technology acceptance are diminishing. Both men and women are actively engaging with and accepting new technologies, making gender less relevant in predicting acceptance.

However, elder individuals may have established habits and systems for traditional financial processes. The inertia to change and the comfort of familiar systems could result in resistance to adopting blockchain technology. Also, a generational gap exists in technology adoption patterns. They may have grown up in an era with less emphasis on digital technologies, making them less inclined to embrace newer, tech-driven financial solutions. Based on the above, the following assumptions can be obtained.

H4. *The factor of gender is irrelevant to users' acceptance of blockchain technology in the financial industry.*

H5. *Blockchain technology faces resistance from older individuals in the financial industry due to the age factor.*

$$\text{Blockchain Technology Acceptance} = \beta_1 \text{ Perceived Information Security} + \beta_2 \text{ Perceived Privacy} + \beta_3 \text{ Level of Understanding of Blockchain} + \beta_4 \text{ Gender} + \beta_5 \text{ Age} \quad (1)$$

4. Questionnaire Analysis

4.1. Questionnaire Design

This research collects first-hand data as the source of the research data by designing and distributing survey questionnaires. In the process of designing the questionnaire, we not only fully considered the research purpose and content of this article but also drew on the designs of relevant questionnaires and modified and improved our questionnaire based on continuous understanding of both the research objects and survey participants. Compared to questionnaire designs in the same research direction, we made improvements and innovations in the following three areas:

Firstly, compared to the questionnaire designed by Garg et al. [38], our survey subjects are no longer limited to blockchain technology professionals or CEOs/business heads who are currently working in relevant sectors; our participants are more randomly distributed among the general population. Secondly, compared to the statistical results of Albayati et al. [39], our survey subjects had a more balanced gender ratio. At the same time, our

age range is wider, with people aged over 35 accounting for a considerable proportion of the survey. Finally, compared to the above-mentioned factors, considering the different backgrounds and relevant knowledge reserves of the respondents, our questionnaire design is more targeted, including a scenario design, which is closer to real life questions and improves the experience of filling out the questionnaire.

The questionnaire can be generally divided into three parts, including the collection of personal information related to the research content only, the level of understanding of blockchain and willingness to further learn about this frontier technology, and the acceptance of blockchain technology used in the financial field. Due to full consideration of the scientific nature of the questionnaire design and the psychological characteristics of the survey subjects, there are a total of eight questions in the questionnaire, constituting a moderate length. The statement of each question is clear to avoid exceeding the understandable scope of the subject and avoid misleading the subject. The questions are arranged appropriately and the logical design between questions is also reasonable.

It should be noted that 1, 2 and 3 of the three-level scale in the questionnaire, respectively, indicate that this factor has a certain impact on the approval/disapproval of the application of blockchain technology in the financial field. When the scale's result enters the measurement model, model variables containing 0 and 1 have the same meaning as the original 1 and 2 level in the questionnaire, while 3 in the original scale enters the intercept as a 0 value because the number of variables should be $n - 1$ (n represents number of categories).

4.2. Reliability and Validity Testing

After pre-collecting the data, we analyzed the reliability and validity of the questionnaire using SPSS to determine the rationality of the question design, as well as the reliability and internal consistency of the sample response results. According to Cronbach's alpha coefficient calculated by SPSS and the KMO and Bartlett test of sphericity test results, the reliability and validity of this questionnaire are good.

4.3. Descriptive Statistical Analysis

The questionnaire collection took about 4 days. After data preprocessing, we ultimately obtained 423 valid data pieces by handling outliers and missing values, etc., in the data. The partial data used in the experiment are shown in Table 1 below.

Table 1. Data display (partial).

Age	Gender	Know	School	Internet	Friend	Agree	m_info_security 0	m_info_privacy 0	m_block_know 0	Willing	Province
1	0	3	1	0	0	1	2	2	2	4	HongKong
1	0	5	1	1	0	1	2	2	3	5	HongKong
1	1	2	1	1	0	1	3	3	3	4	GuangDong
1	0	3	1	0	1	1	3	3	3	5	HongKong
1	1	3	0	1	0	1	3	3	2	4	GuangDong
1	0	1				1	1	1	1	4	GuangDong

Statistical analysis was conducted on gender and age. According to the "Medium- and Long-Term Youth Development Plan (2016–2025)" printed and issued by the Central Committee of the CPC and the State Council, the age range for young people is between 14 and 35 years old. Thus, for the experimental population, we divided age into two categories: 35 years old and below and over 35 years old. The results are shown in Table 2 below.

Table 2. Gender and age.

	Male	Female
35 years old and below	74	88
Over 35 years old	101	160

Secondly, by analyzing the data source regions, it can be seen clearly in Figure 2 that the survey participants are concentrated in Anhui Province, Guangdong Province, Hong Kong, and other eastern regions of China (the larger the red circle, the more samples come from this area):



Figure 2. Data source regions.

The experimental data show that 40.43% (Figure 3) of survey participants have no knowledge of blockchain technology, which is very much in line with the actual situation. As one of the most cutting-edge scientific and technological fields at present, blockchain has not received enough exposure and understanding from people, and related knowledge and applications need to be further popularized. Among the remaining 59.57% who have knowledge of blockchain technology, online learning (such as news, online classes, etc.) and being introduced by family and friends are the main ways for them to learn the technology. In the survey, approximately 79.67% (also shown in Figure 3 below) of people expressed interest in further learning about and understanding blockchain technology.

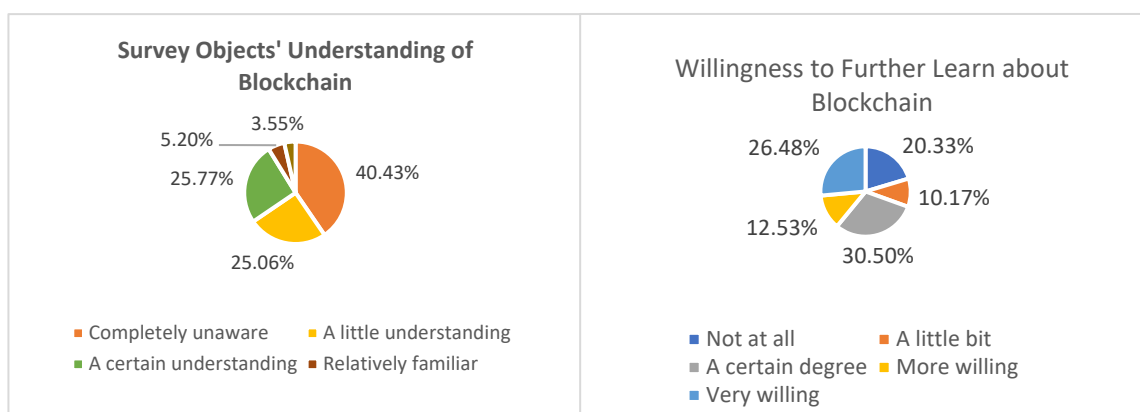


Figure 3. Survey objects' understanding and willingness to further learn about blockchain.

5. Results

The results of the significance test can be summarized as in Figure 4 below. The hypothesis test results can be summarized as in Figure 5 below.

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Exp(Est)
Intercept	1	2.4959	0.2753	82.17	<0.0001	12.133
age_group	0	-0.4448	0.1949	5.21	0.0225	0.641
gender	0	0.0304	0.1672	0.03	0.8557	0.970
m_block_know	0	0.1614	0.3900	0.17	0.6789	1.175
m_block_know	1	0.4828	0.2973	2.64	0.1044	1.621
m_info_privacy	0	-1.1638	0.2366	24.19	<0.0001	0.312
m_info_privacy	1	0.5411	0.3051	3.15	0.0761	1.718
m_info_security	0	1.5477	0.5300	8.53	0.0035	4.701
m_info_security	1	-0.7302	0.3328	4.81	0.0282	0.482

Figure 4. The results of the model regression (result from the SAS Enterprise Miner).

Hypothesis	Content	Result
H1	Perceived Information Security has a negative impact on Users' Acceptance on the Blockchain Technology in Financial Industry.	Hold
H2	Perceived Privacy Security has a positive impact on Users' Acceptance on the Blockchain Technology in Financial Industry.	Hold
H3	Level of understanding of blockchain has a positive impact on Users' Acceptance on the Blockchain Technology in Financial Industry.	Not Hold
H4	The factor of gender is irrelevant to the Users' Acceptance of Blockchain Technology in the Financial Industry.	Hold
H5	Blockchain Technology faces resistance from older individuals in the Financial Industry due to the age factor.	Hold

Figure 5. Hypotheses test results.

The results show that the $m_info_privacy_0$ ($\beta = -1.1638$, $p < 0.0001$) has a highly significant negative impact on users' acceptance of blockchain technology in the financial industry. This means that privacy has a positive impact on users' acceptance of blockchain technology in the financial industry. The $m_info_security_0$ ($\beta = 1.5477$, $p = 0.0035 < 0.05$) has a highly significant positive impact on users' acceptance of blockchain technology in the financial industry. However, the $m_info_security_1$ ($\beta = -0.7302$, $p = 0.0282 < 0.05$) has a highly significant negative impact on users' acceptance of blockchain technology in the financial industry, which means that when a user does not care about information security in the financial industry, they have a tendency to accept blockchain technology; when users care about information security in the financial industry, they have a tendency to not accept blockchain technology. This supports the fact that perceived information security has a negative impact on users' acceptance of blockchain technology in the financial industry. However, $m_block_know_1$, the level of understanding of blockchain ($\beta = 0.4828$, $p = 0.1044 > 0.05$), does not have a significant impact on the acceptance of blockchain technology in the financial industry. Thus, H1 and H2 are supported, while H3 does not hold.

Furthermore, the user's age ($\beta = -0.4448$, $p = 0.0225 < 0.05$) has a significant negative impact on the acceptance of blockchain technology in the financial industry, while the user's gender ($\beta = -0.0304$, $p = 0.8557 > 0.05$) does not have a significant impact on the acceptance of blockchain technology in the financial industry, so H4 and H5 are supported.

Conclusively, H3 is not supported; the level of understanding of blockchain does not have a significant impact on the acceptance of blockchain technology in the financial industry. We believe that the reason for this result may be that users may accept blockchain technology due to advantages and features like faster transactions and reduced costs but they do not need to have a comprehensive understanding of the underlying technology. Users often prioritize the perceived utility of blockchain applications. If they find benefits, they are more likely to accept the technology, regardless of their lack of deep knowledge. Also, currently blockchain applications in the financial industry often feature user-friendly interfaces, minimizing the need for in-depth blockchain understanding.

6. Discussion

Based on our research findings, we propose the following points and suggestions:

Firstly, we conducted targeted research on age and gender, confirming the hypothesis that gender does not affect acceptance but age does.

Secondly, we have reached some further conclusions in terms of risk compared to previous articles [40,41]. We verified that both perceived information security and perceived privacy impact users' acceptance of the technology, demonstrating that information security is receiving increasing attention in the context of the digital age. We suggest conducting more research and improvements on the security factors of blockchain to ensure that blockchain technology does not face serious technical risks such as information leaks when applied in the financial field or even on a larger scale, thereby increasing people's acceptance of blockchain technology. Additionally, it should be considered that when blockchain-based applications and information processing methods are regulated and ensured by local governments, people generally feel more secure [39]. We suggest that the government conscientiously fulfills its regulatory functions, improves relevant laws and regulations, ensures data security and protects personal information rights.

Thirdly, unlike the previous literature, we cannot conclude that technological awareness has a positive impact on user acceptance [40,42]. However, even though the level of understanding of blockchain did not have a significant impact on the research results, we still recommend increasing the knowledge related to blockchain technology, especially targeting the elderly population. As this technology may be more widely used in the future, we still hope that more and more people understand the simple principles of this technology.

7. Conclusions

We have searched through and analyzed a large amount of previous studies in the literature and further explored factors influencing user acceptance of blockchain technology in financial applications. The study focuses on information security, privacy and technology awareness. Based on the TAM and TPC models, hypotheses were developed on how the factors impact acceptance. Next, we used a questionnaire to collect firsthand data on these factors from 423 respondents. A statistical analysis was conducted to understand the sample characteristics. Lastly, we used a logistic regression model to automatically fit the relations between the features. Our results debunked that idea that information security and privacy significantly influence acceptance but technology awareness does not. Age negatively impacts acceptance, while gender is irrelevant. This study provides useful theoretical and practical insights into blockchain acceptance by examining information security, privacy and awareness factors, making a key contribution in identifying drivers and barriers of blockchain acceptance in financial applications.

This study on users' acceptance of blockchain technology in financial applications revealed significant findings regarding key factors influencing adoption. Information security and privacy were identified as crucial determinants, emphasizing the importance of robust security measures in driving user acceptance. It is worth mentioning that technology awareness does not emerge as a significant factor, suggesting that acceptance may be driven more by other perceived advantages rather than in-depth technical knowledge. Age was found to negatively impact acceptance levels, indicating potential resistance from elder individuals, while gender was deemed irrelevant in predicting acceptance.

Looking ahead, future researchers should delve deeper into expanding the sample to a more geographically diverse population and ensuring balanced gender and age distributions could improve representativeness. Additionally, investigating the impact of user education initiatives and user-friendly interface design on enhancing acceptance rates presents a promising avenue for further exploration. Furthermore, examining the influence of regulatory frameworks and compliance requirements on blockchain adoption in the financial sector could offer valuable insights into the broader ecosystem of technology adoption.

Additionally, the paper tested interactions between gender/age and other variables but did not explore potential interactions between the main factors like information security, privacy and technology awareness. This limits the understanding of how these key variables may interact with and influence each other. Thus, we hope that future studies with expanded sampling and variables, causal designs and longitudinal approaches could enrich understanding further. Testing the model in contexts beyond finance may also be fruitful.

By continuing to investigate these multifaceted factors, researchers can gain a more comprehensive understanding of the challenges and opportunities in promoting widespread acceptance of blockchain technology in financial applications. This ongoing research will not only contribute to the academic discourse on technology acceptance but also provide actionable insights for industry stakeholders seeking to leverage blockchain innovations effectively.

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