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Blockchain Adoption for Secure Digital Payments in Modern Business Ecosystems

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ABSTRACT

The rapid growth of digital commerce has significantly increased the demand for secure and reliable digital payment systems within modern business ecosystems. **Traditional centralized payment** infrastructures often face challenges related to security vulnerabilities, fraud risks, and limited transparency, which may reduce user trust and create risks for financial transactions. Therefore, **this study aims** to analyze blockchain adoption as a solution to enhance security, transparency, and reliability in digital payment systems in contemporary business environments. **This research** applies a quantitative research approach by examining the relationships between several key variables, including perceived security, trust, technological readiness, and regulatory support, as independent variables influencing blockchain adoption as the dependent variable. Data are analyzed through a structured research framework supported by statistical evaluation to understand the influence of these factors on blockchain adoption in digital payment systems. **The findings indicate** that perceived security, trust, technological readiness, and regulatory support positively influence the blockchain adoption. Blockchain's decentralized architecture improves transaction transparency, strengthens data protection, and reduces the risks associated with fraud and data manipulation in digital financial transactions. Overall, **the study concludes that** blockchain technology has strong potential to enhance the security, transparency, and efficiency of digital payment systems in modern business ecosystems, while the development of technological infrastructure, supportive regulatory frameworks, and increased user trust are essential to promote wider adoption of blockchain-based financial technologies in the evolving digital economy.

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1. INTRODUCTION

The rapid development of digital technology has significantly transformed financial transactions in modern business ecosystems through the widespread adoption of digital payment systems [1, 2]. The expansion of e-commerce, digital banking, mobile applications, and online financial services has encouraged businesses and consumers to rely increasingly on digital transactions because they offer faster processing, lower operational costs, wider accessibility, and greater convenience. Digital payments have therefore become an

essential component of contemporary digital economies, connecting businesses, financial institutions, technology providers, and consumers [3]. However, the growing dependence on digital payment systems also creates technological and operational risks. Traditional centralized infrastructures may be vulnerable to data breaches, unauthorized access, fraud, system manipulation, and operational disruptions [4, 5]. Limited transparency in transaction processing can also make it difficult for users and organizations to verify transaction information independently, thereby reducing confidence in digital payment services and highlighting the need for infrastructures that provide stronger security, transparency, reliability, and accountability.

In response to these challenges, blockchain technology has emerged as a potential alternative for strengthening digital payment systems. Blockchain uses a decentralized distributed ledger in which transaction information is recorded and maintained across multiple participating nodes [6]. Transactions are validated through consensus mechanisms and stored in a persistent ledger, making unauthorized modification more difficult [7]. Its decentralized architecture reduces dependence on a single central authority, while cryptographic mechanisms support the protection and integrity of transaction data. In digital payment applications, blockchain can facilitate peer-to-peer transactions, improve traceability, enable authorized participants to verify transaction information, and reduce the possibility of unauthorized alteration [8, 9]. Blockchain may also support more efficient transaction processes by reducing intermediary involvement and enabling programmable transactions through smart contracts. These characteristics indicate that blockchain-based payment systems have the potential to improve security, transparency, reliability, and operational efficiency in modern financial environments.

Nevertheless, the technical capabilities of blockchain alone do not guarantee successful adoption. Adoption depends on the interaction of technological, organizational, and environmental factors [10]. Perceived security is important because users and organizations require assurance that sensitive financial information and transaction records are adequately protected. Trust is also essential, as users must have confidence in the reliability, credibility, and performance of blockchain-based payment systems [11]. From an organizational perspective, technological readiness determines whether an organization possesses sufficient infrastructure, technical expertise, financial resources, and human capabilities to implement and maintain blockchain solutions [12, 13]. In addition, regulatory support is necessary because digital payment systems operate within legal and institutional environments that require compliance with financial regulations, data protection requirements, and other relevant standards. Clear and adaptive regulations, government support, institutional coordination, and regulatory initiatives can reduce uncertainty and encourage responsible blockchain adoption [14, 15].

Although perceived security, trust, technological readiness, and regulatory support have been examined in previous studies, these factors should be considered collectively because blockchain adoption involves the interaction between user perceptions, organizational capabilities, and external institutional conditions [16]. A comprehensive analysis of these factors can provide a better understanding of why organizations and users are willing or unwilling to adopt blockchain-based digital payment systems [17]. Furthermore, blockchain adoption has implications beyond technological improvement because secure, transparent, and reliable payment infrastructures can support a more efficient and inclusive digital economy. In this context, blockchain-based digital payments are relevant to Sustainable Development Goals (SDGs) 8, 9, and 16. SDGs 8 emphasizes inclusive economic growth and productive economic activities, SDGs 9 focuses on resilient infrastructure and innovation, and SDGs 16 promotes effective, accountable, and inclusive institutions. Therefore, the development of secure and transparent digital payment infrastructures can contribute to economic development, technological innovation, institutional accountability, and sustainable digital transformation.

Based on these considerations, this study examines the factors influencing blockchain adoption in digital payment systems by focusing on perceived security, trust, technological readiness, and regulatory support. The study develops an integrated research framework to analyze how these four factors influence blockchain adoption within modern business ecosystems. By examining these relationships collectively, the research seeks to provide empirical evidence regarding the conditions that encourage blockchain adoption and to contribute to a broader understanding of blockchain-based digital payment development. The findings are expected to provide practical insights for businesses, financial institutions, technology providers, and policymakers in developing secure, transparent, reliable, and sustainable payment infrastructures. These insights may also support strategic decision-making, strengthen stakeholder confidence, improve organizational preparedness, facilitate regulatory alignment, and encourage responsible technological innovation across increasingly interconnected digital financial ecosystems.

2. LITERATURE REVIEW

This section reviews blockchain technology and its application in digital payment systems within modern business ecosystems. It provides a theoretical foundation for understanding how blockchain improves security, transparency, and efficiency in financial transactions. The discussion covers blockchain technology, its implementation in digital payments, and key factors influencing blockchain adoption. It also highlights blockchain's contribution to a sustainable digital economy and its alignment with global development goals, providing a conceptual basis for analyzing blockchain adoption in digital payment systems.

2.1. Blockchain Technology in Modern Business

Blockchain technology has emerged as one of the most transformative digital innovations in modern business environments [18, 19]. It is a decentralized distributed ledger that records and stores transaction data across multiple interconnected nodes, reducing the risks associated with centralized data management [20]. Transactions are validated through consensus mechanisms and permanently stored in sequential blocks, creating transparent and immutable records. These characteristics enhance data integrity, traceability, and accountability, providing organizations with a reliable infrastructure for managing financial transactions, information exchange, and digital records [21, 22].

In modern business ecosystems, blockchain promotes transparency by allowing authorized participants to access verified transaction information through a shared ledger [23]. This transparency helps reduce fraudulent activities and strengthens trust among businesses, customers, and partners. In addition, cryptographic security mechanisms protect transaction data from unauthorized modification, making blockchain highly resistant to cyber threats [24, 25]. The technology also improves operational efficiency by reducing reliance on intermediaries, lowering transaction costs, and enabling automated processes through programmable protocols. As digital transformation continues across industries, blockchain is increasingly recognized as a strategic infrastructure that supports secure, transparent, and efficient business operations [26].

2.2. Blockchain in Digital Payment Systems

The rapid growth of digital commerce has increased the use of digital payment systems across various economic sectors, enabling businesses and consumers to conduct transactions efficiently and conveniently [27]. However, traditional payment systems often rely on centralized infrastructures managed by financial institutions or payment providers, making them vulnerable to data breaches, fraud, unauthorized access, and system manipulation [28, 5]. These risks can reduce user trust and create challenges for businesses relying on digital financial transactions.

Blockchain technology provides an alternative approach to improving the security, reliability, and efficiency of digital payment systems [29]. Through decentralized networks, blockchain enables peer-to-peer transactions without central intermediaries, while transactions are verified by multiple participants and permanently recorded in a distributed ledger [30, 31]. This reduces fraud and unauthorized modifications while enhancing transaction transparency and traceability. By reducing intermediary involvement, blockchain can also simplify processes, lower operational costs, and shorten settlement times, supporting faster and more cost-efficient digital payment infrastructures [32].

2.3. Factors Influencing Blockchain Adoption

Although blockchain technology offers numerous benefits, its adoption in business environments does not occur automatically. Organizations and individuals typically evaluate several factors before implementing new technologies [33]. One of the most important factors is perceived security, as businesses are more likely to adopt blockchain when they believe it can effectively protect financial information and prevent cyber threats [34]. Blockchain's ability to create immutable transaction records and secure data through cryptographic mechanisms plays a significant role in shaping these security perceptions.

Trust is a critical factor in blockchain adoption, as transparency and verifiability increase confidence in transaction integrity. Technological readiness, including adequate infrastructure, skilled personnel, and organizational support, is also essential [35, 36]. Meanwhile, clear regulations, institutional support, and organizational awareness can encourage adoption by reducing compliance concerns and helping decision-makers assess blockchain's strategic value.

2.4. Blockchain and Sustainable Digital Economy

In addition to improving security and operational efficiency, blockchain technology contributes to a sustainable digital economy by providing transparent, reliable, and accessible financial systems through permanent and verifiable transaction records [37, 38]. This transparency strengthens accountability, reduces fraud and corruption risks, and supports financial inclusion by enabling individuals and small businesses to conduct secure transactions without relying entirely on traditional banking intermediaries. Blockchain also aligns with the United Nations SDGs 8, 9, and 16, which emphasize economic growth, innovation, and strong institutions [39]. By improving transaction efficiency, supporting sustainable innovation, and strengthening technological development and institutional accountability, blockchain can contribute to a more inclusive, transparent, and sustainable digital economy [40].

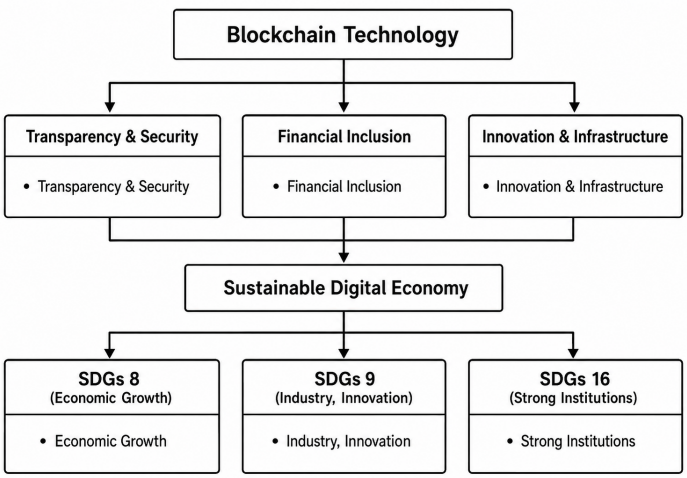


Figure 1. Blockchain Contribution to Sustainable Digital Economy

The Figure 1 shown illustrates how blockchain technology contributes to a sustainable digital economy by enhancing transparency, security, financial inclusion, and digital innovation. These interconnected elements support economic growth and strengthen digital infrastructure, aligning with SDGs 8, 9, and 16. Overall, the figure demonstrates that blockchain adoption provides not only technological benefits but also broader economic and institutional value.

3. RESEARCH METHODOLOGY

This section explains the research methodology used in this study to analyze the factors influencing blockchain adoption in secure digital payment systems within modern business ecosystems. It describes the overall research design, the population and sampling method used to select respondents, as well as the data collection techniques applied in the study. In addition, this section outlines the research variables and indicators used to measure each construct in the research model. The methodology also explains the statistical analysis techniques used to evaluate the relationships between variables and to determine the influence of perceived security, trust, technological readiness, and regulatory support on blockchain adoption in digital payment systems.

3.1. Research Design

This study applies a quantitative research approach to analyze the factors influencing blockchain adoption in secure digital payment systems within modern business ecosystems. A quantitative approach is appropriate because it enables the systematic examination of relationships among variables and provides objective evidence for testing the proposed hypotheses [41]. The study focuses on four independent variables, namely perceived security, trust, technological readiness, and regulatory support, while blockchain adoption serves as the dependent variable. These variables were selected based on previous literature, which identifies them as key determinants influencing the adoption of blockchain technology in digital financial environments.

Furthermore, this study adopts a causal research design to investigate the cause-and-effect relationships between the proposed variables [42]. This design enables the researcher to evaluate how each independent variable contributes to blockchain adoption while providing a structured framework for empirical investigation. The quantitative and causal approaches also ensure that the research is conducted systematically, allowing the findings to be interpreted objectively and consistently [43]. Overall, the selected research design supports a comprehensive understanding of the factors that encourage blockchain adoption and provides empirical evidence that contributes to both academic literature and practical decision-making regarding the implementation of blockchain technology in digital payment systems.

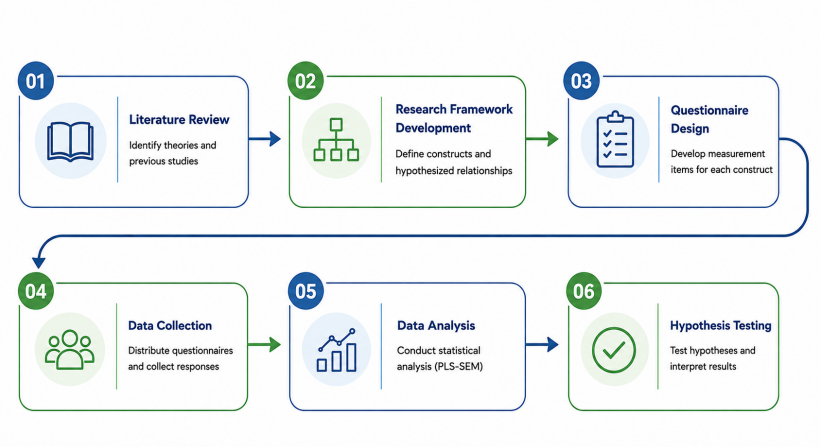


Figure 2. Research Process of the Study

The Figure 2 shown illustrates the research process adopted in this study. The study began with a literature review and the development of the research framework, followed by questionnaire design and data collection. The collected data were analyzed using statistical methods to test the proposed hypotheses, and the findings were then interpreted through discussion before drawing the conclusions and managerial implications.

The research adopts a causal research design to examine the cause-and-effect relationships between the independent variables (perceived security, trust, technological readiness, and regulatory support) and blockchain adoption as the dependent variable. Furthermore, statistical analysis provides empirical evidence to identify the factors influencing blockchain adoption in modern digital payment ecosystems.

3.2. Data Collection Method

Data for this study were collected through structured questionnaires distributed to respondents who were familiar with digital payment systems or had experience with digital financial transactions. The respondents were selected using purposive sampling because they possessed relevant knowledge and experience related to blockchain-based digital payment systems. This sampling technique ensured that the collected responses were appropriate for evaluating the proposed research variables. The questionnaire was designed to measure respondents' perceptions of security, trust, technological readiness, regulatory support, and blockchain adoption. The questionnaire items were developed by adapting measurement indicators from previous studies related to blockchain adoption and digital payment systems. This approach ensured that each item was conceptually aligned with the research variables and supported the consistency of the measurement instrument used in this study. Each questionnaire item represented indicators of the research variables, and respondents evaluated the statements based on their level of agreement. The responses were compiled to produce quantitative data reflecting respondents' perceptions of blockchain-based digital payment systems.

The collected data were analyzed using statistical methods to examine the relationships among the research variables and determine the significance of each factor influencing blockchain adoption. The responses were considered sufficiently representative because they were obtained from individuals with relevant knowledge and experience in digital payment systems, thereby enhancing the reliability of the analysis and supporting the evaluation of blockchain adoption within the scope of this study.

3.3. Research Variables and Indicators

This study uses several variables to analyze the blockchain adoption in digital payment systems within modern business ecosystems. The variables consist of four independent variables and one dependent variable. The independent variables include perceived security, trust, technological readiness, and regulatory support, while the dependent variable is blockchain adoption. These variables represent important technological, organizational, and environmental factors that may influence the adoption of blockchain-based payment systems.

Each variable is measured using several indicators to ensure accurate evaluation of the research constructs and respondents' perceptions of blockchain implementation in digital payment systems. The indicators represent key aspects such as security protection, system reliability, technological capability, and policy support, which help evaluate the factors influencing blockchain adoption in digital financial environments.

Table 1. Research Variables and Indicators

Variable	Type	Indicators
Perceived Security	Independent	Data protection, transaction safety, resistance to cyber threats
Trust	Independent	System reliability, transparency, credibility
Technological Readiness	Independent	Technology infrastructure, technical capability, innovation readiness
Regulatory Support	Independent	Government policy support, legal clarity, institutional support
Blockchain Adoption	Dependent	Intention to use, system acceptance, implementation willingness

The Table 1 shown presents the research variables used to analyze blockchain adoption in digital payment systems. It includes four independent variables perceived security, trust, technological readiness, and regulatory support and one dependent variable, blockchain adoption. Each variable is measured through indicators such as data protection, system reliability, technology capability, policy support, intention to use, system acceptance, and implementation willingness to evaluate factors influencing blockchain adoption.

3.4. Research Framework and Hypotheses

The research framework illustrates the relationships between the independent variables and the dependent variable in this study. The framework explains how perceived security, trust, technological readiness, and regulatory support influence blockchain adoption in digital payment systems. Perceived security reflects the level of protection and safety provided by blockchain technology in financial transactions. Trust represents users' confidence in blockchain-based systems. Technological readiness indicates the availability of infrastructure and technological capabilities required for implementing blockchain solutions. Regulatory support refers to the presence of government policies and legal frameworks that facilitate the blockchain adoption.

These factors are expected to influence the level of blockchain adoption in digital payment systems within modern business ecosystems, as illustrated in the proposed research framework presented in Figure 3 of this study.

The Figure 3 shown illustrates the research framework used to analyze the blockchain adoption in digital payment systems. It presents four independent variables perceived security, trust, technological readiness, and regulatory support that are hypothesized to influence blockchain adoption as the dependent variable. Each relationship is represented by hypotheses H1, H2, H3, and H4, which indicate the expected effect of each factor on blockchain adoption in modern digital payment environments.

Based on the research framework, the following hypotheses are proposed:

- H1: Perceived security positively influences blockchain adoption in digital payment systems.
- H2: Trust positively influences blockchain adoption in digital payment systems.
- H3: Technological readiness positively influences blockchain adoption in digital payment systems.
- H4: Regulatory support positively influences blockchain adoption in digital payment systems.

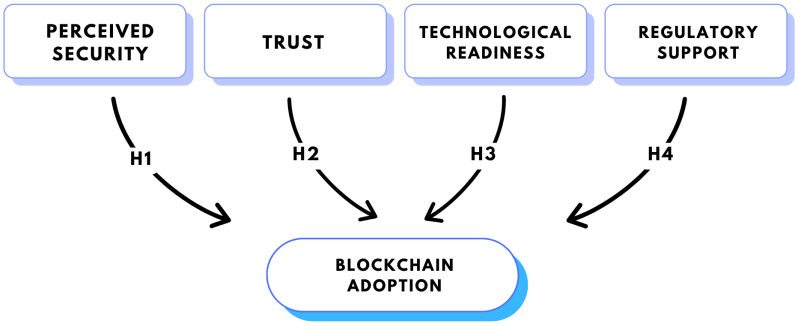


Figure 3. Research Framework

These hypotheses are formulated to evaluate the relationship between the identified variables and blockchain adoption in digital payment environments. The research framework provides a clear visualization of the proposed relationships among the variables, allowing readers to better understand the analytical structure of the study before the empirical analysis is presented.

4. RESULTS AND DISCUSSION

This section aims to explain the results of the research based on the variables and hypotheses proposed in the research methodology. The analysis focuses on examining how perceived security, trust, technological readiness, and regulatory support influence blockchain adoption in digital payment systems. The results are then interpreted to provide a deeper understanding of the factors that encourage the implementation of blockchain technology within modern business ecosystems.

4.1. Respondent Characteristics

This study involved respondents who were familiar with digital payment systems and had experience using financial technologies such as mobile banking, e-wallets, and other online payment services. Their experience with digital financial transactions ensured that they were able to provide relevant responses regarding security, trust, technological readiness, regulatory support, and blockchain adoption. Furthermore, their practical experience with digital payment technologies provided an appropriate basis for evaluating perceptions of blockchain adoption and assessing factors affecting its potential implementation within modern financial environments.

The respondent profile indicates that the sample represents users who actively interact with modern digital financial ecosystems and are aware of the benefits and risks of digital payment systems. Their familiarity with these technologies supports the relevance and representativeness of the collected data for analyzing factors influencing blockchain adoption in modern business ecosystems. Furthermore, their diverse experiences with digital financial services provide valuable insights into user perceptions, behavioral intentions, technological readiness, trust, security concerns, and challenges associated with blockchain implementation across various business contexts.

4.2. Analysis of Research Variables

This section analyzes the variables influencing the blockchain adoption in digital payment systems. The analysis focuses on four independent variables perceived security, trust, technological readiness, and regulatory support and their relationship with the dependent variable, blockchain adoption. These variables represent important factors that determine whether individuals and organizations are willing to adopt blockchain-based digital payment solutions in modern business ecosystems.

Perceived security influences adoption because users tend to adopt digital payment technologies when they believe their financial data and transactions are well protected. Trust also strengthens users' confidence in

the reliability and transparency of blockchain systems. In addition, technological readiness reflects the availability of infrastructure and technical capability required to implement blockchain technology, while regulatory support refers to government policies and institutional support that encourage wider adoption of blockchain-based payment systems in digital financial environments.

4.3. Hypothesis Testing Results

The hypothesis testing analysis was conducted to determine the influence of each independent variable on blockchain adoption in digital payment systems. The results show that all proposed hypotheses (H1–H4) are supported, indicating that perceived security, trust, technological readiness, and regulatory support each have a positive influence on blockchain adoption.

These findings confirm the proposed research framework and provide empirical evidence that the selected variables collectively contribute to blockchain adoption within modern business ecosystems. A summary of the hypothesis testing results is presented in Table 2.

Table 2. Hypothesis Testing Results

Hypothesis	Relationship	Result	Practical Interpretation
H1	Perceived Security → Blockchain Adoption	Supported	Higher security encourages blockchain adoption.
H2	Trust → Blockchain Adoption	Supported	Greater user trust increases adoption willingness.
H3	Technological Readiness → Blockchain Adoption	Supported	Adequate infrastructure facilitates implementation.
H4	Regulatory Support → Blockchain Adoption	Supported	Clear regulations promote wider adoption.

The Table 2 shown summarizes the key findings of this study by presenting the proposed relationships, hypothesis testing results, and their practical interpretation. This summary provides readers with a concise overview of the main factors influencing blockchain adoption before the findings are discussed in greater detail in the following section.

The results also indicate that trust, technological readiness, and regulatory support positively influence blockchain adoption. Higher levels of system reliability and transparency increase user confidence in blockchain-based financial technologies. In addition, adequate technological infrastructure and supportive regulatory frameworks create favorable conditions that encourage the implementation of blockchain technology in digital payment systems. These factors can further strengthen stakeholder confidence, reduce adoption barriers, facilitate organizational preparedness, and support more effective integration of blockchain solutions into existing financial infrastructures and business processes.

4.4. Discussion

The results of this study highlight several key factors influencing blockchain adoption in digital payment systems. Among these, perceived security and trust play a crucial role in shaping users' willingness to adopt blockchain-based financial technologies. Blockchain enhances transaction security through decentralized data storage and cryptographic verification, increasing user confidence and supporting wider adoption [44, 45]. From a practical perspective, organizations should prioritize secure transaction mechanisms and transparent data management to strengthen user trust and encourage blockchain adoption.

Technological readiness and regulatory support influence blockchain adoption [46]. Organizations with adequate technological infrastructure are better positioned to implement blockchain effectively, while clear policies and legal certainty encourage wider adoption by businesses and financial institutions. These findings suggest that organizations should strengthen technological capabilities, whereas policymakers should establish supportive regulations to reduce barriers. Consistent with previous studies, this research confirms the importance of security, trust, technological readiness, and regulatory support while extending the literature by demonstrating that these factors should be considered collectively within modern business ecosystems [47].

Overall, the findings indicate that blockchain has strong potential to improve the security, transparency, and efficiency of digital payment systems. Strengthening technological infrastructure, improving regulatory frameworks, and building user trust are essential to accelerate blockchain adoption. Together, these findings provide practical guidance for organizations and policymakers while offering a more comprehensive

understanding of how the proposed variables collectively influence blockchain adoption in modern business environments.

5. MANAGERIAL IMPLICATIONS

The results of this study provide important insights for businesses, financial institutions, and policymakers in implementing blockchain technology in digital payment systems. Organizations should prioritize security by implementing encryption, secure transaction protocols, and reliable data management to reduce fraud and cyber threats while strengthening user trust. Organizations should also invest in secure blockchain infrastructure, enhance cybersecurity, provide continuous employee training, and improve system transparency to support effective implementation and encourage wider adoption [48]. Technological readiness is also essential for successful blockchain implementation. Organizations should strengthen their technological infrastructure, improve technical capabilities, and collaborate with technology providers, financial institutions, and fintech companies to accelerate blockchain integration [49, 50].

Regulatory support is equally important for accelerating blockchain adoption. Governments and policymakers should establish clear and adaptive regulatory frameworks, implementation standards, and compliance guidelines while promoting regulatory sandbox initiatives and collaboration with industry stakeholders. These efforts can reduce implementation uncertainty, encourage innovation, and support the development of secure, transparent, and sustainable digital payment ecosystems while ensuring consumer protection, regulatory consistency, market stability, and responsible technological development across diverse financial environments and institutional contexts.

6. CONCLUSION

The findings of this study indicate that blockchain technology has significant potential to improve the security and reliability of digital payment systems in modern business ecosystems. The results show that several factors play an important role in influencing blockchain adoption, namely perceived security, trust, technological readiness, and regulatory support. Among these factors, security and trust are particularly important because users prioritize the safety of financial transactions and the reliability of digital systems. In addition, the availability of technological infrastructure and supportive regulatory frameworks also contributes to the successful implementation of blockchain-based digital payment systems. Overall, the study demonstrates that blockchain technology can enhance transparency, security, and efficiency in digital financial transactions.

Overall, this study provides valuable insights into how This research answers the main research objective by identifying the key factors that influence blockchain adoption in digital payment systems. The results confirm that perceived security, trust, technological readiness, and regulatory support positively influence the blockchain adoption. These findings suggest that improving digital security mechanisms, strengthening user trust, enhancing technological capabilities, and providing clear regulatory frameworks are essential to support the wider implementation of blockchain-based financial technologies. However, this study has several limitations. The research mainly focuses on a limited number of variables and relies on questionnaire-based data, which may not fully capture all factors influencing blockchain adoption across diverse contexts in different business environments.

Future research is recommended to explore additional factors that may influence blockchain adoption, such as organizational culture, financial investment capability, and technological innovation strategies. Further studies can also expand the research scope by involving larger and more diverse respondent groups from different industries or countries. In addition, future research may apply different analytical approaches or comparative studies to gain deeper insights into the implementation of blockchain technology in digital payment systems and other financial services. Such research could provide a more comprehensive understanding of how blockchain technology can support the development of secure and sustainable digital financial ecosystems.

7. DECLARATIONS

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7.2. Author Contributions

Conceptualization: IN and SA; Methodology: AH; Software: SA; Validation: IN and JP; Formal Analysis: JP and AH; Investigation: IN; Resources: SA; Data Curation: JP; Writing Original Draft Preparation: SA; Writing Review and Editing: JP; Visualization: IN; All authors, IN, AH, SA and JP have read and agreed to the published version of the manuscript.

7.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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