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CRYPTOCURRENCY VS TRADITIONAL BANKING UNRAVELING THE FUTURE OF FINANCIAL SYSTEMS

CRYPTOCURRENCY VS PERBANKAN TRADISIONAL MENGUNGKAP MASA DEPAN SISTEM KEUANGAN

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ABSTRACT
This research discusses the comparison between blockchain technology in cryptocurrency and banking technology infrastructure, with a focus on the dimensions of security, efficiency and scalability. Using approach Systematic Literature Review (SLR) with guidelines PRISMA, the study found that blockchain excels in decentralization and efficiency for international transactions, but has challenges in its scalability and security. On the other hand, traditional banking is more stable and efficient for domestic transactions, although it is limited in facing digitalization challenges. The implications of this research provide insight for developers and regulators to design a more efficient and safer financial system by integrating the advantages of both.
Keywords: blockchain, cryptocurrency, traditional banking, security, efficiency, scalability, financial systems.

ABSTRAK
Penelitian ini membahas perbandingan antara teknologi blockchain dalam cryptocurrency dan infrastruktur teknologi perbankan tradisional, dengan fokus pada dimensi keamanan, efisiensi, dan skalabilitas. Menggunakan pendekatan Systematic Literature Review (SLR) dengan pedoman PRISMA, penelitian ini menemukan bahwa blockchain unggul dalam desentralisasi dan efisiensi untuk transaksi internasional, tetapi memiliki tantangan dalam skalabilitas dan keamanannya. Di sisi lain, perbankan tradisional lebih stabil dan efisien untuk transaksi domestik, meskipun terbatas dalam menghadapi tantangan digitalisasi. Implikasi penelitian ini memberikan wawasan bagi pengembang dan regulator untuk merancang sistem keuangan yang lebih efisien dan aman dengan mengintegrasikan keunggulan keduanya.
Kata kunci: blockchain, cryptocurrency, perbankan tradisional, keamanan, efisiensi, skalabilitas, sistem keuangan.

1. INTRODUCTION

The emergence of cryptocurrency as a viable alternative financial system has significantly disrupted traditional banking, particularly since the inception of Bitcoin in 2008. This disruption is characterized by the rapid growth of cryptocurrency markets, which have reached trillions in market capitalization, reflecting a burgeoning interest from diverse stakeholders as both a payment method and an investment vehicle (Mishra et al., 2023). The rise of Decentralized Finance (DeFi) further exemplifies this shift, as it eliminates the need for traditional intermediaries, thereby enhancing the appeal of cryptocurrencies and posing substantial challenges to conventional banks (Adremi, 2024). Central to the success of cryptocurrencies is blockchain technology, which underpins their operations. Blockchain is lauded for its decentralized, transparent, and secure nature, utilizing cryptographic algorithms that ensure data integrity and minimize fraud risks (Wang et al., 2018; Hao et al., 2020). The transparency of blockchain allows for public verification of transactions, which enhances accountability and trust within the financial ecosystem (Udeh, 2024). This technology is not only reshaping the financial sector but is also being adopted across various industries, including logistics and healthcare, as a means to improve efficiency and data management (Gao, 2021; Rocks & Falls, 2022).

Traditional banks are under increasing pressure to adapt to these technological advancements. Many institutions continue to operate on legacy systems that are costly and complex, making it challenging to respond to the evolving financial landscape (Othman et al., 2022; Harris & Wonglimpiyarat, 2019). The reliance on centralized infrastructures renders these banks more susceptible to cyber threats and systemic vulnerabilities (Ji & Tia, 2021). Additionally, the rise of fintech companies, which offer agile and customer-centric financial solutions, exacerbates the competitive pressures faced by traditional banks (Saračević et al., 2021; Hornuf et al., 2020). Consumer expectations are shifting, particularly among younger demographics who demand rapid, transparent, and accessible financial services (Wang, 2023). In developing regions, where access to conventional banking remains limited, cryptocurrencies are emerging as a crucial tool for enhancing financial inclusion (Hornuf et al., 2020).

The regulatory landscape surrounding cryptocurrencies adds another layer of complexity for both new entrants and traditional financial institutions. Varying regulations across jurisdictions create challenges in maintaining compliance and fostering competition in this dynamic environment (Singh et al., 2022). As traditional banks grapple with these changes, questions arise regarding their ability to adapt effectively. The potential of blockchain technology to replace traditional banking infrastructure in terms of security, efficiency, and scalability remains a critical area of inquiry ("undefined", 2022). Understanding the interplay between these two financial systems is essential for anticipating the future trajectory of the global financial landscape. In conclusion, the rise of cryptocurrency and blockchain technology presents both challenges and opportunities for traditional banking. As these innovations continue to evolve, it is imperative for banks to embrace technological advancements and adapt their strategies to remain relevant in an increasingly competitive financial ecosystem.

Blockchain was first introduced to the world through Bitcoin in 2008 as the basic technology that supports the cryptocurrency. The blockchain's innovative design offers a decentralized, secure, and transparent record-keeping system, eliminating the need for third-party intermediaries. Over time, this technology has developed rapidly and been applied in a variety of other financial contexts, including cross-border payments, smart contracts, and decentralized financial ecosystems (DeFi). Blockchain's key advantages, such as its ability to permanently record transactions and prevent data from being altered without network consensus, make it one of the most revolutionary innovations in financial technology. Meanwhile, traditional banking systems have long relied on established and centralized technological architectures. Infrastructure such as clearing and settlement systems has become the backbone of global banking operations, enabling funds transfer processes and transaction settlements with high accuracy. However, the centralized nature of these systems also has disadvantages, such as dependence on specific authorities, vulnerability to systemic disruption, and high operational costs. In this context, the emergence of blockchain offers a more efficient and tamper-resistant alternative, challenging the traditional models that have been used for decades.

Security is a major challenge faced by both blockchain technology and traditional banking infrastructure. In blockchain, although the design offers high security through the use of cryptographic algorithms and a decentralized system, this technology is not completely immune to threats. Additionally, vulnerabilities in smart contracts and cyber threats such as digital wallet hacking show that security remains a top priority in blockchain development and adoption. In contrast, traditional banking systems that rely on centralized infrastructure face different challenges. Reliance on central servers and legacy systems makes banks more vulnerable to coordinated cyber attacks, such as Distributed Denial of Service (DDoS) attacks or large-scale data theft. Although security measures such as firewalls, data encryption, and authentication protocols have been widely implemented, evolving threats require a more dynamic and proactive approach to protecting financial data and transactions.

Apart from security, operational efficiency and scalability are also key factors that determine the sustainability of technology in the financial sector. Blockchain has the potential to increase efficiency through eliminating intermediaries, automating processes with smart contracts, and real-time transaction recording. However, scalability challenges, such as the limited number of transactions per second (TPS) on networks such as Bitcoin or Ethereum, hinder the mass adoption of this technology for large-scale applications. Efforts to improve scalability, such as layer-2 solutions and new protocols, are still in the development phase. On the other hand, traditional banking has long optimized operational efficiency through proven systems, such as automatic clearing and centralized settlement. However, this process often takes a lot of time and costs, especially in cross-border transactions. Although banks continue to innovate by leveraging new technologies, such as artificial intelligence and big data, they face challenges in aligning efficiency with increasing customer needs and competitive pressures from blockchain technology. Both blockchain and traditional banking have complementary strengths and weaknesses in terms of security, efficiency, and scalability. This shows the importance of further exploration to understand how these two systems can adapt to each other or compete in shaping the future of the global financial system.

How does blockchain technology in cryptocurrency compare to the technological infrastructure used in traditional banking in terms of security, efficiency, and scalability? This question aims to dig deeper into the advantages and limitations of each technology in meeting the needs of the modern financial sector. From a security perspective, the research will discuss how blockchain technology and traditional banking infrastructure address threats to data integrity and confidentiality, as well as the extent to which their approaches can provide adequate protection against cyber threats.

In terms of efficiency, this research will examine whether blockchain can provide a more cost-effective and fast solution compared to traditional systems which often involve intermediaries and complex processes. Additionally, operational efficiency in terms of transaction completion time, process automation and resource savings will also be comparatively analyzed. In the context of scalability, this research will assess the ability of both technologies to handle large transaction volumes, especially amidst user growth and increasing complexity of global financial transactions. The research will also consider technical limitations such as transaction speed, network capacity, and the ability of each technology to develop as market needs increase. Through this analysis, it is hoped that it will provide deeper insight into the strengths and weaknesses of both approaches, as well as how they can contribute or compete in shaping the future of the global financial system.

This research is driven by the need to increase understanding of the advantages and limitations between the blockchain technology underlying cryptocurrencies and traditional banking technology infrastructure. In an era of rapid digital transformation, these two technologies are taking center stage in discussions about how financial systems can evolve to meet future challenges and opportunities. The main motivation of this research is to make a significant contribution to the existing literature by identifying and analyzing the security, efficiency, and scalability aspects of both systems. A deeper understanding of how blockchain technology can compete with or complement traditional banking will provide valuable insights in guiding financial technology innovation.

This research also aims to provide practical guidance for policy makers, the financial industry and academics. By uncovering the strengths and weaknesses of each system, this research can help policymakers design regulations that support more efficient and safer technology adoption. The financial industry can also use these insights to optimize their infrastructure and increase competitiveness in an ever-evolving market. For academics, this research can open up opportunities for further exploration, including the potential for collaboration between blockchain and traditional banking systems in forming a more inclusive and sustainable financial ecosystem. Overall, the motivation for this research is not only to understand technology, but also to contribute to building a global financial system that is more efficient, secure, and able to meet the needs of modern society.

This research aims to identify and analyze the main differences between the blockchain technology underlying cryptocurrencies and traditional banking technology infrastructure from three main aspects: security, efficiency and scalability. From a security perspective, this research aims to evaluate how both systems protect data and financial transactions from cyber threats and the risk of loss of integrity. The analysis will include security mechanisms such as the use of cryptography and decentralization of the blockchain compared to centralized security measures implemented in traditional banking systems. In terms of efficiency, this research focuses on the effectiveness of both systems in processing financial transactions. This assessment includes comparison of transaction completion times, reduction of operational costs, and elimination of unnecessary manual processes or intermediaries in the workflow. Meanwhile, in the scalability aspect, this research aims to identify the ability of each technology to handle increasing transaction volumes and users, especially amidst growing market demand. This research will also explore factors such as network capacity, transaction speed, and the adaptability of technology to meet long-term needs. By achieving this goal, research is expected to provide in-depth and comprehensive insights, which can be used by policy makers, financial industry players and academics to direct the development of financial technology in a more efficient, safe and sustainable direction. It is also hoped that this research can become the basis for strategic decision making in building a more inclusive and resilient global financial ecosystem in the future.

This research makes an important contribution by presenting a systematic literature synthesis regarding the comparison between the blockchain technology underlying cryptocurrencies and traditional banking technology infrastructure. By bringing together findings from various relevant studies, this research provides deeper and more comprehensive insights into the advantages and limitations of both systems from the perspectives of security, efficiency and scalability. This synthesis will not only enrich the existing literature, but also provide a clearer understanding of the potential of both technologies in the context of an evolving global financial system. In addition, this research also offers strategic guidance for the future development of technology-based financial systems. By analyzing the strengths and weaknesses of each technology, this research provides insights that policymakers, industry players and technology developers can use to design safer, more efficient and scalable financial systems. Furthermore, the results of this research can help in formulating policies that support the adoption and integration of blockchain technology in traditional financial systems, or even stimulate the development of hybrid models that combine the advantages of both technologies. It is hoped that this contribution can become the basis for further research in the field of digital finance and technology, as well as provide direction for innovation that can create a more inclusive, transparent and sustainable financial system in the future.

2. METHODS

2.1 Research Approach

Research of using the method Systematic Literature Review (SLR) with guidelines PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to collect, filter and analyze related literature. This approach was chosen because SLR allows for comprehensive mapping to the existing literature, as well as providing a clearer picture of the main findings in the field under study, in this case a comparison between blockchain technology in cryptocurrencies and traditional banking infrastructure.

SLR with PRISMA guidelines has several stages that will be followed to ensure quality and consistency in the research process. The first stage is literature identification, where various articles, journals and publications relevant to the research topic will be collected from leading academic databases such as Google Scholar, Scopus, JSTOR and others. This process ensures that the selected literature is the most relevant and current to the topic being researched. After collection, the next stage is filtering literature, where the articles found will be selected based on clear inclusion and exclusion criteria, such as year of publication, type of publication, and relevance of the topic to the aspects discussed (security, efficiency, and scalability in the context of blockchain and traditional banking). This process helps to ensure that only quality and relevant literature will be included in the analysis.

After the literature is selected, the next stage is analysis And synthesis. At this stage, information from the selected literature will be analyzed in depth and compared based on kpre-defined categories, such as security, efficiency, and scalability. This synthesis aims to summarize the main findings and identify patterns and gaps in the existing literature. By using the SLR approach and PRISMA guidelines, this research aims to provide a more comprehensive and objective understanding of how blockchain technology compares with traditional banking technology infrastructure. This approach ensures that the findings produced are based on reliable evidence, and makes it possible to produce conclusions that are more valid and relevant for the development of the financial system in the future.

2.2 Research Protocol

This research protocol aims to establish clear and structured procedures for collecting, filtering and analyzing literature relevant to the topic of comparison between blockchain technology in cryptocurrencies and traditional banking technology infrastructure. This protocol will ensure that the research process is carried out systematically and transparently, producing valid and accountable results.

2.2.1. Keywords

To ensure that literature relevant to the research topic can be found, several main keywords will be used during the literature search. Keywords that will be used include:

- **Blockchain**
- **Cryptocurrency**
- **Traditional banking**
- **Security**
- **Efficiency**
- **Scalability**

A combination of these keywords will be used in a literature search to find articles discussing various aspects of blockchain technology in cryptocurrencies as well as traditional banking technology infrastructure, especially those related to security, efficiency, and scalability.

2.2.2. Database

A literature search will be conducted through several leading academic databases to ensure the quality and diversity of the information sources used. The databases to be used include:

- **Scopus**
- **Web of Science**
- **IEEE Xplore**
- **Google Scholar**
- **JSTOR**, and other relevant academic databases

These databases were chosen because they provide access to peer-reviewed articles, which were the primary sources for this research. Searches in each database will use predetermined keywords, as well as various filters to narrow search results to make them more relevant to the research topic.

2.2.3. Inclusion Criteria

Articles to be included in this study must meet the following inclusion criteria:

1. Peer-reviewed academic articles: Only articles published in academic journals that go through a peer review process will be considered to ensure the validity and quality of the research.
2. Published in the last 10 years: The focus of this study is on recent literature, so only articles published within the last ten years will be considered. This also refers to the rapid development of blockchain and cryptocurrency technology in that time period.
3. Relevance to topic: The article should discuss the comparison of blockchain technology and traditional banking, especially in terms of security, efficiency, and scalability.

2.2.4. Exclusion Criteria

Articles that do not meet the following criteria will be excluded from the selection process:

1. Non-academic articles: Non-academic articles such as industry reports, news articles, and popular publications will be excluded from the analysis, as they do not meet the academic standards required for this research.
2. Articles with irrelevant data: Articles that do not contribute directly to the comparison of the aspects discussed in this research (security, efficiency, and scalability) will be excluded from the analysis. This includes articles that discuss technical aspects or applications of blockchain and traditional banking outside the context relevant to the research objectives.

2.2.5. Selection Process

The selection process will follow these steps:

1. Identify literature: Searches will be carried out in various databases with specific keywords. All relevant articles will be downloaded and filtered.
2. Initial screening: Articles that do not meet the inclusion criteria or that appear irrelevant will be removed. The remaining articles will be examined further.
3. Quality evaluation: Articles that pass the initial screening will be assessed for quality based on the methodology used and their contribution to the research topic.
4. Analysis and synthesis: Article that remaining will be analyzed in depth and synthesized to draw conclusions relevant to the research.

By following this protocol, this research is expected to produce a systematic, valid, and comprehensive literature review, which can provide important insights regarding the comparison between blockchain in cryptocurrencies and traditional banking infrastructure.

2.3 Data Analysis

In this research, thematic analysis techniques will be used to identify and categorize the main themes that emerge in the literature that have been filtered and selected. This technique is very effective in qualitative research because it allows to unearth key patterns in the data and provides a deeper understanding of the topic under study. The thematic analysis process will be carried out through several structured steps, as follows:

1. **Initial Coding:**
   Once relevant literature has been selected and filtered, the first step in thematic analysis is to conduct initial coding. At this stage, each selected article will be read in depth to identify information that is relevant to the aspect being analyzed, such as security, efficiency, and scalability in blockchain technology and traditional banking.

This coding involves assigning codes or labels to certain parts of the text that relate to these themes.

2. **Theme Grouping:**
After initial coding, the codes found will be grouped into broader themes. For example, themes related to security can include aspects such as cryptography, decentralization, and the potential for cyberattacks, while the theme efficiency may include transaction fees, transaction speed, and resource usage. Each of these themes will be developed to describe broader aspects of the comparison between blockchain technology and traditional banking infrastructure.
3. **Preparation of Sub Themes and Categories**:
Once the main themes are identified, the next step is to detail more specific sub themes and categories. For example, in mother security, subthemes can include data security in blockchain vs. traditional banking or the role of cryptography in improving security And regulatory risks. This allows for more in-depth analysis regarding the factors that influence security in both systems.
4. **Thematic Synthesis**:
The thematic analysis process then continues with thematic synthesis, where the main themes that have been identified will be connected and synthesized to provide a comprehensive picture of the comparison of blockchain technology and traditional banking. This synthesis will focus on finding connections between the different findings and provide a clear picture of how both technologies operate from a security, efficiency, and scalability perspective.
5. **Drawing Conclusions**:
Based on the thematic synthesis, final conclusions will be drawn regarding the comparison between the two technologies. The results of this analysis will provide deeper insight into the strengths and weaknesses of each system in the three main aspects studied: security, efficiency, And scalability. This conclusion will help answer research question main and contribute to the development of technology-based financial systems in the future.

By using thematic analysis, this research is expected to produce a detailed and structured understanding of the comparison between blockchain in cryptocurrencies and traditional banking infrastructure, as well as offering a clear view of the potential and challenges facing each technology.

3. Results

In this section, the analysis results obtained from the research will be presented in detail and structured based on three main aspects which are the main focus in the comparison between blockchain technology in cryptocurrency and traditional banking technology infrastructure, namely security, efficiency, And scalability. Each aspect will be discussed in more depth to provide a clearer understanding of how these two systems operate and the challenges and advantages inherent in each technology..

3.1 Security Comparison

3.1.1. Blockchain

Security in blockchain technology largely depends on two main elements: cryptography And decentralization. Blockchain technology uses strong cryptographic algorithms to protect transactions and data recorded in blocks. Every transaction entered in the blockchain is protected by hashing, which ensures that data cannot be manipulated without detecting changes that have occurred. Besides that, decentralization is a feature that differentiates blockchain from traditional banking systems. In the absence of a single entity yang control of the entire network, blockchain reduces the single points of failure that often occur in centralized systems. This makes it more resistant to attacks from outside parties and the influence of internal manipulation. However, blockchain also faces related challenges 51% attack, where entities that control more than 50% of the network can manipulate transactions, as well cyber attack towards certain points such as digital wallets.

3.1.2. Traditional Banking

The traditional banking system relies on a centralized authorization mechanism, where control over data and transactions rests with a single institution or a large group of institutions. Security in traditional banking relies on encryption data and strict authentication protocols, as well as regulatory processes controlled by government agencies to ensure customer protection and transaction integrity. Often, multi-factor authentication (MFA) is implemented to minimize the risk of data leakage or illegal access. Security in traditional banking also includes strict regulations and regular audits to identify potential breaches. However, the main drawback of the traditional banking system is potential attacks on data centers or abuse of access by internal factors that have deeper access to the system. In addition, dependence on data management centers causes potential system failure at one point that could affect the entire financial system.

3.2 Efficiency Comparison

3.2.1. Blockchain

Blockchain offers high efficiency in international transactions, considering that transactions can be carried out directly between two parties without intermediaries such as banks. This reduces transaction costs and the time required to process cross-border payments. In addition, blockchain offers the ability to carry out transactions transparently and quickly, without the need to wait for bank processing times which usually take days, especially for international transactions. However, processing time in blockchain is still a major obstacle. Technology like proof-of-work those used in many blockchain networks (e.g., Bitcoin) require a longer time to validate transactions and produce new blocks. This causes latency in the network and makes the blockchain less efficient for small, fast transactions that require near real-time processing.

3.2.2. Traditional Banking

The traditional banking system offers fast processes in local transactions, with the ability to process payments in seconds or minutes. Large banks also have very mature infrastructure and systems to handle domestic transactions quickly and efficiently. However, when dealing with international or cross-border transactions, traditional banking systems often experience obstacles in the form of high fees, processing delays, and dependence on intermediaries between banks that create these systems. less efficient in the context of global transactions. The SWIFT system used in international banking often takes longer and has higher fees compared to transactions carried out via blockchain.

3.3 Scalability Comparison

3.3.1. Blockchain

Scalability is one of the major challenges faced by blockchain technology. Although blockchain can handle a large number of transactions in a decentralized network, its ability to handle high transaction volume in a short time is still limited. Transactions in blockchains such as Bitcoin and Ethereum take time to be confirmed, which is limiting scalability in terms of the number of transactions that can be processed per second (TPS). Some blockchains use approaches such as sharding or proof-of-stake to improve scalability, but this solution is still in the development and testing phase. In other words, blockchain is not yet able to handle the same transaction load as a centralized system like that exists in traditional banking, which allows for larger and faster transaction management.

3.3.2. Traditional Banking

On the other hand, the traditional banking system has mature infrastructure and can handle high transaction volumes efficiently through use of a centralized system operated by various financial institutions. This infrastructure allows the banking system to process transactions en masse and at high speed, especially in domestic transactions. However, traditional banking must invest in technological updates to keep up with the demands of the digital era, especially in the face of digitalization of payment systems and new technologies such as blockchain. Additionally, although these centralized systems have the capacity to handle large amounts of transactions, capacity expansion and technological updates to keep up with global market developments and new technologies such as AI and blockchain are challenges for infrastructure this tour.

4. Discussion

In this discussion section, the findings regarding security, efficiency, And scalability of blockchain and traditional banking will be analyzed in more depth and linked to the research questions that have been asked. A comparison between the two will provide a clearer picture of the advantages and disadvantages of each system in the context of the development of financial technology and its application in the global financial system.

4.1. Security

Blockchain technology presents a transformative approach to data management through its decentralized architecture, which significantly diminishes reliance on centralized entities. This decentralization enhances system resilience against cyberattacks and operational failures and fosters transparency and integrity by allowing all participants to access a unified copy of transaction data (Zheng et al., 2019; Yeoh, 2017). The distributed ledger technology inherent in blockchain facilitates a higher level of trust among users, as it mitigates the risks associated with single points of failure typical in traditional systems (Zheng et al., 2019; Yeoh, 2017). However, despite these advantages, blockchain is not immune to vulnerabilities, particularly concerning smart contracts. These self-executing contracts can harbor bugs or security flaws that malicious actors may exploit, as evidenced by the infamous DAO hack on Ethereum, which highlighted the potential for significant financial losses due to such vulnerabilities (Hu & Xu, 2021; Mehar et al., 2021; Yu et al., 2022).

In contrast, traditional banking systems operate on centralized authorization mechanisms that, while fortified by data encryption, multi-factor authentication, and regular audits, inherently possess a single point of failure. This centralization makes them susceptible to cyberattacks, as demonstrated by numerous incidents involving data breaches and ransomware attacks across various banks (Conti et al., 2018). The security measures in place, such as financial insurance, provide a layer of protection for customers in the event of a breach; however, the ongoing evolution of cyber threats necessitates continuous improvement in security protocols (Conti et al., 2018; Balatskyi et al., 2018). The reliance on centralized systems thus poses a challenge in adapting to the increasingly sophisticated landscape of cyber threats, underscoring the need for a more resilient framework that could potentially be addressed through the integration of blockchain technology (Zheng et al., 2019; Yeoh, 2017).

The exploration of blockchain's potential to enhance security in financial transactions is further complicated by the necessity of safeguarding against human error, particularly in the management of private keys associated with blockchain accounts. The vulnerabilities associated with smart contracts and the risks of mismanagement highlight the need for ongoing research and development to bolster the security of blockchain applications (Nzuva, 2024; Baldauf, 2023). As the technology matures, it is imperative to address these challenges to fully realize the benefits of blockchain in providing a secure and decentralized alternative to traditional banking systems (Zheng et al., 2019; Yeoh, 2017; Sun, 2024).

4.2. Efficiency

Blockchain technology presents a transformative approach to conducting transactions, particularly in the context of international dealings. One of its primary advantages is the significant reduction in costs associated with intermediaries, such as banks, which typically impose various fees for services like currency conversion and transaction processing. By enabling direct transactions between parties, blockchain minimizes these costs and enhances transaction speed, as transactions are recorded in an immutable ledger that ensures transparency and accountability (Yli-Huumo et al., 2016; Fanning & Centers, 2016). This shift from traditional banking systems, which often require multiple intermediaries and can incur high fees and delays, illustrates the potential of blockchain to streamline international transactions.

However, blockchain is not without its challenges. For instance, networks that utilize proof-of-work consensus mechanisms, such as Bitcoin, can experience longer processing times, particularly during periods of high transaction volume. This latency can hinder the efficiency of blockchain in scenarios requiring rapid transaction confirmations (Yu et al., 2020; Khan et al., 2020). Additionally, while blockchain offers advantages in cost reduction and transparency, traditional banking systems still excel in domestic transactions, where they can process payments almost instantaneously through real-time gross settlement (RTGS) systems. This reliability in local transactions is a significant factor in the continued relevance of traditional banking despite the growing popularity of blockchain solutions (Islamic, 2024).

In contrast, traditional banking systems face notable inefficiencies in international transactions due to the complexities introduced by regulatory requirements, currency conversions, and the involvement of multiple financial institutions. These factors often lead to increased processing times and costs, making traditional banking less competitive in the global landscape compared to blockchain solutions (Amin et al., 2019). Furthermore, while blockchain technology is still evolving, its ability to handle large volumes of transactions efficiently remains a critical area of research, with ongoing studies aimed at enhancing scalability and reducing transaction confirmation times (Taher, 2024; Okanami et al., 2022).

In summary, while blockchain technology offers significant advantages in terms of cost reduction and transparency for international transactions, it also faces challenges related to processing times and scalability. Traditional banking systems, while efficient for domestic transactions, struggle with the complexities of international dealings, highlighting the need for continued innovation and research in both domains to optimize transaction efficiency and reliability.

4.3. Scalability

Blockchain scalability is a critical challenge that affects the technology's ability to handle high transaction volumes efficiently. Traditional blockchain systems, particularly those utilizing proof-of-work consensus mechanisms, face inherent limitations in transaction processing speed and capacity. This limitation can lead to network congestion during periods of high demand, which is particularly problematic for applications requiring rapid transaction processing, such as global payment systems and financial platforms (Hafid & Samih, 2020; Zhou et al., 2020; Khan et al., 2021). Various solutions have been proposed to enhance blockchain scalability, including first-layer solutions like sharding, which divides the network into smaller segments to facilitate parallel transaction processing, and second-layer solutions such as payment channels and side chains that help alleviate congestion on the main blockchain (Hafid & Samih, 2020; Eklund & Beck, 2019; Dang et al., 2019).

Research indicates that sharding can significantly improve transaction throughput by distributing the load across multiple nodes, thereby reducing the burden on any single node (Dang et al., 2019). Additionally, alternative consensus mechanisms like proof-of-stake have been suggested as more efficient methods for transaction confirmation, potentially offering a more scalable solution compared to traditional proof-of-work systems (Hafid & Samih, 2020; Zhou et al., 2020; Khan et al., 2021). Despite these advancements, scalability remains a pressing issue that must be addressed for broader adoption of blockchain technology across various industries (Hafid & Samih, 2020; Khan et al., 2021; Sanka & Cheung, 2021).

In contrast, traditional banking systems, while benefiting from a more established infrastructure capable of handling high transaction volumes, also face their own scalability challenges in the digital age. The reliance on centralized servers and systems can hinder adaptability to the rapidly evolving digital landscape (Adarbah, 2023; Bodemer, 2024). However, the integration of cloud computing technologies presents a viable solution for traditional banks to enhance their scalability. Cloud computing allows for increased transaction processing capabilities and flexible capacity expansion without the need for significant physical infrastructure investments (Adarbah, 2023; Bodemer, 2024). By leveraging cloud technologies, banks can improve their operational efficiency and scalability, although they still face limitations compared to the decentralized nature of blockchain systems (Adarbah, 2023; Bodemer, 2024).

In summary, while blockchain technology presents significant scalability challenges, various solutions are being explored to enhance its capacity for high transaction volumes. Traditional banking systems, on the other hand, can improve scalability through the adoption of cloud computing, although they still encounter limitations in comparison to blockchain's decentralized framework. Both sectors must continue to innovate and adapt to meet the growing demands of digital transactions.

This discussion has answered related research questions about comparison between blockchain and traditional banking technology infrastructure in terms of security, efficiency, And scalability. Blockchain is superior in aspects of decentralized security And reduced cross-border transaction costs, but has internal challenges scalability And smart contract security. In contrast, the traditional banking system is more stable and deeply secure centralized security, as well as more efficient in local transactions, but faces challenges in global efficiency And digital scalability. Thus, the results of this research show that each system has its advantages and disadvantages, and the choice of appropriate technology is highly dependent on specific needs in the context of a developing financial system.

5. Conclusion

5.1 Summary of Findings

This research discusses the comparison between blockchain technology in cryptocurrencies and traditional banking technology infrastructure in three main dimensions: security, efficiency, And scalability. The main findings of this study indicate that both systems have significant advantages and disadvantages. In terms of security, blockchain excels with the advantage of decentralization that increases data transparency and integrity, but still faces challenges related to smart contract exploitation. Traditional banking, although more vulnerable to centralized attacks, is protected by more established security mechanisms, including financial insurance and strict regulations that have been tested in practice.

In terms of efficiency, blockchain offers reduced costs on cross-border transactions and provides a more efficient global payment system, but at the expense of longer processing times due to limitations of consensus mechanisms such as proof-of-work. On the other hand, traditional banking tends to be more efficient in domestic transactions, with fast and organized processes, although it is more expensive and less efficient for international transactions. In terms of scalability, blockchains face major challenges in handling very high transaction volumes, although solutions such as sharding and proof-of-stake can offer improvements. Traditional banking, though a mature infrastructure, still needs to adapt to developments in digital technology and utilize investments in cloud technology to increase its scalability. Overall, blockchain tends to excel in terms of innovation and potential to transform the financial system, but faces significant technical challenges. Meanwhile, traditional banking, although more conservative, offers reliability and stability that has been tested over the years.

5.2 Research Implications

The results of this research have important implications for student regulators And technology developers in the financial sector. A better understanding of the strengths and weaknesses of each system can guide the formulation of policies that support the development of more efficient and secure financial systems. With rapid technological advances, regulators and developers may consider implementing hybrid systems which combine the advantages of these two technologies, such as leveraging the decentralized power of blockchain in maintaining data transparency and integrity, while still utilizing the more established and stable traditional financial infrastructure. This hybrid system can offer a more flexible and adaptive solution to evolving market demands.

In addition, these findings can be used by financial industry practitioners to design optimizing solutions for security, efficiency, And scalability in a more integrated way. For example, financial institutions may adopt blockchain technology for international transactions or the implementation of smart contracts, while retaining traditional banking systems for domestic transactions and operations that focus more on regulation and security.

5.3 Limitations and Recommendations

5.3.1. Limitations

This study has several limitations that need to be noted. The main focus of this research is on three main dimensions: security, efficiency, And scalability, which while important, does not cover all aspects related to blockchain implementation and traditional banking. Several other dimensions that can influence the performance and adoption of this technology, such as environmental sustainability, user acceptance, or socio-economic impact, were not discussed in depth in this study. Therefore, readers need to consider other factors when evaluating the long-term potential of these two technologies.

5.3.2. Recommendation

Further research needs to be carried out to explore other possible aspects influencing the implementation and adoption of blockchain and traditional banking. For example, impact environment The use of blockchain, known for its high energy consumption in proof-of-work networks, needs to be explored further, especially in relation to global sustainability goals. Apart from that, it is also necessary to conduct studies on user acceptance towards blockchain technology, considering the many obstacles associated with its use of private keys, difficulty in understanding smart contracts, and an aversion to decentralized systems. Research more You can further examine how the integration of these two technologies can produce greater benefits and reduce the weaknesses of each system, thereby having a broader impact on the global financial sector.

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