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The Role of Blockchain Technology in Increasing Transparency and Security of Financial Management in the Banking Sector

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Abstract

This article discusses the role of blockchain technology in improving the transparency and security of financial management in the banking sector. This study uses a qualitative approach with a literature study method to analyze various references related to the application of blockchain in the banking world, both in terms of theory, policy, and practice. Blockchain, as a decentralized technology that allows for transparent and secure recording of transactions, has great potential to revolutionize the way banks manage financial data and interact with clients and other financial institutions. Through literature analysis, the study identified the key advantages of blockchain, such as reduced fraud risk, increased transaction efficiency, and enhanced data integrity. In addition, the study also discusses the challenges faced by the banking sector in implementing blockchain, including regulatory issues, technological infrastructure, and resistance to change from related parties. By reviewing various case studies of blockchain implementation in leading banks, this article shows how this technology can be used to increase public trust in the financial system. The study concludes that, despite the great challenges that remain, blockchain can play a significant role in strengthening security and transparency in financial management, thereby supporting the creation of a more efficient and accountable banking system in the future.

Keywords: *Blockchain technology, Transparency, Security, Financial Management, Banking Sector.*

Introduction

The development of information technology in recent decades has had a significant impact on various sectors, including the banking sector. One of the most revolutionary innovations in the world of finance is blockchain technology, which offers great potential in improving transparency, security, and efficiency in financial management (Narayanan, 2016; Rane et al., 2023). Blockchain, which was first known through cryptocurrencies such as Bitcoin, allows for immutable recording of transactions and is distributed on a decentralized network, thereby minimizing the risk of manipulation and fraud. In the context of banking, this technology can provide solutions to various problems related to transparency and data security that have been the main concern (Yuan & Wang, 2018; Hasan et al., 2022).

The banking sector, faced with major challenges in managing transactions and data efficiently and securely, continues to look for technologies that can improve integrity and accountability in its operations. According to a report from The Institute of International Finance (IFF, 2020), the costs associated with financial fraud and data security breaches in the global banking sector reach billions of dollars every year. This shows the importance of innovation that can reduce these risks, one of which is the application of blockchain technology. In this regard, blockchain offers a more transparent and secure approach than traditional systems that rely on central authority and falsifying data (Catalini & Gans, 2016; Catalini & Gans, 2018; Catalini & Gans, 2020).

Blockchain is a decentralized technology that allows for secure and transparent data recording without the need for a central authority. Essentially, a blockchain consists of a chain of blocks that each contain transaction data that has been verified by a network of participants (Sarmah, 2018; Yu et al., 2018). Each block is cryptographically connected to the previous block, thus forming an immutable structure. The security of this technology is ensured through the principle of consensus, where all participants in the

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network must agree on the validity of the transaction before it can be included in the block (Nakamoto, 2008). This process reduces the risk of data manipulation and fraud that often occurs in centralized systems, where one party can alter or manipulate information.

One of the main advantages of blockchain is decentralization, which means that no single party controls or manages the entire system (Islam & Apu, 2024; Mahmudnia et al., 2022). The technology uses a distributed network of computers (nodes) to verify and record transactions, so any changes or updates in the blockchain must be approved by the majority of nodes in the network. This provides a high degree of transparency, as each transaction is permanently recorded and accessible to all members of the network, making it difficult to manipulate or hide (Tapscott & Tapscott, 2016). As such, blockchain can provide a fairer and more open system, which is particularly useful in a variety of applications, including in the banking sector, where trust and transparency are essential (Javaid et al., 2022).

In the context of banking, blockchain technology offers a significant solution to the problems of transparency and security that have been a major challenge (Habib et al., 2022). By using blockchain, each transaction can be recorded clearly and irreversibly once recorded, which increases trust between banks and customers. Additionally, blockchain allows for reduced operational costs, such as high transaction fees and the time required for the verification process and transaction completion (Al-Jaroodi & Mohamed, 2019). This is due to the efficiency in data management driven by smart contract automation, which allows transactions to be carried out automatically after meeting certain conditions without the need for third-party intervention (Buterin, 2014). Therefore, blockchain technology has the potential to revolutionize the traditional banking system by improving efficiency, reducing costs, and strengthening trust and data security in financial transactions (Hassani et al., 2018).

However, despite its great potential, blockchain adoption in the banking sector still faces a number of challenges (Akram et al., 2020). Factors such as regulatory uncertainty, limited technological infrastructure, and resistance to change from established banking institutions are the main obstacles to its implementation (Panayi et al., 2018). Some major banks, such as JPMorgan Chase and HSBC, have already begun experimenting with blockchain technology, but widespread adoption is still in its early stages. A study by Accenture (2018) shows that only about 10% of global banks have fully implemented blockchain in their operations, although more than 80% of banks recognize the potential of this technology to improve efficiency and security.

In addition, the implementation of blockchain in the banking sector not only presents benefits, but also various challenges that need to be overcome, such as reliance on interoperability standards between different blockchain systems, as well as regulatory uncertainty that can support its wider adoption (Ali et al., 2021). Some countries, such as China and the United Arab Emirates, have begun to develop policies that support the adoption of these technologies in the banking system, while other countries still need time to set up appropriate legal frameworks (Riffai et al., 2012).

This article aims to examine the role of blockchain technology in improving the transparency and security of financial management in the banking sector, focusing on how this technology can be applied more broadly, as well as the challenges and opportunities associated with its implementation. By using a qualitative approach and literature study, this research is expected to provide a comprehensive overview of the contribution of blockchain in creating a more efficient, secure, and transparent banking system.

This research aims to answer two main questions: (1) how can blockchain technology improve transparency and security in financial management in the banking sector? (2) What are the challenges and opportunities faced by the banking sector in implementing blockchain as a more transparent and secure financial solution?

The research provides significant benefits for a wide range of stakeholders, including banking institutions, regulators, and policymakers, in understanding the potential and challenges associated with the application of blockchain technology in the banking sector. With a better understanding of the application of this technology, it is hoped that a more transparent, safe, and reliable banking system can be created.

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Literature Review

Basic Concepts and Principles

Blockchain is a technology that was first introduced by Satoshi Nakamoto through Bitcoin in 2008. This technology allows financial transactions to be recorded and stored securely and transparently in digital form without involving third parties or central authorities (Nakamoto, 2008) . Blockchain operates on the principle of decentralization, where data is not stored in one place, but is spread across various computers (nodes) in the network. Every transaction that occurs is verified by a consensus agreed upon by the network participants, and once verified, the transaction is included in the block. Each block contains encrypted transaction data and is connected to the previous block through a digital signature, thus forming an immutable chain. This security concept makes blockchain very relevant in the banking sector that requires high transparency and data protection (Tapscott & Tapscott, 2016).

Transparency and Security in the Banking Sector

The banking sector is an industry that relies heavily on transparency and security, especially in managing customer transactions and financial information. However, in practice, there are still a number of challenges related to fraud, identity theft, and data manipulation. One study conducted by Accenture (2018) shows that financial fraud in the global banking sector amounts to more than $30 billion annually, and most of it comes from transactions that cannot be tracked or exposed to the public in real-time. Therefore, technology that can improve the transparency and security of transactions is important. Blockchain offers a solution that allows every transaction to be recorded permanently and accountable to all participants in the network, without the possibility of unauthorized data changes (Catalini & Gans, 2020).

Blockchain in Improving Bank Operational Security and Efficiency

A number of studies have shown that blockchain can improve efficiency and reduce operational costs in the banking sector. In the context of international transactions, for example, global banks face high fees and long times to complete cross-border transactions (Hassani et al., 2018). The use of blockchain can reduce the need for third parties such as correspondent banks, speed up the transaction process, and reduce administrative and transfer costs. Buterin (2014) in his research on smart contracts mentioned that blockchain also allows the automation of financial contracts, where contracts can be fulfilled automatically when predetermined conditions are reached, reducing the risk of human error and increasing efficiency. Additionally, blockchain also introduces a more transparent system in terms of transaction reporting and internal auditing, which is important to avoid data manipulation or mismanagement that can harm banks and customers.

Blockchain and Its Implementation in the Banking Sector

Blockchain adoption in the banking sector is increasing, although there are still a number of challenges related to regulation and acceptance by industry players. Major banks, such as JPMorgan Chase, have begun to integrate blockchain technology in some aspects of their operations, such as in transaction settlement and identity verification (IFF, 2020). In Indonesia, Bank Indonesia and several other financial institutions have also begun to pilot the use of blockchain in payment systems and transaction records, although clear regulations are still in the development stage. A study by Peters & Panayi (2016) emphasizes the importance of developing international standards and adequate regulatory frameworks to support the implementation of blockchain in the banking sector globally. This includes regulations on data privacy, transaction authentication, and dispute resolution that may arise as a result of the use of blockchain.

Challenges and Opportunities of Blockchain in the Banking Sector

While blockchain offers a wide range of potential benefits, its implementation in the banking sector still faces a number of challenges (Alam et al., 2021). Several studies, including by Zohar (2017), identified key challenges in terms of inadequate regulation, resistance to change from traditional banks, as well as the need for a stronger technological infrastructure to support blockchain operations. Additionally, while blockchain is known for its

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ability to secure data, it also has drawbacks related to scalability, which can be a barrier in handling the large volume of transactions that occur in the banking sector (Chauhan et al., 2018). However, despite this, the opportunities offered by blockchain to reduce costs, increase transparency, and strengthen a more inclusive financial system are still enormous. The wider use of this technology in the banking sector can open up opportunities for the creation of a more efficient and secure financial system in the future (Tapscott & Tapscott, 2016).

Blockchain-Related Research in the Banking Sector

Several literature studies show that research related to the application of blockchain in the banking sector is still relatively limited, although interest in this topic is growing. Research by Catalini & Gans (2016) highlights the importance of using blockchain in cross-border transactions and the potential of blockchain in supporting the development of digital currencies. Meanwhile, research by IIF (2020) provides an overview of the regulatory challenges faced by financial institutions in implementing blockchain, especially related to the standards that apply in each country. These studies provide in-depth insights into how blockchain can transform the global financial landscape, as well as the challenges it needs to face in its adoption in the banking sector.

Methods

This study uses a qualitative approach with a literature review method to analyze the role of blockchain technology in improving the transparency and security of financial management in the banking sector. The qualitative approach was chosen because it aims to understand and explore the phenomena that occur in the application of blockchain, as well as to dig deep insights into the impact of this technology on the banking financial system. The literature study method allows researchers to collect, analyze, and synthesize findings from various relevant sources, so that it can provide a comprehensive and evidence-based picture of the issue being studied (Lim et al., 2021; Dixon-Woods, 2010).

Data Source

The data sources used in this study come from various academic publications, industry reports, international journal articles, books, and policy documents that discuss the topics of blockchain, the banking sector, and security and transparency in financial management. The data collected includes research published between 2008 and 2023 to ensure the relevance and updating of the information used in the analysis. These sources are selected based on their credibility, methodology quality, and contribution to understanding the application of blockchain in the banking sector. In addition, the study also involves the analysis of industry reports published by leading institutions such as Accenture (2018), the Institute of International Finance (2020), and various documents issued by other international organizations that focus on technological innovation in the financial sector.

Data Collection Techniques

The data collection technique in this study was carried out by identifying and selecting relevant literature through systematic searches in academic databases such as Google Scholar, JSTOR, SpringerLink, and IEEE Xplore. Keywords used in the search include "blockchain technology", "banking sector", "financial transparency", "financial security", and "cryptocurrency". The literature selection process is carried out by considering inclusion and exclusion criteria, including articles published in international indexed journals, the relevance of the topic to blockchain and the banking sector, and the quality of the methodology used in each study. In addition, only studies based on empirical and credible theoretical research will be included in this review. The literature screening and selection process is carried out repeatedly to ensure that the articles entered really meet the specified quality standards (Okoli & Schabram, 2015).

Data Analysis Methods

The data analysis in this study was carried out using thematic analysis techniques, where researchers identified and categorized the main themes that appeared in the selected literature (Terry et al., 2017). The process involves three main steps: first, data coding to identify key elements related to the implementation of blockchain in the banking

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sector, such as efficiency, security, transparency, and implementation challenges. Second, grouping similar findings to identify patterns or trends that emerge from various sources that have been analyzed. Third, the synthesis of these findings is to compile conclusions that describe the role of blockchain in increasing transparency and security in banking financial management. This entire process aims to provide holistic insights into how blockchain can be effectively applied in the banking sector to mitigate risks and increase public confidence in the financial system.

Validity and Limitations

The validity of the findings in this study is maintained by ensuring that all data used comes from reliable sources and has a good academic reputation. In addition, the limitations of this research lie in its nature of relying only on secondary data from existing literature studies, which may limit the scope of more specific empirical findings related to blockchain implementation in the banking sector directly. To overcome these limitations, this research combines diverse sources from different parts of the world and involves a review of relevant policies and practices in different countries to gain a broader perspective.

Using this approach, this research is expected to provide a deeper understanding of how blockchain technology can be applied to improve transparency and security in financial management in the banking sector, as well as identify the challenges and opportunities associated with its adoption.

Results and Discussions

Increased Transparency in Financial Management

Transparency in the banking sector refers to the ability to view and verify the flow of funds, as well as ensuring that all parties involved in the transaction can access relevant information. In traditional banking systems, transaction traceability is often limited by the various centralized systems used by individual banks. This can lead to opacity in transaction monitoring or even potential data manipulation, affecting the integrity of the financial system (Fung, 2014).

Blockchain addresses this problem by providing a transparent decentralized ledger, where all transactions are stored in non-modifiable blocks without the consent of the entire network. Because blockchain is decentralized, no third party or intermediary such as a bank is required to verify transactions, which can reduce the likelihood of fraud or data errors.

According to a PwC report (2018), the use of blockchain in the financial sector can reduce transaction verification costs and improve data traceability, as all transactions are monitored in real-time and can be independently audited. By utilizing this technology, banks can reduce reliance on third parties for audits, which previously required a long time and high costs. This transparent system allows for a more efficient and faster audit process, which in turn reduces operational costs and risks.

One example of a real implementation of blockchain in the banking sector is the use of this technology by Bank Santander in a cross-border payment system. Before the implementation of blockchain, international transactions took several days to process due to the intermediaries involved, administrative fees, and regulations that differed in each country (Ganne, 2018). This causes a slow payment process and sometimes is not transparent for consumers and parties involved in transactions.

However, after adopting blockchain technology, Bank Santander was able to reduce the time of international transactions from a few days to just a few hours. Blockchain-based systems allow for direct payments between parties involved without the need to go through multiple layers of intermediaries. Through this platform, called One Pay FX, cross-border transactions become faster, more transparent, and cost-effective. The data recorded in the blockchain ensures that all transactions can be viewed and verified openly, which reduces the potential for errors or manipulation of information (Rosdiana, 2019).

In addition to increasing transparency, the implementation of blockchain also has a significant impact on reducing operational costs in the banking system. In traditional international transactions, the fees incurred

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by banks can reach billions of dollars each year, especially for verification fees, currency conversion, and intermediary commissions. With blockchain, these costs can be minimized because transactions can be made directly between banks without intermediaries and at lower fees.

For example, a report by PwC (2018) shows that the implementation of blockchain in the global banking system can save up to $20 billion per year in cross-border transaction costs. Blockchain reduces the need for fees that typically arise from transaction verification, auditing, and processing processes performed by third parties. With this reduction in costs, banks not only improve efficiency but also provide more affordable services to their customers (Rosdiana, 2019).

In addition to Bank Santander, many other global financial institutions have also begun to explore the application of blockchain to improve transparency and security. For example, HSBC has used blockchain to simplify the payment process and reduce costs in international trade. In one case, HSBC managed to reduce transaction times for commodity trading from a few weeks to just a few days through a blockchain platform they developed with technology company R3 (Barber, 2021).

According to a Deloitte report (2019), more than 40% of major financial institutions around the world have already piloted or implemented blockchain solutions in various applications, from payments to asset management. More than 20% of these institutions reported that they have seen significant improvements in operational efficiency and cost reductions after implementing blockchain technology.

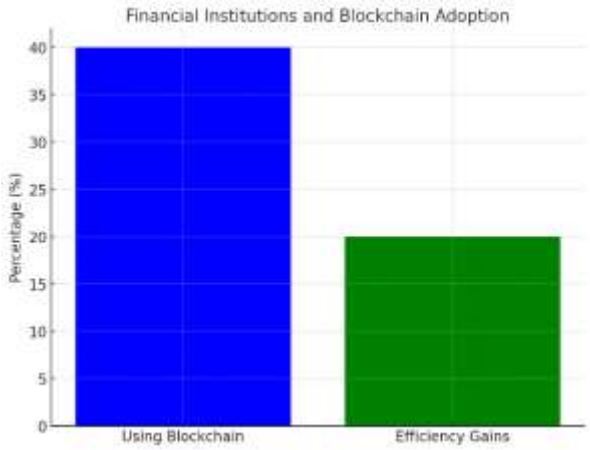

Figure 1. Financial Institutions and Blockchain Adoption

Improving Security in the Financial System

Blockchain has become a revolutionary solution in improving security and transparency in the banking sector. With its decentralized nature and high-level cryptographic technology, every transaction on the blockchain is protected by a mechanism that ensures the data cannot be modified without the consent of the majority of the network. This creates a permanent ledger system that can be audited independently and transparently, so that the risk of data manipulation or fraud can be minimized. A study by Balagolla et al. (2021) shows that blockchain combined with proactive anomaly detection is able to prevent fraud in credit card transactions before the transaction enters the network. In addition, the integration of machine learning with blockchain provides real-time fraud detection capabilities through transaction pattern analysis, as proposed by Bello & Iyelolu (2024).

A clear example of blockchain implementation is JPM Coin by JPMorgan Chase, which improves the security and efficiency of international fund transfers by allowing transactions to take place quickly and securely. A similar implementation by HSBC managed to cut the transaction time of commodity trading from weekly to just a few days, demonstrating the advantages of blockchain in operational efficiency. In addition to improving security, blockchain is also able to reduce operational costs in the banking sector.

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According to Sharma & Damle research (2022), blockchain adoption can cut audit, transaction verification, and security costs by up to $20 billion per year globally. This technology not only creates a more transparent and efficient system, but also helps banks mitigate fraud risks significantly.

Globally, the trend of blockchain adoption in the financial sector shows rapid development. More than 40% of financial institutions have piloted or implemented blockchain, with most reporting significant improvements in security and operational efficiency. With transparency, speed, and lower costs, blockchain is an important solution for the banking sector to answer cybersecurity challenges and improve the integrity of the financial system.

Potential Cost Reduction and Operational Efficiency

Blockchain technology plays a significant role in reducing operational costs in the banking sector, particularly in processing transactions, verifying identities, and managing data. Traditional systems like SWIFT for international transactions often involve multiple intermediaries, leading to high fees and slow processing times. For example, Ripple, a blockchain-based platform, enables international transactions to be completed at a fraction of the cost and time compared to SWIFT, reducing fees to below $0.01 per transaction (Myronov, 2024).

The adoption of blockchain technology has been estimated to save the banking sector billions of dollars annually. According to PwC (2018), blockchain implementation in payments and risk management can reduce costs by up to $20 billion per year, particularly for banks that handle thousands of cross-border transactions daily. Another study estimates that implementing blockchain technology could save up to $27 billion by 2030 on international transactions alone by eliminating intermediaries and increasing efficiency (Myronov, 2024).

In addition to cost savings, blockchain significantly enhances the speed of transactions. For example, Ripple processes transactions in seconds, while SWIFT can take multiple days. Blockchain networks like Ethereum and Solana are capable of processing thousands of transactions per second (TPS), far outpacing traditional banking systems. Solana, for instance, can handle up to 65,000 TPS, showcasing blockchain's potential for scalability and efficiency in international payments (Myronov, 2024).

Blockchain also reduces overhead costs by streamlining processes and improving transparency. By eliminating the need for multiple layers of verification and reducing paperwork, blockchain allows for faster settlement of payments. This efficiency is particularly valuable for global banks and financial institutions, which frequently process large volumes of transactions across borders (Giri et al., 2021).

In conclusion, blockchain technology drastically reduces operational costs for banks by minimizing intermediary fees, speeding up transactions, and improving transparency. The cost-saving potential for the banking sector, particularly in international transactions, underscores the transformative impact of blockchain in modernizing financial systems.

No	Category	Value
1.	Cost per Transaction with Ripple	$0.01
2.	Cost per Transaction with SWIFT	$50
3.	Annual Cost Savings with Blockchainc	$27 Billion
4.	Transaction Speed (TPS)	65,000 TPS

Table 1. Blockchain Cost Efficiency

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Implementation Challenges and Obstacles

Blockchain has great potential to improve efficiency, transparency, and security in the banking sector, but its implementation faces a number of obstacles that need to be overcome. One of the main challenges is the need for large investments in IT infrastructure as well as human resource training. Banks must significantly update their technology systems and ensure employees have an adequate understanding of these technologies. In addition, the issue of scalability is a major obstacle, especially on proof-of-work (PoW)-based blockchains such as Bitcoin and Ethereum, which are only capable of processing 7-15 transactions per second (TPS), far below the capacity of traditional systems such as Visa which reaches 24,000 TPS (Khan et al., 2021).

High energy consumption is also a serious concern. The mining process in the PoW system, such as in Bitcoin, requires enormous computing power and is equivalent to the annual energy consumption of a small country (Alshahrani, 2023). Solutions such as Proof-of-Stake (PoS) and energy optimization algorithms have been proposed to reduce the environmental impact of blockchain (Alofi et al., 2022). In addition, ununiform regulations and legal uncertainty in various countries have also hindered the widespread adoption of blockchain. Banks must ensure compliance with local and global regulations that often overlap and do not yet cover these technological developments (Hashimzai & Ahmadzai, 2024).

Another challenge is interoperability between different blockchain systems. Different blockchain technologies often cannot operate together, so the development of standard protocols is needed for better integration between platforms and between banks (Mafike & Mawela, 2022). By addressing these challenges through technical solutions such as sharding, the development of more energy-efficient consensus models, and more mature regulation, blockchain has the potential to become a strong foundation in the transformation of the global financial system. Here is a table depicting a comparison of transaction capacity per second (TPS), blockchain energy consumption, and potential annual savings

No	Category	Value
1.	Bitcoin TPS	7 TPS
2.	Ethereum TPS	15 TPS
3.	View TPS	24,000 TPS
4.	Blockchain Energy Use (TWh/year)	150 TWh/year
5.	Annual Blockchain Savings (USD Billion)	$27 Billion

Table 2. Blockchain Scalability and Cost Data

Future Implications of Blockchain Technology in the Banking Sector

Based on this analysis, it can be concluded that blockchain technology has enormous potential to change the financial management landscape in the banking sector, especially in terms of transparency and security. While challenges such as scalability and implementation costs are still an issue, future technological developments and wider adoption are expected to address these barriers.

The implementation of blockchain in the banking sector is not only a matter of technology, but also related to a paradigm shift in the way banks operate. As stated by Tapscott and Tapscott (2017), blockchain has the potential to create a fairer, more transparent, and efficient banking system, which will ultimately provide significant benefits to customers and financial institutions themselves.

Discussions

This study reveals the great potential of blockchain technology in the banking sector, especially in

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improving transparency, security, and operational efficiency. However, the challenges in the implementation of this technology also need to be considered in depth.

Increased Transparency

Transparency in the banking sector is key to ensuring trust between financial institutions and customers. In traditional systems, transaction traceability is often hampered by centralized structures, which can lead to ambiguity and potential data manipulation. With blockchain, every transaction is recorded in a decentralized ledger that can be accessed by all parties involved. This reduces reliance on third parties and allows for independent audits in real-time, thereby improving the accountability and integrity of the financial system. For example, Bank Santander has successfully implemented blockchain technology in their cross-border payment system, reducing transaction times from a few days to just a few hours. This system not only makes transactions faster but also more transparent for all parties involved. This success shows that blockchain can overhaul the traditional way banks operate and increase customer trust in financial institutions.

Reduced Operational Costs

Blockchain has significant potential to reduce operational costs in the banking sector. In traditional international transactions, the fees incurred by banks can be very high due to the involvement of many intermediaries. By using blockchain, transactions can be made directly between banks without intermediaries, which reduces verification and administrative costs. A PwC report (2018) estimates that blockchain adoption can save up to $20 billion per year in cross-border transaction costs. Additionally, platforms like Ripple point out that transaction fees can drop below $0.01 compared to the average $50 fee for the SWIFT system. This cost reduction not only improves the operational efficiency of the bank but also allows them to offer more affordable services to customers.

Improving Security

Security is a crucial aspect in the banking sector, and blockchain offers an innovative solution to this problem. By using high-level cryptographic technology and the decentralized nature of the blockchain, every transaction is protected from modification without the consent of the majority of the network. This creates a permanent ledger that can be independently audited, so the risk of data manipulation or fraud can be minimized. Studies show that the combination of blockchain with anomaly detection technology can prevent fraud before it happens. For example, JPMorgan Chase with its JPM Coin has improved the security of international fund transfers by utilizing blockchain technology to ensure transactions are fast and secure. This shows that blockchain not only improves efficiency but also strengthens the integrity of the financial system.

Implementation Challenges

Despite the many benefits, blockchain implementation in the banking sector faces a number of challenges. One of the main challenges is the need for large investments in IT infrastructure as well as human resource training. Banks must significantly update their technology systems and ensure employees have an adequate understanding of these new technologies. In addition, the issue of scalability is the main obstacle. Many proof-of-work (PoW)-based blockchain systems such as Bitcoin are only capable of processing 7-15 transactions per second (TPS), far below the capacity of traditional systems such as Visa which reaches 24,000 TPS. The high energy consumption of the mining process is also a serious concern, with several solutions such as proof-of-stake (PoS) being developed to address this issue.

Regulations that are not uniform in different countries also hinder the widespread adoption of this technology. Banks must ensure compliance with various local and global regulations that often overlap and do not yet fully cover the development of new technologies such as blockchain.

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Future Implications

The future of blockchain technology in the banking sector looks promising despite the challenges that must be faced. With the development of technology and wider adoption, many of the current obstacles are expected to be overcome. Blockchain not only offers technical solutions but also drives a paradigm shift in the way banks operate.

With increasing awareness of the benefits of blockchain and advancements in regulation and infrastructure, we can expect to see significant transformations in the global financial system. As stated by Tapscott and Tapscott (2017), this technology has the potential to create a fairer, more transparent, and efficient banking system, providing significant benefits to customers and financial institutions themselves.

Conclusions

Transparency in the banking sector is an important aspect that includes the ability to view and verify the flow of funds, as well as ensuring that all parties involved in the transaction can access relevant information. In traditional banking systems, transaction traceability is often limited by various centralized systems, which can lead to ambiguity and potential data manipulation, thus affecting the integrity of the financial system. Blockchain technology offers a solution by providing a transparent decentralized ledger, where all transactions are stored in non-modifiable blocks without the consent of the entire network. With this decentralized nature, no third party or intermediary such as a bank is required to verify the transaction, thus reducing the likelihood of fraud or data errors. The PwC report states that the use of blockchain in the financial sector can reduce transaction verification costs and improve data traceability, as all transactions are monitored in real-time and can be independently audited.

One example of a real implementation of blockchain in the banking sector is the use of this technology by Bank Santander in a cross-border payment system. Prior to the implementation of blockchain, international transactions took several days to process due to the involvement of various intermediaries and high administrative costs. However, after adopting blockchain technology, Bank Santander was able to reduce international transaction times from a few days to just a few hours through the One Pay FX platform. This blockchain-based system allows for direct payments between the parties involved without the need to go through multiple layers of intermediaries, thereby increasing transparency and efficiency.

In addition to increasing transparency, the application of blockchain also has a significant impact on reducing operational costs in the banking system. The fees incurred by banks for international transactions can reach billions of dollars each year, especially for verification and currency conversion. With blockchain, these costs can be minimized because transactions can be made directly between banks without intermediaries. The PwC report estimates that the implementation of blockchain in the global banking system could save up to $20 billion per year in cross-border transaction costs.

Blockchain also plays an important role in improving security in the financial sector. With its high-level cryptographic technology and decentralized nature, each transaction is protected by a mechanism that ensures the data cannot be modified without the consent of the majority of the network. This creates a permanent ledger system that can be independently audited, so the risk of data manipulation or fraud can be minimized. Research shows that the combination of blockchain with anomaly detection technology is able to prevent fraud in transactions before entering the network.

However, despite its many benefits, blockchain implementation in the banking sector faces a number of challenges, including the need for large investments in IT infrastructure and human resource training. In addition, the issue of scalability is a major obstacle for many proof-of-work-based blockchain systems that are only able to process a small number of transactions per second compared to the capacity of traditional systems. The high energy consumption of the mining process is also a serious concern. Solutions such as proof-of-stake and energy optimization algorithms have been proposed to reduce the environmental impact of blockchain.

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Despite these challenges, the potential of blockchain technology to transform the banking sector is enormous. With the development of technology and wider adoption in the future, many current obstacles are expected to be overcome. Blockchain implementation is not just about the technology itself but also about a paradigm shift in the way banks operate. Blockchain has the potential to create a fairer, more transparent, and efficient banking system, providing significant benefits to customers and financial institutions themselves.

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We recognize that challenges in blockchain implementation, such as high investment requirements, scalability issues, and ununiform regulations, are obstacles that need to be overcome. Therefore, we appreciate the research contributions by Khan et al. (2021) and Alshahrani et al. (2023) who address these issues in depth.

Finally, we hope that this research can be a reference for further research in exploring the full potential of blockchain in the banking sector, as well as driving the adoption of this technology to create a more transparent, efficient, and secure financial system.

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