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BLOCKCHAIN TECHNOLOGY INNOVATION AS AN OPTIMIZATION OF TRANSACTION SECURITY IN ISLAMIC FINANCIAL INSTITUTIONS

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Abstract

This study examines the role of blockchain technology in enhancing security within Islamic financial institutions, which adhere to Sharia principles emphasising transparency, fairness, and ethical conduct. The primary purpose is to explore blockchain's potential to address financial risks and inefficiencies while ensuring compliance with Islamic values. Islamic financial institutions face challenges maintaining transaction security and transparency under Sharia constraints, especially as risks like fraud, manipulation, and operational inefficiencies persist. Blockchain's decentralised ledger system offers solutions by ensuring immutable transaction records, real-time transparency, and secure cryptographic frameworks. Smart contracts further automate Sharia-compliant processes, reducing risks of non-compliance and fraud, while operational efficiencies are achieved through reduced costs and faster transaction processing. However, implementing blockchain in Sharia financial institutions faces limitations, including a lack of technical expertise, regulatory clarity, and inadequate infrastructure in many regions. These barriers highlight the need for capacity-building initiatives and robust regulations to support blockchain adoption in Islamic finance. The study emphasises blockchain's transformative potential to revolutionise Islamic finance, fostering trust and operational excellence while overcoming current barriers through collaborative efforts. Further research is necessary to optimise blockchain's integration into this sector.

Keywords: *Blockchain Technology, Transaction Security, Islamic Financial Institutions, Sharia Financial Institutions*

I. INTRODUCTION

Technological developments have increased rapidly since the Fourth Industrial Revolution, as indicated by continued innovation that facilitates human existence. One of these innovations is the emergence of the financial technology field, often called Fintech. Financial Technology is one of the technological innovations in finance that heralds a new model in the community so that people can now conduct financial transactions modernly, effectively, and efficiently through the Internet. Indonesians cannot live without the Internet, leaving market share open for Fintech development.

Blockchain is one type of financial technology being discussed right now. Blockchain is a decentralised transaction system where transaction information is recorded openly, transparently, and securely in interconnected blocks. This makes it possible to create a distributed database that cannot be easily manipulated. Blockchain is often discussed in relation to cryptocurrency, commonly called digital currency. The Blockchain ecosystem in Indonesia has grown and rivals other nations. For example, in Southeast Asia, Indodax offers a platform for buying and selling crypto assets and is among the neighbourhood exchanges with the greatest membership. Blockchain has influenced changes in the business world, especially regarding the security and efficiency of business operations.[1] Tapscott & Tapscott argue that Blockchain is a revolutionary technology in the 21st century.[2]

In recent years, Blockchain technology has become an innovation that has attracted the broader community's attention. With its ability to create a secure and transparent decentralised database, the technology can change how financial transactions are conducted. On the other hand, Islamic law principles in Islamic financial transactions have distinct perspectives and rules that must be followed. The development of Sharia finance is inseparable from public enthusiasm regarding Sharia economic practices and the innovation of Sharia services in the form of Fintech.

Sharia Fintech differs from conventional Fintech because it is more inclusive, transparent, and ethical, benefitting all parties and following Sharia principles. Both Fintech and Sharia Fintech are distinguished only by Sharia compliance. It should be noted that any innovation or progress is permissible in Islam unless there is clear evidence prohibiting it. Meanwhile, in recent years, Islamic financial institutions have experienced rapid growth. Overall, the growth of Indonesia's Sharia financial assets had reached IDR 2,450.55 trillion or around USD 163.09 billion as of June 2023. This figure shows growth of 13.37% (yoy) with a market share of 10.94% of the total national financial industry.[3]

In practice, Islamic financial establishments must be equipped to meet the demands of Sharia compliance, which varies from conventional finance. The system incorporates Islamic finance principles prohibiting usury, excessive speculation, and investment in certain sectors. This dynamic creates challenges

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[1] Dondy Indraprakoso and Haripin, "Eksplorasi Potensi Penggunaan Blockchain Dalam Optimalisasi Manajemen Pelabuhan di Indonesia: Tinjauan Literatur," *Sanskara Manajemen Dan Bisnis* 1, no. 03 (July 31, 2023): 140–60, https://doi.org/10.58812/smb.v1i03.131.

[2] Don Tapscott and Alex Tapscott, *Blockchain Revolution: How the Technology behind Bitcoin Is Changing Money, Business, and the World* (Penguin, 2016).

[3] Binekasri, R. (2023). Potensi Keuangan Syariah di Indonesia Sebesar ini. Retrieved from https://www.cnbcindonesia.com/syariah/20231013165255-29-480399/potensi-keuangan-syariah-di-indonesia-sebesar-ini

in managing risk, requiring innovative strategies and models.[4] Like conventional financial institutions, Islamic financial institutions remain subject to financial risks. In contrast, Islamic financial institutions face more complex financial risks because, in addition to having to comply with government regulations, they must also comply with Sharia principles.[5] Some of the challenges faced by Islamic financial institutions in managing risk include:

1. Regulatory and supervisory challenges. Islamic financial institutions face difficulties complying with various regulatory systems in several countries.
2. Like other financial institutions, the main problem for Islamic financial institutions is credit/financing risk. Businesses and individuals can obtain financing, and default by the borrower can result in losses for Islamic financial institutions.
3. Market risk affects Islamic financial institutions' asset valuation depending on fluctuations in interest rates, exchange rates, and market conditions.
4. Failure to comply with Sharia principles violates Sharia law, which can result in reputational damage and monetary losses. Islamic financial institutions must ensure that all financial operations abide by Islamic ethical and moral norms.

These challenges emphasise the need for a robust risk management system to ensure adherence to Sharia principles. Based on the description above, it can be understood that risk management is needed, considering that the sustainability and stability of Islamic financial institutions largely depend on their ability to manage risk effectively. Without careful risk management, these institutions risk financial losses, harm to shareholders, and threats to long-term sustainability.[6]

Financial concepts based on Sharia principles, such as the prohibition of usury and socially responsible investment, are increasingly gaining the global community's attention. However, Islamic financial institutions face obstacles in managing transactions and financial data security like conventional financial institutions. The difference here, however, is that Islamic Financial Institutions (LKS) encounter more complex financial risks because, in addition to having to comply with juridical regulations, they must also comply with Sharia principles.

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[4] Wirman Siti Hajar, "Implementasi Manajemen Risiko Dalam Dunia Perbankan Syariah," March 21, 2023, 500–513, https://doi.org/10.5281/ZENODO.7756555.

[5] Ahmad Abbas, Wa Ode Rayyani, and Rini Purnamasari, "Sharia Banks and Their Business Earnings: An Empirical Exploratory of The Case of Indonesia," *Airlangga International Journal of Islamic Economics and Finance* 3, no. 1 (June 25, 2020): 31, https://doi.org/10.20473/aijief.v3i1.19326.

[6] "Badan Kebijakan Fiskal - Keuangan Syariah Sangat Berperan Dalam Pemulihan Ekonomi Nasional," accessed February 3, 2024, https://fiskal.kemenkeu.go.id/baca/2021/08/25/4308-keuangan-syariah-sangat-berperan-dalam-pemulihan-ekonomi-nasional.

Blockchain technology innovation is also emerging as a potential solution to optimise transaction security in Islamic financial institutions. Blockchain technology is one of the biggest advances since the invention of the internet. This technology provides various advantages, especially in terms of transparency and security. Blockchain has become increasingly popular in various circles in recent years. Blockchain is a new technology that can provide a new way of acquiring, processing, and sharing data and information.[7]

Islamic finance follows the principles of Sharia, which strongly emphasises justice, unity, and adherence to Islamic law. Specifically, financial transactions in Islamic financial institutions follow Sharia principles that prohibit the practice of *riba* (interest), *gharar* (uncertainty), *maisir* (speculation), and *maysir* (gambling). The emergence of blockchain technology has provided solutions to strengthen and improve the Islamic financial system. Blockchain technology allows for the decentralisation and transparent management of data. Islamic financial institutions can benefit from blockchain's unique ability to record transactions and secure data without intermediaries.

Initially, blockchain was known primarily as the underlying technology of cryptocurrencies like Bitcoin. Still, today, blockchain has come into its own as an idea that has the potential to change the existing financial system entirely. Islamic financial institutions prioritising security and justice are attracted to blockchain's potential for maintaining these principles. Blockchain technology can make transactions faster, cheaper, transparent, and secure. It can also use a digital platform so that near- and long-range transactions can happen in real-time.[8]

However, the adoption of blockchain in the context of Islamic financial institutions is still very in its infancy. Therefore, more investigation is required to identify the potential of blockchain to strengthen transaction security in Islamic financial institutions, taking into account compliance with Islamic principles. Blockchain research has been conducted by Lutfia Salsabila et al. entitled "Utilization of Blockchain Technology in Waqf Fund Management". This research identified significant effects on optimising the management of *waqf* funds. The study also found that blockchain technology has great potential for the financial industry, as it can ensure security, transparency, and data integrity, especially for *waqf* funds.[9]

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[7] "Transformasi Digital dalam Industri Halal di Indonesia (Studi Implementasi Teknologi Blockchain dalam Proses Sertifikasi Halal)," *Indo-Fintech Intellectuals: Journal of Economics and Business* 3, no. 2 (September 20, 2023): 360, https://doi.org/10.54373/ifijeb.v3i2.240.

[8] Muhammad Bahanan and Muhammad Wahyudi, "Analisis Pengaruh Penggunaan Teknologi Blockchain dalam Transaksi Keuangan pada Perbankan Syariah". *ITHISOM : Jurnal Ekonomi Syariah* 2, no. 1 (2023):43-54. doi: https://doi.org/10.70412/its.v2i1.42.

[9] Lutfia Salsabila, Mahira Fikriya, Farid Abdullah, and Muhammad Affan."Pemanfaatan Teknologi Blockchain Dalam Pengelolaan Dana Wakaf". *Jurnal Ekonomi Dan Bisnis Digital* 1, no. 2 (2023): 233-244, 239.

Further research was conducted by Diana Farid et al., entitled "The Effect of Digital Zakat on Poverty Alleviation in the Digital Era". The results of this study show that digital zakat has significant potential for poverty alleviation in the digital era. With digital zakat, transparency and accountability can be enhanced through blockchain technology, enabling a digital footprint of every zakat transaction.[10] Additionally, Akhmad Ilham Hanafi et al. found in their paper, "Exploring the Impact of the Latest Technological Innovations in Sharia Investment, " that introducing blockchain technology will increase transparency in the Islamic investment ecosystem. Using a distributed ledger, blockchain improves transparent tracking and auditing of finances, thereby reducing the risk of transactions that violate Shariah principles.[11]

The next research was conducted by Muhammad Bahanan et al. entitled "Analysis of the Effect of Using Blockchain Technology in Financial Transactions in Islamic Banking". The study results show that using blockchain technology in financial transactions in Islamic banking contributes significantly to increased security. Blockchain technology uses strong cryptographic algorithms and decentralised consensus mechanisms to ensure the integrity and authenticity of data. In the context of Islamic banking, this protects customer funds from fraud, manipulation, and cyberattacks.[12]

Previous studies on blockchain in Sharia finance focused on waqf, zakat, and investment. Meanwhile, transactions in Islamic financial institutions remain rarely studied. This article explores blockchain technology as a strategy to enhance transactions at Islamic financial institutions and identify how blockchain can meet specific Islamic security requirements, thereby strengthening integrity and trust in financial transactions. Islamic financial institutions can achieve better operational efficiency with reduced time and administrative costs. This research explores how blockchain implementation can optimise transaction processes without compromising Islamic principles.

The method used in this study is a literature study, which is a research approach carried out by collecting, reviewing, and analysing existing relevant literature, including scientific journals, books, articles, research reports, and conference proceedings.

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[10] Diana Farid et al., "Pengaruh Zakat Digital Terhadap Pengentasan Kemiskinan Di Era Digital," *JSE: Jurnal Sharia Economica* 2, no. 2 (2023): 4, https://doi.org/10.46773/jse.v2i2.679.

[11] Akhmad Ilham Hanafi and M Aditya Firdaus, "Mengeksplorasi Dampak Inovasi Teknologi Terbaru dalam Investasi Syariah" 1 (2023): 1316.

[12] Bahanan and Wahyudi, "Analisis Pengaruh Penggunaan Teknologi Blockchain Dalam Transaksi Keuangan Pada Perbankan Syariah," 50.

II. UNDERSTANDING BLOCKCHAIN TECHNOLOGY

Blockchain is a technology that enables the creation and management of transaction records in an open and decentralised manner. Simply put, a blockchain is a network of connected blocks that function as a digital ledger containing interrelated data using cryptographic techniques. Blockchain also functions as an encrypted digital database stored in blocks and shared by several parties in a list called a chain on a distributed network. Every transaction on the network is noted, confirmed, and maintained in a database. Transactions are propagated to all participants in the network, and transaction logs are created and cannot be changed.[13]

Blockchain technology is additionally referred to as distributed ledger technology. Dai and Vasarhelyi define blockchain technology as a system in which transaction records are stored in blocks across several computer-connected networks (peer-to-peer) that use algorithms to verify transactions. Blockchain technology is considered one of the most important disruptive technological innovations that have developed in recent years.[14]

Blockchain technology can make transactions faster, cheaper, transparent, and more secure. Transactions are quicker because they use digital platforms, so near and long-distance transactions can happen in real-time. Transactions are more affordable because they don't require third parties. Transactions are more transparent because every transaction flow is permanently recorded in the blockchain system and can be verified by related parties. Transaction security is enhanced by the impossibility of external parties hacking this distributed verification mechanism. A 2019 World Bank Study identified the blockchain system as a technological innovation that could trigger an industrial revolution that could disrupt economic and business models. This system could encourage increased productivity in various industries, especially the Islamic financial sector.[15]

Bitcoin and other cryptocurrencies are impossible without blockchain technology, but do not make cryptocurrencies and real-value assets possible. Blockchain operations must continue subject to government and policymaker oversight so that users feel more comfortable. Governments can send the wrong signals to markets, policymakers, law enforcement agencies, and usually their representatives. Besides, government policies and their relationships with private parties regarding blockchain applications will result in innovation.[16]

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[13] Andini Ramadhani, Dhina Aprilia Ananda, and Zul Azmi, "Teknologi Blockchain dan Sistem Akuntansi: Potensi dan Tantangan" 1, no. 1 (2024): 39.

[14] Rafiqi Ihsan, "Peluang Dan Tantangan Penggunaan Blockchain Technology Pada Perbankan Syariah di Indonesia," *E-QIEN* 11, no. 3 \(November 2022): 1037–49.

[15] World Bank, *Blockchain: Opportunities for Private Enterprises in Emerging Markets.* (Washington DC: World Bank, 2019).

[16] Ihsan, "Peluang Dan Tantangan Penggunaan Blockchain Technology Pada Perbankan Syariah di Indonesia."

The blockchain process is complex and quite complicated, where one device connects to other devices to record and check each other's data. A hash is a function that satisfies the encrypted request required to complete a computation from the Blockchain. Each block in the blockchain has unique hash information and contains reference information to the previous block, so any changes in the block will be detected and marked across the entire blockchain network. Hashes have a fixed length because it is almost impossible to guess the hash length if someone tries to crack the Blockchain. The same data will always result in the same hash value.[17] In more detail, blockchain works as follows:

1. Transactions: Users conduct transactions, such as money transfers, voice recordings, or other data recordings. This transaction requires the consent of the parties involved.
2. Verification: The blockchain user network verifies the proposed transaction, which consists of many scattered nodes. Verification involves checking data integrity, transaction validity, and node consensus.
3. Transaction Grouping: Verified transactions are grouped into blocks. Each block has transaction capacity limits that depend on the blockchain protocol used.
4. Block Addition: A block is formed and added to the existing blockchain, usually using a consensus mechanism agreed upon by the network. The consensus mechanism ensures that all nodes in the network agree to accept new blocks into the chain.
5. Cryptographic Security: Each block in the blockchain is associated with the previous block using cryptographic technology, which makes it difficult to change the data in a block without changing the entire chain of prior blocks. This renders the blockchain highly secure and difficult to manipulate.
6. Distribution and Decentralization: Data in a blockchain is stored in a distributed manner across many nodes in a network, preventing centralisation on a single entity or party. This increases security and reduces the risk of a single-point failure.
7. Transparency: Every transaction and block in the blockchain can be verified by every network member, so the monitoring and auditing process can be done transparently.

Blockchain has been used as the platform for various applications, including digital currencies such as Bitcoin and Ethereum, logistics, digital identification, asset ownership, and more.[18] This idea has been used in several businesses to improve data security, transparency, and resilience. Blockchain has a significant

[17] Rizki Lail Rahman, "Penggunaan Teknologi Blockchain Sebagai Solusi Keamanan Data Sistem Informasi," n.d.

[18] Akhmad Daniel Sembiring, *Sistem Pemilihan Umum Digital Dengan Teknologi Blockchain* (Vitraining, 2023).

role in digital marketing because digital advertising depends on third parties. With blockchain, marketers can collect valid customer data and create and store customer profiles. This will help marketers create more targeted and efficient campaigns and ads.[19]

II.A. Blockchain Technology Principles

There are seven principles in blockchain design:

1. Network integrity. Trust is a fundamental building block of social and economic interaction. Data integrity is encoded at every process stage on a blockchain and distributed to all users. This system integrity allows each member to exchange data or transactions with other parties without concern for integrity violations. Blockchain optimises the presence of a distributed peer-to-peer network and the use of adequate cryptography to maintain data integrity.
2. Distributed power and centralised power risks resulting in system failure caused by the actions of a few individuals. Blockchain distributes that authority to a peer-to-peer network so that if any individual system fails, it will not cause a system-wide failure.
3. Value is an incentive and a system. Blockchain aligns the incentives of its members with this principle. Incentives can be given somewhat to all members according to their activities and contributions to the system.
4. Security. Blockchain inherently maintains the network's security level to minimise the risk of failure and maintains confidentiality, authenticity, and non-repudiation of occurring activities.
5. Privacy. Blockchain maintains data privacy. With the development of a digital integrity model, the curiosity of one party to another can be minimised.
6. Right preserved: Property rights are transparent and coercive. Individual rights are recognised and respected.
7. Inclusion. Blockchain protocol applies to all users.

With these principles, blockchain has become the latest technology that can build trust and integrity without causing mistrust or scrutiny by other parties. With this mechanism, blockchain can still meet other criteria individuals expect in transactions. As a result, parties who initially function as intermediaries or intermediaries risk experiencing a decline in function, disappearing, or being required to seek other intermediation functions.

[19] "Systematic Literatur Review Dengan Metode Prisma: Dampak Teknologi Blockchain Terhadap Periklanan Digital," *Jurnal Ilmiah M-Progress* 14, no. 1 (January 25, 2024): 2, https://doi.org/10.35968/m-pu.v14i1.1182.

II.B. Types of Blockchain

1. Public Blockchain: This blockchain operates with native tokens and is extensively dispersed. Because anybody can contribute to its upkeep, this kind of public blockchain is called open source.
2. Permissive Blockchain: This blockchain offers guidelines for creating a blockchain network system by developers. The source code can be closed or open.
3. Private Blockchain: This blockchain functions on a small-use scale and does not require native tokens. In a private blockchain, only one person is responsible for safeguarding essential aspects of the chain so that the responsible party can give mining rights or even not give them to anyone.[20]

II.C. Blockchain Technology Phase

Blockchain has undergone a rapid evolution. Thus far, blockchain development has evolved through three phases.

1. Blockchain 1.0 Phase
   This phase saw the emergence of blockchain as a digital currency milestone. Technology in this phase emerges as the culprit behind the scenes. Examples in the blockchain 1.0 phase included mining, hashing, and public ledger technology platforms. The advantages of using blockchain 1.0 were lower transaction fees for online-based purchases, improved anatomical offers compared to credit cards, and protection from inflation.
2. Blockchain 2.0 Phase
   This stage of development was related to the digital economy. With the availability of several financial applications that offered conveniences like payments, transfers, and business transaction execution, the world of finance underwent a revolution in this phase. The blockchain 2.0 phase gave rise to smart contacts, which ensure mutual agreement through regulations or agreements in database networks.
3. Blockchain 3.0 Phase
   This phase has brought the evolution from the digital economy to the digital society. In this phase, those involved are from the business world and various fields such as health, education, government, communication, science, and others.[21]

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[20] Daffa Eka Septianda, Sitti Fatimah Khairunnisaa, and Rachma Indrarini, "Blockchain Dalam Ekonomi Islam," *Sibatik Journal: Jurnal Ilmiah Bidang Sosial, Ekonomi, Budaya, Teknologi, dan Pendidikan* 1, no. 11 (October 30, 2022): 2629–38, https://doi.org/10.54443/sibatik.v1i11.407.

[21] Septianda, Fatimah Khairunnisaa, and Indrarini.

II.D. Characteristics of Blockchain Technology

Blockchain technology is seen as a protocol that can build trust between parties. Many Blockchain technologies can be implemented in different ways, but all chains share some common characteristics:

1. Use of distributed ledgers. This distributed ledger system creates a peer-to-peer relationship. This distributed model allows changes among blocks to be made effectively and efficiently; changes cannot be made in one block without causing changes in other blocks. Meanwhile, the use of centralised records in conventional models has been shown to have caused the global financial crisis and an increase in transaction costs, which in turn must be borne by the public.
2. Encrypted data. Each block is encoded to maintain data integrity. In this case, Blockchain uses two asymmetric keys to encode data (asymmetric key encryption), thus minimising data misuse and strengthening user trust. Consequently, the data that has been encoded is impossible to change. Using adequate algorithmic mechanisms, data integrity can be maintained reliably.
3. Update and synchronise data continuously. So far, public blockchain platforms take around 10 minutes to update and simultaneously synchronise data. With the development of technology in the future or the use of private platforms, blockchain will allow for real-time updating and synchronisation of data. Every time there is a change in data, it is immediately updated and synchronised.
4. The data recorded in blocks is financial data and other relevant data accompanying financial data. Data that can be recorded includes contracts, birth certificates, health records, marriage certificates, and other data that require the involvement of more than one party with various interests in the data.
5. Maintain an audit trail. Continuous recording using advanced digital technology capabilities allows chronological tracing of data changes to be carried out effectively and efficiently. Digital technology will enable data to be traced over time while maintaining its reliability and validity.[22]

III. ISLAMIC FINANCIAL INSTITUTIONS

Sharia financial institutions, which can take the shape of banks or nonbanks, are companies whose financial sector operations are grounded in Sharia principles, or to put it another way, following verses from the Quran and As-Sunnah about the morality of Ramallah and commercial transactions. Under Sharia

[22] Arizona dkk Mustikarini, *Agenda Riset Bisnis Dan Ekonomi Topik Terkini Terbarukan* (Yogyakarta: AMDI Angggota IKAPI), 2022).

principles, some transactions, including usury, are prohibited. *Riba* is the excess or additional loan amounts charged to the borrower, or in the conventional banking world, 'interest'.[23]

A commercial entity or institution primarily possessing financial, non-financial, or tangible assets subject to Sharia law is known as a Sharia financial institution (LKS). Islamic financial institutions can be divided into two categories: Sharia depository financial institutions called Sharia banks and non-depository financial institutions called non-bank Sharia financial institutions. The role of Islamic financial institutions is financial intermediation between those who have excess funds or surplus inputs (ultimate lenders) and those who lack funds or deficit units (ultimate borrowers). Non-bank institutions are grouped into three parts, including contractual institutions, attracting public funds by offering funds to protect depositors against uncertainty risks.

The characteristics of an Islamic Financial Institution can be seen in the following:

1. Islamic financial institutions are required to abide by the Sharia Supervisory Board's fatwas while taking deposits and making investments.
2. As intermediary institutions, Islamic financial institutions have a partnership-based arrangement among investors, fund recipients, and themselves rather than a debtor-creditor relationship as in conventional banking.
3. The business of Islamic financial institutions is not only based on profit-oriented but also *falah*-oriented, namely prosperity in the world and happiness in the hereafter.
4. Sharia financial institution transactions are based on the principles of profit-sharing partnerships, buying, selling, or leasing for commercial transactions, and lending and borrowing (cards/credit) for social transactions.
5. Sharia financial institutions only make halal investments that don't hurt people or violate Islamic law.[24]

III.A. Functions of Islamic Financial Institutions (LKS)

Financial institutions are essential since they provide both a location for capital accumulation and access. Islamic financial institutions perform the same roles as conventional financial organisations, which include:

1. Funds Collection

   Aggregate money in the form of savings from the local population. It is referred to as *wadi'ah* products in Islamic *fiqh*, and in reality, Islamic

[23] Singgih Muheramtohadi, "Peran Lembaga Keuangan Syariah Dalam Pemberdayaan UMKM Di Indonesia," 2017, 66.

[24] Ungguh Priyadi, *Bank Dan Lembaga Keuangan Syariah, Modul Eksa4206*, n.d.

financial institutions handle it through Wadiah Savings. Monetary managers can invest *wadi'ah* savings in enterprises with the depositors' consent. This is known as *wadi'ah yad dhamanah*. As entities entrusted with funds, LKS might employ these funds to be managed more productively. Wadi'ah in the Islamic system can take any form, whether in money, gold, silver, or other valuable goods. Wadi'ah is a custom that dates back to early Islamic history and is deemed acceptable by experts. Apart from offering *wadi'ah* products, LKS can also use the *mudharabah* and *ijarah* principles for fundraising. Even now, most fundraising sources that are popular in the community apply the mudharabah principle. This is because goods that use the Maharajah principle are thought to be more lucrative. After all, unlike investments based on the *wadi'ah* principle, which merely offer speculative dividends, they offer depositors profit sharing periodically.

2. Distribution of Funds to the Community
   Following the collection of savings deposits from the community, LKS returns the money to those who most need it. Funds should only be directed toward parties with businesses and business development within the Islamic banking system. Regarding non-business requirements, such as SPP payments, the contract is solely borrowed money; no interest or profit sharing is involved. As previously indicated, these savings and loans are called qirodh or mudharabah in the Islamic banking system. Furthermore, *waka lah, qardh al Hasan*, and other services are provided through Islamic banking.
3. Social Functions
   That is to collect funds from the community through Zakat, Infaq, or Alms (Ziswaf), then distribute them to those who need them without expecting profits or rewards. Islamic financial institutions, as per the laws and regulations, have the right to collect Zakat, *Infaq*, and *Sadaqah* funds from the public to be distributed to those who need them. Its role is almost the same as the 'mail', where the provisions get the right to 1/5 of Ziswaf funds raised. This social function is one of the differentiators of LKS from conventional banking financial institutions.[25]

III.B. Principles of Islamic Financial Institutions

Fundamentals of Islamic law form the foundation of Islamic financial institutions. Ensuring compliance with Islamic law directs the functioning of Islamic financial institutions. Islamic financial institutions uphold several core values, including fairness, ethics, and adherence to Islamic law. Among the basic principles of Islamic financial organisations are:

[25] Muheramtohadi, "Peran Lembaga Keuangan Syariah Dalam Pemberdayaan UMKM Di Indonesia." 67-68

1. The Prohibition of *Riba* (Interest): Islamic financial institutions cannot charge or pay interest. This concept is based on the prohibition of *riba* in Islam.
2. Sharia Compliance: Islamic financial institutions must ensure that all business practices comply with the teachings of Islamic law and that no part of their services or products are prohibited.
3. Profit and Loss Sharing Principle: When transacting or making investments, Islamic financial institutions prefer to implement a profit-sharing system where institutions and

IV. BLOCKCHAIN TECHNOLOGY IN ISLAMIC FINANCE

In Islamic finance, blockchain technology can have a significant impact. As described above, Islamic finance is a financial system that operates by the principles of Islamic economics. Islamic finance adheres to the principles of Sharia, which involve ethics and fairness in economic activities. The Islamic financial system consists of various Islamic instruments, such as *ijarah*, *mudarabah*, *musharakah*, Islamic bonds, *Istishna*, and others. In addition, Islamic finance strongly emphasises encouraging risk and profit sharing between parties to financial transactions and avoiding usury. The principal objective of Islamic finance is to establish sustainability and fairness in the financial system.

As a decentralised and transparent technology, blockchain provides a framework to reinforce these values. Blockchain technology has revolutionised many sectors, and Islamic finance is no exception. In Islamic finance, which prioritises ethical and Sharia principles, blockchain can increase security, transparency, and efficiency in financial operations. However, challenges such as scalability, regulation, and industry acceptance still need to be overcome to optimise the benefits of these technologies in the context of the Islamic economy.[26]

Blockchain may have significant implications in Islamic finance, bringing innovation in transparency, security, and Islamic compliance. Here are some ways blockchain technology can be applied in Islamic finance:

1. Blockchain enables public and decentralised records of transactions. Stakeholders, particularly Islamic authorities, can more easily supervise financial transactions in this system. It increases transparency and accountability, which are essential values in Islamic finance.
2. Blockchain stores transaction data in a way that is easy to verify. Because Islamic authorities can quickly and effectively verify whether a transaction

[26] Djumadi, "Teknologi Blockchain Dalam Perspektif Ekonomi Islam / Keuangan Islam", *Al-Kharaj: Jurnal Ekonomi, Keuangan & Bisnis Syariah* 6, no. 4 (2024):4335-4351. https://doi.org/10.47467/alkharaj.v6i4.887.

or financial product complies with Sharia principles, it simplifies the audit process.

3. Blockchain technology can create smart contracts that automatically execute contracts by Sharia law. This can lower the likelihood of non-compliance and provide legal clarity on financial transactions.
4. In Islamic finance, blockchain technology can simplify and speed up the process of payments and remittances. This offers compliance with Sharia norms governing interest and *ribawi* transactions while lowering transaction costs and shortening settlement periods.
5. Blockchain technology can easily track financial assets like buildings or investment instruments. This contributes to preventing fraud or conflicting ownership, which can increase the security of Islamic finance operations.
6. Crowdfunding platforms built on blockchain technology can help fund initiatives that adhere to Islamic finance standards. This allows Muslims to contribute to the financing of Sharia projects without running afoul of Sharia principles.

While blockchain technology in Islamic finance can significantly improve efficiency, transparency, and compliance in financial transactions and activities, this technology must be carefully regulated and monitored to ensure conformity with Islamic values.

Islamic finance can benefit from adopting blockchain-based platforms like those supporting Bitcoin for various transactional needs. Peer-to-peer network nodes in Bitcoin validate transactions, and cryptography is used to link transactions that are recorded in a dispersed public network. The financial sector's use of blockchain opens up new daily opportunities across various industries. The field of crowdfunding is one example of such an application. Blockchain should not be conflated with Bitcoin, although it does enable the production and transfer of real-value assets in addition to cryptocurrency. Government and policymakers' oversight of blockchain operations will continue to ensure that users feel more at ease.[27]

V. BLOCKCHAIN TECHNOLOGY IN ISLAMIC FINANCIAL INSTITUTIONS

Islamic financial institutions adhere to Islamic economic principles or Sharia principles. These rules, rooted in Islamic beliefs, prohibit interest (*riba*), obscurity (*gharar*), excessive speculation (*Maisie*), and involvement in companies that engage in forbidden (*haram*) activities. The main purpose of establishing

[27] Rafiqi Ihsan, "Peluang Dan Tantangan Penggunaan Blockchain Technology Pada Perbankan Syariah Di Indonesia", *Jurnal Ekonomi dan Bisnis* 11, no. 3 (2022): 1037-1049. https://doi.org/10.34308/eqien.v11i03.1166.

Islamic financial institutions is to fulfil the commands of Allah SWT in the economic field, *muamalah,* while freeing the Islamic community from activities prohibited by Islam.[28]

According to Sharia law, Islamic financial institutions consist of several entities that provide different financial services and products. Among the main entities contained in Islamic financial institutions are:

1. Sharia Banks: Sharia banks are generally financial institutions whose main business is to provide depository, financing, and payment services.[29] Sharia or Islamic banks offer a wide range of banking products and services, including investments, financing, and savings, none of which accrue interest or otherwise usurious payments.
2. Sharia Microfinance Institutions: A microeconomic institution engages in raising funds and distributing financing to small communities, both social (non-profit), such as zakat, *infaq*, and *sadaqah*.[30] These organisations comply with Sharia law by offering financial services to underprivileged communities. They offer savings accounts, micro-loans, and other financial products to support economic progress in poor areas.
3. Sharia Insurance: Sharia insurance is included in the financial institution category based on the Sharia concept. The development of the concept of Sharia is a solution and another option in the development of the concept of the *Ribawi* economy, where the concept of *Ribawi* cannot answer the increasingly complex global economic problems.[31] Founded on Sharia principles, Sharia insurance companies offer insurance services to legitimate companies and avoid engaging in usurious loan transactions.
4. Sharia Financing Institutions: Financial institutions that adhere to Sharia principles offer Sharia-based financial solutions such as financing for the purchase or construction of a residential property, financing to support businesses and business projects, financing for consumer needs, such as the purchase of vehicle equipment, or other consumer goods, microfinance to support small and intermediate business activities, Islamic financing can provide financing for health costs, such as medical treatment or the purchase of medical equipment and various other funding.

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[28] Alvi Khikmatin and Putri Setianingsih, "Analisis Peluang Dan Tantangan Lembaga Keuangan Syariah Dalam Upaya Meningkatkan Daya Saing Terhadap Lembaga Keuangan Konvensional di Indonesia," *Al-Iqtishod : Jurnal Ekonomi Syariah* 3, no. 1 (June 5, 2021): 54, https://doi.org/10.51339/iqtis.v3i1.257.

[29] Hamdi Agustin, "Teori Bank Syariah," *JPS (Jurnal Perbankan Syariah)* 2, no. 1 (April 9, 2021): 68, https://doi.org/10.46367/jps.v2i1.279.

[30] M. Taufiq, "Optimalisasi Peran Dewan Pengawas Syariah di Lembaga Keuangan Mikro Syariah," *Al-Huquq: Journal of Indonesian Islamic Economic Law* 2, no. 1 (July 24, 2020): 75, https://doi.org/10.19105/alhuquq.v2i1.3350.

[31] Prima Dwi Priyatno, Lili Puspita Sari, and Isti Nuzulul Atiah, "Penerapan Maqashid Syariah pada Mekanisme Asuransi Syariah," *Journal of Islamic Economics and Finance Studies* 1, no. 1 (August 12, 2020): 3, https://doi.org/10.47700/jiefes.v1i1.1927.

5. Sharia Investment Companies: Investment products that adhere to Sharia principles are provided by Sharia investment institutions. By ensuring that investments are made in halal companies (allowed under Sharia principles) and in line with Islamic ideals, keeping an eye on funds under management.
6. Sharia Stock Exchanges: Sharia stock exchanges are financial markets where Islamic financial instruments are traded. Businesses that offer their shares on this exchange are by Sharia principles. Stocks listed on a Sharia Stock Exchange must pass through the 'Sharia filter'. This involves an assessment of the company's compliance with Sharia principles, such as the lawful nature of the business, reasonable debt levels, and profits generated from activities that comply with Sharia principles.
7. International Islamic Financial Institutions: Internationally, Islamic financial institutions offer financial services in line with Sharia principles in various countries. This institution provides various financial products and services that comply with Sharia principles. These products include Islamic financing, Islamic investment, Islamic insurance, and other financial services that do not involve elements of riba and are by Islamic principles.

The above Sharia-compliant financial institutions strive to uphold Islamic ideals in finance, ensure fair and long-term economic viability, and offer Sharia-compliant financial products to customers. Islamic finance institutions aim to provide financial services based on Islamic justice and ethics principles and support sustainable and inclusive economic development. The financing provided by these institutions may take various forms, such as *ijarah*, *Ishtishna*, mudarabah (profit sharing), *musharakah* (cooperation), and others, which follow the principles of Islamic finance.

Various types of contracts can be used for various entities in Islamic financial institutions. Thus, blockchain technology has great potential to play an important role in Islamic financial institutions as it brings several benefits and solutions to various challenges the Islamic financial industry faces. Some of the reasons blockchain has excellent potential in Islamic financial institutions involve fulfilling Islamic principles through its multiple benefits, including transparency, security, Sharia compliance, operational efficiency, and financial inclusivity.

VI. BLOCKCHAIN CHALLENGES AND OPPORTUNITIES IN ISLAMIC FINANCIAL INSTITUTIONS

In Islamic financial institutions, blockchain has several challenges and opportunities. One of the main challenges and opportunities is human resources. Until now, Indonesia is still said to be a country with human resources

that cannot use artificial intelligence.[32] Experts are needed to apply blockchain technology. To produce digital talent in Indonesia, of course, the cooperation of all stakeholders, government, academics, organisations, communities, and the corporate sector is needed to overcome this problem. Indonesia still needs nine million trained individuals to meet the expected needs through 2035, or around 600,000 recruits annually. There are many internship programs in places that focus on Blockchain technology.[33]

Indonesia's engagement with digital technology lags far behind that of other countries, such as India, where Indonesia prefers to engage in digital businesses such as e-commerce.[34] This happens because e-commerce businesses may focus more on growth and operational scalability in existing markets rather than exploring new technologies. A proven business model is considered a safer option for achieving sustainable growth. In addition, users feel more comfortable with the e-commerce model that is already commonly used compared to the use of blockchain technology, which may still be considered complex and difficult to understand. Accordingly, blockchain technology is still foreign to many people in Indonesia.

Blockchain technology in its application within Islamic banking establishments is a new technology. Of course, many professionals may not be familiar with this technology or at least not fully understand how it works. It takes effort to increase understanding and awareness among the relevant human resources. Blockchain implementation requires specialised technical skills, such as programming smart contracts, blockchain security, and managing distributed networks. This lack of skills in human resources may hinder the adoption of this technology. Blockchain presents a new paradigm in the way data and transactions are managed. Changing existing mindsets and work processes to adapt to blockchain decentralisation and transparency may create resistance from some human resources accustomed to conventional models.

If human resources in Indonesia are qualified to use blockchain technology, there could likely be significant changes within Islamic banking establishments. Skilled human resources in blockchain technology can improve the operational efficiency of Islamic financial institutions. Decentralised and automated

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[32] Willy Medi Christian Nababan, "SDM Indonesia Dinilai Belum Siap Manfaatkan Kecerdasan Buatan," kompas.id, May 14, 2023, https://www.kompas.id/baca/ekonomi/2023/05/14/sdm-indonesia-belum-siap-manfaatkan-ai.

[33] "Sumber Daya Manusia Jadi Kunci Tingkatkan Ekosistem Blockchain dan Industri Kripto - TribunNews.Com," accessed February 4, 2024, https://www.tribunnews.com/bisnis/2022/01/06/sumber-daya-manusia-jadi-kunci-tingkatkan-ekosistem-blockchain-dan-industri-kripto.

[34] "Fokus di Konsumsi, Ekonomi Digital RI Tertinggal Jauh dari India," accessed February 4, 2024, https://www.cnnindonesia.com/ekonomi/20230308125226-532-922379/fokus-di-konsumsi-ekonomi-digital-ri-tertinggal-jauh-dari-india.

transaction processes can speed up settlement, reduce administrative costs, and enhance fund management efficiency. Given human resources who understand blockchain, Islamic financial institutions can build a high transparency system. Blockchain provides an immutable track record and real-time access to transaction data, ensuring compliance with Shariah principles and providing customers with confidence. And as for other opportunities, namely:

1. Blockchain technology is also smart contracts. Experts proficient in programming smart contracts can automate monitoring and apply Sharia principles to every transaction. This can help Islamic financial institutions ensure better compliance and reduce the risk of violating Sharia principles blockchain. Some smart contracts and experts are proficient in programming smart contracts and can automate monitoring and apply Sharia principles to every transaction. This can help Islamic financial institutions ensure compliance and reduce the risk of violating Sharia principles.
2. Blockchain technology can be utilised by trained human resources to create new Islamic financial services and products. This includes making financial instruments such as Islamic crowdfunding sites, *sukuk* based on blockchain technology, and other cutting-edge financial products.
3. Blockchain-savvy human resources can help create more inclusive financial products. The application of this technology provides access to financial services to layers of society that were previously difficult to reach by conventional financial institutions.
4. Blockchain-savvy human resources can improve the quality of services provided by Islamic financial institutions. Increasing efficiency, openness, and safety in operations can increase customer satisfaction.

In addition to human resources being a challenge facing blockchain in Islamic financial institutions, there is also support (infrastructure) for using blockchain technology. Until now, the optimisation of internet channels in Indonesia has not been evenly distributed in areas without evenly distributed internet access. Of course, this has limited telecommunications infrastructure and internet availability. Blockchain requires a stable and fast internet connection so that infrastructure limitations can be a serious obstacle. If this can be overcome, the public may quickly learn blockchain technology and get information through digital literacy about the positive impact of using blockchain.

Another question is whether it is necessary to inform stakeholders about optimising the use of blockchain technology in Islamic financial institutions. Socialisation on the use of blockchain can help Islamic financial institutions understand how this technology can increase transparency and ensure

compliance with Islamic principles. Introducing Islamic financial institutions to use blockchain is a preparatory step for the future. This technology constantly evolves and can provide the foundation for further innovation in Islamic finance. With good socialisation, users can understand the benefits of blockchain technology and how its use can strengthen Islamic financial institutions. This increased understanding could drive the adoption of this technology in the Islamic finance industry, opening the door to innovation, efficiency, and better adherence to Islamic principles.

However, it must be emphasised that human resources, equitable distribution of internet channels, and socialisation create successful blockchain adoption. It also requires other factors, such as regulation, government support, and acceptance from the public and industry players. This is particularly important because regulatory clarity is necessary to create a stable legal environment, guide financial institutions using the technology, and provide legal certainty for blockchain users. Regulation can help regulate the security and protection of consumers using blockchain in Islamic financial institutions. This involves data security policies, privacy policies, and consumer protection against potential risks in using these technologies.

With government support, Islamic financial institutions can feel supported in efforts to adopt blockchain technology. This support can also create an environment conducive to innovation and growth of the blockchain ecosystem. Government support can include fiscal incentives, research funding, and a supportive regulatory framework. With government support, Islamic financial institutions can feel supported in efforts to adopt blockchain technology.

Accordingly, the secret to successfully implementing blockchain technology is to make people accept it. People's lack of trust and understanding of this technology can make its implementation difficult. Raising public awareness regarding the advantages and security of blockchain through socialisation and education can increase its acceptance. In addition, it is important to gain the trust of financial institutions and other businesspeople. Industry players may hesitate to use blockchain technology if they feel the technology is insecure, does not comply with Sharia law, or provides business benefits. This confidence can improve collaboration and accelerate the adoption of blockchain-based solutions.

Applying blockchain technology in Islamic financial institutions for smoother and more sustainable operations is possible with clear laws, strong government support, and public and industry acceptance. These elements provide a solid and favourable basis for developing these technologies to meet the demands of Islamic financial markets and principles.

VII. BLOCKCHAIN TECHNOLOGY AS A TRANSACTION SECURITY SOLUTION IN ISLAMIC FINANCIAL INSTITUTIONS

Applying blockchain technology to the security needs of Islamic financial organisations is promising. This concerns several features of blockchain technology that can improve security, transparency, and compliance with Islamic law. For Islamic financial institutions. Blockchain is considered a potential security solution for Islamic financial institutions for the following reasons:

1. Blockchain offers a transparent, decentralised ledger. Every transaction on the blockchain can be observed and verified by all verified users or parties involved. As a result, there is a high level of transparency, in line with Sharia principles, which emphasise the importance of fairness and transparency in all financial transactions.
2. Most network users must agree before any data entered into the blockchain can be altered. By requiring this, an immutable record is generated, providing assurance and security in handling ownership of assets and transaction records.
3. Shariah compliance in every transaction can be automated with the help of smart contracts, which are executed on the blockchain. Smart Contracts lower the likelihood of errors or non-compliance by ensuring that all Sharia standards and provisions are met without human intervention.
4. Due to their decentralised structure, blockchains are more secure against cyberattacks. Strong cryptographic techniques are used to encrypt data stored on various network nodes, adding an extra level of protection to sensitive data and preventing unauthorised alterations.
5. Using blockchain technology, a secure identity management system can be built. Only authorised parties can access digital identities stored on the blockchain, and identity owners control entirely all their data. Ownership of assets can be recorded easily and transparently with the use of blockchain. This lowers the likelihood of questionable transactions or manipulation of asset ownership, resulting in ownership security and legal clarity.
6. Attacking or manipulating blockchains is more difficult due to their decentralised and consensus nature. System integrity and continuity can be maintained even when one or more network nodes are compromised.

It is important to remember that applying blockchain technology in Islamic financial institutions requires a strong understanding of Islamic compliance and technological issues. Therefore, socialisation and education about this technology are crucial to ensure stakeholders understand and implement blockchain solutions appropriately.

VIII. APPLICATION OF BLOCKCHAIN TECHNOLOGY IN ISLAMIC FINANCE

The application of Islamic law in blockchain technology includes efforts to integrate the principles of Islamic law into the features and mechanisms of Blockchain technology so that transactions and activities carried out through this technology adhere to Islamic values and principles. Islamic law can be maintained through blockchain in the following ways:

1. Prohibition of Usury (Interest)
   Blockchain technology can be regulated so that transactions involving interest payments (usury) can be avoided or prevented. Through smart contracts, automated transactions can be arranged to avoid interest payments, which are forbidden in Islamic law.
2. Asset Separation
   Blockchain can ensure clear segregation between assets or funds involved in transactions. This is especially important in Islamic investments, where assets must be disclosed to ensure no mix between halal and haram assets.
3. Clarity and Transparency
   The principle of transparency and clarity in Islamic law can be applied in blockchain by ensuring that all transactions are permanently recorded and accessible to interested parties. This helps ensure that all parties involved have the same information.
4. Maisir Ban (Excessive Speculation)
   Blockchain can regulate Islamic investment or trading transactions to avoid excessive speculation (maisir). Smart contracts can be programmed to ensure transactions do not involve haram elements.
5. Fairness in Transactions
   The concept of fairness in Islamic law can be applied in blockchain transactions by arranging smart contracts that ensure fairness for all parties involved. For example, profit and risk sharing can be programmed according to the principle of fairness.
6. Auditability and Tracking
   Blockchain allows for easy audibility and tracking, which is the principle of accountability in Islamic law. Transactions can be monitored and audited more efficiently, preventing fraud or violations.
7. Validation by Sharia Authority
   In some cases, Islamic authorities may validate or approve transactions or contracts executed through Blockchain technology to ensure compliance with Islamic law.

Blockchain is utilised to record, track, monitor, and trade all assets as a registry and inventory system. Blockchain functions like a spreadsheet or mega ledger to record all assets and transactions relating to them on a global scale. It can register any asset owned by any party anywhere in the globe. Blockchain can, therefore, be utilised for all asset registrations, inventories, and transactions, including all tangible and intangible financial, economic, and financial management domains. There is nowhere in the folder where the data sent over Blockchain is kept. A huge peer-to-peer network approves and verifies each transaction using a ledger that records the transaction. Every computer donated by volunteers dispersed randomly over the globe powers the operation. Consequently, there's no central database to compromise.

IX. CONCLUDING REMARKS

This research explores the potential of blockchain technology to improve transaction security for Islamic financial institutions. Traditional financial institutions face challenges in complying with Sharia principles, emphasising fairness, transparency, and ethical conduct. With its decentralised ledger system and focus on security and immutability, blockchain technology offers a potential solution. Blockchain strengthens Islamic finance principles: The transparency and security features of blockchain can enhance Islamic financial institutions' ability to adhere to Sharia principles like the prohibition of usury and risk-sharing. Improved transaction security: Blockchain technology offers a more secure way to conduct financial transactions, reducing the risk of fraud and manipulation. Blockchain can streamline processes and potentially lower transaction costs for Islamic financial institutions. While the potential benefits are promising, further research is needed to explore how blockchain can be best implemented in Islamic finance while ensuring Sharia compliance. The article emphasises that blockchain technology has the potential to revolutionise Islamic finance by promoting security, transparency, and adherence to Sharia principles. However, it acknowledges the need for further research and development to realise these benefits fully.

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