



Blockchain Implementation In Zakat Management: Potentials And Challenges In The Digital Era

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Keywords:

Blockchain,
Zakat Management,
Transparency,
Regulatory Challenges,
Digital Literacy

ABSTRACT:

Blockchain technology offers promising opportunities to reform and enhance zakat management by increasing transparency, accountability, and efficiency through immutable distributed ledgers and automated smart contracts that ensure compliance with Islamic principles such as nisab and haul. It facilitates direct, real-time tracking of zakat funds from muzakki to mustahiq, reducing the potential for fraud and administrative inefficiencies. However, despite these benefits, the adoption of blockchain in zakat systems faces significant multidimensional challenges. Technically, issues like scalability, energy consumption, and interoperability hinder seamless integration and widespread use. Regulatory frameworks specific to blockchain application in zakat are largely absent in many countries, creating legal uncertainty and complicating compliance with data protection laws such as GDPR and Indonesia's UU PDP. Socially and culturally, the limited digital literacy and skepticism toward new technologies among stakeholders slow acceptance and trust in blockchain-based zakat systems. To fully realize blockchain's potential in transforming zakat management, a comprehensive mitigation approach addressing technical infrastructure, clear and adaptive regulations, and targeted educational programs to improve digital competency and trust is essential. This multi-stakeholder effort, involving regulators, Islamic scholars, technologists, and zakat institutions, is critical to ensure that the benefits of blockchain align not only with operational efficiency but also with Shariah compliance and social acceptance.

INTRODUCTION

Traditional zakat management in Indonesia faces three core problems that undermine its effectiveness. First, transparency and accountability deficits cause a crisis of public trust. Studies show only 20-30% of zakat institutions publish regular financial reports, creating information asymmetry between muzaki, mustahiq, and Zakat Management Organization (OPZ). Second, operational inefficiency is reflected in the high administrative cost (reaching 35-45% of total fund) and the length of distribution process (15-30 working days) due to manual data collection, physical verification of mustahiq, and cash mechanism (Haryanti, 2025; Musana, 2023). Third, regulatory fragmentation results in overlapping distribution and coverage gaps. Law No. 23/2011

has not been fully integrated with modern supervisory systems, thus triggering variations in accounting standards between OPZs (unairnews, 2024).

Digital revolution opens transformative opportunities through sharia fintech. BAZNAS data (2023) shows a significant increase in the contribution of digital zakat payments-from 12% (2019) to 68% (2023)³. Platforms such as LAZIS Digital and Baznas Go utilize sharia e-wallets for instant payments and real-time tracking, targeting the younger generation (70% of mustahiqs are 25-44 years old) ³⁵. Islamic fintech based on muamalah contracts (murabahah, mudharabah, wakalah) offers inclusive and sharia-compliant solutions, especially for 3T areas (Frontier, Outermost, Disadvantaged) ². However, its development is hampered by low sharia financial literacy (only 15% of the public understand sharia contracts) and limited dual-expertise (technical-sharia) human resources.

Blockchain offers structural solutions through three main mechanisms. First, blockchain brings radical transparency with its distributed ledger technology that enables end-to-end and real-time tracking of zakat funds. Every transaction is permanently recorded with a timestamp and cryptographic hash, thus minimizing the risk of misuse. A case study at Lembaga Zakat Selangor showed a 42% increase in muzaki trust within two years after the implementation of this system. Secondly, operational efficiency is achieved through the use of smart contracts that automate nisab calculation, mustahiq verification, and fund distribution. With this, the zakat distribution time from 15-30 days can be cut to only 2-48 hours, while the transaction cost drops from 8-15% to 1-3%. Third, blockchain supports sharia compliance by integrating fiqh criteria in its algorithm, ensuring distribution according to asnaf priorities and avoiding usury and gharar practices. The United Arab Emirates is pioneering the application of blockchain-based AI validator models for the mustahiq screening process (Pratiwi, Ramadhan, & Rusli, 2025).

The implementation of blockchain in the zakat sector faces four multidimensional challenges. First, technical barriers that include the unequal condition of Indonesia's digital infrastructure, especially with limited internet and electricity networks in around 12,000 remote villages. In addition, the capacity of zakat organizations such as BAZ in managing blockchain nodes is also still minimal, while the high initial cost of implementation-for example, the development of smart contracts and dedicated servers-is a heavy burden for small institutions. Second, regulations are still fragmented because Indonesia does not yet have a specific legal umbrella for blockchain in the zakat sector. Existing regulations such as SE No. 18/22/DKSP/2016 from Bank Indonesia only regulate digital banking in general without accommodating distributed ledger for philanthropic activities. Third, there is a literacy gap where nazir's understanding of blockchain technology is still low, with only around 15% of amil being digitally trained, as well as resistance to change from traditional systems. On the public side, there are still doubts over the halal status of cryptocurrencies as a means of zakat transactions. Fourth, there is a sharia debate among scholars who are divided between those who allow blockchain because of its transparency in line with maqashid sharia, especially the principle of justice, and those who reject it because of concerns over the volatility of crypto assets and the potential for gharar or uncertainty in smart contracts (Prasetyo, 2022).

Based on the challenges identified, this study aims to explore the potential of blockchain in improving accountability and financial inclusion in Islamic finance through a comparative study of its implementation in Malaysia, the United Arab Emirates, and a pilot project in Indonesia. The research focuses on the design of an integrated technical architecture for zakat and waqf, as well as smart contract mechanisms based on Islamic contracts. Additionally, this research examines barriers holistically, covering technical dimensions such as infrastructure readiness and migration costs, regulatory aspects through an analysis of gaps in Law No. 23/2011 on Zakat Management, and Islamic aspects through a review of MUI fatwas related to cryptocurrency and smart contracts. In terms of significance, this research offers three strategic contributions to the digital Islamic economy. Theoretically, this study develops a modified Technology Acceptance Model (TAM) by incorporating variables of religious trust and sharia compliance to support blockchain adoption in zakat institutions (Fasluki, 2023). Practically, this study provides a roadmap for the gradual implementation of blockchain, including human resource training and pilot projects in provincial BAZs, as well as the design of a prototype integrated zakat-waqf platform. Finally, from a policy perspective, this study provides regulatory recommendations to the OJK and the Ministry of Religion regarding technical standards, sharia audits, and the use of gold-backed stablecoins as an alternative to speculative cryptocurrencies in zakat transactions.

RESEARCH METHODOLOGY

Approach

This study uses a qualitative approach with descriptive analysis to explore the complexity of blockchain implementation in holistic zakat management. This approach was chosen because it can reveal multidimensional phenomena (technical, regulatory, sharia) through the perspectives of participants (nazhir, regulators, technology practitioners, and sharia economic experts), as well as analyze the interactions between factors that cannot be measured quantitatively (Khasanah, 2021; ‘Metodologi Penelitian Kualitatif: Pengertian, Jenis, Contoh, Dan Sistematikanya’, 2024). The design is exploratory in nature to map the potential and challenges contextually in Indonesia, referring to case study models on platforms such as Hijra and Labaik (Hasan, Al-Zahra, Auralia, & Maharani, 2024).

Data Sources

The data sources in this study include three main types. First, academic literature consisting of journals, books, and policy documents related to blockchain, sharia fintech, and zakat regulations, such as Law No. 23 of 2011 concerning Zakat Management and the DSN-MUI Fatwa on cryptocurrency. This literature was analyzed to identify theoretical gaps and global best practices in the application of blockchain in zakat management, taking into account case studies from various countries such as Malaysia and the United Arab Emirates (Thohira, Priatnasari, & Winias, 2025). Second, the research uses case studies of blockchain-based zakat platforms, namely Hijra and Labaik, which are analyzed through participatory observation methods to observe the workflow from the fund collection process, mustahik verification, to zakat distribution.

Additionally, technical document analysis was conducted on the whitepapers, sharia audit reports, and smart contract architecture designs of both platforms (Putra, Atika, & Inayah, 2024).

The case study evaluation focused on parameters of real-time transparency, cost efficiency, and compliance with Sharia principles. Third, in-depth interviews were conducted with sharia economics experts, such as members of the Indonesian Ulema Council's National Sharia Board (DSN-MUI), to explore the compatibility of blockchain technology with sharia objectives and moral risks such as *gharar* (uncertainty) (Sitasari, 2022). Interviews were also conducted with blockchain technology practitioners who examined infrastructure barriers and smart contract design aspects, as well as zakat institution administrators to understand operational readiness and resistance to system changes. The interview guide used a semi-structured format focused on three main aspects: the potential, challenges, and implementation strategies of blockchain in zakat management. This data triangulation approach ensures a comprehensive and valid analysis of the phenomenon being studied within the real-world context of blockchain-based digital zakat management (Sulistyaningsih, Majid, Hidayah, Priwegga, & Kusumo, 2024).

Analysis Technique

Thematic analysis is a systematic qualitative data analysis technique for identifying, organizing, and reporting thematic patterns (themes) in a dataset. In the study titled “The Implementation of Blockchain in Zakat Management: Potential and Challenges in the Digital Age,” this technique is highly relevant for exploring the complexity of the phenomenon of implementing new technology in a sensitive religious context (Alhak, 2025). Here is a comprehensive explanation:

1. Basic Concepts and Relevance

Thematic analysis follows the Braun & Clarke (2006) model with six stages: data familiarization, initial code generation, theme search, theme review, theme definition, and report production. This method is suitable for this study because:

- a. **Multidimensional complexity:** It can unravel the interactions between technical aspects (blockchain), sharia (zakat law), and social aspects (public trust) that cannot be quantified numerically.
- b. **Flexibility:** It can be applied to various data sources (interviews, observations, literature) to build a holistic understanding.
- c. **Deep contextualization:** Allows researchers to describe local nuances such as infrastructure gaps in 3T areas or resistance from traditional *amil* (Halik, Parakkasi, & Parmitasari, 2025).

2. Applicative Procedures in Blockchain-Zakat Research

a. Research Preparation and Design

The research began with the formulation of a conceptual framework based on an in-depth literature review of blockchain, zakat regulations (Law No. 23/2011), and sharia fatwas related to digital assets. This stage involves mapping the gap between the theoretical potential of blockchain (absolute transparency, cost efficiency) and the empirical reality of zakat management in Indonesia.

The research design adopts an exploratory qualitative approach with units of analysis including:

- i. Zakat institutions (BAZNAS/LAZ) that have initiated digital platforms (e.g., Hijra, Labaik).

- ii. Regulators (OJK, Kemenag) and Sharia Councils.
- iii. Financial technology and Islamic economics experts.
- b. Sampling and Inclusion Criteria
 - Purposive sampling was applied with the following criteria:
 - i. Nazhir: Minimum of 3 years of experience in managing digital zakat.
 - ii. Technology Practitioners: Involved in the development of blockchain or smart contracts for Islamic philanthropy.
 - iii. Sharia Experts: Members of the DSN-MUI or academics with publications related to Islamic fintech.
 - iv. Samples were recruited until data saturation was reached ($\approx 15 - 20$ informants), referencing the case study of the Palopo City Zakat Collection Agency (Hamdani, 2020).

RESULT AND DISCUSSIONS

Blockchain Potentials for Zakat

Transparency and Accountability

Blockchain technology offers a revolutionary paradigm in real-time tracking of zakat funds, creating a transparent and immutable audit trail from muzakki (zakat givers) to mustahik (recipients). The distributed ledger mechanism allows each transaction to be recorded chronologically and decentralized across a network of computers. When zakat funds are sent, each stage (from payment initiation, verification, to distribution) is recorded as a cryptographically linked block. Once verified by network consensus, the block becomes permanent and immutable, ensuring data integrity throughout the zakat cycle. This technology eliminates the single point of failure vulnerable to manipulation in traditional centralized systems (Susanto et al., 2025)

Empirical evidence from bibliometric studies shows that blockchain implementation significantly improves vertical accountability (government to the public) and horizontal transparency (between zakat institutions). Research on 44 scientific publications (2019-2024) reveals that blockchain-based systems facilitate real-time verification by all stakeholders, including regulators, muzakki, and the general public. Donors can track the movement of their funds through a digital dashboard, view distribution status, confirm recipient acceptance, and even monitor post-distribution fund usage through integration with supporting technologies such as the Internet of Things (IoT). This transparency minimizes the risk of fund misuse and enhances public trust, a critical factor in increasing zakat participation (Santoso, 2023).

Table 1. 1 Comparison of Traditional Zakat Fund Tracking Models vs Blockchain

Aspect	Traditional Model	Blockchain Model
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Real-time Tracking	Manual Reports (Weekly / Monthly)	Real Time Transaction recording
Audit Trail Centralized	Susceptible to Manipulation Decentralized	Immutable
Stakeholder Access	Limited to Periodic Reports	24/7 Access Via Public Ledger
Transaction Verification	Requires Manual Reconciliation	Automated Via Network Consensus
Transparency Level	Partial and Delayed	Complete and Instantaneous

Despite its significant potential, the implementation of blockchain in zakat faces complex challenges. A critical study based on PRISMA-SLR (2025) identified institutional barriers such as digital infrastructure readiness, lack of technical capacity in zakat institutions, and unclear regulations on sharia-compliant smart contracts. In many majority-Muslim countries, inadequate digital infrastructure hinders blockchain optimization, while the digital literacy gap among the population limits adoption. Another challenge is sharia compliance, particularly regarding the energy-intensive proof-of-work consensus mechanism, which contradicts the principle of *maṣlaḥah*. Solutions require the development of green blockchain based on proof-of-stake and the integration of the Sharia Supervisory Board (DPS) in smart contract code validation. The government's role is crucial through adaptive regulatory frameworks and collaborative incentives. Research by Rahayu et al. (2025) recommends three policy strategies: First, the creation of a regulatory sandbox for blockchain trials in selected zakat institutions (Rahayu, Al-Ahsani, Suroyya, & Yudiawan Agus, 2025). Second, funding for collaborative research between universities, the fintech industry, and zakat bodies to develop Shariah-compliant protocols. Third, public education campaigns to improve digital literacy and Sharia finance. Pilot initiatives in Malaysia and Indonesia have proven the effectiveness of a hybrid model, where blockchain is integrated with existing systems gradually, enabling tracking without disrupting operations (Wahfiudin, 2025).

The potential of blockchain in zakat is not merely automation but a transformation of Islamic philanthropy governance. Integration with AI (Artificial Intelligence) can optimize the identification of beneficiaries through real-time poverty data analysis, while the tokenization of zakat assets enables payments with illiquid assets such as property or commodities. However, future research should explore interoperability between global zakat platforms for cross-border transactions and automated sharia audit standards based on smart contracts. Multilateral collaboration between the World Zakat Authority, fintech regulators, and religious scholars is needed to establish a holistic legal framework (Zamroni, 2023).

Operational Efficiency

The use of blockchain for zakat management, particularly through smart contracts, represents a significant breakthrough in improving operational efficiency, transparency, and accountability. Smart contracts—computer programs that automatically execute agreements when conditions are met—enable the full automation of zakat fund distribution from collection to disbursement to mustahik

(zakat recipients). This mechanism eliminates the need for manual intervention in the validation, verification, and transfer of funds, which traditionally involves multiple layers of administration prone to inefficiency. The implementation of smart contracts on blockchain ensures that every transaction is permanently recorded, transparent, and immutable, thereby minimizing the risk of fund misuse and building public trust. Technical characteristics of blockchain such as decentralization, asymmetric cryptography, and distributed consensus create a more reliable and corruption-resistant zakat ecosystem (Willya, Arifin, Mediawati, & Mokodenseho, 2023).

Reduced administrative costs are a key advantage of blockchain in the context of zakat. Conventional systems often face high costs related to manual verification of beneficiaries, financial statement reconciliation, interbank transfers, and external oversight. Smart contracts automate these critical processes: beneficiary verification criteria can be integrated with external data sources (such as government poverty data) via blockchain oracles, while fund transfers occur directly to beneficiaries' digital wallets without bank intermediaries. Eliminating intermediaries not only accelerates distribution from days/weeks to minutes/hours but also reduces transaction costs by up to 80%, according to case studies of similar systems in the international charitable sector. This efficiency ensures a larger proportion of zakat funds (approaching 100%) reaches beneficiaries, unlike the traditional model where 15-30% of funds are absorbed by operational costs. A study by the World Economic Forum (2023) estimates that the adoption of blockchain in global philanthropy could redirect an additional \$25 billion/year to recipients due to reduced administrative leakage (Rejeb, 2020).

The practical application of this technology has been proven in other relevant sectors. Blockchain has improved supply chain efficiency by enabling real-time tracking and automatic verification, such as in the logistics management of agricultural products. Similar principles apply to zakat: smart contracts can automate the flow of funds from the zakat giver → zakat institution → zakat recipient → purchase of basic necessities (rice, medicine, etc.), with each stage recorded on a distributed ledger. Integration with the Internet of Things (IoT), such as sensors on food aid packages, enables automatic verification of aid receipt by recipients, which then triggers payment release to service providers—a model tested in the UNHCR's “smart aid distribution” project. Cross-chain technology implementation also enables interoperability between the zakat blockchain and central bank digital currency (CBDC) systems or digital payment platforms, expanding the scope of financial inclusion (Baiquni & Dirgahayu, 2023).

Despite its promise, implementation challenges remain. The scalability of public blockchains like Ethereum still faces transaction speed limitations and high gas fees during peak demand. Potential solutions include the use of sidechains or private/hybrid blockchains optimized for high throughput.

Legal and Sharia aspects are also critical: the MUI fatwa (No. 140/2023) requires strict audits of smart contract code to ensure Sharia compliance (e.g., avoiding gharar/uncertainty transactions). Additionally, digital literacy among beneficiaries and cybersecurity (such as protection against 51% attacks or code bugs) require investment in education and AI-based threat detection systems.

Empirical studies are beginning to support the effectiveness of this model. A blockchain zakat pilot project in Indonesia shows a 40% increase in distribution speed and a 35% reduction in operational costs compared to conventional methods. Meanwhile, 50% increase in donor trust after the implementation of real-time fund tracking via blockchain. Key policy recommendations include: (1) collaboration between regulators (BAZNAS/BWI) and blockchain developers to establish technical standards; (2) tax incentives for donors who use verified platforms; and (3) extensive training for zakat administrators in managing this autonomous system (Yuannisa & Nasution, 2024) .

Financial Inclusion

The unbanked—those without access to traditional banking services—face structural barriers such as limited infrastructure, lack of official identification, and distrust of conventional financial institutions. In Muslim countries, this group is often marginalized from the formal zakat system despite their potential as both recipients (mustahiq) and contributors (muzaki). Blockchain-based digital wallets have emerged as a transformative solution, leveraging mobile phone penetration rates of 70–80% even in rural areas. This technology enables the unbanked to manage cryptocurrency or stablecoins with only a basic internet connection, without requiring a bank account. A World Bank study (2024) shows that digital wallets reduce transaction costs by up to 80% compared to traditional financial services, while also increasing the speed of emergency aid distribution from days/weeks to minutes. In the context of zakat, this efficiency means more funds flow to mustahiq rather than being absorbed by administrative costs (Redot, 2025; Vision NP, 2025).

Mechanism for Integrating Digital Wallets with the Zakat Blockchain Ecosystem

1. Decentralized Registration and Identity Verification: The unbanked community can create blockchain-based digital identities (DIDs) such as the Polygon ID system adopted by Bhutan. DIDs verify profiles without relying on physical documents, overcoming the obstacles often posed by ID cards. This system is integrated with government or zakat institution poverty data to automatically validate the status of mustahiq (Mokodenseho, Syafitri, Hasrullah, & Judijanto, 2023).
2. Collection and Distribution via Smart Contracts: Muzaki transfer zakat in stablecoins (such as USDC or cUSD) to digital wallets. Smart contracts then automate distribution based on programmed criteria:
 - a. Triggering transfers to mustahiq when their wallet balance falls below the poverty threshold.

- b. Allocating productive funds for UMAS micro-programs based on qard al-hasan (interest-free loans).
 - c. Recording all transactions on an immutable distributed ledger, enhancing accountability (Shields, 2024).
3. Interoperability with Local Systems: Platforms like Kotani Pay in Africa enable automatic conversion of crypto assets to cash via agents (e.g., M-Pesa), ensuring beneficiaries without smartphones can still access fund (Moser, 2022)s.

Fraud Prevention

The application of blockchain technology in zakat management offers a revolutionary solution to prevent misuse of funds through its permanent (tamper-proof) recording characteristics. This mechanism creates an immutable transaction recording system once verified and added to the block. Every zakat transaction—from the muzakki's contribution to the distribution to the mustahiq—is recorded chronologically, encrypted, and distributed across the network of nodes. This design eliminates the possibility of financial record manipulation by any party, including zakat institution administrators, as unilateral changes to one copy will be immediately detected by copies across the network (Guo & Yu, 2022; Khairi, 2024) .

In the context of zakat, this feature directly minimizes the risk of fraud such as fund diversion, nominal mark-ups, or fictitious recording. For example, if there is an attempt to change the amount of zakat received or the name of the recipient, the entire network will reject the change because it does not comply with the consensus (Zikriani & Fatwa, 2025). Research at the Palopo City Zakat Collection Agency shows that this system can increase accountability by up to 80% compared to conventional systems, where records are vulnerable to manipulation due to centralized authority. Additionally, real-time transparency allows donors to track the flow of their funds all the way to the final recipient, thereby reducing opportunities for misuse (Pratiwi, 2024). Blockchain integration reduces zakat fund misappropriation by up to 95% within three years of implementation. The system also cuts audit costs by 40% as all transactions are automatically verified through smart contracts. Smart contracts—programs that execute automatically based on predefined conditions—ensure funds are only disbursed if recipient criteria are met, preventing unauthorized distribution. Blockchain serves as a solution for integrating Islamic finance by securing the flow of funds from source to destination (Tan, Mahula, & Cromptvoets, 2022).

Despite its promise, implementation faces challenges such as uneven digital infrastructure, high implementation costs, and low digital literacy among the public. Specific regulations regarding the legality of blockchain for zakat are also limited in Indonesia. Kassim et al. (2023) propose a

conceptual framework for phased blockchain adaptation, starting with zakat institutions in urban areas with greater digital readiness (Kassim, 2023).

Implementation Challenges

Shari'ah Compliance

One of the main challenges in implementing blockchain for zakat management is validating the compliance of smart contracts with fiqh zakat provisions, such as nisab and haul requirements. Smart contracts in blockchain can automate the process of collecting and distributing zakat based on certain parameters, but the entire mechanism must be in line with sharia principles so that the distribution of zakat remains valid according to Islamic law. This validation is not merely about ensuring automatic collection once nisab and haul are reached, but also encompasses ownership, the classification of zakat-eligible assets as maal, and the accurate determination of mustahiq. The automation process via smart contracts must be transparent, documented, and auditable to ensure all transactions meet the pillars and conditions of zakat according to both classical and contemporary fiqh (Ma'ruf, Islam, & Millah, 2024).

Blockchain implementation offers decentralization, enabling zakat management to be conducted directly between the zakat payer (muzakki) and the zakat recipient (mustahiq) without the involvement of an intermediary institution. This model increases transparency, efficiency, and reduces the risk of fund misappropriation. However, this has sparked debate because zakat management practices in Indonesia are regulated by official authorities, namely the National Zakat Agency (BAZNAS) and the Zakat Management Institution (LAZ). The dominance of these centralized institutions is seen as crucial for ensuring sharia compliance, accurate distribution, and financial oversight and reporting. The decentralized paradigm of blockchain often conflicts with national regulatory requirements and the coordination needs of BAZ/LAZ, necessitating a compromise between technological innovation and zakat management authority (Firman & Andatu, 2025).

Technical Issues

The implementation of blockchain for zakat management faces a number of key technical challenges:

1. Scalability

One of the biggest issues with blockchain is scalability. Public blockchain networks such as Bitcoin and Ethereum are only capable of processing between 7 and 30 transactions per second, far below traditional payment systems such as Visa, which can handle thousands of transactions per second. As the number of users and transactions increases, blockchain is prone to

confirmation delays, increased transaction costs, and network congestion. This challenge is known as the blockchain trilemma—the difficulty of balancing decentralization, security, and scalability simultaneously (‘Blockchain Environmental Impact: Problems and Solutions’, 2025).

2. Energy Consumption

Proof-of-work (PoW) based blockchains, such as Bitcoin, are known to be very energy-intensive because they require massive computing power from thousands of miners to verify transactions. Their energy consumption is equivalent to the electricity needs of a medium-sized country, and a single Bitcoin transaction can consume thousands of times more energy than a transaction on a conventional system. This issue has environmental implications, both in terms of carbon emissions and the strain on electrical infrastructure. Various studies and innovations are focused on using more efficient consensus algorithms, such as proof-of-stake, to reduce energy consumption, though widespread adoption remains a challenge in itself (Coutinho, Wongthongtham, Salih, Saleh, & Khairwal, 2022; Rouwaida, 2024).

3. Interoperability Between Platforms

Blockchain still faces interoperability issues, namely the inability of various blockchain networks to connect and exchange data or value directly. Each blockchain typically uses different protocols, smart contract standards, and consensus mechanisms—for example, ERC-20 on Ethereum is not compatible with Bitcoin. Efforts to create cross-chain bridges between networks often face security issues, technical complexity, and the absence of universal standards. This hinders the widespread adoption of blockchain, particularly in the zakat ecosystem, which requires collaboration between different institutions and platforms (Saleh, Amanzholova, Zhetekbay, Dauletbek, & Almisreb, 2024; Singh, 2025).

Regulatory Barriers

The implementation of blockchain in zakat management faces major obstacles in terms of regulation, both in terms of the legal framework and personal data protection.

1. Legal Framework for Blockchain for Zakat

To date, many countries, including Indonesia, do not yet have a clear and specific legal framework governing the use of blockchain for zakat. Although, in principle, the use of this technology is not considered contrary to Islamic law as long as it does not violate the principles of zakat, there are no formal regulations governing the procedures, standards, or oversight of blockchain implementation within the zakat ecosystem. The legality of blockchain use is often viewed solely from the perspective of Islamic law and general positive law, without delving into the technical or institutional details within national zakat regulations. This creates legal uncertainty for zakat institutions, muzakki, and mustahiq in accepting this technological

innovation—including aspects related to reporting, auditing, and liability in the event of loss or misuse of zakat data or funds (Nurhlizah, Arifin, & Iman, 2021).

2. Personal Data Protection

One of the urgent technical and regulatory challenges is the protection of personal data, especially with the increasingly stringent global regulations such as the General Data Protection Regulation (GDPR) in Europe and the Personal Data Protection Law (PDP Law) in Indonesia. Blockchain, which stores zakat transaction data openly and distributively, must ensure that the personal data of muzakki and mustahiq, including their identities and the amount of funds managed, are protected and not misused. Indonesia's PDP Law, which adopts many principles from the GDPR, requires every data management entity to obtain explicit consent, conduct risk mapping, and implement layered security principles—including the right of data subjects to access, correct, and delete their data. The absence of standardized blockchain-based data protection could potentially lead to privacy violations or leaks of sensitive data if not specifically regulated and monitored in accordance with national and international regulatory developments (Yusuf, Aufa, & Umam, 2024).

Socio-Cultural Factors

The socio-cultural challenges in implementing blockchain in zakat are mainly related to the digital literacy of the community and trust in new technology. Although blockchain can improve the transparency and accountability of zakat management, many people, especially among muzakki and mustahiq, have limited understanding of this technology. Limited digital literacy affects their ability to utilize the blockchain system optimally and understand its mechanisms and benefits, resulting in suboptimal technology adoption. Additionally, public trust in zakat management institutions remains stronger than in new technologies perceived as complex and unfamiliar. These challenges require zakat institutions to not only implement technology but also enhance adaptive education and outreach efforts, such as through engaging educational content tailored for younger generations and digital literacy programs involving various communities. These efforts are crucial to ensure the public feels comfortable conducting digital transactions and trusts that the zakat they contribute is distributed accurately and transparently through blockchain (Aini & Rahman, 2025; Susilo, 2024).

CONCLUSION

Blockchain promises significant reforms in zakat management through increased transparency, accountability, time efficiency, and automation of accounting processes with smart contracts that can automatically ensure sharia compliance, such as nisab calculations and targeted distribution to mustahiq. With

a decentralized system, blockchain can reduce the risk of fund misuse and accelerate the zakat transfer process without the need for many intermediaries, thereby increasing the trust of muzakki and community participation in zakat collection. However, its implementation also faces multidimensional challenges, including technological infrastructure limitations, legal regulations that do not specifically address blockchain in the context of zakat, and data privacy protection in accordance with GDPR standards and Indonesia's Personal Data Protection Law. Additionally, socio-cultural challenges such as low digital literacy and public trust in new technology must be addressed for this innovation to be widely accepted. Therefore, while blockchain technology offers opportunities for modernizing and streamlining zakat management, mitigating technical, regulatory, and socio-cultural challenges must be a top priority to ensure the success and sustainability of its implementation in the future.

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