

A Blockchain-Based Cash Waqf Model for Financing Ultra-Micro Enterprises in Indonesia

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ABSTRACT

Keywords:

Blockchain; Cash Waqf; Islamic Social Finance; Micro Waqf Bank; Ultra-Micro Enterprises;

Background: Ultra-micro enterprises in Indonesia continue to face limited access to formal financing because of inadequate collateral, weak financial records, irregular cash flows, and high administrative costs. Cash waqf has the potential to provide sustainable financing, but its implementation is constrained by fragmented institutional records, limited transparency, weak accountability, and low public trust.

Research Gap: The existing literature remains largely disconnected between Islamic microfinance, cash waqf governance, and blockchain applications. Limited discussion exists of a model designed specifically for Indonesia that brings together the protection of the waqf principal, institutional responsibilities, and permissioned blockchain governance for ultra-micro enterprise financing.

Novelty: This study develops a blockchain-based cash-waqf model that integrates institutional actors (waqif, LKS-PWU, registered nazhir, Indonesian Waqf Board, Micro Waqf Banks, Sharia supervisory boards, auditors, mentors, and ultra-micro enterprises) through a permissioned consortium blockchain. It distinguishes blockchain as governance infrastructure from cryptocurrency, separates financial settlement from recordkeeping, and incorporates privacy-by-design through off-chain data protection.

Method: A qualitative descriptive-analytical approach based on library research and document analysis was employed. Data were obtained from peer-reviewed publications, scholarly books, regulations, government documents, and institutional reports concerning cash waqf, Micro Waqf Banks, Islamic microfinance, blockchain, smart contracts, and financial inclusion. Data were analysed through descriptive, qualitative content, and thematic analyses.

Results: The proposed model uses a permissioned consortium blockchain where all financial transactions remain in Indonesian rupiah while blockchain records approvals, fund allocations, disbursements, repayments, mentoring, audits, and impact reports. Smart contracts support operational stages including programme approval, beneficiary screening, gradual disbursement, repayment tracking, and auditing. Sensitive personal information is stored separately in secure off-chain databases. The integration of these mechanisms enhances transparency, institutional coordination, accountability, and efficient fund distribution while preserving the principal value of cash waqf.

Conclusion: Blockchain can strengthen the governance of cash-waqf financing when supported by clear institutional responsibilities, Sharia supervision, data protection, cybersecurity, and regulatory compliance. The proposed model remains conceptual and requires expert validation, prototype development, and pilot implementation.

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INTRODUCTION

Ultra-micro enterprises constitute an economically important but financially vulnerable segment of Indonesia's livelihood economy. Most ultra-micro enterprises operate with limited resources and depend largely on the direct involvement of their owners. Their income is often unstable, while formal bookkeeping, credit records, and acceptable collateral are generally unavailable. These conditions make it difficult for them to access financing from formal financial institutions, even when the business is capable of meeting the owner's basic household needs. Studies on Islamic microfinance also suggest that the financial challenges faced by low-income entrepreneurs cannot be resolved simply by providing more credit. Sustainable financial inclusion also requires suitable financing contracts, social intermediation, business mentoring, institutional governance, and delivery mechanisms that are accessible to financially underserved communities (Rohman et al., 2021).

Indonesia has developed several financial-inclusion initiatives intended to serve micro and ultra-micro entrepreneurs. One of the relevant institutional innovations is the Micro Waqf Bank, or Bank Wakaf Mikro (BWM), which provides small-scale Sharia-compliant financing combined with group-based assistance and entrepreneurial mentoring. The BWM model is particularly relevant to communities that have not yet met the requirements of commercial banks. Nevertheless, extending its outreach depends on more than the availability of financing recipients. The sustainability of BWM operations is also influenced by funding continuity, operational efficiency, risk management, managerial capacity, community participation, and coordination between supervisory institutions. Recent evidence from Indonesia demonstrates that these financial and institutional sustainability dimensions remain critical to ensuring that BWM can consistently serve low-income entrepreneurs (Andayani et al., 2025).

Cash waqf offers an alternative source of Islamic social finance that can complement existing microfinance programmes. Unlike short-term charitable transfers, cash waqf can be structured as a sustainable financial instrument in which the waqf principal is protected and its economic benefits are allocated to eligible beneficiaries. When managed productively, cash waqf can support entrepreneurship, poverty alleviation, education, healthcare, and other forms of socioeconomic development. The integration of Islamic social finance with commercial and microfinance institutions may also create a progressive pathway through which low-income beneficiaries move from basic economic assistance to productive financing and, eventually, formal financial inclusion. Existing literature therefore positions waqf not merely as a charitable instrument but as an institutional mechanism capable of supporting long-term socioeconomic transformation (Maulina et al., 2023; Sukmana, 2020; Widiastuti et al., 2022).

Despite its potential, the development of cash waqf in Indonesia continues to face institutional and governance constraints. The gap between potential collections and realised contributions cannot be explained exclusively by limited public awareness. The effectiveness of waqf management is also determined by regulatory quality, institutional capacity, professional competence, governance processes, information systems, reporting mechanisms, and the measurable impact of waqf programmes. The development of Indonesia's National Waqf Index confirms that regulation, institutional arrangements, management processes, systems, outcomes, and socioeconomic impacts are interconnected dimensions of national waqf performance (Lestari et al., 2023). Comparative evidence from Indonesia, Malaysia, and Türkiye similarly indicates that innovation in cash waqf must be supported by clear governance structures and institutional coordination (Nofianti et al., 2026). Furthermore, recent research on Indonesian cash-waqf instruments identifies public distrust, inadequate professionalism, limited literacy, and insufficient transparency as major barriers to their optimisation (Ryandono et al., 2025).

Digitalisation provides an opportunity to improve the accessibility of cash waqf, but the provision of an online payment interface alone does not resolve the underlying governance problems. Studies concerning digital cash-waqf behaviour show that participation is influenced by knowledge, trust, perceived usefulness, ease of use, facilitating conditions, social influence, and confidence in the

institutions responsible for managing funds. Indonesian millennials are more likely to participate in cash waqf when they understand the instrument and perceive the collection mechanism as credible and accessible (Aldeen et al., 2022). More recent evidence indicates that technological knowledge, perceived behavioural control, institutional support, usefulness, and ease of use remain central determinants of online cash-waqf intentions (Widiastuti et al., 2025). Research integrating the Unified Theory of Acceptance and Use of Technology and Diffusion of Innovation Theory further demonstrates that the future of waqf digitalisation depends on both technological attributes and the institutional environment in which the technology is implemented (Kasmon et al., 2025).

Within this context, blockchain technology may offer a more advanced infrastructure for managing transactions and information across multiple institutions. Blockchain can be understood as a distributed ledger in which authorised participants share, verify, and retain synchronised transaction records. Smart contracts can automate predefined procedures, such as verification, approval, staged disbursement, repayment recording, and reporting, once agreed conditions have been fulfilled. These characteristics may reduce information asymmetry and improve the traceability and auditability of transactions involving parties that do not fully rely on a single institutional database (Cong & He, 2019). In accounting and auditing, blockchain-based records can strengthen the availability of verified transaction trails and facilitate more continuous forms of oversight (Han et al., 2023). Nevertheless, blockchain does not automatically create trust. Its effectiveness depends on governance arrangements, access rights, data quality, consensus mechanisms, cybersecurity, legal recognition, and the accountability of the institutions operating the network (Polcumpally et al., 2024).

The relevance of blockchain to waqf management has received increasing scholarly attention. Blockchain-based systems have been proposed to address fragmented records, reporting delays, difficulties in tracing fund distribution, and weak integration between waqf institutions. Evidence from waqf administrators suggests that blockchain-supported traceability can contribute to resolving accountability and transparency problems, particularly when multiple organisations participate in collection, investment, distribution, and supervision (Mohaiyadin et al., 2022). Smart contracts have also been examined in corporate-waqf crowdfunding, where their perceived security, transparency, and automation capabilities can support stakeholder participation (Megat et al., 2024). Other studies have developed business-process models for cash-waqf crowdfunding and proposed blockchain-based records for waqf asset management (Al-Daihani et al., 2025; Setiawan & Nurzaman, 2022). These studies collectively indicate that blockchain may support waqf governance, although most models focus on waqf assets, crowdfunding, or donor participation rather than the financing process of ultra-micro enterprises.

This study treats blockchain as a record-keeping and verification system rather than as a form of cryptocurrency. The use of distributed-ledger technology does not mean that cash-waqf funds must be transformed into crypto-assets. In Indonesia, both cash-waqf contributions and financial settlements should remain denominated in rupiah and be processed through legally recognised Islamic financial institutions. In this arrangement, blockchain serves only as a shared infrastructure for documenting transactions, monitoring fund flows, and confirming the activities of the institutions involved. Since waqf management is subject to formal regulation and institutional oversight, a permissioned consortium blockchain is more suitable than an open public network. This structure allows transaction validation and access to confidential information to be restricted to authorised institutions. Studies of institutional blockchain implementation show that regulated organisations commonly rely on permissioned architectures in which governance and access are controlled by designated participants rather than anonymous network users (Semenzin et al., 2022). Indonesian conceptual research also emphasises that blockchain-based waqf management can be developed without involving cryptocurrency (Setiawan & Nurzaman, 2022).

Accordingly, the proposed model should distinguish between financial settlement, distributed transaction recording, and personal-data management. Financial transfers should be conducted through an Islamic Financial Institution Receiving Cash Waqf (Lembaga Keuangan Syariah Penerima Wakaf Uang or LKS-PWU) and managed by a legally registered cash-waqf nazhir. The blockchain network can record transaction hashes, institutional approvals, programme allocations, financing milestones, repayment records, audit results, and impact indicators. Meanwhile, identity documents, detailed business records, and other protected personal information should remain in secured off-chain

databases. This arrangement can preserve transaction traceability without unnecessarily exposing beneficiaries' personal data.

Despite growing interest in these areas, the existing literature is still largely disconnected. Studies on Islamic microfinance tend to focus on poverty reduction, financial outreach, institutional sustainability, and waqf-based financing. Research on cash waqf, meanwhile, has mainly examined governance, donor participation, crowdfunding, and digital adoption. Blockchain studies have developed along a separate path, with greater attention to smart contracts, transaction traceability, auditing, and institutional trust. This separation leaves an important research gap. There is still limited discussion of a model designed specifically for Indonesia that brings together the protection of the waqf principal, the formal responsibilities of BWI, LKS-PWU, registered nazhir, Micro Waqf Banks, auditors, and financing recipients, as well as permissioned blockchain governance, data privacy, and smart-contract-supported financing for ultra-micro enterprises. Addressing this gap is essential because technology alone cannot correct weak governance. Without appropriate institutional arrangements and Sharia compliance, digitalisation may simply reproduce existing problems in a new technological form.

Therefore, this study aims to develop a Sharia- and regulation-aligned blockchain-based cash-waqf model for financing ultra-micro enterprises in Indonesia. The proposed model connects waqif, LKS-PWU, registered cash-waqf nazhir, the Indonesian Waqf Board, Micro Waqf Banks or other authorised Islamic microfinance institutions, independent auditors, business mentors, and ultra-micro enterprises through a permissioned blockchain network. The study addresses the following research question:

How can a permissioned blockchain-based cash-waqf model be designed to improve the traceability, accountability, and efficiency of financing for ultra-micro enterprises in Indonesia while safeguarding the waqf principal and complying with Sharia and regulatory requirements?

This study makes three main contributions to the literature. First, it brings together Islamic social finance, Islamic microfinance, and blockchain governance in a single conceptual framework. Second, it explains how institutional responsibilities, information flows, approval processes, and accountability mechanisms can be organised to develop cash waqf into a financing system that is easier to trace and monitor. Third, it offers a policy-oriented model in which blockchain is understood as part of the institutional governance structure, rather than as cryptocurrency or merely a digital platform for raising funds.

METHOD

This study employed a qualitative descriptive-analytical approach based on library research and document analysis. This design retained the original methodological orientation, which relied on secondary data from journals, books, official websites, and documents related to waqf and blockchain technology. The approach was selected because the study aimed to interpret institutional, technological, regulatory, and sharia issues rather than statistically test the effect of blockchain on ultra-micro enterprises.

The study focused on five areas: cash-waqf governance, micro waqf banks, financing constraints of ultra-micro enterprises, blockchain and smart-contract applications, and the Indonesian regulatory and sharia framework. Blockchain was examined as a shared infrastructure for recording, verification, monitoring, and auditing rather than as a cryptocurrency-based payment instrument.

Data were obtained from peer-reviewed journal articles, scholarly books, official regulations, institutional reports, and government publications. Academic literature was identified through scopus, web of science, sciencedirect, emerald insight, springerlink, and google scholar. Priority was given to reputable and recent publications, particularly those discussing cash waqf, Islamic social finance, Islamic microfinance, blockchain governance, smart contracts, transparency, accountability, and financial inclusion. Official documents were obtained from institutions such as the Indonesian waqf board, the financial services authority, the ministry of religious affairs, the ministry of finance, and bank Indonesia.

Sources were selected purposively based on relevance, credibility, recency, and institutional authority. Earlier publications were retained when they provided foundational concepts, whereas unverifiable sources, promotional materials, and studies focusing solely on speculative cryptocurrency activities were excluded. Purposive document selection is appropriate when research requires sources that directly explain a specific institutional or conceptual problem (bowen, 2009).

Data were collected through documentation and organised according to several analytical categories, including waqf governance, financing mechanisms, blockchain functions, institutional roles, sharia compliance, regulatory compatibility, implementation benefits, and technological risks. The data were then analysed using descriptive analysis, qualitative content analysis, and thematic analysis. Thematic analysis was applied to identify recurring patterns concerning financing constraints, public trust, transaction traceability, institutional coordination, smart-contract functions, data protection, and implementation challenges (braun & clarke, 2006).

The conceptual model was developed by integrating the findings from the literature and official documents. The original model involving waqif, laznas or nazhir, the indonesian waqf board, islamic banks, micro waqf banks, auditors, business mentors, and ultra-micro enterprises was retained and refined by clarifying the legal and operational roles of each actor. The revised model positions lks-pwu as the receiving institution, a registered nazhir as the waqf manager, and micro waqf banks or authorised islamic microfinance institutions as financing and mentoring institutions.

The proposed model relies on a permissioned blockchain to document key activities, including programme approval, fund allocation, financing disbursement, repayment, mentoring, and audit results. All financial transactions continue to be conducted in Indonesian rupiah, while confidential identity and business information is kept separately in secure off-chain databases. At the conceptual level, the model was assessed by considering its compliance with Sharia principles and national regulations, the strength of its governance structure, its technological suitability, its operational practicality, and its ability to protect sensitive data.

The study was limited to secondary data and conceptual analysis. No interviews, expert validation, prototype testing, or field implementation were conducted. Therefore, the findings represent a theoretically and institutionally grounded model that requires further empirical validation.

RESULTS

Analytical Findings and Model Refinement

The analysis identified that financing constraints faced by ultra-micro enterprises are not exclusively caused by the limited availability of capital. The problem also involves information asymmetry, weak financial records, limited collateral, irregular business income, and the high administrative costs required to serve small financing recipients. Consequently, a financing model for ultra-micro enterprises should not merely provide financial capital but should also integrate beneficiary selection, business mentoring, transaction monitoring, and institutional accountability. Islamic microfinance studies similarly emphasise that the effectiveness of financing for low-income entrepreneurs depends on the integration of financial services with social intermediation and business development assistance (rohman et al., 2021).

The original manuscript positioned the micro waqf bank as an intermediary that provides financing and mentoring to economically productive low-income communities that have limited access to formal financial institutions. It also emphasised group-based financing, collective responsibility, spiritual development, and assistance in improving business-management capabilities. This institutional function should be retained because the value of the micro waqf bank does not lie solely in fund distribution. Its contribution also derives from its role as a social and business incubator for financially excluded entrepreneurs. Empirical research on micro waqf banks supports the importance of financing combined with religious and entrepreneurial assistance in strengthening community empowerment (hidayat & makhrus, 2021).

The document analysis further found that cash-waqf financing requires an integrated governance mechanism. Cash-waqf management includes collection, asset protection, productive management, benefit distribution, supervision, and impact measurement. These functions are currently carried out by different institutions, which may generate fragmented records and repeated administrative verification. The national waqf index developed for indonesia demonstrates that effective waqf management depends on the interaction of regulatory, institutional, process, system, outcome, and impact dimensions rather than on the amount of funds collected alone (lestari et al., 2023).

The original blockchain-waqf model involved the waqif, laznas as nazhir, the indonesian waqf board, islamic banks or lks-pwu, micro waqf banks, independent auditors, business mentors, and ultra-

micro enterprises. It proposed smart contracts to automate contractual procedures and identified four expected benefits: improved financing access, greater transparency and accountability, lower transaction costs, and more efficient fund distribution. These actors and objectives remain relevant. However, the analysis identified several elements requiring substantial refinement, particularly the institutional status of laznas, the protection of the cash-waqf principal, the use of cryptocurrency, personal-data management, and the limits of smart-contract automation.

Table 1. The revised model is therefore based on six design principles.

Design principle	Main requirement
Institutional clarity	Each participant performs a clearly defined legal and operational role
Preservation of waqf principal	The principal value of cash waqf must be separated from distributable benefits and operational funds
Permissioned governance	Only authorised institutions may validate or access relevant blockchain records
Separation of settlement and recordkeeping	Financial transfers remain in rupiah, while blockchain records approvals and transaction evidence
Privacy by design	Sensitive personal and business data remain off-chain
Controlled automation	Smart contracts automate predefined procedures but do not replace human, legal, or sharia judgement

These principles transform the original model from a general blockchain-waqf scheme into an institutional governance architecture specifically designed for ultra-micro enterprise financing.

Proposed Blockchain-Based Cash Waqf Architecture

The principal result of this study is a permissioned consortium blockchain model connecting cash-waqf institutions, islamic microfinance intermediaries, supervisory bodies, and ultra-micro enterprises. A permissioned architecture is more appropriate than a fully public blockchain because the proposed ecosystem involves regulated institutions, confidential financial information, and protected beneficiary data. Blockchain governance research shows that trust does not emerge automatically from decentralisation. It depends on network authority, validation arrangements, accountability rules, access rights, and dispute-resolution mechanisms (polcumpally et al., 2024). The proposed architecture contains three interconnected layers.

a. Financial settlement layer

The financial settlement layer manages the actual receipt, placement, investment, allocation, and disbursement of cash-waqf funds. Transactions remain denominated in indonesian rupiah and are processed through authorised islamic financial institutions. Blockchain is not used as a substitute for money, banking settlement, or the institutional management of cash waqf.

This arrangement revises an important component of the original manuscript, which proposed transferring verified waqf funds in the form of cryptocurrency. The revised model rejects that mechanism. Blockchain and cryptocurrency are conceptually separable. A distributed ledger can record and verify transactions without converting the underlying cash-waqf assets into crypto-assets. Indonesian blockchain-waqf studies have also proposed blockchain-based waqf management without requiring cryptocurrency as the underlying financial instrument (setiawan & nurzaman, 2022; suryaningsih et al., 2020).

b. Distributed governance and recording layer

The blockchain layer functions as a shared ledger for authorised institutions. It records essential transaction evidence, including:

- 1) Confirmation of cash-waqf receipt;
- 2) Approval of financing programmes;
- 3) Allocation of funds to particular programmes;
- 4) Results of beneficiary eligibility verification;

- 5) Financing approval and disbursement;
- 6) Completion of business milestones;
- 7) Repayment or revolving-fund records;
- 8) Mentoring and supervision reports;
- 9) Audit findings; and
- 10) Financial and social-impact indicators.

The use of a shared ledger reduces dependence on separate and potentially inconsistent institutional databases. Blockchain-supported accounting records can provide append-only, shared, verified, and consensus-based transaction information. These characteristics may strengthen real-time recordkeeping and facilitate continuous auditing when supported by reliable governance and internal controls (han et al., 2023).

c. Off-chain data-management layer

The third layer stores sensitive information outside the blockchain. Identity documents, customer addresses, detailed business information, financing assessments, bank-account information, and other protected data should be stored in secure institutional databases. The blockchain should record only transaction hashes, verification status, institutional approvals, timestamps, and limited information required for audit and traceability.

This design addresses a fundamental limitation of blockchain. Immutability is useful for transaction verification, but it becomes problematic when incorrect, confidential, or excessive personal information is placed permanently on-chain. The use of off-chain storage consequently provides a balance between transaction traceability and personal-data protection.

The three architectural layers interact through controlled data exchange. Financial transactions are executed through authorised institutions, while only transaction references, timestamps, verification status, institutional approvals, and cryptographic hashes are recorded on the permissioned blockchain. Detailed identity, financing, and business information remains in secure off-chain databases. Data consistency can be maintained through unique transaction identifiers, hashes, timestamps, and periodic reconciliation, while discrepancies should trigger institutional review rather than automatic data replacement.

Governance of the permissioned consortium should rely on clearly defined validation and access rights. Each institution should validate only transactions within its legal and operational authority, while sensitive or high-risk actions may require multi-party approval. Role-based access should ensure that waqf, nazhir, financing institutions, auditors, supervisors, and beneficiaries receive only the information relevant to their responsibilities. Blockchain consensus therefore validates authorised records but does not replace institutional, legal, or Sharia decision-making.

Institutional Actors and Responsibilities

The proposed model maintains the main institutional actors identified in the original manuscript but clarifies their respective responsibilities.

Table 2. Institutional Actors and Responsibilities in the Proposed Blockchain-Based Cash Waqf Model

Actor	Responsibility in the proposed model
<i>Waqif</i>	Provides cash waqf and selects an eligible financing programme
Lks-pwu	Receives cash waqf and records the receipt through an authorised financial channel
Registered cash-waqf <i>naẓhir</i>	Manages, develops, allocates, and reports cash-waqf assets
Indonesian waqf board	Conducts institutional supervision and waqf-governance development
Micro waqf bank or authorised lkms	Selects beneficiaries, distributes financing, and provides business mentoring
Sharia supervisory board	Reviews contracts, fund allocation, and smart-contract rules for sharia compliance

Independent auditor	Examines financial records, internal controls, and fund utilisation
Business mentor	Evaluates business progress and verifies financing milestones
Ultra-micro enterprise	Receives financing and participates in mentoring and monitoring programmes
Technology administrator	Maintains system security, interoperability, user permissions, and blockchain infrastructure

The institutional separation in this model is important because fund collection, waqf management, financing distribution, supervision, and system administration should not be concentrated in a single actor. The original manuscript designated laznas as nazhir. In the revised model, laznas may perform this function only when it is separately authorised and institutionally competent to manage cash waqf. Otherwise, the function must be assigned to a registered cash-waqf nazhir.

This separation supports stronger checks and balances. Integrated islamic social-finance governance requires coordination among social-finance institutions, commercial financial institutions, regulators, and community organisations. The integration must nevertheless preserve the specific ownership, accountability, and distribution characteristics of each islamic financial instrument (maulina et al., 2023; widiastuti et al., 2022).

The proposed model is designed to complement, rather than replace, Indonesia's existing waqf governance framework. Its institutional structure remains consistent with the respective roles of BWI, LKS-PWU, registered cash-waqf nazhir, Micro Waqf Banks or authorised LKMS, and Sharia supervisory bodies. The model also aligns with the governance logic of the National Waqf Index, which emphasises regulatory, institutional, process, system, outcome, and impact dimensions. Blockchain may strengthen these dimensions by providing standardised transaction records, clearer institutional accountability, traceable financing processes, and more structured reporting of financing and socioeconomic outcomes.

Regulatory and Sharia Alignment of the Proposed Model

The proposed model operates within an existing multi-layered legal and institutional framework rather than within a regulatory vacuum. At the waqf level, the collection, management, development, and distribution of cash waqf are governed by Law No. 41 of 2004 on Waqf and Government Regulation No. 42 of 2006, as amended by Government Regulation No. 25 of 2018. These provisions are complemented by the Ministry of Religious Affairs Regulation No. 4 of 2009 concerning cash waqf administration and by regulations issued by the Indonesian Waqf Board (BWI), particularly BWI Regulation No. 1 of 2020 concerning the management and development of waqf assets and BWI Regulation No. 2 of 2010 concerning the registration of cash-waqf nazhir. Accordingly, the blockchain architecture proposed in this study does not alter the legal status of the waqf, LKS-PWU, nazhir, or BWI. Rather, it provides an additional information and verification layer through which legally mandated activities can be documented and monitored.

This regulatory distinction is particularly important for the roles of the LKS-PWU and the Micro Waqf Bank. Cash-waqf contributions remain received through an officially designated LKS-PWU, while management and development of the waqf assets remain the responsibility of a registered cash-waqf nazhir. Where a Micro Waqf Bank operates as a Sharia Microfinance Institution (Lembaga Keuangan Mikro Syariah or LKMS), its financing activities must also comply with the regulatory framework applicable to microfinance institutions. OJK Regulation No. 41 of 2024 on Microfinance Institutions regulates, among other matters, institutional licensing, business activities, sources of funding, Sharia contracts, governance, reporting, consumer protection, and supervision. Consequently, the proposed blockchain network cannot transfer legally assigned financing or supervisory functions from authorised institutions to an automated protocol.

The technological component of the model should likewise be distinguished from digital-asset or cryptocurrency activities. Indonesia's financial-technology regulatory framework has developed substantially through OJK Regulation No. 3 of 2024 on Financial Sector Technology Innovation (Inovasi Teknologi Sektor Keuangan or ITSK), which provides a framework for innovation testing, regulatory sandbox arrangements, registration, licensing, monitoring, and supervision. Where the implementation of the proposed blockchain platform falls within the scope of regulated financial-sector technological innovation, its operators would need to assess the applicable sandbox, registration, or

licensing requirements before deployment. This regulatory assessment should therefore form part of the pilot-development stage rather than being treated as a purely technical matter.

At the same time, OJK Regulation No. 27 of 2024, as amended by OJK Regulation No. 23 of 2025, governs the trading of digital financial assets, including crypto-assets. These provisions establish an important regulatory boundary for the present model. The proposed system does not issue, trade, or settle cash waqf through crypto-assets, tokens, or speculative digital instruments. Cash-waqf contributions and financing settlements remain denominated in Indonesian rupiah and are processed through authorised financial institutions. Blockchain functions only as a permissioned infrastructure for recording, validating, and sharing authorised transaction evidence. Therefore, the model should not be classified simply as a crypto-asset arrangement merely because distributed-ledger technology is employed.

Data governance represents another regulatory dimension. Because the proposed network contains information relating to waqif, financing recipients, financial transactions, and business activities, its implementation must also comply with Law No. 27 of 2022 on Personal Data Protection and the applicable rules governing electronic systems and transactions. The proposed separation between on-chain and off-chain information is therefore not merely a technical design choice. Keeping detailed identity documents, bank-account information, financing assessments, and confidential business records in controlled off-chain databases reduces unnecessary permanent exposure of personal information, while blockchain retains only limited verification references required for traceability and auditing.

Taken together, these regulatory layers reinforce the central governance principle of the model: blockchain supplements rather than replaces existing legal institutions. BWI continues to perform its waqf-governance and supervisory functions; the LKS-PWU remains the authorised channel for receiving cash waqf; the registered nazhir remains accountable for managing and developing the waqf assets; the Micro Waqf Bank or authorised LKMS remains responsible for financing and mentoring activities; and the Sharia Supervisory Board retains authority over Sharia compliance. The validity of institutional decisions therefore derives from applicable law, regulatory authority, and Sharia governance rather than from blockchain consensus alone.

From a Sharia perspective, blockchain is treated as a neutral record-keeping infrastructure rather than a financial asset or contractual substitute. Its use is permissible insofar as the underlying transactions comply with Sharia, preserve the cash-waqf principal, avoid gharar and maysir, and remain subject to human and institutional supervision. The Sharia Supervisory Board should assess the model with reference to the MUI Fatwa on Cash Waqf and relevant DSN-MUI standards on qard, mudharabah, and musharakah. Accordingly, qard hasan is suitable for socially oriented financing, while mudharabah or musharakah may be applied to productive risk-sharing arrangements subject to fund-source and waqf-preservation requirements. Blockchain strengthens BWI supervision through traceable records and structured reporting without altering BWI's statutory authority.

Operational flow of the proposed model

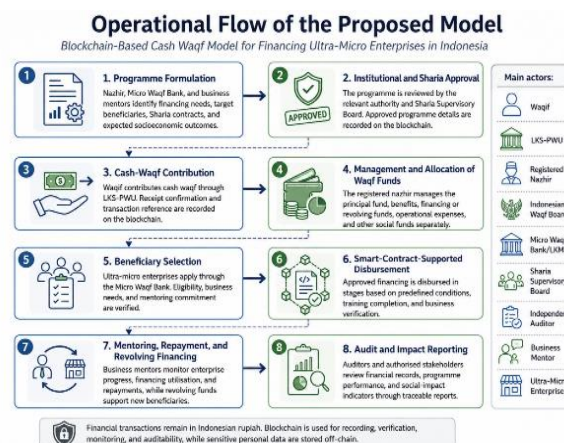


Figure 1. The Proposed Model Operates Through Eight Interconnected Stages.

1. Stage 1: programme formulation

The registered nazhir, Micro Waqf Bank, and business mentors jointly assess the financing needs of ultra-micro enterprises. Based on this assessment, they prepare a programme proposal that specifies the intended beneficiaries, financing objectives, eligibility requirements, proposed Sharia contracts, risk-control measures, mentoring arrangements, financing duration, and expected socioeconomic outcomes.

This stage retains the original manuscript's principle that the waqf manager should conduct a feasibility assessment and formulate the financing programme before collecting cash waqf for a specific programme. In the revised model, however, the proposal must also include clearly defined financial, Sharia, operational, and social-impact criteria.

2. Stage 2: institutional and sharia approval

The proposed programme is reviewed by the relevant institutional authority and the Sharia Supervisory Board. The review covers the financing mechanism, protection of the waqf principal, beneficiary-selection criteria, permitted use of funds, risk-mitigation measures, and reporting indicators.

Once the programme has been approved, its identification number and approval details are recorded on the blockchain. This record helps prevent unauthorised changes to the programme's original purpose unless the amendment is formally documented and approved.

3. Stage 3: cash-waqf contribution

The waqif selects an approved programme and contributes cash waqf through the designated lks-pwu. The financial institution confirms the receipt, while a digital transaction reference is recorded on the blockchain. The waqif can then access information regarding the programme's objectives, total funds received, allocation status, and aggregated impact.

This process improves the traceability of cash-waqf contributions without publicly disclosing the identity or private financial information of the waqif.

4. Stage 4: management and allocation of waqf funds

The registered nazhir manages the cash-waqf assets in accordance with the approved structure. The model requires a separation between:

- a. The principal cash-waqf fund;
- b. Returns or benefits generated from productive management;
- c. Financing or revolving funds;
- d. Operational expenses; and
- e. Other charitable funds, such as donations, infak, or corporate social-responsibility contributions.

The preservation of the waqf principal is a central design requirement. Waqf differs from an ordinary donation because its assets are intended to generate sustained benefits. Waqf scholarship therefore places productive management, institutional capability, governance, and long-term socioeconomic impact at the centre of waqf development (sukmana, 2020).

The contractual structure of the proposed model should distinguish the waqf relationship from the subsequent financing relationships. The transfer of cash from the waqif through the LKS-PWU to the registered nazhir constitutes cash waqf and should not be treated as a qard, mudharabah, or musharakah financing transaction. In accordance with the principle of cash waqf, the principal value remains a protected waqf asset, while its management and generated benefits are directed toward the approved socioeconomic purposes. The Indonesian cash-waqf framework and the MUI Fatwa on Cash Waqf emphasise that the principal value of cash waqf must remain preserved and may not be transferred as an ordinary disposable charitable fund.

The contracts applied between the financing institution and ultra-micro enterprises may nevertheless differ according to programme objectives, the source of financing, beneficiary capacity, and the level of commercial risk. Qard hasan is particularly relevant when the programme prioritises social inclusion and capital access for vulnerable entrepreneurs. Under this structure, an eligible beneficiary receives financing without an interest-based return obligation and repays only the principal according to the agreed schedule. Repayments may subsequently replenish a designated revolving-financing pool. To

avoid exposing the protected waqf principal to direct financing losses, qard-based financing should preferably be sourced from distributable waqf returns, specifically designated revolving funds, or other permissible non-principal funds, unless another structure has been expressly approved by the nazhir and Sharia Supervisory Board and complies with applicable waqf regulations.

Mudharabah may be used where an ultra-micro entrepreneur contributes entrepreneurial effort and management while the financing institution provides the agreed business capital. Profit-sharing ratios must be established clearly in advance, while financial losses are treated in accordance with the applicable Sharia rules unless they result from negligence, misconduct, or contractual breach. Musharakah may be more appropriate where both the financing institution and the entrepreneur contribute capital to the business and share profits according to an agreed ratio, with losses borne according to the respective capital contributions. Because mudharabah and musharakah contain genuine business-risk exposure, the model should not assume that the protected cash-waqf principal can automatically be placed into these contracts. Their use must be linked to the relevant fund category, risk-mitigation mechanism, waqf-preservation requirement, and approval of the Sharia Supervisory Board.

Accordingly, the smart contract does not constitute the Sharia contract itself. The underlying qard, mudharabah, musharakah, or other approved contract must first be agreed by the relevant parties and reviewed for Sharia compliance. The smart contract subsequently translates only objectively verifiable contractual conditions into automated procedures, such as confirmation of approval, staged disbursement, due-date reminders, repayment recording, and fulfilment of predefined business milestones. Matters involving hardship, business failure, negligence, restructuring, disputes, force majeure, or Sharia interpretation remain subject to human and institutional review.

5. Stage 5: beneficiary selection

Ultra-micro enterprises submit financing applications through the micro waqf bank or another authorised Islamic microfinance institution. Selection includes identity verification, business assessment, financing needs, repayment capacity where relevant, willingness to join mentoring programmes, and compliance with programme criteria.

Only the result of the verification, the authorised institution, the date, and the application status are stored on-chain. Detailed applicant information remains off-chain.

The selection mechanism should not imitate conventional collateral-intensive lending. The original bwm model is directed at productive low-income entrepreneurs who cannot easily access formal financial institutions and combines financing with group assistance and business mentoring. Research on Islamic microfinance likewise indicates that financial inclusion for low-income entrepreneurs requires instruments adapted to their economic and social conditions (Rohman et al., 2021).

6. Stage 6: smart-contract-supported disbursement

After approval, the system activates the relevant smart-contract rules. Funds may be disbursed in stages based on predefined conditions, such as completion of business training, verification of business activity, purchase of productive equipment, or submission of periodic reports.

Smart contracts can reduce repetitive manual verification by automatically executing rules after specified conditions are fulfilled. In financial systems, smart contracts can improve commitment, automate contractual processes, and reduce certain forms of opportunistic behaviour when the underlying conditions can be objectively coded (Cong & He, 2019).

Nevertheless, smart contracts should not independently determine matters requiring human judgement. Business failure, restructuring, disputes, natural disasters, force majeure, or Sharia interpretation cannot be resolved solely through automated code. Such cases require review by the micro waqf bank, nazhir, Sharia supervisory board, and other authorised parties.

Smart contracts should be limited to objectively verifiable procedures such as approval status, staged disbursement, repayment recording, reporting deadlines, and verified business milestones. Decisions involving hardship, default, restructuring, disputes, force majeure, or Sharia interpretation must remain under human and institutional authority. This limitation is also important to reduce potential gharar arising from unclear contractual conditions or automated decisions. The risk of maysir is minimised because the proposed model does not involve speculative token trading, cryptocurrency

investment, or chance-based financial outcomes; all settlements remain in Indonesian rupiah and are linked to genuine financing activities.

7. Stage 7: mentoring, repayment, and revolving financing

After disbursement, business mentors record periodic information regarding business continuity, sales development, financing utilisation, training participation, and repayment performance. Where the programme applies a revolving financing mechanism, repayments are returned to the designated fund and subsequently allocated to other eligible enterprises.

The integration of mentoring into the blockchain model distinguishes the proposed system from a general digital crowdfunding platform. The intended outcome is not merely the transfer of funds but the economic progression of beneficiaries. Integrated islamic social finance can be more effective when assistance is structured according to the beneficiary's economic stage, from economic rescue and recovery to reinforcement and resilience (widiastuti et al., 2022).

8. Stage 8: audit and impact reporting

The independent auditor is granted controlled access to transaction records, financial reports, smart-contract logs, and supporting institutional documents. Audit results are recorded through immutable references, while detailed audit working papers remain off-chain. The waqif and authorised stakeholders receive aggregated reports concerning:

- a. Cash waqf collected;
- b. Funds managed and allocated;
- c. Number of ultra-micro enterprises financed;
- d. Financing repayment or revolving-fund performance;
- e. Completion of mentoring programmes;
- f. Business continuity;
- g. Employment generated;
- h. Income-development indicators; and
- i. Identified programme risks.

Blockchain-supported records may strengthen audit quality by providing consistent and time-stamped transaction evidence. However, the reliability of audit results still depends on the quality of the original data and the effectiveness of organisational controls (han et al., 2023; qader & cek, 2024).

To clarify the distinctive contribution of the proposed model, it is useful to compare it with existing cash-waqf and Micro Waqf Bank arrangements in Indonesia. Existing models have established important mechanisms for waqf management, financing, and business mentoring, but their institutional records, monitoring processes, and reporting mechanisms are generally managed within separate organisational systems. The proposed blockchain-based model builds on these existing arrangements by introducing a shared permissioned infrastructure for transaction verification, financing monitoring, auditing, and impact reporting. Table 3 summarises the main differences between the existing arrangements and the proposed model.

Table 3. Comparative Analysis of Existing Cash-Waqf and Micro Waqf Bank Models and the Proposed Blockchain-Based Model

Aspect	Existing Cash-Waqf / BWM Model	Proposed Blockchain Model
Institutional records	Mostly institution-specific	Shared permissioned records
Transparency	Periodic reporting	Traceable and time-stamped records
Financing process	Financing and mentoring	Financing, mentoring, monitoring, audit, and impact reporting
Automation	Mainly manual	Limited smart-contract-supported processes

The proposed model therefore does not replace existing cash-waqf or Micro Waqf Bank arrangements. Its main added value lies in integrating financing, mentoring, monitoring, auditing, and impact reporting within a shared permissioned information infrastructure, while preserving existing institutional and Sharia responsibilities.

Potential Benefits for Ultra-micro Enterprises

a) Broader access to financing

The model may broaden financing access by connecting cash-waqf contributors with organised and verifiable ultra-micro financing programmes. Digital access may reduce geographical limitations and allow programmes managed by different institutions to be presented through a shared platform.

However, blockchain does not directly create additional capital. Its contribution lies in improving the governance infrastructure through which cash waqf is collected, allocated, monitored, and reported. Increased financing availability will depend on public participation, institutional credibility, programme quality, and the capability of the nazhir to manage the funds productively.

b) Transparency and accountability

Transparency represents the strongest potential contribution of the model. The waqif, nazhir, micro waqf bank, auditor, and supervisor can access consistent versions of authorised transaction records. This reduces the possibility that separate institutions maintain conflicting information concerning fund collection, allocation, disbursement, and repayment.

Research involving waqf administrators indicates that blockchain can address accountability and transparency problems by strengthening record traceability and information sharing among participating institutions (mohaiyadin et al., 2022). Earlier studies cited in the original manuscript also identified traceability, data integrity, and secure recordkeeping as potential contributions of blockchain to waqf management (suryaningsih et al., 2020; zulaikha & rusmita, 2018).

c) More efficient institutional coordination

A shared ledger may reduce repeated document exchange and reconciliation among the nazhir, lks-pwu, micro waqf bank, auditor, and supervisory authorities. Smart contracts may also automate notifications, approval status, reporting deadlines, and staged disbursements.

Cash-waqf crowdfunding research demonstrates that clear business-process modelling is essential because fundraising, institutional approval, financial transfer, project implementation, and reporting involve different actors and information flows (al-daihani et al., 2025). The proposed blockchain model extends this logic to ultra-micro financing by incorporating beneficiary verification, mentoring, repayment, and revolving-fund management.

d) Improved targeting and fund monitoring

The model allows financing to be linked with verified beneficiary profiles and programme objectives. Monitoring records can indicate whether financing is used for approved productive activities and whether the beneficiary has completed the required mentoring stages.

This feature is important because the success of ultra-micro financing cannot be measured solely by the amount disbursed. It must also consider business continuity, income generation, repayment performance, and the beneficiary's movement toward sustainable financial inclusion.

e) Strengthened donor confidence

Traceable programme information may increase confidence among waqif by enabling them to observe how contributions are managed and what socioeconomic outcomes are generated. Nevertheless, technology-mediated transparency should not be equated with institutional trust. Public confidence also depends on the competence of the nazhir, sharia compliance, the reliability of reports, independent auditing, and credible regulatory supervision.

DISCUSSION

Implementation risks and critical discussion

The results do not support the assumption that blockchain will automatically reduce all administrative costs. Blockchain implementation requires infrastructure development, system integration, cybersecurity controls, staff training, software maintenance, and institutional coordination. Empirical evidence from accounting organisations shows that technological complexity, integration problems, limited knowledge, and increased adoption costs can hinder blockchain implementation (akter et al., 2024).

The model also faces the “garbage in, garbage out” problem. Blockchain can preserve records after validation, but it cannot guarantee that information entered by the participating institutions is factually correct. False business reports, inaccurate beneficiary data, or improper institutional approvals may become permanently traceable without becoming substantively valid. Strong verification procedures and internal controls must therefore precede blockchain recording.

Cybersecurity and access governance constitute additional risks. A permissioned blockchain reduces unrestricted public access but does not eliminate compromised credentials, malicious insiders, poor software configuration, or smart-contract vulnerabilities. Technical governance should include multi-signature approval, role-based access, regular security audits, backup procedures, code review, and emergency suspension mechanisms.

Sharia-related risks should also be distinguished from purely technological risks. Blockchain technology does not inherently create *gharar* or *maysir*; however, their underlying causes may arise when contractual and technological arrangements are inadequately designed. *Gharar* may emerge if the identity and obligations of the contracting parties, financing amount, profit-sharing mechanism, repayment conditions, business milestones, default procedures, or consequences of smart-contract execution are materially uncertain. A coded rule may also amplify contractual uncertainty if the data source, triggering event, or method of verification is ambiguous. Therefore, every automated financing rule should correspond to a clearly specified underlying Sharia contract and should be reviewed by the Sharia Supervisory Board before being deployed.

The risk of *maysir* is materially reduced in the proposed model because blockchain is not used for speculative token trading, cryptocurrency investment, wagering, or price-based financial speculation. Funds remain denominated and settled in Indonesian rupiah, while blockchain records institutional and transaction evidence. Nevertheless, the system should expressly prohibit mechanisms in which financing eligibility, returns, beneficiary entitlements, or fund allocation depend on chance-based outcomes or speculative fluctuations unrelated to genuine productive economic activity. The avoidance of *gharar* and *maysir* therefore depends not merely on the choice of blockchain architecture but on contractual clarity, transparent allocation rules, identifiable productive purposes, Sharia supervision, and the exclusion of speculative digital-asset mechanisms.

Human oversight remains essential in this context. Smart contracts should automate only conditions that can be objectively verified and should include procedures for suspension and institutional review when exceptional circumstances occur. Business failure, disputed data, repayment hardship, force majeure, or disagreement regarding Sharia interpretation should not trigger irreversible automated consequences without review by the Micro Waqf Bank or authorised LKMS, the *nazhir*, and the Sharia Supervisory Board. This controlled-automation approach reduces the possibility that technical certainty at the code level produces substantive uncertainty or unfairness at the contractual level.

The permanent nature of blockchain records also requires strict data-minimisation rules. Only information necessary for transaction verification and institutional accountability should be stored on-chain. Personal identities, complete financing documents, and confidential business information should remain off-chain.

Finally, institutional readiness may become a greater constraint than technological availability. The proposed model requires agreement concerning standard data formats, institutional responsibilities, financing indicators, smart-contract rules, audit procedures, and dispute resolution. Blockchain governance research confirms that technological trust remains inseparable from institutional governance and organisational capability (polcumpally et al., 2024).

A further implementation constraint concerns digital literacy among both ultra-micro entrepreneurs and participating waqf institutions. The proposed architecture should not assume that beneficiaries understand blockchain, smart contracts, digital signatures, or distributed-ledger terminology. Such an assumption would be particularly problematic because ultra-micro financing is intended to serve financially underserved groups whose access to formal financial services, administrative documentation, and digital infrastructure may already be limited. Previous studies of digital cash-waqf adoption also indicate that knowledge, ease of use, facilitating conditions, institutional support, and perceived usefulness influence users' willingness to adopt digital waqf services (Aldeen et al., 2022; Widiastuti et al., 2025).

For this reason, beneficiaries should interact with a simplified user interface rather than directly with the technical blockchain layer. Registration, financing applications, mentoring records, and repayment information should be presented in familiar language and through accessible mobile or assisted-service channels. Where digital capability is limited, Micro Waqf Banks and business mentors should provide assisted onboarding, face-to-face support, and basic digital-financial education. The technological complexity of the blockchain infrastructure should therefore remain largely invisible to beneficiaries unless technical information is necessary for informed consent or transaction verification.

Digital readiness is equally important for nazhir, Micro Waqf Bank staff, auditors, Sharia supervisors, and technology administrators. Participating institutions require training not only in operating the platform but also in data verification, access control, cybersecurity, smart-contract governance, incident reporting, and the distinction between blockchain records and legally authoritative institutional decisions. The adoption process should consequently include standard operating procedures, role-based training, user-support mechanisms, and periodic competency assessments.

These considerations support a gradual rather than immediate large-scale implementation strategy. An initial pilot should involve a limited number of institutions and beneficiaries and should evaluate not only transaction speed and technological performance but also user comprehension, digital accessibility, training requirements, error rates, complaint handling, Sharia compliance, and institutional workload. If blockchain increases administrative complexity or excludes intended beneficiaries, the model should be redesigned before broader implementation. Digital inclusion should therefore be treated as a substantive criterion of model effectiveness rather than as a secondary technological issue.

Implementation should therefore proceed through a phased pilot involving infrastructure preparation, institutional agreements, regulatory assessment, staff training, and controlled deployment. Cybersecurity, data protection, access control, dispute-resolution procedures, and regular system audits should form the core risk controls. Financial feasibility should be assessed by comparing development and maintenance costs with administrative savings and governance benefits relative to existing systems. Initial implementation should involve capable registered nazhir and Micro Waqf Banks, followed by gradual expansion across programmes, regions, and institutional partners when operational, regulatory, and financial readiness is demonstrated. Waqif should receive accessible information on fund allocation, programme outcomes, and feedback mechanisms, while regulators and government agencies should facilitate interoperability, capacity building, and appropriate regulatory-sandbox arrangements.

Theoretical and practical contributions

The principal theoretical contribution of this study is an end-to-end governance model integrating Islamic social finance, Islamic microfinance, and blockchain specifically for ultra-micro enterprise financing. Unlike previous blockchain-waqf models centred mainly on crowdfunding, donor participation, asset records, or transparency, this framework connects waqf collection, financing, mentoring, repayment, auditing, and impact reporting within a permissioned institutional architecture. It conceptualises blockchain as governance infrastructure for reducing institutional fragmentation and information asymmetry, while treating technological transparency as complementary to, rather than a substitute for, institutional and Sharia-based trust. Although designed for Indonesia, the framework may be transferable to other Muslim-majority jurisdictions where compatible waqf regulation, authorised Islamic financial institutions, Sharia supervision, and adequate digital infrastructure exist. It also extends the application of Islamic fintech toward financial inclusion, poverty alleviation, and SDG-oriented social-finance innovation.

Practically, the model provides a foundation for developing a pilot platform involving a registered cash-waqf nazhir, lks-pwu, micro waqf bank, sharia supervisory board, auditor, and selected ultra-micro enterprises. Initial implementation should be limited to one financing programme and a controlled number of beneficiaries. The pilot should evaluate operational costs, transaction speed, data accuracy, user acceptance, sharia compliance, cybersecurity, financing performance, and the additional value of blockchain compared with a conventional centralised database.

Because the present study is conceptual, the identified benefits represent expected institutional outcomes rather than empirically proven effects. Further research should validate the model through expert interviews, focus-group discussions, prototype testing, and field implementation.

CONCLUSION

This study proposes a blockchain-based cash-waqf model for financing ultra-micro enterprises in Indonesia. The model retains the central objective of the original study, namely improving access to productive financing, transparency, accountability, transaction efficiency, and supervision in the distribution of cash-waqf funds to ultra-micro enterprises. However, the proposed framework refines the original model by clarifying institutional responsibilities, protecting the principal value of cash waqf, separating blockchain technology from cryptocurrency, and incorporating sharia, regulatory, governance, and data-protection requirements.

The proposed model uses a permissioned consortium blockchain involving the waqif, lks-pwu, registered cash-waqf nazhir, Indonesian waqf board, micro waqf bank or authorised Islamic microfinance institution, sharia supervisory board, independent auditor, business mentor, technology administrator, and ultra-micro enterprises. Financial transactions remain denominated in Indonesian rupiah and are processed through authorised Islamic financial institutions. Blockchain functions as a shared infrastructure for recording programme approvals, waqf receipts, fund allocations, financing disbursements, repayment records, mentoring activities, audit findings, and socioeconomic-impact reports. Sensitive personal and business information is retained in secure off-chain databases.

Conceptually, the model may improve transaction traceability, strengthen institutional accountability, facilitate coordination among participating institutions, and provide more reliable information to waqif, regulators, auditors, and financing beneficiaries. Smart contracts may also support staged disbursement, reporting deadlines, financing monitoring, and revolving-fund management. Nevertheless, blockchain should not be treated as an automatic solution to weaknesses in waqf management. Its effectiveness depends on data accuracy, institutional competence, sharia supervision, cybersecurity, regulatory compatibility, technological readiness, and clearly defined governance arrangements.

The model further requires contract-specific Sharia governance. Qard hasan, mudharabah, musharakah, or other financing contracts should be selected according to programme objectives, beneficiary characteristics, the relevant source of funds, and the requirement to preserve the cash-waqf principal. Smart contracts should support the administration of these agreements rather than replace the underlying Sharia contracts or the judgement of authorised institutions. Potential gharar and maysir risks should be mitigated through contractual clarity, predetermined and transparent rules, Sharia supervision, human review of exceptional cases, and the exclusion of speculative crypto-asset mechanisms.

Practical implementation also depends on the digital readiness of the institutions and beneficiaries involved. Consequently, future pilot testing should evaluate user comprehension, accessibility, digital-literacy requirements, assisted-service mechanisms, institutional training, and user acceptance alongside cybersecurity, operational cost, transaction efficiency, and financing performance.

The proposed framework also emphasises that financing should be integrated with beneficiary selection, business mentoring, supervision, and impact measurement. This is particularly important because the empowerment of ultra-micro enterprises cannot be assessed solely by the amount of financing distributed. It should also be evaluated through business continuity, income improvement, repayment or revolving-fund performance, employment creation, and progress toward formal financial inclusion.

This study is limited to secondary data and conceptual analysis; therefore, the proposed benefits require empirical validation. Future research should examine whether the blockchain-based model

improves governance quality, transaction efficiency, user trust and usability, financing performance, and beneficiary outcomes relative to conventional cash-waqf management. A mixed-method pilot combining expert validation, stakeholder interviews, system-usability testing, and comparative quantitative assessment is recommended. Relevant indicators include operating cost, processing time, data accuracy, Sharia-compliance findings, auditability, user acceptance, repayment performance, business continuity, income improvement, and financial inclusion. Comparative studies using matched blockchain and conventional programmes, or before-and-after pilot designs, would provide stronger evidence of effectiveness and economic feasibility.

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AUTHOR CONTRIBUTION STATEMENT

Conceptualization, methodology development, and the formulation of the blockchain-based cash-waqf model were carried out by the authors. Data collection, including the gathering of peer-reviewed publications, scholarly books, regulations, government documents, and institutional reports, was conducted jointly. Formal analysis, qualitative content analysis, thematic analysis, and the integration of findings into the proposed model were performed by the authors. Original draft preparation and writing were conducted by the authors, while review, editing, and revision were performed collaboratively. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of this work.

AI DISCLOSURE STATEMENT

During the preparation of this work, the author(s) used AI-assisted tools, such as grammar checkers and language enhancement software, solely for the purpose of improving readability and refining the language of the manuscript. No generative AI tools were used for conceptual model development, institutional analysis, Sharia-compliance assessment, regulatory interpretation, or core scientific writing. The authors take full responsibility for the originality, accuracy, and integrity of the research findings, the proposed conceptual model, and the final content of this article.

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CONFLICTS OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The research was conducted independently, and the results are presented objectively and without bias. The authors have no affiliation with or financial interest in any blockchain technology provider, waqf institution, or financial organization that could be perceived as influencing the analysis or conclusions of this study.

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