

BLOCKCHAIN TECHNOLOGY INTO WAQF MANAGEMENT: A FRAMEWORK FOR TRANSPARENT AND ACCOUNTABLE ISLAMIC SOCIAL FINANCE

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Abstract: *Waqf is a core Islamic social finance instrument intended to generate sustainable socio-economic benefits, yet waqf administration in Malaysia continues to face issues of transparency, accountability, record fragmentation and stakeholder trust. This paper develops a governance framework for integrating blockchain technology into waqf management to strengthen transparent reporting, auditable accountability and integrity of waqf fund flows. Using a qualitative design based on document analysis and semi-structured interviews with six respondents from financial planning, trading, takaful, accounting and Shariah advisory backgrounds, the study examines current waqf processes, stakeholder verification needs, blockchain system requirements and regulatory readiness. The findings show that blockchain can improve waqf governance when deployed as a permissioned system with role-based access, maker-checker controls, Shariah review, immutable audit logs, standardized data fields and privacy-preserving dashboards. However, the technology must be supported by clear legal recognition, Shariah governance protocols, cybersecurity controls, data quality rules and national implementation parameters. The paper proposes a Permissioned Waqf Chain framework that links collection, documentation, fund management, project development, asset administration and beneficiary distribution through auditable records and controlled transparency. The framework contributes to Islamic social finance by positioning blockchain as a governance infrastructure rather than merely a fundraising tool.*

Keywords: Blockchain technology; Waqf governance; Islamic social finance; Transparency and accountability; Sustainable waqf management

1. Introduction

Waqf is an important instrument in Islamic social finance that transforms private wealth into sustainable social assets intended to generate long-term socio-economic benefits (Shaikh et al., 2017). Unlike one-time charitable giving, waqf is built around perpetuity and therefore requires strong governance, transparent administration and accountable stewardship to ensure that assets and funds continue to benefit society across generations (Jatmiko et al., 2023). Effective waqf management depends on reliable documentation, proper record-keeping and compliance

with the waqif's intentions and Shariah principles (Laallam et al., 2020; Mohaiyadin et al., 2022).

Contemporary waqf institutions face operational challenges such as fragmented management systems, inconsistent reporting practices, weak monitoring mechanisms and limited transparency in fund distribution and asset administration (Maretaniandini et al., 2025; Yunus et al., 2024). These challenges are significant because waqf institutions and mutawalli are responsible for asset preservation, investment management, beneficiary distribution and compliance with legal and Shariah requirements (Khalid et al., 2019). As waqf activities expand into education, healthcare, poverty alleviation and mosque development, administrative complexity increases and manual or siloed systems make it difficult to trace transactions, reconcile records and verify that distributions match approved waqf purposes.

Blockchain technology has emerged as a potential governance-enabling solution because it can provide transparent, immutable and time-stamped transaction records (Zulaikha & Rusmita, 2018). Through shared ledgers, role-based access and auditable logs, blockchain can improve traceability across the waqf lifecycle, from collection and receipt issuance to fund administration and distribution. Smart contracts may further support governance by automating defined approvals and compliance checkpoints where rules are sufficiently clear (Krasnokutskaya & Koray, 2023). However, blockchain alone cannot guarantee good governance. Its usefulness depends on institutional controls, reliable data entry, Shariah oversight, privacy protection and clear legal and regulatory parameters.

In Malaysia, the need for standardized blockchain implementation is especially important because waqf administration is decentralized across State Islamic Religious Councils (MAIN/SIRC). Differences in procedures, reporting practices and technology capabilities can produce fragmented adoption and inconsistent governance standards. Therefore, a national framework is needed to define minimum data fields, approval workflows, access rights, audit responsibilities, disclosure standards and Shariah compliance procedures. This paper addresses that need by proposing a blockchain-based waqf management framework that improves transparency and accountability while preserving privacy and legal compliance.

Problem Statement

Waqf institutions in Malaysia are increasingly expected to demonstrate strong transparency and governance because waqf is a trust-based religious endowment and legitimacy depends on public confidence. The role of SIRC/MAIN as legally designated trustees further increases the need for credible reporting and consistent oversight (Abas & Raji, 2018). However, governance and reporting practices vary across jurisdictions and institutions, making comparability and stakeholder assurance difficult (Roslan & Muhamad, 2024).

Although digitalization and fintech are receiving greater attention, the policy issue is how to govern blockchain-enabled waqf in a standardized and trustworthy way. Without agreed rules on what blockchain records mean, which fields must be captured, how approval checkpoints should operate and what disclosures must be made, institutions may adopt technically sophisticated systems that remain institutionally inconsistent. This ambiguity creates governance risks because blockchain implementation requires clear decisions about validation authority, error correction, smart-contract logic and audit responsibility (Beck et al., 2018; Pisa, 2018).

This study therefore aims to assess current Malaysian practices and readiness in integrating blockchain technology into waqf management, identify governance and regulatory

gaps affecting blockchain-enabled waqf and develop a standardized framework and parameter set for transparent and accountable waqf management in Malaysia.

2. Literature Review

Past studies on waqf governance consistently highlight accountability and transparency weaknesses that can undermine stakeholder trust and reduce the effectiveness of Islamic social finance delivery (Adnan et al., 2021; Ismail et al., 2025). In the Malaysian context, weak governance, inconsistent disclosure, mismanagement risks and stakeholder demands for better transparency are recurring concerns as waqf administration becomes more complex (Talib et al., 2018). This literature shows that waqf management challenges are not only operational but also institutional, because administrators must demonstrate trustworthy stewardship to donors, beneficiaries, regulators and Shariah governance actors.

Scholarship on blockchain frames the technology as a distributed ledger capable of providing traceable, time-stamped and difficult-to-alter records that can strengthen auditability and reduce opportunities for manipulation (Atal et al., 2022). Because waqf management depends heavily on reliable documentation for donation collection, receipting, project allocation and distribution, blockchain is increasingly positioned as a governance-enabling infrastructure rather than merely a fundraising tool (Mokthar et al., 2024). Its value lies in creating shared verification among authorized stakeholders while supporting internal control and oversight.

Focused studies on blockchain and waqf suggest that the technology can address concrete weaknesses in the waqf process. Mohaiyadin et al. (2022) identify transparency issues such as errors in receipt issuance and difficulty tracking distributions, and they argue that blockchain mechanisms such as unique identifiers, public or shared ledgers and controlled distribution data can mitigate these weaknesses. Similarly, studies in Islamic social finance indicate that blockchain adoption is likely to shape future delivery models, but warn that innovation is often ahead of regulation (Kunhibava et al., 2024). This creates a need for governance standards covering disclosure, data governance, oversight roles and risk controls.

2.1 Blockchain and Smart Contract

Blockchain is a distributed ledger technology that uses cryptography and a network of nodes to record and verify transactions (Abojeib & Habib, 2019). Data are stored in blocks that are linked chronologically, and once transactions are verified, they are difficult to amend or delete without leaving evidence. This characteristic makes blockchain attractive in settings where trust depends on shared records, auditability and resistance to unauthorized modification (Mia et al., 2022).

Smart contracts are programmed protocols that execute predefined terms when specific conditions are met. In a waqf context, smart contracts could help ensure that disbursements follow approved waqf purposes, authorization checkpoints and Shariah conditions. Nevertheless, smart contracts should not be treated as a replacement for governance. They require legal recognition, Shariah validation, robust data inputs and clearly defined procedures for exceptions and rectification.

2.2 Waqf Blockchain

Waqf blockchain refers to the application of blockchain technology to improve transparency, traceability and accountability in fundraising, record keeping, asset development and distribution to beneficiaries. A blockchain-enabled waqf system can connect cash waqf collection, receipt issuance, project allocation, investment or development activities and distribution through a single audit trail. This can reduce information gaps between donors and administrators and provide stronger evidence for auditors, regulators and Shariah committees.

The literature also stresses that waqf blockchain must balance openness with confidentiality. Donors and public stakeholders may need summary dashboards and project-level updates, while internal administrators, auditors and Shariah reviewers require deeper access to evidence, approvals and exception records. A permissioned blockchain is therefore more appropriate for Malaysian waqf because it can combine immutable logs with role-based access and privacy protections (Mutmainah et al., 2021).

3. Methodology

This study uses a qualitative research design to explore governance challenges and blockchain readiness in waqf management. The design combines document and content analysis of waqf governance, blockchain and Islamic social finance literature with semi-structured interviews. The approach is suitable because the study seeks to understand institutional views, governance expectations and practical requirements rather than measure predetermined variables statistically.

Purposive sampling was used to recruit six respondents who could provide diverse perspectives on waqf, finance, accountability and Shariah governance. The respondents were a licensed financial planner, a stock and futures trader, a takaful consultant, a financial adviser, a Shariah advisor and an accountant. These profiles were selected because they represent donor-facing, market, governance, compliance and accounting perspectives relevant to waqf blockchain design.

The interview questions focused on current waqf management practices, transparency and accountability challenges, stakeholder verification, perceived value of blockchain, trusted system features, risks and concerns, validation authority, Shariah governance controls, regulatory gaps and indicators of successful adoption. Open-ended questions allowed respondents to elaborate on operational weaknesses and system requirements. The data were analysed using thematic analysis, which involved identifying repeated ideas and grouping them into themes aligned with the research objectives.

Table 1: Interview Guide

Focus	Question
Current management	How is waqf currently managed in terms of collection, recording, approvals and distribution?
Transparency challenges	What are the most significant transparency and accountability challenges in waqf management?
Stakeholder verification	How do donors or stakeholders verify that waqf funds or assets are used according to stated objectives?
Blockchain value	Where could blockchain add value in the waqf lifecycle?
Trusted system features	What features would a trusted blockchain-based waqf system need in Malaysia?
Risks and concerns	What privacy, cybersecurity, governance or immutability risks should be anticipated?

Authority and roles	Who should validate, approve and view records in a blockchain-enabled waqf system?
Shariah controls	What documentation or controls are necessary for Shariah compliance?
Regulatory gaps	What guidance or standardized parameters are missing in Malaysia?
Successful adoption	What indicators, reporting expectations and audit requirements should define success?

4. Findings and Discussion

The findings show that blockchain-enabled waqf should be understood as a governance design, not merely a technology installation. Respondents repeatedly linked trust to evidence: the ability to see what was collected, where funds were allocated, who approved a decision, what project milestones were reached and whether Shariah conditions were observed. Four major themes were identified: current waqf governance and processes; transparency, traceability and stakeholder verification; blockchain system requirements and governance design; and Shariah, legal, regulatory readiness and risk management.

4.1 Current Waqf Governance and Processes

Respondents described current waqf governance as a sequence of control points involving documented intent, receipt issuance, internal approval, disbursement and post-transaction reporting. Market-facing respondents such as financial planners and advisers observed that external stakeholders often see only receipts and summary updates, while internal approvals, reconciliations and evidence of distribution remain less visible. Governance-focused respondents emphasized separation of duties, formal oversight and documented approvals. The accountant highlighted reconciliations, vouchers, asset registers and audit checks as practical evidence that governance is functioning.

Overall, stakeholders agreed that effective waqf governance should include approval trails, separation of duties, standardized documentation and reporting. However, their experience of the process differs. External actors tend to see outcomes and summaries, while internal actors focus on detailed documentation and control evidence. This gap supports the need for a system that connects operational records with stakeholder-facing transparency.

4.2 Transparency, Traceability and Stakeholder Verification

Transparency and traceability were identified as the main weaknesses in current waqf systems. Respondents noted a gap between what donors want to know and what they usually receive. Donors may receive receipts, annual reports or audit statements, but they cannot easily track donations from contribution to beneficiary or project outcome. This creates a “black box” problem in which trust depends on institutional reputation rather than verifiable evidence.

Governance and Shariah-oriented respondents stressed that transparency should not mean uncontrolled public disclosure. Instead, transparency should provide auditable proof that funds are used according to waqf intent and Shariah requirements. This requires documented approvals, monitored distribution and reliable records. The accountant linked traceability to internal controls, explaining that good evidence must include reconciliations, vouchers, project schedules and asset records. Therefore, an effective solution must provide both visibility and control: detailed records for authorized users and privacy-preserving dashboards for donors and the public.

4.3 Blockchain System Requirements and Governance Design

Respondents agreed that a blockchain-enabled waqf solution would be trusted only if its governance design clearly specifies who can write, approve, validate and view records. Market-facing respondents emphasized donor dashboards, timely updates and the ability to trace contributions from donation to project and distribution. Governance respondents emphasized role-based permissions, maker-checker controls, Shariah review and audit access. The accountant emphasized standardized data fields, audit logs, document references and exportable records for reconciliation and external audit.

The findings therefore point to a permissioned blockchain architecture with layered transparency. Internal governance users should have access to detailed transaction records, supporting documents, approvals and exception logs. External stakeholders should receive limited but reliable verification views such as donation ID status, project milestones, total collection, disbursement status and impact indicators. This design avoids the privacy weaknesses of fully public blockchains while retaining the accountability benefits of immutable audit trails.

Table 2: Customer Needs Matrix

Stakeholder Focus	Primary Need	Secondary Need	Importance
Market / Donors	End-to-end transparency	Track funds from donation to final distribution; provide timely updates; display verified social impact; present intuitive dashboard.	5
Shariah / Governance	Strict governance and compliance	Execute role-based access; embed Shariah compliance checkpoints; generate immutable audit trails; allow documented error correction.	5
Administration / Accounting	Standardized administration	Force standardized data fields; link financial records to asset actions; produce exportable records for reconciliation and audit.	5
All stakeholders	Visibility with security	Protect donor and beneficiary data and limit deep audit views to authorized internal roles.	5

Table 3: Target Specifications

No.	Metric	Unit	Marginal Value	Ideal Value
1	Transaction visibility latency	Seconds	< 60	< 5
2	End-to-end fund allocation traceability	%	98	100
3	Smart contract Shariah compliance check execution time	Seconds	< 10	< 2
4	Required role-based approval nodes before disbursement	Count	3	4
5	Immutable audit log generation for governance decisions	%	100	100
6	Standardized data field compliance for new projects	%	100	100

7	Data compatibility export for external audit	Formats	CSV, PDF	API, CSV, JSON
8	Encryption and redaction of sensitive data	Milliseconds	< 500	< 100
9	Unauthorized access prevention rate	%	99.9	100

Table 4: Concept Scoring Matrix

Selection Criteria	Weight	Centralized DB	Public Blockchain	Permissioned Waqf Chain
End-to-end traceability	25%	3	5	5
Shariah compliance automation	20%	3	4	5
Data privacy	20%	3	1	4
Immutable audit log generation	20%	3	5	5
Integration with state laws	15%	3	1	4
Total weighted score	100%	3.00	3.40	4.65
Rank		3	2	1

Table 5: Final Specifications

Spec No.	Metric	Final Value	Justification
1	Transaction visibility latency	< 15 seconds	Balances near real-time updates with permissioned consensus processing.
2	End-to-end fund allocation traceability	100%	Non-negotiable for Shariah auditing and donor trust.
3	Smart contract Shariah compliance check	< 5 seconds	Prevents workflow bottlenecks in crowdfunding campaigns.
4	Required role-based approval nodes	4 nodes	Requires Maker, Checker, Shariah Review and Audit access.
5	Data export compatibility	API, CSV, JSON	Supports integration with fragmented state accounting systems.
6	Unauthorized access prevention rate	100%	Protects sensitive donor and beneficiary data.

4.4 Shariah, Legal, Regulatory Readiness and Risk Management

Respondents identified Shariah defensibility, legal recognition and risk controls as prerequisites for blockchain-based waqf. Shariah advisors and takaful respondents emphasized that digitalisation must not weaken Shariah decision-making. Approvals, documentation and rectification protocols must be clear, especially because an immutable ledger can permanently record errors or non-compliant transactions unless exception handling is designed from the beginning.

Legal and regulatory concerns focused on responsibility when multiple parties share the same infrastructure, including waqf institutions, technology vendors, auditors and consortium nodes. Respondents also highlighted privacy, cybersecurity, vendor dependence, immutability risk and poor data quality. These concerns confirm that blockchain readiness is primarily an institutional and regulatory issue, not only a technical issue. Successful adoption

requires clear Shariah controls, enforceable accountability, cybersecurity requirements, data governance standards and procedures for exceptions and disputes.

4.5 Proposed Permissioned Waqf Chain Framework

The proposed framework translates stakeholder needs into an integrated Permissioned Waqf Chain. The platform connects six major stages: donor contribution, digital documentation, fund management and governance, project development, asset management and beneficiary or social impact reporting. Each stage creates a record that is time-stamped, linked to a unique transaction or project ID and controlled through role-based permissions.

At the intake stage, contributors may participate through approved waqf channels such as cash waqf or wakalah-based arrangements. Each contribution is recorded and linked to a specific waqf project so that allocations can be traced. The documentation layer captures base forms, approvals, amendments and final terms. The governance layer requires maker-checker review, Shariah approval and audit visibility before disbursement. Project and asset layers then record development milestones, asset registration, maintenance, leasing and other key events. The donor-facing layer provides privacy-protecting dashboards showing contribution status, collection totals, milestone progress and social impact indicators.

The framework supports controlled transparency. Internal users such as administrators, auditors and Shariah reviewers access detailed evidence, while donors and public stakeholders access verified summaries. This design balances the need for accountability with confidentiality and data protection. It also allows state-level waqf institutions to adopt common data structures without forcing identical operational systems.

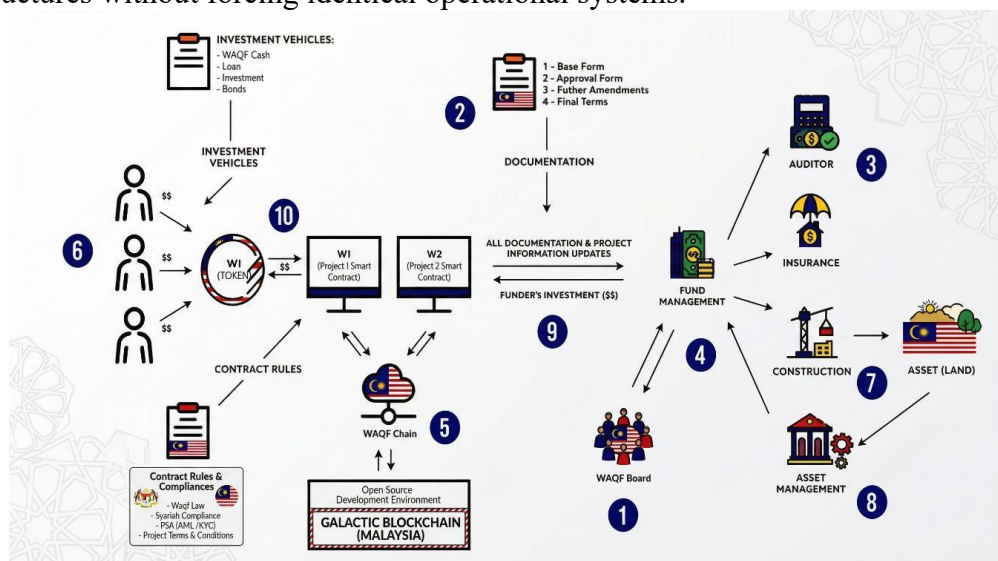


Figure 1: Integrated Blockchain in Waqf Management Workflow and Process Flow

4.6 Analytical Prototype Application of Waqf Chain

To clarify how the proposed framework operates, this section describes an analytical prototype application of Waqf Chain. The prototype begins when a donor selects a waqf project through a digital interface. The system generates a unique contribution ID and records the donor category, waqf purpose, restriction status, payment reference and project code. Sensitive personal details are encrypted or stored off-chain, while the blockchain stores hashes and

governance-relevant metadata. This arrangement allows later verification without exposing donor or beneficiary information unnecessarily.

After the contribution is received, the system routes the transaction to the documentation layer. The mutawalli uploads or references the relevant waqf declaration, project approval paper, budget, Shariah review note and any amendments. Each document receives a hash and timestamp so that the institution can prove which version was used when a decision was made. If the project purpose changes, the amendment must be recorded as a new governance event rather than silently replacing earlier information. This protects the waqif's intention and reduces the possibility of undocumented changes.

The fund management stage requires sequential approval. A maker prepares the allocation, a checker verifies completeness, the Shariah reviewer confirms compliance with waqf conditions and the audit or board role receives visibility before disbursement. The system does not remove human judgment; instead, it makes human judgment traceable. Each decision is attached to a user role, timestamp and supporting evidence. Where smart contracts are used, their logic should be limited to rules that are already approved, such as preventing disbursement before required approvals are completed or blocking allocations outside the recorded project purpose.

During project execution, milestones such as procurement, construction progress, asset registration or beneficiary distribution are linked back to the original contribution and project ID. Donors may see a simplified dashboard showing total collection, percentage allocated, milestone status and impact indicators. Internal users may access invoices, vouchers, inspection evidence, reconciliation records and exception reports. This two-layer design gives the public enough visibility to trust the process while giving auditors enough evidence to test controls. It also supports state-level supervision because records are standardized and exportable even when institutions use different front-end systems.

The prototype also includes an exception and rectification protocol. If an error is entered, the ledger should not delete the original transaction. Instead, an authorized correction entry should be created, linked to the error, approved by defined roles and supported by evidence. If a Shariah non-compliance issue is detected, the rectification event should identify the nature of the issue, responsible role, remedial action and approval. This is important because immutability without rectification can turn blockchain from an accountability tool into a permanent record of unresolved mistakes. The framework therefore treats error management as a core governance requirement.

The prototype can be implemented gradually. A first phase may record donations, receipts and project allocations only. A second phase may add approval workflows and audit exports. A third phase may connect asset management records, impact indicators and limited smart-contract automation. This phased approach reduces adoption risk because institutions can improve transparency and reporting before automating higher-risk decisions. It also allows regulators and SIRC/MAN to test common data fields, user roles and disclosure requirements across pilot projects before issuing broader implementation standards.

For institutional users, the prototype also creates practical evidence for continuous improvement. Repeated exception reports can show where staff training, data validation or policy clarification is needed. Repeated delays at a specific approval node can reveal bottlenecks. Over time, these analytics can help waqf institutions strengthen governance performance, not only prove past compliance. This makes the system useful for both accountability and management learning, especially across repeated multi-state implementation pilots.

5. Conclusion and Policy Implications

This paper developed a framework for integrating blockchain technology into waqf management to improve transparency, accountability and stakeholder trust in Islamic social finance. The study found that current waqf governance challenges are rooted in fragmented records, limited donor verification, inconsistent reporting and unclear accountability across the waqf lifecycle. Blockchain can address these weaknesses when used as a permissioned governance infrastructure with standardized data fields, role-based access, maker-checker controls, Shariah review, immutable audit logs and privacy-preserving dashboards.

The proposed Permissioned Waqf Chain contributes by connecting collection, documentation, fund management, project execution, asset administration and impact reporting into one auditable workflow. Its value is not only technical but institutional: it makes stewardship visible, approvals traceable and reporting more reliable. However, blockchain adoption should be guided by clear legal definitions, national implementation parameters, Shariah governance protocols, cybersecurity standards and procedures for correcting errors or exceptions on immutable ledgers.

Policy implications include the need for regulators and relevant waqf authorities to define minimum blockchain record fields, validation roles, audit access, disclosure baselines, data privacy requirements, smart-contract review procedures and cross-state reporting standards. Waqf institutions should begin with pilot projects using permissioned access and strong internal controls before scaling to broader implementation. Future research may validate the framework through case studies with SIRC/MAN, prototype testing and quantitative assessment of stakeholder trust before and after blockchain adoption.

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7. Author Contributions

All authors contributed to the conceptualisation, literature review, methodology, analysis and preparation of the manuscript. All authors reviewed and approved the final manuscript.

8. Conflict of Interest

The authors declare no conflict of interest.

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