Reimagining Waqf in the Digital Age: A Framework for Smart Waqf Governance Through Emerging Technologies

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ABSTRACT

This paper explores the modernization of the waqf institution through the integration of emerging technologies such as blockchain, artificial intelligence (AI), and digital platforms. While waqf has historically served as a powerful tool for socio-economic development in Muslim societies, inefficiencies in management and lack of transparency have hindered its full potential. By proposing a "Smart Waqf" framework, this study examines how digital transformation can enhance waqf asset management, improve stakeholder trust, and support sustainable development goals. Case studies and contemporary models from selected Muslim-majority countries are analysed to demonstrate practical implementation and policy recommendations.

Keywords: Waqf, Technology, Governance, Integration, Digital

INTRODUCTION

The institution of waqf, an Islamic endowment established for charitable and social purposes, has played a crucial role in shaping the socio-economic and cultural development of Muslim societies for centuries. Historically, waqf has financed public infrastructure such as schools, hospitals, and mosques, embodying a sustainable model of wealth redistribution rooted in Islamic principles. Despite its historical relevance, many waqf institutions today struggle with inefficiencies, lack of transparency, poor asset management, and limited public trust. These issues often stem from outdated administrative systems and insufficient technological integration.

In the digital era, where technology is revolutionizing finance, governance, and philanthropy, the waqf sector remains largely underutilized. Emerging technologies are rapidly evolving tools that have the potential to transform existing systems (Rotolo, Hicks, & Martin, 2015). Emerging technologies such as blockchain, artificial intelligence (AI), and mobile platforms-present unique opportunities to revitalize waqf operations and governance. These tools can enhance transparency, automate recordkeeping, reduce corruption, and streamline donations and asset management. Moreover, as Muslim populations become increasingly tech-savvy, there is a growing demand for digital solutions that align with both Islamic values and modern convenience.

This paper aims to bridge the gap between traditional waqf practices and modern technological advancements by proposing a conceptual framework for "Smart Waqf." The objective is to explore how digital tools can improve governance, operational efficiency, and stakeholder engagement in waqf institutions. Using real-world examples and recent technological innovations in the Islamic finance sector, this study highlights best practices and outlines strategic pathways for implementation.

By reimagining waqf through a technological lens, this paper contributes to the broader discourse on Islamic social finance and sustainable development, offering practical insights for policymakers, waqf administrators, Islamic scholars, and technologists alike.

LITERATURE REVIEW

Historical Foundations of Waqf

Waqf is an Islamic charitable endowment that has been an integral part of Muslim societies since the early Islamic period. Rooted in the Arabic term waqafa, meaning "to stop" or "to hold," it denotes the permanent dedication of assets for religious or philanthropic purposes (Kahf, 1998). During the Abbasid, Ottoman, and Mughal eras, waqf played a central role in supporting public services such as education, healthcare, and religious institutions. Landmark establishments like Al-Azhar University in Cairo were sustained through extensive waqf networks (Cizakca, 2000).

Contemporary Challenges in Waqf Management

In recent decades, the institution of waqf has suffered from inefficiencies, poor documentation, and limited adaptation to modern economic systems. Common issues include: Inefficient asset management, often due to manual or outdated recordkeeping, legal and regulatory ambiguity, especially in secular jurisdictions, lack of transparency in governance and fund allocation, limited youth engagement, partly due to the absence of digital interfaces (Ismail & Haji-Othman, 2017)

Studies have shown that despite significant waqf assets in many Muslim-majority countries, much of this wealth remains underutilized due to bureaucratic constraints and weak governance structures (Kahf, 2003; Mohsin, 2013).

Technology in Islamic Finance

Islamic finance has begun integrating emerging technologies to improve service delivery and compliance. Islamic fintech initiatives include mobile zakat applications, robo-advisors for halal investments, and blockchain-based solutions for transparency (Laldin & Hafas, 2019). These tools offer significant potential to reform Islamic charitable institutions by improving trust, accessibility, and operational efficiency.

Blockchain, with its immutable ledger and decentralized nature, has been proposed as a tool for waqf documentation and distribution (Mohsin, 2020). AI has also been explored for use in predictive waqf asset valuation and performance monitoring (Aziz et al., 2021).

Prior Research Linking Waqf and Technology

A growing number of studies highlight the promise of digitalizing waqf administration:

Hasan & Siraj (2017) emphasized the digitization of waqf records to reduce land disputes and mismanagement.

Mohsin et al. (2020) proposed blockchain-based waqf models in Malaysia for improving auditability and public trust.

Omar & Arshad (2022) evaluated mobile waqf platforms, finding that ease of use and perceived transparency influence donor participation.

Despite these contributions, much of the existing research remains conceptual, with few comprehensive frameworks that integrate multiple technologies into a unified waqf governance model. This paper seeks to fill that gap by proposing a “Smart Waqf” system that addresses both technical and governance challenges.

TECHNOLOGICAL TOOLS FOR WAQF INNOVATION

As waqf institutions seek to regain relevance in the modern era, digital technology offers a powerful toolkit to address longstanding inefficiencies in governance, asset management, and donor engagement. This section explores key technologies that can be integrated into waqf systems, along with real-world examples of their implementation.

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Blockchain Technology

Blockchain is a decentralized and immutable ledger system that enables transparent, secure, and tamper-proof recordkeeping. Its potential applications in waqf include:

Transparent donation tracking, allowing donors to monitor how their contributions are utilized.

Immutable land and asset registries, which can prevent disputes and encroachments on waqf property.

Smart contracts that automate waqf fund disbursement based on predefined conditions (Mohsin et al., 2020).

In the UAE, the Dubai Blockchain Strategy includes provisions for Islamic charitable initiatives, including waqf, while Malaysia's Selangor Waqf Corporation has considered blockchain for waqf land titling (Hasan & Siraj, 2017).

Artificial Intelligence (AI)

AI technologies; such as predictive analytics and machine learning can be used to optimize waqf asset performance. Applications include:

Forecasting returns on waqf investment portfolios.

Detecting inefficiencies or underutilized assets in waqf property holdings.

Automated decision support for mutawalli (trustees) based on historical data (Aziz et al., 2021).

These capabilities can lead to data-driven waqf management, improving financial sustainability while ensuring compliance with Shariah principles.

Mobile and Web-Based Waqf Platforms

Digital platforms enable real-time donor interaction and broaden access to waqf participation, particularly for younger and global Muslim communities. These platforms typically include:

Online waqf contribution systems with e-wallet or bank integration.

Geolocation-based asset tracking to allow donors to view and support specific waqf projects.

Interactive dashboards for transparency and performance reporting (Omar & Arshad, 2022).

Examples include

E-Waqf Malaysia, an initiative that allows individuals to donate waqf funds digitally via state Islamic councils.

GlobalSadaqah.com, a crowdfunding platform for Islamic charitable giving that includes waqf projects.

Internet of Things (IoT) and Geographic Information Systems (GIS)

IoT and GIS technologies, while less commonly applied, hold potential in waqf property monitoring and land management. IoT devices can monitor the usage and maintenance of waqf buildings or facilities.

GIS mapping of waqf lands can support asset visualization, help prevent encroachment, and facilitate strategic development planning (Hassan & Noor, 2021).

These technologies are particularly valuable in countries where waqf assets are geographically dispersed and often undocumented.

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The integration of modern technology into waqf operations is no longer a theoretical discussion but a practical necessity. From blockchain-based recordkeeping to AI-powered investment tools and mobile-friendly donation platforms, digital innovation can help waqf institutions regain their socio-economic influence and re-engage a global Muslim population. However, for these tools to be effective, they must be embedded within a holistic framework of governance, which is discussed in the next section.

Proposed "Smart Waqf" Framework

The concept of "Smart Waqf" refers to the integration of advanced digital technologies within the structure and governance of waqf institutions to create a more transparent, efficient, and accountable system. While smart governance define is a new mode of governance enabled by technology that enhances public service delivery, stakeholder participation, and data transparency (Chourabi et al., 2012). This framework emphasizes not only the use of tools such as blockchain, AI, and digital platforms, but also ensures compliance with Islamic jurisprudence and local legal standards. The proposed model rests on three pillars: Technology Integration, Stakeholder Engagement, and Governance Reform.

Core Components of the Smart Waqf Framework

Digital Asset Registry

A blockchain-based waqf registry that records all waqf assets (land, buildings, cash) transparently and immutably. Each asset is assigned a digital ID with ownership, purpose, and historical data. Ensures protection from fraudulent claims and facilitates easy auditing (Mohsin et al., 2020).

Smart Contracts for Fund Disbursement

Use of smart contracts to automate the release of funds for specific causes (e.g., education, healthcare) based on predetermined triggers such as deadlines or milestones. Ensures funds are used for their intended purposes without manual intervention.

AI-Driven Asset Monitoring

AI can analyse performance data of waqf assets and recommend strategic decisions (e.g., lease, reinvestment). Predictive analytics help in forecasting waqf growth, maintenance needs, and donor behaviour (Aziz et al., 2021).

Donor-Facing Platforms

A mobile/web platform that allows users to:

Browse waqf projects

Make online contributions

Track fund utilization in real-time

Receive automated reports and impact metrics (Omar & Arshad, 2022)

Stakeholders and Their Roles

A successful Smart Waqf model requires coordinated efforts from key stakeholders:

Stakeholder	Role
Mutawalli (Trustee)	Oversees daily waqf operations; trained in using digital tools

Waqf Board/Authority	Regulates and monitors waqf compliance and technology integration
Donors (Waqif)	Contribute funds; interact through digital platforms
Technologists	Develop and maintain digital infrastructure
Shariah Advisors	Ensure all processes comply with Islamic principles

Governance Features

To ensure sustainability and compliance, the framework incorporates:

Shariah auditing mechanisms integrated within digital systems

Cybersecurity protocols to protect sensitive waqf and donor data

Open data policies, where appropriate, to improve public trust and participation

Legal integration with national waqf laws and property regulations

Visual Representation

The Smart Waqf Framework created is a conceptual framework. This is to propose model based on literature synthesis, which supported by secondary data from several case studies and exploratory projects that demonstrate the real world feasibility of integrating technology into waqf governance.

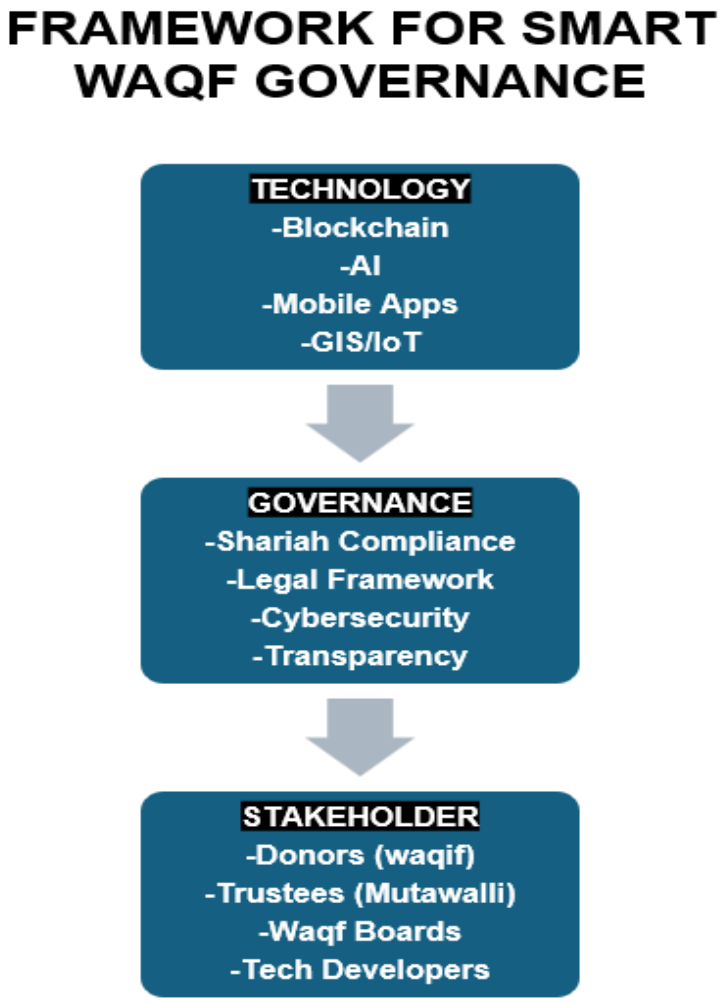

Figure 1: Framework for Smart Waqf Governance

This framework illustrates the integration of modern technology in the waqf system through three interconnected layers: (1) the Technology Layer includes tools such as blockchain, AI, mobile applications, and GIS/IoT that enable efficient and transparent waqf management; (2) the Governance Layer ensures Shariah compliance, legal integrity, cybersecurity, and transparency; and (3) the Stakeholder Layer highlights the main actors including donors (waqif), trustees (mutawalli), waqf boards, and technology developers who drive and benefit from the system.

The Smart Waqf framework presents a holistic, technologically enabled model that modernizes waqf governance while remaining rooted in Islamic values. By adopting a system that empowers all stakeholders and leverages digital innovation, waqf institutions can achieve greater impact, accountability, and global outreach.

For waqf institutions, smart governance refers to the application of emerging technologies such as blockchain, artificial intelligence (AI), mobile platforms, and geographic information systems (GIS) to enhance the effectiveness and accountability of waqf management. These technologies can ensure Shariah compliance by embedding Islamic principles into digital processes and automated systems (Mohamad et al., 2019). Blockchain improves financial transparency by providing immutable and auditable records of waqf transactions (Rashid, Zainal, & Hamid, 2020). GIS and IoT enable real-time monitoring and spatial planning of waqf assets (Yusof, Basri, & Latif, 2021). Mobile platforms help to facilitate donor-trustee communication and expand stakeholder engagement (Ismail & Ahmad, 2022), while AI supports evidence-based decision-making by analyzing patterns and optimizing resource allocation (Nurhadi & Abdullah, 2021).

This framework supported by several study

WaqfChain (Malaysia) – Blockchain Integration

Pilot: Developed by BLOXea and MyANGKASA, this platform uses blockchain to improve transparency and traceability in waqf donations.

Source: Rashid et al. (2020) – Blockchain in Waqf Management.

Relevance: Supports the Technology Layer (Blockchain for transparency).

CrowdWaqf Platform (Indonesia)

Case: Uses mobile and crowdfunding platforms to allow public contributions and monitor project progress.

Backed by: Badan Wakaf Indonesia and Dompet Dhuafa.

Relevance: Supports Mobile App & Stakeholder Engagement components.

SmartWaqf-GIS Project (UAE & Indonesia)

Application: Some waqf institutions use GIS for mapping land and physical assets to optimize their use.

Relevance: Demonstrates the practicality of GIS/IoT components in the Technology Layer.

AI for Asset Management

While still limited in practical use, some research (e.g., Ismail & Ahmad, 2022) proposes using AI to optimize asset allocation and maintenance.

Relevance: Conceptually supports the inclusion of AI for forecasting and planning.

METHODOLOGY

Although the Smart Waqf Framework is conceptual in nature, it is grounded in real-world case studies that have piloted discrete components of the framework. These include blockchain-based waqf platforms (e.g., WaqfChain), mobile applications (e.g., CrowdWaqf), and GIS-based asset mapping. Together, they demonstrate the feasibility and growing interest in digitally transforming waqf management.

Implementation Strategies

While the proposed Smart Waqf framework is conceptually robust, its successful adoption depends on practical, step-by-step strategies that consider institutional readiness, legal frameworks, technological capacity, and public awareness. This section outlines a roadmap for implementing the framework effectively.

Policy and Regulatory Alignment

Before adopting new technologies, waqf institutions must ensure legal compatibility with national laws and Islamic jurisprudence. Key steps include:

Reviewing existing waqf laws to identify gaps or outdated clauses that hinder digitalization (Ismail & Othman, 2017).

Forming a regulatory task force to draft guidelines on digital waqf operations, data protection, and smart contracts.

Engaging Shariah councils early in the process to ensure all tools and processes align with Islamic principles.

Capacity Building and Training

Digital transformation requires a knowledgeable and adaptable workforce. Thus:

Waqf officers and mutawalli (trustees) must be trained in digital tools such as blockchain platforms, AI dashboards, and cybersecurity protocols.

Workshops and e-learning modules can be developed in partnership with Islamic fintech companies and universities.

Pilot programs in selected waqf institutions can serve as learning labs for scalable adoption.

Strategic Technology Partnerships

Waqf institutions typically lack the in-house expertise to develop complex technologies. To address this:

Partner with Islamic fintech startups and blockchain developers for platform development and maintenance.

Collaborate with Islamic universities and tech research centers for tailored innovation.

Leverage public-private partnerships to secure funding and foster trust in digital waqf platforms.

Community Engagement and Donor Education

Donor trust and public engagement are crucial. Institutions should:

Launch awareness campaigns on social media and mosques to educate Muslims on digital waqf and its benefits.

Highlight real-time transparency features (e.g., dashboards showing how waqf funds are used).

Provide incentives, such as tax benefits or digital recognition badges for recurring donors.

Phased Rollout Approach

To minimize risk, a phased implementation is recommended:

Phase 1 – Assessment and Planning: Conduct readiness audits and establish regulatory clarity.

Phase 2 – Infrastructure Development: Build core digital platforms and train key staff.

Phase 3 – Pilot Testing: Roll out Smart Waqf projects in selected locations.

Phase 4 – Evaluation and Scaling: Assess impact and scale successful models nationally or internationally.

The transition to a Smart Waqf system requires more than technology- it needs regulatory support, human capacity, and cultural change. A strategic, multi-stakeholder approach ensures the system is inclusive, sustainable, and impactful. With the right execution, Smart Waqf can rejuvenate a centuries-old institution for the digital age.

Case Studies and Examples

To better understand the potential and practical application of technology in waqf management, this section explores a selection of real-world initiatives and hypothetical models. These examples demonstrate how different technologies, such as blockchain, mobile platforms, and GIS- are transforming waqf administration across various countries.

Case Study: Selangor Waqf Blockchain Prototype (Malaysia)

In Malaysia, several state religious councils have begun exploring blockchain to manage waqf land records and donation tracking. The Selangor Waqf Corporation developed a pilot blockchain-based registry to:

Digitally verify waqf land ownership

Prevent unauthorized sales or encroachments

Increase public confidence through transparent land documentation (Mohsin et al., 2020)

This initiative aligns with the Smart Waqf model by using tamper-proof digital ledgers and integrating it with the national property database.

Case Study: GlobalSadaqah.com (International)

GlobalSadaqah is an Islamic crowdfunding platform based in Malaysia with a global reach. It allows individuals and organizations to contribute to verified waqf, zakat, and sadaqah campaigns via digital payment systems. Key features include:

Real-time project updates

Donation receipts and impact reports

Collaboration with Shariah advisory boards (Laldin & Hafas, 2019)

This demonstrates the effectiveness of donor-facing platforms and how technology can bridge the gap between intention and action in charitable giving.

Case Study: Endowment Chain (United Arab Emirates)

The UAE's Endowment Blockchain Project, launched under the Dubai Blockchain Strategy, focuses on creating endowment contracts stored on blockchain. It:

Facilitates digital creation of endowments (waqf/sadaqah jariyah)

Automates compliance and fund usage through smart contracts

Enhances efficiency in Islamic philanthropy via digital wallets (Omar & Arshad, 2022)

This model is scalable and aligns closely with the Smart Waqf framework, offering transparency and automation.

Hypothetical Example: "WaqfGo" Mobile App

A proposed application, WaqfGo, could combine geolocation, blockchain, and AI features to:

Allow users to find nearby waqf projects needing funding

Contribute digitally and track project milestones

View AI-generated reports on asset performance

This example illustrates how a Smart Waqf application could offer seamless interaction between donors, trustees, and regulators.

These case studies showcase how the integration of digital technologies into waqf systems is not only feasible but already underway in parts of the Muslim world. They also underscore the adaptability of the Smart Waqf framework across diverse socio-economic and regulatory contexts.

RECOMMENDATIONS AND CONCLUSIONS

Recommendations

To ensure successful implementation of the Smart Waqf model, the following recommendations are proposed:

Legal and Regulatory Reform

Update waqf laws to include provisions for digital asset management and smart contracts.

Create national digital waqf registries supported by Shariah-compliant governance.

Investment in Technology Infrastructure

Allocate funds for blockchain platforms, mobile application development, and AI-driven tools tailored to Islamic philanthropy.

Partner with Islamic fintech startups to co-develop secure, scalable systems.

Capacity Building and Education

Train waqf administrators and Shariah advisors on digital technologies.

Educate the public, especially youth, on digital waqf participation through media and school programs.

Stakeholder Collaboration

Establish multi-stakeholder working groups involving religious authorities, technologists, donors, and community leaders.

Promote open innovation through hackathons and grants focused on waqf tech solutions.

Pilot and Scale

Begin with small-scale pilot projects in strategic locations.

Evaluate impact metrics and iterate before national or global rollout.

Conclusion

The waqf institution, deeply rooted in Islamic tradition, has historically played a crucial role in social welfare, education, and community development. However, contemporary challenges- such as administrative inefficiencies, lack of transparency, and low donor engagement- have significantly hindered its impact in the modern era.

This paper introduced the concept of Smart Waqf, an innovative, technology-driven framework designed to modernize waqf governance and revitalize its role in socio-economic development. By leveraging technologies like blockchain, AI, mobile platforms, and GIS, the Smart Waqf model enhances transparency, optimizes asset management, and fosters greater trust among stakeholders.

Real-world case studies and implementation strategies show that digital transformation is not only necessary but also achievable, provided that waqf institutions align technology with Shariah compliance and stakeholder engagement. As digital literacy and Islamic fintech continue to rise globally, now is the ideal time to transform waqf into a future-ready institution.

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