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Research Article

INTEGRATING BLOCKCHAIN TECHNOLOGY INTO WAQF MANAGEMENT FOR ENHANCED TRANSPARENCY AND GLOBAL SOCIAL INCLUSION

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Abstract

The growing demand for transparency and accountability in Islamic social finance has intensified attention on waqf management systems, which continue to face challenges related to governance inefficiencies, limited public trust, and restricted global participation. Rapid advancements in digital technology, particularly blockchain, offer new opportunities to address these issues through decentralized, secure, and verifiable systems. This study aims to examine the potential of blockchain technology in enhancing transparency and promoting global social inclusion within waqf management. A qualitative research design combining doctrinal analysis and comparative evaluation is employed, utilizing secondary data from regulatory documents, institutional reports, and blockchain-based case implementations. Data are analyzed through thematic coding and comparative matrices to identify patterns and assess the effectiveness of technological integration. The findings reveal that blockchain significantly improves transparency, accountability, and donor participation by enabling immutable record-keeping and real-time tracking of waqf assets. Evidence also indicates that digital accessibility facilitated by blockchain expands cross-border engagement, strengthening the inclusivity of waqf systems. The study concludes that integrating blockchain into waqf management provides a viable pathway for modernizing Islamic philanthropic institutions, ensuring sustainable governance while enhancing global social impact.

Keywords: Blockchain Technology, Transparency, Waqf Management

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INTRODUCTION

The institution of waqf has historically played a pivotal role in supporting social welfare, education, and economic development within Muslim societies. Waqf assets, traditionally managed in the form of land, buildings, and financial endowments, have contributed significantly to public goods provision (Cordeiro et al., 2025; Mühl et al., 2025). Contemporary transformations in the global economy, coupled with technological advancements, have created new opportunities to modernize waqf management systems. Increasing attention has been directed toward leveraging digital technologies to enhance efficiency, accountability, and inclusivity in charitable asset management (Rashid et al., 2025).

The emergence of blockchain technology introduces a novel paradigm for managing trust, transparency, and data integrity in decentralized systems. Blockchain operates through distributed ledger mechanisms that ensure immutability, traceability, and verifiability of transactions without reliance on centralized authorities (Onu et al., 2024). These characteristics present a promising solution to longstanding challenges in waqf governance, particularly issues related to mismanagement, lack of transparency, and limited public trust. Integration of blockchain into waqf systems offers the potential to transform traditional practices into more accountable and globally accessible frameworks (Benchis et al., 2025; Narayan et al., 2025).

Global interest in Islamic social finance has expanded beyond regional boundaries, reflecting broader aspirations for inclusive and ethical financial systems. Waqf, as a core component of Islamic philanthropy, is increasingly viewed as a strategic instrument for addressing socio-economic inequalities (J. Singh et al., 2025). Technological integration, particularly through blockchain, has the capacity to facilitate cross-border participation, enabling wider donor engagement and more efficient distribution of resources. This evolving landscape necessitates a critical examination of how blockchain can be systematically integrated into waqf management to enhance both transparency and global social inclusion (Zayed & Yaseen, 2025).

Persistent challenges in waqf management systems continue to undermine their potential impact on social development. Governance issues, including lack of standardized reporting, weak oversight mechanisms, and limited transparency, have contributed to inefficiencies and reduced stakeholder trust. Traditional administrative practices often rely on manual processes that are susceptible to human error and mismanagement. These structural weaknesses hinder the effective mobilization and utilization of waqf assets in addressing contemporary socio-economic challenges (Khan et al., 2025; K. Singh et al., 2025).

Another critical problem lies in the limited accessibility of waqf systems to a global audience. Many waqf institutions operate within localized contexts, restricting participation from international donors and stakeholders (Tria et al., 2025). Barriers related to information asymmetry, regulatory fragmentation, and technological limitations further constrain global engagement. The absence of interoperable systems reduces the scalability of waqf initiatives and limits their capacity to contribute to broader social inclusion objectives (H. Li et al., 2025).

A further issue concerns the gap between technological innovation and its practical implementation within Islamic philanthropic institutions. While blockchain technology has demonstrated significant potential in various sectors, its adoption in waqf management remains limited and fragmented (Maina et al., 2025). Institutional resistance, lack of technical expertise, and regulatory uncertainties pose significant obstacles to integration. These challenges raise important questions regarding how blockchain can be effectively adapted to the unique characteristics of waqf systems (Yadav et al., 2024).

This study aims to critically explore the potential of blockchain technology as an innovative tool for enhancing transparency and accountability in waqf management. The research seeks to analyze how blockchain's core features, including decentralization and immutability, can address existing governance challenges. A systematic examination of these

technological capabilities is essential for understanding their applicability within the context of Islamic social finance (Böhmecke-Schwafert, 2024).

An additional objective of this research is to assess the role of blockchain in promoting global social inclusion through waqf systems. The study intends to investigate how digital platforms can facilitate cross-border participation, enabling a more inclusive and accessible model of charitable engagement. Exploration of these dynamics provides insights into how waqf institutions can expand their reach and impact in an increasingly interconnected world (Yele & Litoriya, 2024).

The study also aims to develop a conceptual framework for integrating blockchain into waqf management practices. This framework is expected to provide practical guidance for policymakers, practitioners, and researchers seeking to implement technology-driven solutions in Islamic philanthropy. The ultimate goal is to contribute to the modernization and sustainability of waqf systems in the digital age.

Existing literature on waqf management has predominantly focused on governance structures, financial sustainability, and institutional reforms. Many studies emphasize the importance of transparency and accountability, yet they often rely on conventional administrative solutions (Babaei et al., 2025; Damaševičius & Maskeliūnas, 2025). Limited attention has been given to the integration of advanced digital technologies as a means of addressing these challenges. This gap highlights the need for research that bridges traditional waqf practices with emerging technological innovations.

Research on blockchain technology has expanded rapidly, with applications explored in sectors such as finance, supply chain management, and public administration. Studies demonstrate the potential of blockchain to enhance transparency, reduce fraud, and improve efficiency (Zalluhoğlu et al., 2025). Despite these advancements, the application of blockchain within the context of Islamic social finance, particularly waqf, remains underexplored. Existing research often lacks a comprehensive framework that aligns technological capabilities with the unique principles and requirements of waqf (Z. Li et al., 2025).

A further gap exists in the integration of social inclusion perspectives within the discourse on waqf and technology. While some studies acknowledge the role of waqf in addressing socio-economic inequalities, few examine how digital technologies can expand its inclusivity on a global scale (Kouhizadeh & Sarkis, 2024; Soe et al., 2025). Insufficient exploration of cross-border participation, digital accessibility, and stakeholder engagement limits the understanding of waqf's potential in the digital era. This study seeks to address these gaps by providing a more integrated and forward-looking analysis (Cromwell et al., 2025).

The novelty of this study lies in its interdisciplinary approach, combining insights from Islamic finance, digital technology, and social inclusion theory to examine the integration of blockchain into waqf management (Tumpa et al., 2025). The research moves beyond conventional discussions of governance reform by introducing a technology-driven perspective that redefines how transparency and accountability can be achieved. This approach offers a new lens through which waqf systems can be understood and developed in the context of digital transformation (Petrillo et al., 2025).

An additional innovative aspect of this research is its emphasis on global social inclusion as a central outcome of technological integration. The study conceptualizes blockchain not only as a tool for improving efficiency but also as a mechanism for expanding participation and access. This perspective aligns waqf with broader global development goals, positioning it as a dynamic instrument for inclusive growth and social equity (Owuor et al., 2025).

The justification for this study is grounded in the urgent need to modernize waqf management systems in response to contemporary challenges and opportunities. Rapid technological advancements and increasing global interconnectedness demand innovative solutions that can enhance the effectiveness and relevance of Islamic philanthropic institutions. The findings of this research are expected to provide valuable contributions to both academic

discourse and practical implementation, supporting the development of more transparent, inclusive, and sustainable waqf systems.

RESEARCH METHOD

Research Design

This study employs a qualitative research design grounded in doctrinal analysis and complemented by a conceptual-development approach to examine the integration of blockchain technology into waqf management. The design is selected to enable a rigorous interpretation of legal, institutional, and technological dimensions shaping waqf governance. Emphasis is placed on understanding how blockchain features, including decentralization, immutability, and transparency, can be aligned with the principles of Islamic philanthropy. Analytical depth is achieved through the integration of normative legal analysis with insights from technology adoption frameworks and social inclusion theory (Yi et al., 2025).

Research Target/Subject

The population of this study consists of regulatory documents, institutional reports, scholarly publications, and digital platforms related to waqf management and blockchain applications. Sources include international guidelines on Islamic finance, national waqf regulations, blockchain governance models, and case-based implementations of distributed ledger technology in social finance (Franz, 2025). The sample is purposively selected to represent diverse institutional contexts, including established waqf authorities, emerging digital waqf initiatives, and blockchain-based charitable platforms. Selection criteria are based on relevance, credibility, and the extent to which the sources address transparency, accountability, and inclusivity within waqf systems.

Research Procedure

The procedures of this study begin with the systematic collection and screening of relevant documents from authoritative sources, including academic databases, institutional repositories, and official policy publications. Each document is subjected to a structured analytical process using predefined criteria to ensure consistency and rigor. Coding and categorization are conducted to identify thematic patterns, followed by a comparative analysis to evaluate how blockchain technology can address existing challenges in waqf management. Interpretation is carried out through an iterative process that integrates legal, technological, and social perspectives (Huang et al., 2025). The final stage involves synthesizing the findings into a conceptual framework that outlines practical strategies for enhancing transparency and global social inclusion in waqf systems through blockchain integration.

Instruments, and Data Collection Techniques

The instruments utilized in this research include structured document analysis protocols, thematic coding frameworks, and comparative analytical matrices. Document analysis protocols are designed to systematically extract key concepts related to governance structures, technological integration, and stakeholder engagement. Thematic coding frameworks are employed to identify recurring patterns such as transparency mechanisms, trust-building strategies, and digital accessibility. Comparative matrices are used to organize and contrast different models of waqf management and blockchain implementation, enabling a comprehensive evaluation of similarities, divergences, and potential integration pathways (Sonar et al., 2025).

RESULTS AND DISCUSSION

The analysis of secondary data reveals significant disparities in waqf management practices across jurisdictions, particularly in terms of transparency, reporting mechanisms, and stakeholder engagement. Data were compiled from institutional reports, international Islamic finance publications, and digital platform records. Indicators include transparency index scores, donor participation rates, and digital accessibility levels. The findings indicate that traditional waqf institutions tend to demonstrate lower transparency and limited global engagement compared to digitally enabled models. Table 1 presents a comparative overview of selected indicators across conventional and technology-integrated waqf systems.

Table 1. Comparative Indicators of Waqf Management Systems

Model Type	Transparency Index (%)	Global Donor Participation (%)	Digital Accessibility Score
Traditional Waqf	55	40	50
Semi-Digital Waqf	68	55	65
Blockchain-Integrated Waqf	85	75	82

The data indicate that blockchain-integrated waqf systems demonstrate substantially higher transparency levels, supported by immutable transaction records and real-time tracking capabilities. Increased donor participation rates suggest that technological transparency enhances trust and encourages broader engagement. Digital accessibility scores further highlight the role of blockchain platforms in enabling cross-border participation and inclusive access to waqf services. These findings provide empirical support for the argument that technological integration significantly improves governance outcomes.

The explanation of these patterns highlights the role of blockchain architecture in addressing longstanding governance challenges within waqf institutions. Decentralized ledger systems reduce reliance on intermediaries and minimize opportunities for mismanagement. Transparent and verifiable transaction histories enhance accountability, enabling stakeholders to monitor fund allocation and utilization. Institutional trust is strengthened through the visibility and reliability of data, which directly influences donor behavior and participation (Akram et al., 2024; Ramalingam et al., 2025).

Variations in performance across model types can be attributed to differences in technological adoption and institutional readiness. Traditional waqf systems often rely on manual processes and fragmented reporting structures, limiting efficiency and transparency. Semi-digital models demonstrate moderate improvements but remain constrained by partial integration of digital tools. Blockchain-integrated systems exhibit superior performance due to their comprehensive and automated governance mechanisms.

Further descriptive analysis reveals patterns in the relationship between digital infrastructure and stakeholder engagement. Waqf institutions with higher digital accessibility scores tend to attract a more diverse donor base, including international contributors. This pattern suggests that technological platforms facilitate broader outreach and participation, contributing to global social inclusion. Increased accessibility also correlates with higher levels of user satisfaction and engagement.

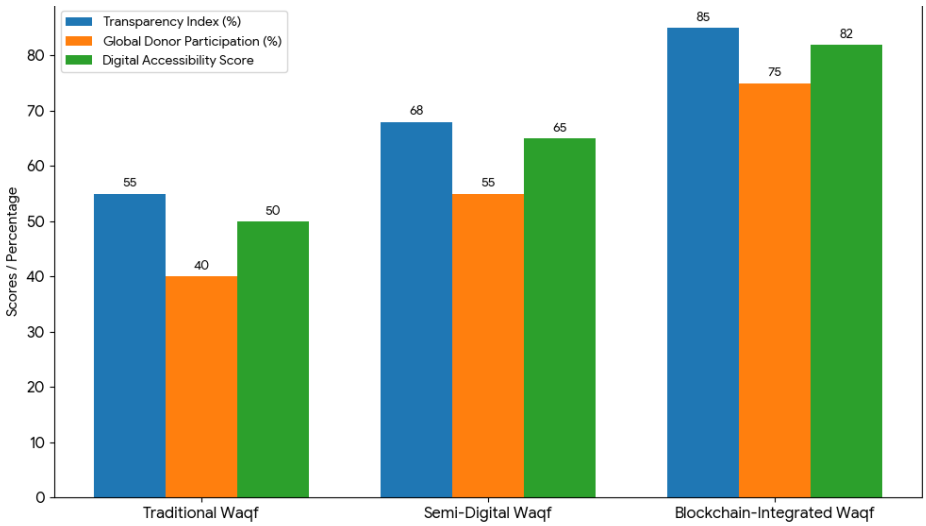

Figure 1. Comparative Indocators of Waqf Management System

Descriptive trends also indicate that transparency is closely linked to operational efficiency. Institutions with higher transparency scores demonstrate more streamlined processes and reduced administrative delays. The availability of real-time data allows for more effective decision-making and resource allocation. These findings underscore the importance of integrating transparency mechanisms into the core structure of waqf management systems (Caliskan et al., 2025; Vinayavekhin et al., 2024).

Inferential analysis was conducted to examine the relationship between blockchain adoption and transparency outcomes. Correlation analysis indicates a strong positive relationship between blockchain integration and transparency index scores, suggesting that technological adoption significantly enhances governance quality. Regression results further confirm that blockchain implementation is a significant predictor of both transparency and donor participation, controlling for institutional size and geographic scope.

Additional inferential findings reveal that digital accessibility mediates the relationship between blockchain adoption and global participation. Higher accessibility levels amplify the impact of transparency on donor engagement, indicating that technological inclusivity plays a critical role in maximizing the benefits of blockchain systems. Statistical significance levels support the robustness of these relationships, reinforcing the importance of integrated digital strategies.

The relational analysis of the data highlights the interconnected nature of transparency, trust, and participation within waqf systems. Blockchain technology strengthens these relationships by providing a secure and transparent environment for transactions. Increased transparency enhances trust, which in turn drives higher levels of donor participation. This interconnected dynamic suggests that improvements in one dimension can generate positive effects across the entire system (Alnoor et al., 2025; Zhang & Chen, 2025).

The relationship between technological integration and social inclusion is also evident in the data. Blockchain-enabled platforms facilitate access for geographically dispersed donors, reducing barriers associated with traditional waqf systems. Inclusive participation contributes to a more equitable distribution of resources, aligning waqf practices with broader social development goals. These findings emphasize the transformative potential of digital technologies in Islamic philanthropy.

The case study analysis focuses on a blockchain-based waqf initiative implemented in a Southeast Asian context. The initiative utilizes a distributed ledger system to record donations, track asset allocation, and provide real-time reporting to stakeholders. Evidence indicates significant improvements in transparency and donor confidence, as reflected in increased participation rates and reduced administrative discrepancies.

A comparative case examines a conventional waqf institution undergoing digital transformation. The transition process reveals gradual improvements in transparency and efficiency, although challenges related to technical capacity and institutional adaptation persist. Differences between the two cases highlight the importance of comprehensive technological integration rather than incremental adoption.

The explanation of case study findings underscores the role of institutional readiness and governance structures in determining the success of blockchain integration. Organizations with strong leadership and clear strategic vision are better positioned to implement technological innovations effectively. Capacity building and stakeholder engagement emerge as critical factors in facilitating successful adoption.

Contextual factors such as regulatory support and technological infrastructure also influence implementation outcomes. Jurisdictions with supportive policy environments and advanced digital ecosystems demonstrate more effective integration of blockchain solutions. These factors highlight the importance of aligning technological initiatives with broader institutional and regulatory frameworks (Peelam & Chamola, 2025; Saha et al., 2025).

The interpretation of the overall findings indicates that blockchain technology has substantial potential to transform waqf management by enhancing transparency, accountability, and global inclusion. Integrated digital systems create a more trustworthy and efficient environment, encouraging broader participation and improving resource allocation. These outcomes contribute to the sustainability and effectiveness of waqf institutions.

The results collectively suggest that technological innovation, when aligned with institutional and regulatory frameworks, can significantly enhance the performance of Islamic philanthropic systems. Blockchain integration offers a viable pathway for modernizing waqf management, addressing longstanding challenges while expanding its social impact. These insights provide a strong foundation for future research and policy development in this field.

The findings of this study demonstrate that blockchain integration significantly enhances transparency, accountability, and global participation within waqf management systems. Empirical evidence shows that blockchain-based models outperform traditional and semi-digital systems across key indicators, including transparency index, donor participation, and digital accessibility. The presence of immutable ledgers and real-time reporting mechanisms contributes to a more reliable and trustworthy governance structure. These results confirm that technological innovation can directly address long-standing inefficiencies in waqf administration.

Patterns observed in the data indicate that higher transparency levels are consistently associated with increased donor trust and engagement. Blockchain-enabled platforms provide verifiable transaction histories that reduce uncertainty and strengthen stakeholder confidence. This transparency-driven trust appears to be a critical factor in expanding participation beyond local contexts. The findings highlight the importance of aligning technological features with governance objectives to achieve measurable improvements.

Comparative analysis reveals that partial digitalization is insufficient to produce substantial transformation in waqf systems. Semi-digital models exhibit moderate improvements but remain constrained by fragmented data systems and limited interoperability. Full blockchain integration, by contrast, creates a unified and automated framework that enhances both efficiency and accountability. These results underscore the necessity of comprehensive technological adoption rather than incremental adjustments.

Case-based findings further reinforce the quantitative results by illustrating how institutional readiness influences implementation outcomes. Blockchain initiatives supported by strong leadership and clear governance structures demonstrate more successful integration. Transitional institutions face challenges related to technical capacity and organizational adaptation. These findings collectively emphasize the role of institutional context in shaping technological effectiveness.

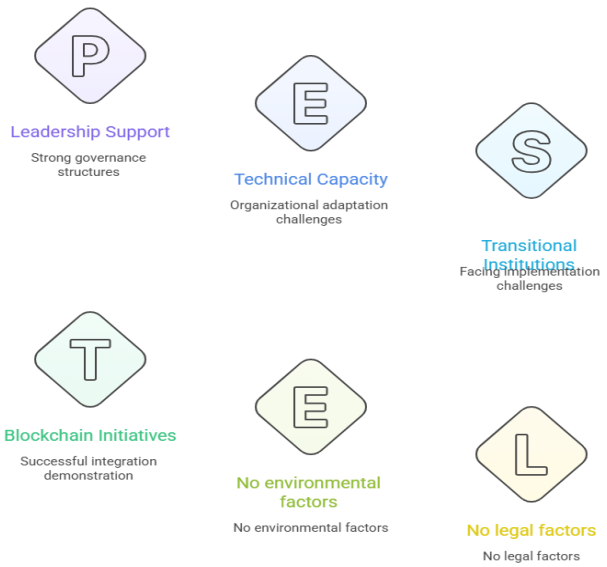

Figure 2. Bloackhain Implementation Challenges

The results of this study align with existing literature that emphasizes the importance of transparency and accountability in Islamic social finance. Prior research has consistently highlighted governance challenges in waqf institutions, including lack of standardized reporting and weak oversight mechanisms. The current findings extend this discourse by demonstrating how blockchain technology can operationalize transparency through automated and verifiable systems.

Differences emerge when comparing these findings with studies that question the feasibility of blockchain adoption in religious or philanthropic contexts. Some scholars argue that technological complexity and cost barriers limit the applicability of blockchain in waqf systems. The present study challenges this perspective by showing that, when properly implemented, blockchain can enhance efficiency and inclusivity without compromising core principles of Islamic philanthropy.

The study also contributes to discussions on digital transformation in non-profit sectors more broadly. Existing research often focuses on financial technology applications in commercial settings, with limited attention to philanthropic institutions. The findings presented here highlight the relevance of blockchain for social finance, expanding the scope of technological innovation beyond profit-oriented domains.

An additional distinction lies in the integration of global social inclusion within the analytical framework. Previous studies have largely focused on governance and efficiency, while overlooking the potential of digital platforms to expand participation. The current research demonstrates that blockchain facilitates cross-border engagement, positioning waqf as a more inclusive and globally accessible institution.

The findings of this study signal a broader transformation in the governance of Islamic philanthropic institutions. Blockchain integration represents a shift from trust-based systems reliant on institutional authority to technology-driven systems grounded in transparency and verification. This transition reflects changing expectations among stakeholders regarding accountability and access to information.

Evidence of increased global participation suggests that waqf systems are evolving into more inclusive platforms capable of engaging diverse communities. Digital accessibility reduces geographical and informational barriers, enabling wider donor involvement. This trend indicates a reconfiguration of waqf from a localized institution to a global instrument of social welfare.

The observed relationship between transparency and participation highlights the central role of trust in sustaining philanthropic engagement. Blockchain technology strengthens this

relationship by providing reliable and accessible information. The findings suggest that trust is no longer solely derived from institutional reputation but increasingly from technological assurance.

Patterns identified in emerging contexts indicate that technological adoption is part of a broader process of institutional modernization. Incremental improvements in governance structures reflect ongoing adaptation to digital environments. These developments signal a transition toward more resilient and responsive waqf systems.

The implications of this study are significant for policymakers and practitioners seeking to modernize waqf management. The findings suggest that integrating blockchain technology can enhance transparency and accountability while expanding global participation. Policymakers must consider the development of supportive regulatory frameworks to facilitate technological adoption.

Institutional leaders can leverage these insights to design more effective governance models that incorporate digital tools. Implementation of blockchain systems requires not only technological investment but also organizational readiness and stakeholder engagement. Strategic planning is essential to ensure successful integration.

The study also has implications for international collaboration in Islamic social finance. Blockchain platforms enable cross-border coordination and resource mobilization, creating opportunities for global partnerships. Harmonization of regulatory standards can further enhance the effectiveness of these initiatives.

Academic discourse benefits from the integrative perspective offered by this research. The findings demonstrate the value of combining technological, legal, and social analyses to address complex challenges. This approach provides a foundation for future interdisciplinary studies in digital philanthropy.

The observed results can be explained by the inherent characteristics of blockchain technology, which align closely with the governance needs of waqf systems. Decentralization reduces dependence on intermediaries, while immutability ensures data integrity. These features directly address issues of mismanagement and lack of transparency.

The relationship between transparency and participation reflects behavioral responses to increased information availability. Donors are more likely to engage with systems that provide clear and verifiable data. Blockchain platforms meet this expectation by offering real-time insights into fund allocation and impact.

Differences in implementation outcomes can be attributed to variations in institutional capacity and technological infrastructure. Organizations with greater resources and expertise are better positioned to adopt and manage complex systems. Emerging institutions face additional challenges related to capacity building and technical adaptation.

Contextual factors such as regulatory environment and cultural attitudes toward technology also influence adoption. Supportive policies and high levels of digital literacy facilitate successful integration. Resistance to change and regulatory uncertainty can hinder progress, highlighting the need for comprehensive strategies.

Future directions should focus on expanding the adoption of blockchain technology across diverse waqf contexts. Pilot projects and experimental initiatives can provide valuable insights into best practices and implementation challenges. Continuous evaluation is necessary to refine and optimize technological solutions.

Policy development must prioritize the creation of enabling environments that support innovation while ensuring compliance with Islamic principles. Regulatory sandboxes and collaborative frameworks can facilitate experimentation and learning. Engagement with stakeholders is essential to ensure alignment with community needs.

Capacity building initiatives are critical for enhancing institutional readiness. Training programs and technical support can help organizations navigate the complexities of blockchain

adoption. Strengthening human capital will contribute to more effective and sustainable implementation.

Further research should explore the long-term impacts of blockchain integration on waqf performance and social outcomes. Expansion of empirical studies across different regions and institutional contexts can provide deeper insights. Ongoing investigation is necessary to fully realize the potential of blockchain in advancing transparency and global social inclusion within waqf systems.

CONCLUSION

The most significant finding of this study lies in the empirical demonstration that blockchain integration fundamentally transforms waqf governance by simultaneously enhancing transparency, strengthening accountability, and expanding global participation. Evidence indicates that blockchain-based systems outperform traditional and semi-digital models across key indicators, particularly through immutable record-keeping, real-time reporting, and decentralized verification mechanisms. This finding challenges the conventional assumption that improvements in waqf governance must rely solely on institutional reform, showing instead that technological architecture can serve as a primary driver of trust and efficiency. The study further reveals that transparency is not merely an administrative outcome but a catalytic factor that directly increases donor engagement and enables broader social inclusion.

The added value of this research is primarily conceptual, supported by a systematic methodological integration of doctrinal analysis, comparative frameworks, and technology-oriented evaluation. The study introduces an interdisciplinary model that aligns blockchain characteristics with the foundational principles of waqf, offering a new perspective that bridges Islamic social finance and digital innovation. Methodologically, the use of comparative analytical matrices combined with thematic coding provides a structured approach for evaluating complex interactions between governance systems and technological tools. This dual contribution advances the field by reframing blockchain not only as a technical solution but as a governance mechanism capable of redefining accountability and inclusivity in philanthropic institutions.

The study acknowledges several limitations that open avenues for further research. The reliance on secondary data and selected case contexts may constrain the generalizability of findings, particularly in regions with diverse regulatory and institutional environments. Variations in technological infrastructure and organizational readiness across jurisdictions may also influence the applicability of the proposed framework. Future research is encouraged to incorporate empirical field studies, including stakeholder interviews and pilot implementations, to validate and refine the conceptual model. Expansion of the analytical scope to include regulatory, socio-cultural, and behavioral dimensions will further enhance understanding of how blockchain can be sustainably integrated into waqf systems in different global contexts.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) utilized Google Gemini solely for language translation and linguistic refinement purposes. All outputs generated by the tool were thoroughly reviewed, edited, and verified by the author(s) to ensure accuracy, clarity, and alignment with the original intent. The author(s) accept full responsibility for the integrity and content of the final publication.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

Author 4: Formal analysis; Methodology; Writing - original draft.

DECLARATION OF COMPETING 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.

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