

Development of an AI-Based Productive Waqf Fintech Model for Economic Empowerment of Vulnerable Communities

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Abstract

The rapid convergence of Artificial Intelligence (AI), financial technology (fintech), and Islamic social finance has created new opportunities to strengthen productive waqf as an instrument for economic empowerment, particularly for vulnerable communities. This study develops an AI-based productive waqf fintech model designed to enhance asset optimization, expand financial inclusion, and improve socio-economic resilience. The model integrates three technological pillars: Smart Waqf systems, AI-driven financial analytics, and digital crowdfunding mechanisms to ensure that waqf governance becomes more transparent, efficient, and equitable. The research adopts a qualitative systematic approach supported by a PRISMA-guided literature screening process to synthesize evidence from recent academic studies, policy documents, and empirical reports. Findings indicate that AI can enable automated credit scoring, personalized financial education, and precise beneficiary targeting, resulting in greater accessibility for microenterprises and low-income groups. Moreover, integrating crowdfunding and microfinance platforms within waqf systems enhances capital mobilization and accelerates the distribution of economic benefits. The model also aligns with global development priorities, particularly the Sustainable Development Goals (SDGs), by promoting inclusive growth, reducing poverty, and strengthening social welfare ecosystems. However, several challenges persist, including low digital literacy among beneficiaries, weak regulatory frameworks, data privacy risks, and the need for AI ethics grounded in maqasid al-shariah. To address these issues, the study recommends strengthening digital governance, enhancing cross-institutional collaboration, improving literacy programs, and ensuring human-centric AI development. Overall, the proposed model demonstrates significant potential to transform waqf into a scalable, technology-enabled instrument for sustainable community empowerment.

Keywords: Artificial intelligence; productive waqf; fintech; Islamic social finance; vulnerable communities

Introduction

The rapid evolution of Artificial Intelligence (AI) and financial technology (fintech) has fundamentally reshaped global financial ecosystems, creating unprecedented opportunities for inclusive development, poverty alleviation, and socio-economic empowerment. These technological disruptions are not merely improving transactional efficiency; they are redefining how financial systems can broaden access, reduce inequality, and deliver targeted social outcomes. Within the sphere of Islamic social finance, such advancements have become increasingly relevant, especially in optimizing productive waqf assets, strengthening

institutional governance, and expanding long-term socio-economic benefits for vulnerable populations. Waqf institutions, traditionally dependent on manual processes and conventional asset management models, now have the opportunity to transform through digital innovation. Recent studies emphasize that integrating AI, fintech, and waqf management enhances transparency, governance credibility, operational efficiency, and long-term sustainability, all while supporting global development priorities, including the Sustainable Development Goals (SDGs) (bin Yusof, 2025; Melzatia et al., 2025). These developments position Islamic social finance particularly productive waqf as a strategic instrument for inclusive growth in both Muslim-majority and non-Muslim contexts.

Digitalized waqf systems commonly referred to as Smart Waqf have risen to prominence as blockchain solutions, big data analytics, and AI-powered auditing tools significantly improve public trust, institutional accountability, and data integrity (Ismail et al., 2025; Jafar et al., 2025; Maretaniandini et al., 2025). These technologies do not simply digitize existing processes; they restructure core waqf operations by enabling real-time financial reporting, automated compliance monitoring, and transparent asset tracking. By reducing bureaucratic bottlenecks and information asymmetries, digital waqf platforms streamline administrative procedures, accelerate the distribution of social benefits, and foster inclusive economic participation. This ensures that waqf contributions yield tangible socio-economic returns that align with SDG-driven priorities such as poverty reduction, quality education, health access, and sustainable economic growth (N et al., 2025). Ultimately, Smart Waqf initiatives set a new benchmark for institutional integrity and social impact measurement in Islamic social finance.

The transformative impact of AI in macro-level Islamic finance systems further demonstrates its potential to revolutionize productive waqf. Evidence from Malaysia and Indonesia shows that AI-driven financial innovation increases national economic performance, improves the efficiency of Islamic financial products, and enhances the precision of risk management strategies (bin Syed Musa et al., 2025). These advancements indicate that Islamic finance is rapidly converging with global financial technologies while maintaining sharia compliance. Parallel success in AI-powered zakat management—particularly in areas such as automated mustahik identification, real-time fund distribution, and predictive poverty analytics—provides a strong precedent for similar applications in waqf ecosystems (Rabbani et al., 2022). These developments collectively demonstrate that AI is not merely a supportive tool but a transformative force capable of elevating the strategic role of waqf in national development agendas.

Meanwhile, fintech-enabled crowdfunding, peer-to-peer lending, and microfinance models have emerged as powerful mechanisms for bridging donors, waqf institutions, and vulnerable beneficiaries such as micro-entrepreneurs, low-income households, rural communities, and displaced populations (Salaudeen, 2024; Darajatun & Makhrus, 2025). By providing accessible financing channels and reducing dependence on conventional collateral-based systems, fintech-driven waqf platforms significantly enhance micro-business productivity, stimulate community-based entrepreneurship, and expand employment opportunities (Nurjanah & Hasanah, 2021; Khan et al., 2021; Intan & Nurhayati, 2025; Wanda, 2024). The integration of AI into microfinance ecosystems further deepens these impacts by supporting automated credit scoring, personalized risk detection, fraud prevention, and custom-

designed financial literacy modules tailored to beneficiary needs (Opeyemi et al., 2024; Oyedokun et al., 2025; Yaramolu, 2025). Collectively, these technological innovations increase financial inclusion and reduce structural poverty barriers, particularly for communities traditionally excluded from formal financial systems.

However, despite its transformative potential, the adoption of AI-driven productive waqf models continues to face several structural, ethical, and socio-technical challenges. Key issues include low digital literacy among beneficiaries, underdeveloped regulatory frameworks for Islamic fintech, algorithmic bias in AI decision-making, cybersecurity vulnerabilities, and persistent concerns regarding compliance with maqasid al-sharia principles (Nawi, 2025; Opeyemi et al., 2024; Rifai et al., 2025). These limitations underscore the need for robust governance structures, ethical AI frameworks, and sharia-compliant digital protocols that prioritize fairness, transparency, inclusivity, and social protection. Without such safeguards, the integration of advanced technologies may inadvertently reproduce inequality or misalign with the foundational objectives of waqf.

Given these considerations, this article aims to synthesize global theoretical and empirical insights and develop an integrative conceptual model for an AI-Based Productive Waqf Fintech System. Such a system is envisioned to empower vulnerable communities through technology-enabled Islamic social finance, enhance institutional governance, and strengthen the strategic role of waqf in national and global development. By situating AI and fintech within the ethical framework of Islamic finance, the proposed model contributes to the emerging discourse on how digital transformation can unlock the full socio-economic potential of productive waqf in the contemporary era.

Methods

This study employs a mini systematic literature review designed to comprehensively synthesize recent conceptual and empirical findings on the integration of AI, fintech, and productive waqf management. The review seeks to map current scholarly developments, identify emerging themes, and highlight research gaps that can inform the construction of a conceptual model for AI-based productive waqf systems. To ensure methodological rigor, the review process adhered to the core principles of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), particularly in terms of search transparency, inclusion criteria, and systematic screening procedures. Articles were identified through major academic databases including Scopus, Web of Science, and Dimensions, which were selected due to their comprehensive coverage of high-impact publications in Islamic finance, financial technology, and socio-economic development. A structured search protocol was developed using a combination of keywords and Boolean operators such as “artificial intelligence,” “fintech,” “productive waqf,” “Islamic social finance,” “digital waqf,” “AI governance,” and “economic empowerment,” ensuring that both conceptual and empirical studies were captured.

Once the initial pool of literature was gathered, duplicate entries were removed using automated and manual cross-checking to prevent redundancy and maintain dataset accuracy. The remaining records underwent a rigorous multi-stage screening process. The first stage involved title screening to eliminate articles that were clearly unrelated to waqf, AI, fintech, or Islamic finance. The second stage consisted of abstract analysis to assess preliminary relevance

and methodological alignment. Only studies demonstrating a clear linkage between digital technologies and Islamic social finance mechanisms proceeded to full-text evaluation. During the full-text screening, articles were assessed based on methodological rigor, clarity of theoretical contribution, contextual relevance to Islamic finance, and empirical robustness where applicable. Studies employing qualitative, quantitative, mixed-method, or conceptual approaches were retained as long as they contributed to understanding the transformative role of AI and fintech in productive waqf systems.

To ensure that the findings remained relevant to the rapidly evolving digital transformation landscape, only studies published within the last five years were included. This temporal filter allowed the review to focus on cutting-edge developments in AI-powered Islamic finance innovations, emerging fintech applications, and contemporary waqf management reforms. Earlier publications were excluded unless referenced for foundational concepts. By narrowing the scope to recent scholarly contributions, the review captures the most current technological advancements and governance debates shaping the digitalization of waqf institutions. Overall, this methodological approach ensures that the synthesized insights are robust, timely, and aligned with the technological realities and institutional challenges of today's Islamic social finance environment.

To ensure clarity regarding the literature selection process, the following PRISMA diagram illustrates the systematic flow of identification, screening, eligibility assessment, and final inclusion of studies used in this review.

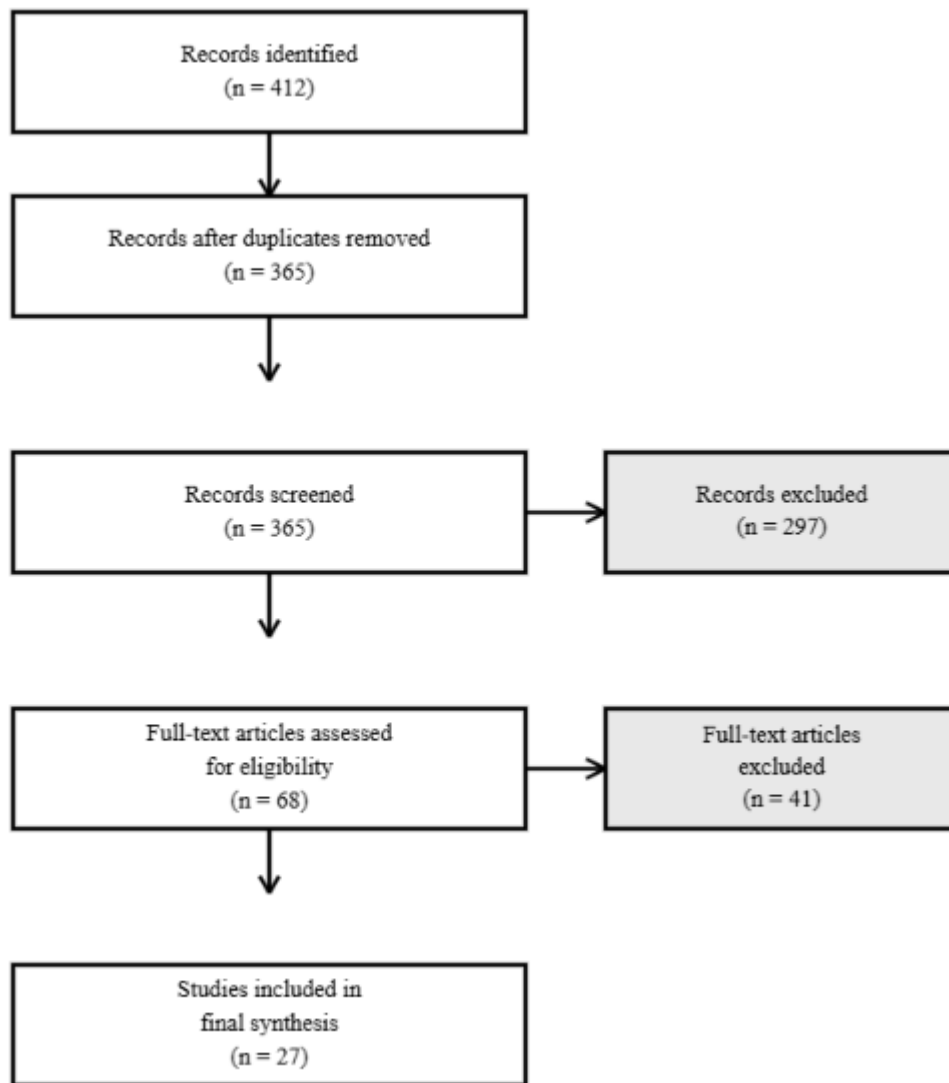


Figure 1. PRISMA Flowchart of Literature Selection

Figure 1 presents the PRISMA flowchart outlining the systematic process used to identify, screen, and select the final body of literature included in this review. The diagram shows that the initial search across major academic databases produced 412 records. After removing duplicate entries, 365 unique articles remained and proceeded to the screening stage. During the title and abstract screening, 297 studies were excluded for not meeting the thematic or methodological criteria. The remaining 68 articles were assessed in full-text form to evaluate their relevance to AI, fintech, and productive waqf integration. Of these, 41 were excluded due to insufficient methodological rigor, lack of direct relevance, or outdated scope. Ultimately, 27 studies fulfilled all inclusion criteria and were incorporated into the final synthesis. This process demonstrates the structured and transparent approach used to ensure the reliability, contemporary relevance, and academic quality of the literature selected for review.

Results

The analysis reveals that integrating AI and fintech into productive waqf management significantly enhances asset optimization, operational transparency, and financial inclusion for vulnerable communities. Smart Waqf initiatives that employ blockchain architecture, algorithmic auditing, and real-time digital reporting systems demonstrate substantial improvements in governance effectiveness, accountability, and public trust toward waqf institutions (Ismail et al., 2025; Jafar et al., 2025). By automating record-keeping and enabling tamper-proof documentation, these technologies reduce administrative leakages and ensure that waqf revenues are allocated more efficiently toward productive ventures.

In parallel, the adoption of digital crowdfunding platforms and fintech-based microfinance models broadens access to capital for micro-enterprises, rural entrepreneurs, and low-income households. These digitally enabled funding mechanisms ease long-standing financial constraints, allowing beneficiaries to develop sustainable livelihoods, expand small-scale businesses, and reduce structural poverty (Salaudeen, 2024; Intan & Nurhayati, 2025). The integration of AI-driven credit scoring further strengthens this process by leveraging alternative data to assess borrowers with limited or non-existent financial histories, thus enabling more inclusive financing for micro-entrepreneurs, gig workers, and informal sector participants typically excluded from conventional banking systems (Oyedokun et al., 2025; Yaramolu, 2025).

However, despite these promising benefits, several systemic risks remain. Key challenges include persistent data security vulnerabilities, limited regulatory clarity concerning Islamic fintech compliance, and the possibility of algorithmic bias that may unfairly disadvantage particular groups (Nawi, 2025; Opeyemi et al., 2024). These risks underscore the importance of developing robust governance frameworks, ethical AI guidelines, and sharia-compliant digital safeguards to ensure that technological integration in productive waqf continues to uphold equity, transparency, and maqasid al-sharia principles.

To consolidate the major findings, the following table synthesizes the core thematic dimensions identified in the literature and their implications for productive waqf development.

Table 1. Summary of Key Findings in AI-Based Productive Waqf Fintech Development

| Dimensional Focus | Key Findings | Impact on Productive Waqf |
|-----------------------------|--|---|
| Smart Waqf & Digitalization | Blockchain, AI auditing, big data analytics | Strengthened accountability, increased transparency, enhanced trust |
| Crowdfunding & Microfinance | Seamless donor-beneficiary linkage, reduced bureaucracy | Rapid capital distribution, poverty reduction, improved micro-enterprise performance |
| AI for Financial Inclusion | Automated scoring, risk prediction, tailored financial education | Broader credit access for vulnerable groups, especially those without financial history |

| | | |
|---------------------|--|---|
| Systemic Challenges | Regulatory gaps, low digital literacy, data privacy issues | Risk of exclusion, algorithmic bias, governance vulnerabilities |
|---------------------|--|---|

Table 1 provides a structured synthesis of the major thematic dimensions identified in the literature concerning AI-based productive waqf fintech development. The table illustrates how different clusters of technological innovation such as smart waqf digitalization, AI-enabled financial inclusion tools, and fintech-powered crowdfunding contribute to enhancing the entire waqf value chain. Within the smart waqf and digitalization dimension, technologies like blockchain, AI-driven auditing, and big data analytics collectively strengthen transparency and accountability, addressing long-standing governance issues in waqf management.

The section on crowdfunding and microfinance highlights the role of digital platforms in streamlining donor beneficiary interactions, reducing bureaucratic delays, and accelerating the mobilization of capital for productive ventures. This directly contributes to poverty reduction and improvements in micro-enterprise performance. AI-supported financial inclusion technologies such as automated credit scoring and predictive risk modelling further expand equitable access to financing for marginalized populations who lack formal financial records.

Finally, the table underscores systemic challenges that accompany digital transformation efforts. These include regulatory gaps, limited digital literacy, and concerns around data privacy and algorithmic fairness, all of which can undermine the intended benefits if left unaddressed. By presenting both opportunities and vulnerabilities, Table 1 provides a holistic overview of the technological, institutional, and socio-economic implications of AI-driven waqf innovation.

To demonstrate how these technological dimensions converge into a unified operational framework, Figure 2 presents the conceptual architecture of an AI-Based Productive Waqf Fintech System. The figure integrates insights from Table 1 by visualizing how AI analytics, smart governance mechanisms, and digital financing tools interact to produce sustainable socio-economic empowerment. This visual model serves as a bridge between theoretical insights and practical application, illustrating the pathways through which AI-enabled systems

can optimize productive waqf management and expand financial inclusion.

Smart Waqf Platform System Architecture

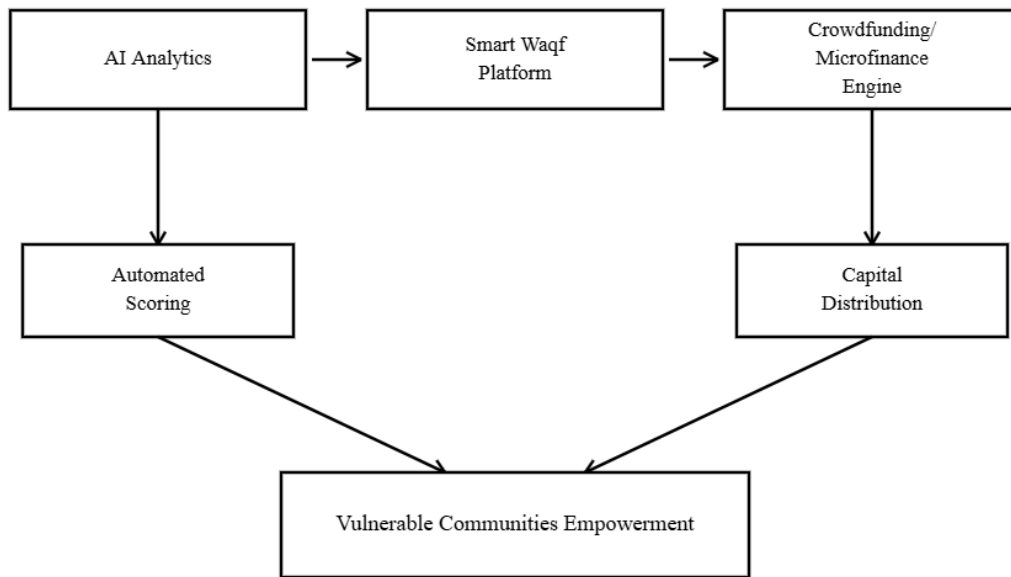


Figure 2. Conceptual Model of the AI-Based Productive Waqf Fintech System

Figure 2 illustrates the core functional components and workflow of the proposed AI-Based Productive Waqf Fintech System, presenting a holistic integration of technological, financial, and social mechanisms within a unified digital ecosystem. The model begins with the incorporation of AI analytics, which process diverse datasets including financial histories, behavioral indicators, business performance patterns, and socio-economic profiles to produce actionable insights that enhance managerial decision-making. These AI-driven insights are then transmitted to the Smart Waqf Platform, where blockchain-based ledger systems, algorithmic auditing frameworks, and digital asset management tools work collectively to strengthen transparency, prevent data manipulation, and enable real-time monitoring of waqf resources. This ensures that governance processes remain accountable, traceable, and aligned with sharia-compliant principles.

The Smart Waqf Platform subsequently interacts with the digital crowdfunding and microfinance engine, which functions as the financial mobilization hub of the ecosystem. Through digital donations, peer-to-peer microfinancing, and innovative waqf investment pools, the engine facilitates efficient capital aggregation while broadening participation from both institutional donors and individual contributors. The integration of automated scoring algorithms enhances this process by objectively evaluating beneficiary eligibility and risk levels using data-driven criteria. This reduces the possibility of subjective judgment or favoritism, while simultaneously expanding opportunities for micro-entrepreneurs and underserved populations who traditionally face barriers within conventional financing systems.

Once beneficiaries are assessed, the model channels resources into targeted capital distribution. This component ensures that funds are directed precisely toward the intended recipients especially vulnerable communities such as micro-business owners, low-income

households, and marginalized socioeconomic groups. Such targeted disbursement supports the creation of sustainable livelihoods, improves asset productivity, and fosters long-term financial independence. Ultimately, the combined operation of these components leads to enhanced socio-economic empowerment, driven by expanded access to productive capital, equitable financing mechanisms, and transparent institutional governance.

By mapping these sequential interactions, Figure 2 highlights how digital transformation when strategically guided by AI and fintech can modernize waqf institutions, strengthen institutional trust, and significantly amplify the role of waqf in promoting inclusive economic development. The model underscores the potential of technology-enabled Islamic social finance as a catalyst for poverty reduction, financial inclusion, and community-level resilience in the contemporary digital era.

Discussion

The results indicate that the integration of AI and fintech presents substantial opportunities for transforming productive waqf into a more inclusive, transparent, and sustainable instrument for socio-economic development. Smart Waqf technologies powered by blockchain infrastructure, AI-based auditing mechanisms, and automated digital reporting significantly enhance institutional governance by reducing information asymmetry, ensuring tamper-proof documentation, and minimizing operational inefficiencies that have historically constrained the effectiveness of waqf institutions (Ismail et al., 2025; Maretianiandini et al., 2025). Beyond governance improvements, AI-driven analytical tools contribute to the precision of waqf asset management by enabling data-based beneficiary profiling, dynamic risk evaluation, and optimized allocation of productive capital. These advancements reflect broader global trends toward data-driven social finance, demonstrating how Islamic social finance can remain competitive and relevant in the digital era (bin Syed Musa et al., 2025; Rabbani et al., 2022).

The expansion of digital crowdfunding and microfinance platforms further strengthens the developmental potential of productive waqf by widening access to financial resources for micro-entrepreneurs, refugees, informal workers, and low-income households. By bypassing conventional collateral requirements and accelerating fund mobilization, these platforms help bridge long-standing financial inclusion gaps and support the creation of sustainable livelihoods (Intan & Nurhayati, 2025; Wanda, 2024). Nevertheless, the realization of these benefits depends on addressing several persistent structural and ethical challenges. These include low digital literacy among beneficiaries, technological disparities between urban and rural regions, regulatory ambiguities surrounding Islamic fintech, and concerns over algorithmic bias that may produce unintended discrimination. Without appropriate safeguards, AI-driven systems risk reinforcing existing socio-economic inequalities or violating core principles of fairness and justice embedded within Islamic ethical norms (Opeyemi et al., 2024; Rifai et al., 2025).

Therefore, the effective adoption of an AI-Based Productive Waqf Fintech ecosystem requires a comprehensive and multidimensional strategy. This includes regulatory harmonization to ensure sharia compliance and consumer protection, capacity-building

programs to support digital literacy among beneficiaries, strategic collaboration between waqf institutions, fintech firms, and policymakers, and the development of robust ethical AI frameworks rooted in maqasid al-sharia. These efforts are critical not only for mitigating risks but also for ensuring that AI-based waqf systems do more than simply digitize existing processes. Instead, they must elevate waqf's social value, strengthen its developmental impact, and advance its contribution to global sustainable development agendas.

Conclusion

The study concludes that an AI-Based Productive Waqf Fintech Model holds substantial potential to advance financial inclusion, strengthen waqf governance, and generate meaningful empowerment for vulnerable communities. The integration of Smart Waqf mechanisms such as blockchain-ledger systems, automated auditing, and real-time digital reporting with crowdfunding platforms and AI-driven financial analytics creates a transformative ecosystem capable of optimizing both the managerial and social dimensions of productive waqf. Through this integration, waqf institutions can achieve more transparent, efficient, and equitable distribution of economic benefits, reducing leakages, enhancing accountability, and ensuring that funds are directed toward communities most in need.

Furthermore, the model provides a structured pathway for modernizing traditional waqf practices by aligning them with global advancements in financial technology and data-driven decision-making. However, its successful implementation is contingent upon several enabling factors, including supportive regulatory frameworks that ensure sharia compliance, strong institutional collaboration among waqf bodies, fintech providers, and policymakers, and deliberate efforts to enhance digital literacy among beneficiaries and waqf administrators. Equally important is the adoption of ethical AI principles that uphold fairness, transparency, inclusivity, and the maqāṣid al-sharī'ah, ensuring that technological innovation operates in harmony with Islamic ethical values.

Accordingly, this model presents a forward-looking framework capable of strengthening the socio-economic resilience of vulnerable populations in the era of rapid digital transformation. By bridging technological innovation with the foundational objectives of Islamic social finance, the proposed system not only modernizes waqf management but also reinforces its role as a sustainable instrument for inclusive development and long-term community empowerment.

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