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Cash Waqf-Based Crowdfunding Model Using Blockchain Technology: Problem, Solution, and Strategies for Family Waqf

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Abstract

The development of waqf has increasingly adopted crowdfunding platforms to enhance cash waqf collection. However, these platforms present significant challenges, particularly regarding legality, data security, and transparency—creating vulnerabilities that may lead to legal and ethical violations. Blockchain technology offers a promising solution by providing secure, transparent, and verifiable transaction records that address these issues. This study aims to identify the most effective strategies for solving problems in waqf crowdfunding platforms by leveraging blockchain technology. The Analytic Network Process (ANP) method is used for its strength in handling complex decision-making involving interrelated factors. Although limited in respondent numbers, this qualitative study involves regulators, practitioners, and scholars through in-depth interviews, focus group discussions, and structured questionnaires, ensuring diverse and relevant insights. The findings indicate that integrating blockchain can significantly enhance platform security and transparency. Additionally, improving public literacy and religiosity, alongside strengthening legal and sharia-based regulations and supervision, are critical strategies for optimizing cash waqf crowdfunding implementation. These results offer practical implications for policymakers and platform developers in designing more trustworthy and effective waqf systems.

Keywords

cash waqf crowdfunding; blockchain technology; Islamic financial technology; sharia governance; Analytic Network Process (ANP)

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1. INTRODUCTION

As the era progresses and technology advances rapidly, financial systems have undergone a major transformation with the emergence of Financial Technology (FinTech). FinTech integrates innovative technologies and business models to improve the accessibility, efficiency, and transparency of financial services (Garg et al., 2023). One of the prominent applications of FinTech is crowdfunding, a collective method of raising funds for various projects through online platforms. However, the main challenge in crowdfunding today is the issue of trust and transparency, as fraudulent activities and misuse of funds increasingly discourage potential donors (Festa et al., 2023).

In Indonesia, the development of crowdfunding platforms has shown significant growth, especially in philanthropic and Islamic social finance sectors such as zakat, infaq, and waqf (Testa et al., 2022). The integration of waqf and crowdfunding—commonly called waqf crowdfunding—has

emerged as an innovative effort to increase waqf collection and distribution efficiency through digital means (Masrizal et al., 2022). Indonesia has several portals allowing donation-based crowdfunding, including kitabisa.com, embodied.com, and Ayopeduli.com (Wulandari et al., 2021). The Waqf Information System (SIWAK) of the Ministry of Religious Affairs reports that the potential for cash waqf in Indonesia reaches IDR 180 trillion annually, indicating a vast opportunity for digital optimization. The Indonesian Waqf Board (BWI) also recognizes this potential, encouraging online crowdfunding platforms to enhance waqf fundraising for social projects such as education, health, and disaster relief (Badan Wakaf Indonesia, 2024).

Despite its potential, the implementation of waqf crowdfunding faces several critical challenges, particularly in legality, cybersecurity, and transparency. Previous studies have identified that sharia-based crowdfunding platforms in Indonesia still encounter regulatory ambiguity, weak data protection, and a lack of accountability in fund management (Alfarisi & Hannase, 2024; Mat Radzi et al., 2024; Syamsuri et al., 2023). Moreover, research by Priambudi et al. (2023) shows that even in developed countries, crowdfunding is considered one of the riskiest financial instruments due to the high potential for fraud and data misuse (Priambudi et al., 2023). These challenges highlight a persistent research gap—the lack of effective and sharia-compliant mechanisms to ensure security and transparency in online waqf-based crowdfunding systems.

To address this gap, the integration of blockchain technology is proposed as a strategic solution. As a decentralized and immutable digital ledger, blockchain can enhance trust by enabling transparent and verifiable transactions without intermediaries. In waqf crowdfunding, blockchain offers the potential to securely record donations, monitor fund allocations, and ensure that all transactions comply with sharia principles. Previous studies (Saleh et al., 2019; Turhan & Akman, 2024) have highlighted the benefits of blockchain for improving transparency and accountability in charitable and public sectors, yet empirical research focusing on its application to waqf crowdfunding in Indonesia remains limited.

Therefore, this study aims to analyze the challenges of cash waqf crowdfunding and develop an optimized model using blockchain technology to enhance transparency, legality, and data security in a sharia-compliant framework. The novelty of this research lies in its integrative approach that combines Islamic social finance (waqf) with blockchain-based crowdfunding mechanisms, offering a new perspective on how digital transformation can strengthen public trust and maximize the socio-economic impact of waqf in Indonesia.

2. METHODS

This study adopts a qualitative approach combined with the Analytic Network Process (ANP) method to identify and prioritize strategic solutions for optimizing blockchain-based waqf crowdfunding in Indonesia. ANP is appropriate for this study because it allows researchers to analyze complex, interdependent factors within a decision-making structure, rather than assuming independence among criteria as in the traditional Analytic Hierarchy Process (AHP) (Ascarya, 2005). In the context of this research, the challenges in waqf crowdfunding—such as legality, transparency, and cybersecurity—are mutually interrelated, requiring a network-based analytical framework rather than a linear or hierarchical one. Therefore, ANP provides a systematic and rigorous framework to model feedback relationships among variables and to generate prioritized solutions based on expert judgments.

Although this study employs a qualitative approach, ANP bridges qualitative expert opinions with quantitative prioritization, enabling a balanced assessment between empirical insights and

analytical rigor (Saaty, 2004). This makes ANP particularly suitable for exploratory studies in emerging fields like blockchain-based Islamic finance, where quantitative datasets are limited but expert knowledge is substantial.

2.1. Respondent and Data Collection

The study uses primary data collected through in-depth interviews, Focus Group Discussions (FGD), and structured questionnaires. Respondents were selected using purposive sampling, based on expertise and experience in waqf crowdfunding, blockchain technology, and Islamic financial regulation. The limited number of respondents (five experts) is methodologically justified because ANP emphasizes expert judgment quality and consistency rather than statistical generalization. In ANP applications, small expert panels are commonly used when dealing with complex decision systems requiring deep domain expertise.

The respondents represent three key stakeholder groups essential to this study's analytical framework. This triangulation of respondent types ensures that the analysis captures perspectives from both policy and implementation levels, reinforcing the validity and reliability of the findings:

Table 2.1 Respondents' Profile

No	Respondent	Description	Respondent's Profile
1	Regulator	those responsible for waqf governance and supervisory functions.	(R1) Supervision and Management Division of Indonesian Waqf Board (BWI)
2	Practitioner	individuals with operational experience in crowdfunding and blockchain-based platforms.	(R2) CEO of Fund Ex (R3) CRCO of PT. Urun Bangun Negeri
3	Expert/Academics	those with theoretical and regulatory insight into Islamic finance and sharia compliance.	(R4) Sharia Supervisory Board of PT. Urun Bangun Negeri (R5) Legal and Sharia Compliance of PT Ethis Fintech Indonesia (AI)

2.2 Analytical Reasoning and ANP Application

The analytical reasoning in this study proceeds through three main stages:

(1) *Problem Structuring and Model Development*: Based on preliminary interviews and literature insights, key issues in waqf crowdfunding were identified and categorized into problem clusters such as legality, transparency, and cybersecurity (Arief et al., 2023). These clusters and their interconnections form the ANP network model, reflecting the real-world dependencies among factors influencing the adoption of blockchain in waqf crowdfunding. The following are the results of the ANP model in Super-Decision software:

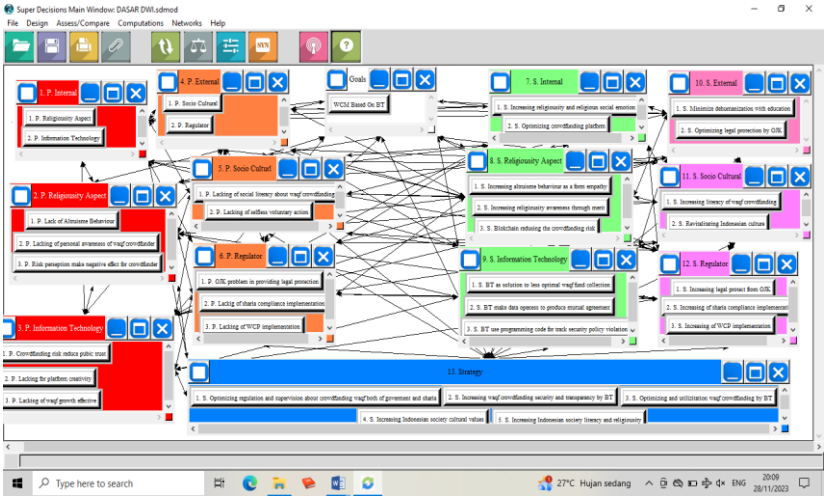

Figure 2.2.1 ANP Model in Super-Decision Software

Source: Researcher Data Processed

(2) *Expert Judgment and Pairwise Comparison*: Experts evaluated the relative influence between factors using pairwise comparisons, which quantify the strength and direction of relationships across clusters. This process transforms qualitative reasoning into quantitative priority values, capturing the consensus and divergence among experts.

In this step is input data from the questionnaire into the Super-Decision software to compile a comparative questionnaire. This question forms a pairwise comparison between the elements in the cluster to determine which one has the most influence (more dominance) and how much difference (on a scale of 1-≥9) is seen from one side. The numerical scale used is a translation of a verbal assessment questionnaire to expert practitioners and academicians (Saaty, 2004)

(3) *Synthesis and Priority Derivation*: The pairwise comparison results were synthesized using Super Decisions software to calculate local and global priority weights. These weights represent the relative importance of each factor and proposed strategy, guiding which blockchain-based mechanisms are most critical for improving transparency, legal compliance, and security in waqf crowdfunding.

Kendall's Coefficient of Concordance (W) was applied not as a statistical test of significance, but as an analytical measure of agreement among expert judgments, ensuring internal consistency in the decision model. After inputting the results of the questionnaire into the software, the researcher looks for the average value of each respondent's answers. This stage is called the synthesis results, once it is done as a final interpretation of the results of the research stage (Ascarya; Masrifah, 2014).

In summary, the application of ANP in this study is justified because it: (1) Enables systematic reasoning for complex, interdependent decision problems, (2) Converts qualitative expert insights into quantifiable strategic priorities, (3) Accommodates small, expert-based samples appropriate for exploratory research, and (4) Provides a robust analytical foundation for proposing blockchain-based solutions to enhance sharia-compliant crowdfunding.

Through this reasoning-based methodological design, the study moves beyond procedural description. It emphasizes the logic of analysis, ensuring the ANP model effectively captures the nuanced interrelations among Indonesia's technological, regulatory, and ethical dimensions of waqf crowdfunding. ANP model research phases can be seen in the flow below:

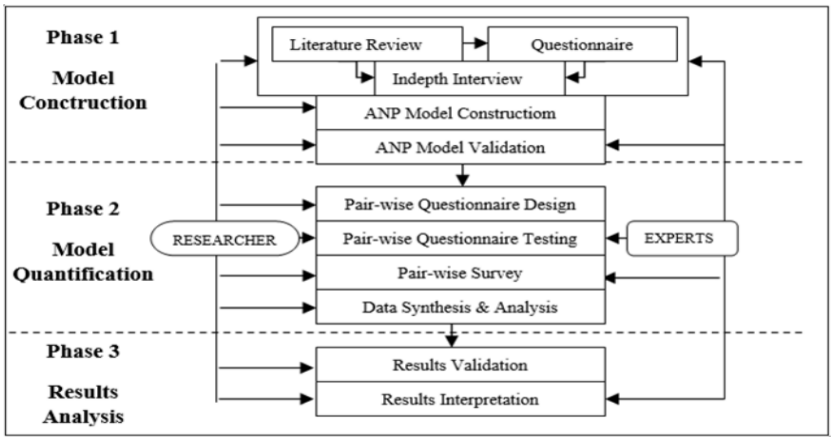

Figure 2.2.4 ANP Model Research Phases

Source: (Saaty & Vargas, 2006)

Based on the ANP construction result and the preceding description, a conceptual framework may be constructed by taking into the ANP network structure, as illustrated in the figure below:

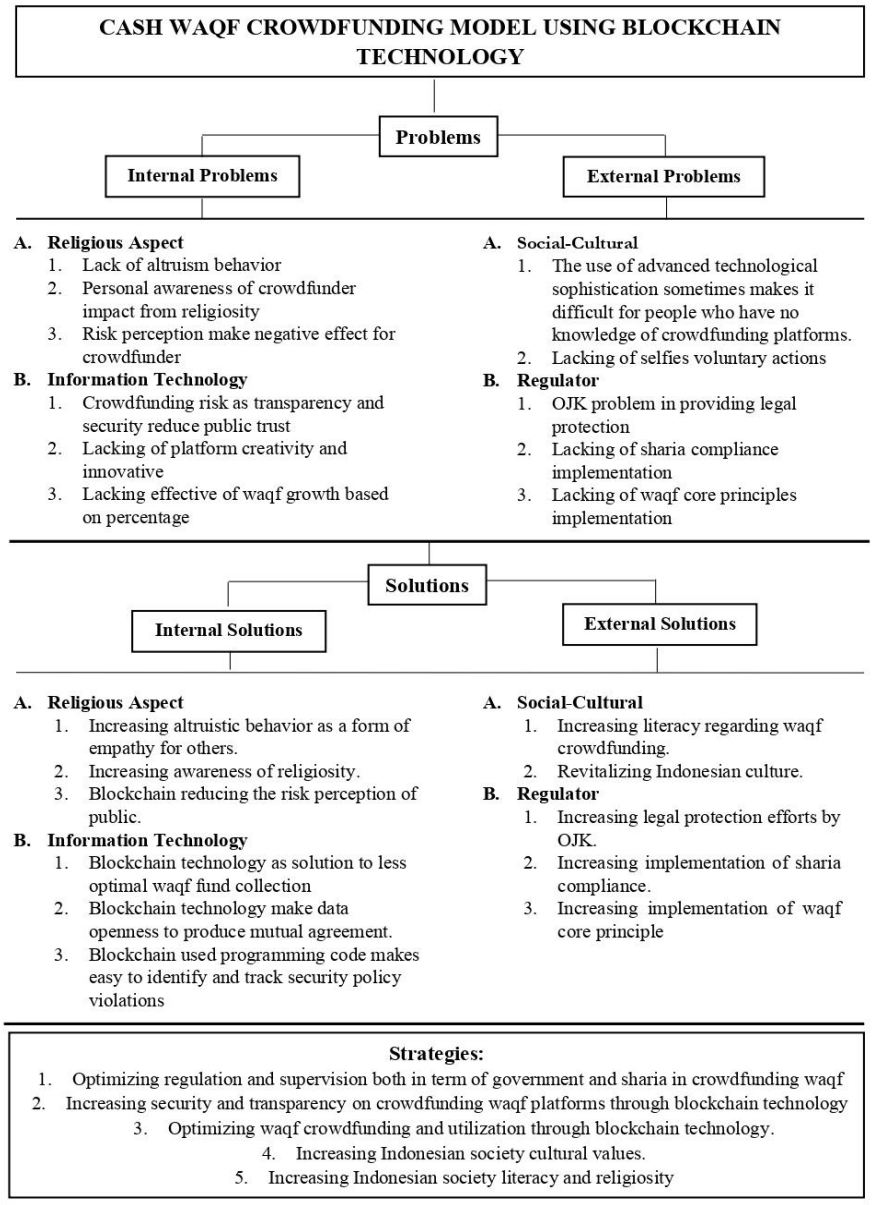

Figure 2.2.5 ANP Network Model
Source: Researcher Elaboration

3. FINDINGS AND DISCUSSION

3.1 Cash Waqf Crowdfunding

Base on the type of crowdfunding, cash waqf crowdfunding (CWS) is included in the scope of donation-based crowdfunding, which is crowdfunding intended for non-profit projects, where organizers do not expect financial returns (Nugroho & Rachmaniyah, 2019). Crowdfunding Waqf Model (CWM represents a collection of waqf funds raised through technology-based platforms. This approach utilizes digital connectivity to invite public participation in financing social or religious projects (Al-Daihani et al., 2025).

Crowdfunding platforms can serve as *nadhir* or cooperate with registered *nadhirs*. Therefore, waqf crowdfunding can be defined as a web-based fundraising mechanism involving many contributors (*wakif jama'i*) whose donations are directed toward waqf objectives. This digital mechanism is regulated under the Financial Service Authority Regulation Number 57/POJK.04/2020 concerning securities offerings through information technology-based services (Azganin et al., 2021).

The waqf institution typically appoints a fund manager to invest the collected cash. Profits generated from the pooled funds are later distributed to beneficiaries, such as farmers, through pre-agreed investment contracts. This model reflects the integration between Islamic social finance principles and digital innovation, forming a hybrid system that enhances waqf's liquidity, reach, and inclusiveness. The cash waqf concept is utilized here to facilitate the financing of farmers, with the illustration in Figure 3.1 below:

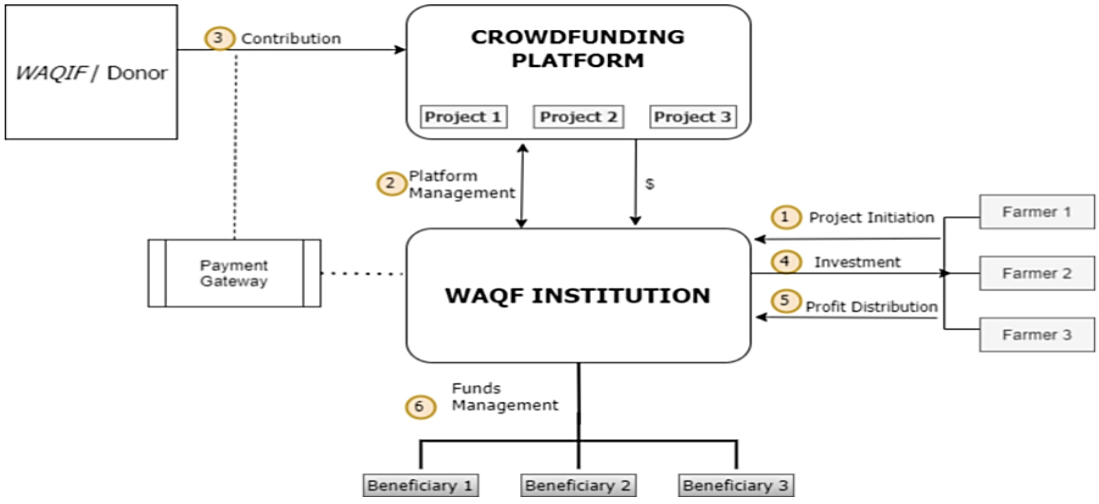

Figure 3.1. Cash Waqf Financing Investment (CWFI)
Source: Azganin, Kassim, and Sa'ad, 2021

However, conventional crowdfunding mechanisms often lack transparency, weak regulatory oversight, and data security risks. In this context, integrating blockchain technology into waqf crowdfunding provides a transformative opportunity to enhance trust and accountability, which are fundamental to Islamic financial ethics (*amanah* and *transparency*).

3.2 Blockchain Technology

Blockchain is a distributed ledger that records all transactions across a network of participants.

Its decentralized nature allows every participant to view, verify, and validate transactions without relying on a single central authority. This technological feature establishes trust through transparency, immutability, and cryptographic verification—qualities that align with the Sharia principle of *amanah* (trustworthiness) and *adl* (justice) (Zulkarnaen et al., 2021) (Syamsuri et al., 2019).

Unlike centralized banking systems where an authorized institution controls the main ledger, blockchain data can be accessed by all verified nodes in the network. Conceptually, this resembles a shared "Google Docs" environment—where all users can verify but not alter previously validated entries. Each block in the chain is cryptographically linked to the previous one, ensuring that any tampering would disrupt the entire chain, making the system inherently secure and transparent (Allessie et al., 2019).

In the context of waqf management, these attributes are particularly valuable. Blockchain ensures that waqf transactions—such as fund collection, investment, and distribution—are recorded transparently and verifiably, reducing risks of fraud or mismanagement that have often hindered public trust in traditional waqf institutions.

3.3 Waqf Crowdfunding Based on Blockchain Technology

The introduction of blockchain also gives rise to *smart contracts*, which automatically execute pre-defined agreements between parties. These contracts operate peer-to-peer without intermediaries, minimizing operational costs and the potential for human error or bias. In waqf management, smart contracts can automate the process of fund disbursement once certain conditions are met—such as project completion verification or *sharia compliance* approval—thus enhancing operational efficiency and integrity (Isyunanda, 2020).

Nevertheless, while smart contracts are recognized within the legal framework of Book III of the Indonesian Civil Code, their specific regulation in the financial sector remains limited. This indicates the necessity for *regulatory innovation* from authorities like Bank Indonesia (BI) and the Financial Services Authority (OJK) to accommodate blockchain-based waqf practices (BWI, 2019).

Furthermore, in waqf crowdfunding, blockchain technology enables the implementation of *smart* contracts, which can automate the disbursement of funds according to pre-defined sharia-compliant conditions. This reduces the risk of human error and moral hazard while ensuring that every waqf transaction is traceable by both donors (*wakif*) and beneficiaries (*mauquf 'alaih*) (Syamsuri et al., 2020). This shift implies a new governance paradigm for waqf institutions: trust is no longer concentrated in a single nadhir or regulator, but distributed across a transparent digital infrastructure (Fedro et al., 2019). This theoretical perspective forms the analytical foundation for interpreting the findings of this study.

DISCUSSION

3.4 Problem with Cash Waqf Crowdfunding

The synthesis of internal and external problem clusters reveals two primary internal factors—religiosity and information technology—and two external factors—socio-cultural and regulatory issues. Result GM Value of Internal and External Problems in cash waqf crowdfunding as follows:

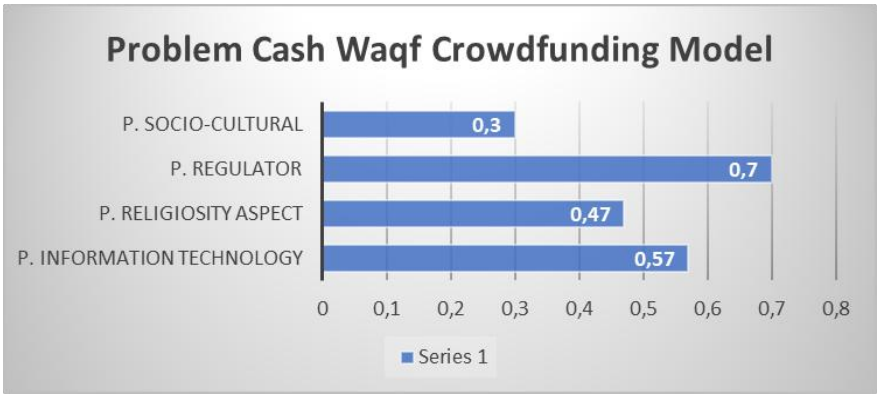

Figure 3.4.1 Result GM Value of Internal and External Problems

Source: Researchers Processed Data

Analyzing internal and external problem clusters in the cash waqf crowdfunding model reveals a complex interaction between technological readiness, religiosity, regulatory frameworks, and socio-cultural adaptation. Using the ANP synthesis, internal factors—particularly information technology (0.57) and religiosity (0.43)—and external factors—namely regulation (0.70) and socio-cultural dynamics (0.30)—emerge as critical determinants influencing the success or failure of blockchain-based waqf crowdfunding.

Based on the geometric results, it is found that the priority of the main problems in the waqf crowdfunding model is. Furthermore, it can be seen in more detail in the following graphs:

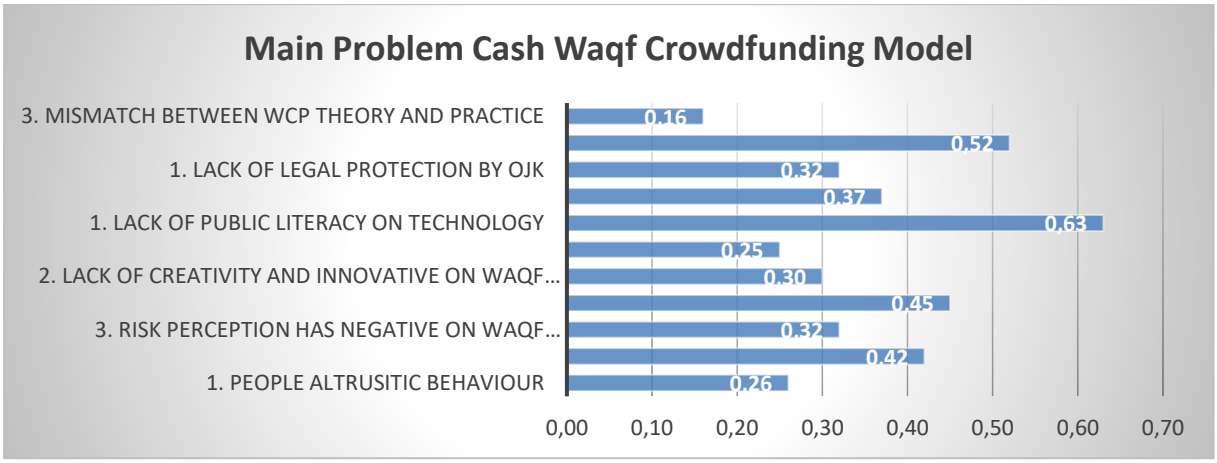

Figure 3.4.2 Problem Priorities of Cash Waqf Crowdfunding

Source: Researchers Processed Data

The graph above shows that the priority of problems in waqf crowdfunding is *the lack of public literacy of Indonesian* society on technology, with a weight of 0,63. The second priority is *the lack of implementation of sharia compliance* at 0,52, and the third priority is the *crowdfunding risk still high* at 45%.

The first problem that is the highest priority in the waqf crowdfunding model was agreed upon by respondents. The results of this study support research conducted by Ahwal (2021), which can be used as a benchmark for public knowledge regarding waqf, especially crowdfunding-based cash waqf (Ahwal, 2021). *The second* most priority problem of lack of sharia compliance implementation support by research conducted by Indria et.al (2023) about waqf core principle and sharia governance (Lenap et al., 2023), and Azganin et.al (2022) about Regulatory Compliance Parameters, Shariah Compliance Parameters, The Risk Management, and Waqf Governance Parameters (Azganin et al., 2021). *The third*

most priority problem of crowdfunding risk is still high and supported by Shalihah et.al (2022) (Shalihah et al., 2022) which includes any problem about legality, security (cybersecurity) and lack of transparent on the crowdfunding platform.

3.4.1 Internal Problems: Digital Capacity and Religious Motivation

The finding that information technology ranks as the most dominant internal problem (0.57) indicates a *structural digital gap* in Indonesia's Islamic philanthropic ecosystem. Many waqf managers and potential donors still rely on conventional mechanisms, reflecting a limited capacity for digital transformation. Respondents in the ANP analysis emphasized the *lack of secure, standardized, and user-friendly platforms* as a key barrier to trust. This aligns with the theory of *digital trust asymmetry*, which argues that users are reluctant to engage with digital financial services without institutional guarantees.

This dominance of technological issues highlights the *systemic vulnerability of waqf institutions* that still depend on traditional data management and manual reporting systems. Without a trusted technological infrastructure, the principles of *amanah* (trustworthiness) and *transparency*—central to Islamic finance—cannot be operationalized effectively. With its decentralized verification mechanism, Blockchain technology directly addresses this weakness by creating a transparent and tamper-proof ledger for recording waqf transactions. Thus, the finding that technology is the top internal challenge not only identifies a practical deficiency but also underscores a *theoretical tension between institutional trust and technological mediation* in Islamic social finance.

The second internal factor, religiosity (0.43), reflects the motivational dimension of waqf participation. ANP respondents noted that *low religio-digital literacy*—a combination of weak religious awareness and limited digital competence—reduces public willingness to participate in online waqf crowdfunding. In other words, even when digital platforms exist, users' trust and engagement depend on their understanding of the waqf's spiritual value and legitimacy. Hence, technological innovation must be accompanied by *religious literacy initiatives* to sustain user participation and align digital practices with the moral foundations of *sadaqah jariyah.*

In line with Harahap et al. (2020), sub-optimal cybersecurity can undermine public trust. Therefore, blockchain implementation is seen as a potential solution, as its decentralized ledger system guarantees data security, verification, and transaction transparency—addressing the very trust gap that hinders participation in waqf crowdfunding (Harahap, Eka Purnama; Aini, Qurotul; Anam, 2020). From a blockchain theory perspective, this finding highlights the *importance of decentralization and immutability* as mechanisms for strengthening data integrity. Implementing blockchain-based waqf systems could minimize fraud and ensure that every transaction is securely recorded and verified, thereby addressing the trust deficit identified by respondents.

3.4.2 External Problems: Regulatory Ambiguity and Socio-Cultural Adaptation

Externally, the regulatory factor emerged as the most significant challenge (0.70). Respondents identified *the absence of clear legal instruments addressing blockchain-based waqf crowdfunding* as a primary obstacle. Although the Financial Services Authority (OJK) regulates crowdfunding under POJK 57/2020, its scope remains limited to equity and donation-based models without specific provisions for *blockchain verification, smart contracts, or waqf-specific governance*. This regulatory gap creates operational uncertainty for institutions attempting to integrate blockchain within Islamic social finance frameworks.

This finding reveals a broader *governance challenge within Indonesia's fintech ecosystem,* where rapid innovation outpaces institutional readiness. This creates a paradox in the context of waqf: while

blockchain promises greater transparency and accountability, its adoption is constrained by *regulatory inertia and fragmented oversight* between OJK, BWI, and MUI. Hence, the dominance of the regulatory issue is not merely a compliance problem but a symptom of *institutional misalignment* within Indonesia's Islamic economic governance.

The socio-cultural factor (0.30) further compounds these challenges. Respondents observed that *community unfamiliarity with digital waqf mechanisms* limits adoption, especially in rural or less digitally literate regions. Cultural trust in traditional *Nadhir* practices often overrides confidence in technology-based platforms. This demonstrates that the success of blockchain-based waqf crowdfunding is not purely technological but also *socio-institutional*, requiring the reconciliation of local religious norms with global digital standards (Wibisono et al., 2022).

This echoes findings by Widodo et al. (2020), who identified challenges in ensuring legal protection for equity crowdfunding services. Similar issues arise in the Islamic finance sector, highlighting the urgency of developing *comprehensive legal and sharia frameworks for blockchain waqf operations.* Conceptually, this reflects a *regulatory lag*—a mismatch between technological innovation and existing legal structures. Blockchain theory suggests that *smart contracts* can serve as programmable legal instruments that reduce regulatory ambiguity through self-executing, transparent compliance mechanisms. However, regulatory bodies such as OJK and BWI must establish *standardized frameworks* that reconcile sharia compliance with digital governance for practical adoption.

3.4.3 Integrated Interpretation: Blockchain as a Structural Corrective Mechanism

The interdependence between internal (technology, religiosity) and external (regulation, socio-culture) factors reveals that the challenges of waqf crowdfunding are not isolated, but *structurally embedded* within Indonesia's digital and institutional ecosystem. Technological limitations reduce transparency, undermining regulatory trust; weak regulations discourage innovation, perpetuating technological stagnation. This cyclical relationship creates what can be termed a *"trust deficit loop"* in digital waqf management.

Theoretically grounded in *distributed trust and algorithmic governance*, blockchain offers a potential resolution to this structural impasse. By decentralizing verification and ensuring immutability, blockchain reduces dependence on human intermediaries and strengthens regulatory traceability. It transforms compliance from a reactive process into an embedded feature of the system—aligning with the Sharia principle of *hisbah* (self-regulation).

From an institutional perspective, adopting blockchain mitigates internal issues (by automating transparency and data security) and addresses external ones (by providing regulators with auditable transaction trails). Hence, the empirical dominance of technology and regulation as the main problems reflects the *precise domains where blockchain can serve as a transformative solution*—bridging the gap between digital infrastructure, governance, and religious accountability.

In summary, while the quantitative ANP results identify information technology and regulatory implementation as dominant problems, their deeper meaning lies in exposing Indonesia's waqf ecosystem's *institutional fragility and digital asymmetry*. Addressing these requires more than technical upgrades; it demands an integrated blockchain-based governance model that redefines trust, accountability, and compliance in Islamic philanthropy.

3.5 Solution for Strengthening Blockchain-Based Cash Waqf Crowdfunding

Based on the geomean results, the ANP results identified three primary internal and external solutions; more details can be seen in the following figure:

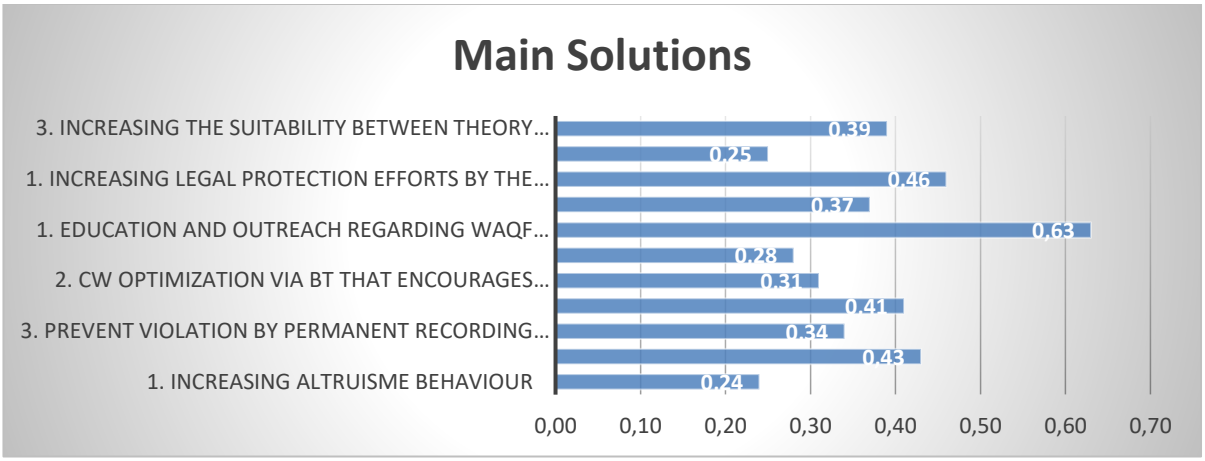

Figure 3.5.1 Main Solutions Priorities of Waqf Crowdfunding
Source: Researchers Processed Data

From the graph above, it can be seen that the priority of the solution is identified as three solutions:

1. **Education and public outreach on blockchain-based waqf crowdfunding (weight = 0,63)**

From a blockchain perspective, the first solution addresses the *knowledge gap in digital trust systems.* Public literacy in blockchain and waqf mechanisms is essential to mitigate skepticism about online donations. The concept of "*trust through transparency*" is central here: when donors can view immutable transaction records on-chain, trust shifts from intermediaries to technology. The results of this study support research conducted by Amin Andri (2022) that shows public literacy about waqf depends on religiosity, so increasing public literacy is associated with increasing religiosity. (Jawi & Soemitra, 2022)

2. **Enhancing legal protection and supervision by regulators (OJK, BWI) (0,46)**

The second solution underscores the *need for regulatory innovation*. Rather than applying conventional financial regulations to digital waqf, regulators must design *adaptive legal standards* incorporating blockchain's decentralization and traceability features. For instance, regulators could explore *RegTech* approaches for real-time supervision of waqf transactions via blockchain data analytics. The results of this study support research conducted by Viodi and Dona (2020), its shows that the crowdfunding problems was found in providing legal protection to the parties faced by the Financial Services Authority in equity crowdfunding services are divided into three factors, namely: (a) legal substance, (b) legal structure, and (c) legal culture (Childnadi Widodo & Budi Kharisma, 2020).

3. **Increasing religiosity awareness to strengthen waqf participation (0,43)**

The third solution—enhancing religiosity—reflects the *ethical foundation of blockchain in Islamic finance,* where technology is a tool for efficiency and a means to reinforce spiritual values of honesty, accountability, and social welfare (*maslahah*). The results of this study support research conducted by Zulfian (2020) showed increasing awareness of religiosity through rewards to increase people's interest in donating in the afterlife. (Zulfian, 2020)

3.6 Strategic Priorities for Cash Waqf Crowdfunding Based on Blockchain Technology

The Analytic Network Process (ANP) results reveal three strategic priorities for developing cash waqf crowdfunding through blockchain technology:

(1) increasing platform security and transparency (0.29),
(2) enhancing public literacy and religiosity (0.25), and
(3) optimizing regulation and supervision from both legal and Sharia perspectives (0.19).

While these priorities seem distinct, they are in*terdependent components* of a broader socio-technical ecosystem where technological reliability, social acceptance, and institutional trust reinforce one another. Based on the geomean results, it is found that the priority solution to solve the main problems of waqf crowdfunding. More details can be seen in the following graphs:

Figure 3.6.1 Strategy Priorities of Waqf Crowdfunding Based on Blockchain Technology
Source: Researcher, Data Processed

From the graph above, it can be seen that the final synthesis identifies three strategic priorities:

1. Security and Transparency: Building Technological Trust

The dominance of the first strategy—improving platform security and transparency—directly corresponds to the earlier finding that information technology is the most critical internal problem (0.57). This strategy addresses the root cause of digital distrust, where users hesitate to donate or invest waqf funds online due to concerns about data integrity, misuse, or fraud.

Blockchain contributes to this strategy as a technological enhancement and a trust architecture. Its decentralized ledger and immutability features ensure that every transaction is verifiable and tamper-proof, reducing opportunities for data manipulation or unauthorized fund diversion. Through smart contracts, blockchain embeds compliance mechanisms directly into the system—turning Sharia and regulatory rules into programmable logic. This transforms transparency from a voluntary reporting practice into an automated governance function.

However, this technological trust has limits. Blockchain cannot by itself ensure that information uploaded to the system is accurate, nor can it replace the ethical accountability (*amanah*) of waqf managers. Therefore, technological transparency must be supported by institutional verification and moral oversight, demonstrating that blockchain is necessary but not sufficient for systemic trust.

This directly relates to blockchain's theoretical foundation of *decentralized consensus* and *cryptographic validation*, which minimizes fraud and ensures accountability. For waqf institutions, implementing blockchain can serve as a digital *audit trail*, reducing dependence on manual oversight. The results of this study support research conducted by Fattah et al. (2022) showed that blockchain

technology which is a smart application capable of accommodating large-scale big data, can support and improve waqf crowdfunding in the digital era. (Fattah, 2022)

2. Public Literacy and Religiosity: Strengthening Social Legitimacy

The second strategic priority—enhancing public literacy and religiosity—addresses the second dominant internal issue: low religio-digital literacy and limited public understanding of waqf's spiritual and economic value. While blockchain can secure transactions, it cannot automatically generate *niyyah* (intention) or *tawakkul* (trust). Respondents in the ANP process noted that many potential donors remain hesitant to engage with digital waqf platforms because they perceive them as impersonal and distant from the traditional spirit of waqf ibadah.

Thus, literacy and religiosity programs are essential for bridging the gap between digital efficiency and spiritual meaning. Educational campaigns can contextualize blockchain not as a replacement for religious intention but as a facilitator of transparent *amal jariyah* (perpetual charity). Increasing literacy also mitigates the adoption gap by empowering users to understand, evaluate, and monitor digital waqf systems.

This strategy, therefore, interacts with the first: technological trust requires social understanding, and literacy programs create the informed user base needed for blockchain's benefits to materialize. Without adequate literacy, the transparency offered by blockchain remains underutilized—a case of "*technology without transformation*." The results of this study support research conducted by Abdillah and Danial (2015) and Zulfian (2020) showed that education and outreach regarding waqf crowdfunding based on blockchain technology to increase public understanding of the benefits of combining waqf fund collection with technology (Abdillah & Danial, 2015) (Zulfian, 2020).

3. Regulatory and Supervisory Optimization: Institutionalizing Accountability

The third strategy—optimizing regulation and supervision—connects directly to the most dominant external problem (regulatory ambiguity, 0.70). Blockchain's potential to ensure transparency will not yield its full benefit unless accompanied by institutional alignment among the Financial Services Authority (OJK), Indonesian Waqf Board (BWI), and sharia councils.

Regulatory optimization serves two purposes: (1) it translates blockchain's technical logic of distributed verification into formal accountability mechanisms, and (2) it ensures legal interoperability between fintech regulations, waqf governance, and sharia compliance. This means developing clear guidelines for blockchain-based waqf management, including smart contract validation, data privacy, and zakat–waqf integration.

Importantly, regulation also functions as a cyber-risk mitigator. The earlier analysis identified cybersecurity risk as one of the top practical challenges in digital waqf systems. Legal supervision can set minimum security standards, establish audit trails, and define liability in the case of data breaches—thereby institutionalizing the preventive functions that blockchain alone cannot enforce. The results of this study support research conducted by Apriani et.al (2023) showed that increasing regulatory compliance, both in terms of law and sharia, by using blockchain technology-based waqf crowdfunding to uphold the benefit of the world and avoid losses.

3.7 Integrative Analysis: Toward a Socio-Technical Governance Framework

The three strategies—technological (security), social (literacy), and institutional (regulation)—are not standalone interventions but mutually reinforcing pillars of a unified governance system.

- Security and transparency generate *technological trust*.
- Literacy and religiosity generate *social legitimacy*.
- Regulation and supervision generate *institutional accountability*.

Their synergy can be conceptualized as a *"Blockchain-Based Waqf Governance Triangle"*, where each dimension supports and constrains the others. Blockchain functions as the *technical enabler*, but its sustainability depends on social acceptance and institutional adaptation.

This integrated perspective reframes blockchain not simply as a digital infrastructure but as a *socio-technical instrument of sharia governance*—embedding ethical norms, procedural transparency, and regulatory compliance into a single operational system. Yet, the analysis also reveals blockchain's limitation: its inability to resolve non-technical challenges such as public distrust, religious interpretation, or bureaucratic inertia. Hence, the strategic implication is clear—*the success of blockchain in waqf crowdfunding depends on the co-evolution of technology, society, and regulation.*

From a theoretical standpoint, these strategic priorities illustrate how *Islamic philanthropy in the digital era must transition from value-based management to system-based governance*. Blockchain enables *hisbah*-like self-supervision, but human and institutional elements remain the moral anchors ensuring that digital efficiency aligns with maqasid al-shariah principles—justice, transparency, and public welfare (*maslahah*).

Practically, the integrated strategy provides a roadmap for waqf institutions:

- Adopt blockchain to institutionalize transparency,
- Run national literacy programs to normalize digital waqf practices, and
- Collaborate with regulators to develop comprehensive blockchain waqf frameworks.

In conclusion of the strategy section, while ANP results rank security, literacy, and regulation as the top strategies, their significance lies in how they collectively transform blockchain from a technical innovation into an ethical–institutional infrastructure. The future of blockchain-based waqf crowdfunding depends not only on stronger code but on stronger conscience, regulation, and community participation—where technology serves as both tool and testimony of trust in Islamic social finance.

4. CONCLUSION

This study concludes that developing cash waqf crowdfunding platforms requires an integrated approach that combines technological, social, and regulatory strategies. The Analytic Network Process (ANP) results highlight three strategic priorities: enhancing platform security and transparency through blockchain integration (29%), improving public literacy and religiosity (25%), and optimizing legal and sharia-based regulation and supervision (19%). Among these, blockchain technology proves most effective in addressing data security and transparency issues, yet its impact remains limited when socio-institutional gaps—such as low literacy and weak governance—persist.

Theoretically, this study contributes to the growing discourse on digital Islamic finance by demonstrating how blockchain can operationalize maqasid al-shariah values of trust and accountability. Practically, it provides policy insights for regulators and waqf institutions to strengthen digital governance frameworks. However, the limited number of expert respondents constrains the generalizability of the results. Future research should expand to empirical or comparative case studies to measure blockchain's real-world performance in improving compliance, transparency, and public engagement within Islamic philanthropic ecosystems.

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