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Designing an Integrated Blockchain-Based Waqf Governance Model for Indonesia: Delphi-Likert Approach

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Abstract

Waqf experiences significant developments every year. At the same time, transparency and accountability remain crucial challenges related to waqf in Indonesia. This study aims to identify the key characteristics of blockchain-based waqf governance and propose a relevant governance model in the Indonesian. The digitalization of waqf through blockchain technology offers significant opportunities to enhance transparency and accountability in waqf governance in Indonesia. To identify characteristics and propose a relevant model in the Indonesian context, a Delphi-Likert method was used, involving eleven respondents comprising academics, regulators, and practitioners in the waqf and blockchain fields. The results indicate that the most important aspects for blockchain integration are strengthening the database system, collecting, and managing waqf. The majority of respondents believe blockchain needs to be implemented immediately, with a preference for hybrid and public networks. Furthermore, a limited open ecosystem is seen as the most realistic form of governance because it balances the need for transparency with the protection of the institution's internal data. This study contributes theoretically to the literature on Islamic social finance and practically provides recommendations for an integrated governance model for waqf institutions in Indonesia.
Keywords: Blockchain; Delphi-Likert; Governance; Model; Waqf

Abstrak

Wakaf mengalami perkembangan yang signifikan setiap tahunnya. Pada waktu yang sama, permasalahan transparansi dan akuntabilitas masih menjadi tantangan krusial terkait wakaf di Indonesia. Penelitian ini bertujuan mengidentifikasi karakteristik utama tata kelola wakaf berbasis blockchain dan mengusulkan model tata kelola yang relevan dalam konteks Indonesia. Digitalisasi wakaf melalui teknologi blockchain menawarkan peluang besar untuk meningkatkan transparansi dan akuntabilitas tata kelola wakaf di Indonesia. Untuk menemukan karakteristik dan usulan model yang relevan dalam konteks Indonesia, maka pendekatan Delphi-Likert dengan melibatkan sebelas responden terdiri dari akademisi, regulator, dan praktisi pada bidang wakaf dan blockchain. Hasil penelitian menunjukkan bahwa aspek yang paling penting untuk diintegrasikan dengan blockchain adalah penguatan sistem database, penghimpunan, dan pengelolaan wakaf. Mayoritas responden menilai bahwa blockchain perlu diimplementasikan segera dengan preferensi pada jaringan hybrid dan publik. Selain itu, ekosistem terbuka terbatas dipandang sebagai bentuk tata kelola paling realistis karena mampu menyeimbangkan kebutuhan transparansi dengan perlindungan data internal lembaga. Penelitian ini berkontribusi secara teoritis dalam memperkaya literatur keuangan sosial Islam dan secara praktis memberikan rekomendasi model tata kelola terintegrasi bagi Lembaga wakaf di Indonesia.
Kata kunci: *Blockchain; Delphi-Likert; Tata Kelola; Model; Wakaf*

INTRODUCTION

The rapid development of digital technology has generated significant benefits for the governance of financial institutions. Among the most prominent innovations is blockchain technology, which is characterized by decentralization, persistency, anonymity, and auditability (Wang et al., 2018). Blockchain has been widely applied across various sectors, including cryptocurrency, financial services, public and private administration, insurance, healthcare, supply chain management, and the Internet of Things (Shrimali & Patel, 2022). More recently, it has attracted increasing attention in the context of Islamic social finance. In waqf management, blockchain technology is believed to address several long-standing challenges, such as limited transparency, the absence of a centralized and reliable data repository, misuse by custodians, difficulties in tracing impact, and, most importantly, issues of public trust (Aysan & Al-Saudi, 2023). Consequently, the integration of blockchain into waqf governance has emerged as an important area of scholarly discourse that warrants further investigation.

With the rapid advancement of financial technology, blockchain offers transformative opportunities for waqf institutions by enhancing transparency, security, and operational efficiency, thereby strengthening public trust (Mohsin & Muneeza, 2019). Decentralized blockchain systems reduce the risks associated with manipulation by centralized authorities and improve efficiency by eliminating barriers inherent in traditional financial systems (Mokthar et al., 2024). In addition, blockchain enhances data security and privacy through encryption and distributed ledger mechanisms, which make the system more resilient to cyberattacks and unauthorized access. By supporting user anonymity while maintaining transaction transparency, blockchain effectively balances privacy with accountability (Marsal-Llacuna, 2018).

The integration of Islamic social finance and blockchain technology represents a compelling research domain, particularly given the rapid pace of technological innovation and the substantial potential of Islamic social finance to support Islamic financial development in Indonesia (Shifah & Marliyah, 2025). From an academic perspective, such research is crucial for understanding how technological integration can serve as a catalyst for addressing the institutional and governance challenges currently faced by waqf organizations. Accordingly, this study aims to contribute to the development of waqf in Indonesia and to inform the formulation of more effective policies for optimizing waqf potential and enhancing the attractiveness and credibility of waqf institutions.

Several countries have implemented blockchain technology within their socio-economic systems. China, Switzerland, Singapore, and the United States are at the forefront of blockchain innovation, with major technology firms such as IBM and Microsoft actively developing blockchain-based solutions (Mobiloitte, 2024). In addition, the United Arab Emirates has initiated the integration of blockchain into its financial system to support the Dubai World Trade Center program (Elbahrawy,

2021). These cases illustrate that financial digitalization through blockchain technology offers a potential breakthrough in addressing governance challenges in financial systems, including those related to Islamic social finance.

Previous studies have examined the integration of waqf and blockchain from various perspectives. Early studies highlight the role of digital innovation in cash waqf collection and distribution, where digital platforms and financial instruments, including blockchain, are increasingly used to facilitate donations (Hasbulah et al., 2025; Falah & Fitrianto, 2023; Fauzi et al., 2023). More specific studies address blockchain's contribution to governance, such as its advantages in ensuring data security, transaction transparency, decentralization (Arwani & Priyadi, 2024), and accountability (Wildana & Imamia, 2022), while others emphasize its implications for fund management (Salsabila et al., 2023).

Several blockchain-based waqf frameworks have also been proposed, including Ethereum, Hyperledger, Finterra Waqfchain, and Waqf Blockchain, with Ethereum often identified as the most suitable platform (Huang & Nordin, 2021). Additional studies have introduced performance measurement systems to optimize waqf governance (Zulaikha & Rusmita, 2018). At the institutional level, studies highlight organizational maturity as a prerequisite for adoption (Salleh et al., 2023), the role of blockchain in waqf sustainability (Kasmon et al., 2023), and governance frameworks tailored to waqf institutions (Khairil Faizal Khairi et al., 2023). Other studies examine stakeholder perspectives, indicating that donor adoption is influenced by performance expectations, social influence, and facilitating conditions (Mokthar & Sapuan, 2023), while several authors underscore the importance of regulatory clarity in addressing legal and sharia-related uncertainties (Budi Santoso & Kusuma, 2023; Aysan & Al-Saudi, 2023; Vidiati et al., 2021). Although existing studies provide valuable insights into the potential, benefits, and impacts of blockchain technology in waqf management, much of the current literature remains conceptual in nature. Moreover, limited research has systematically identified the defining characteristics required for an effective blockchain-based waqf governance model that aligns with both technological capabilities and institutional needs.

Based on these research gaps, the first objective of this study is to identify the essential characteristics of blockchain-based waqf governance using the Delphi method combined with Likert-scale measurement (Delphi–Likert). This approach enables the identification of core criteria that a viable blockchain-based waqf governance model must fulfill. The second objective is to propose a blockchain-based waqf governance model that is both relevant and feasible for implementation in the Indonesian context.

LITERATURE REVIEW

Waqf Governance

Several studies have been conducted on waqf governance for various purposes. A literature survey was conducted by Zulkifli et al. (2022) who provided a systematic literature review on waqf governance. A total of 49 documents were

published between 2011 and 2022 on waqf governance. A literature study was also conducted by Ramdani et al. (2024) on the implementation of Islamic values in waqf governance. This study describes monotheism, justice, accountability, trustworthiness, deliberation, awareness of Allah, amar ma'ruf nahi munkar, and the objectives of sharia in waqf governance. Furthermore, there is a systematic literature review study on waqf institutions, where the research is categorized into three themes: governance and accountability of waqf institutions; waqf-based financial and sustainability models in Islamic social finance; and the socio-economic impact of waqf institutions (Kamaruzaman & Ishak, 2023).

A number of these studies have been conducted in several countries besides Indonesia, such as Guinea (Sano & Kassim, 2021), Brunei Darussalam (Abu Bakar et al., 2020), Malaysia (Kamaruddin & Hanefah, 2021), Singapore, Kuwait, and the United Arab Emirates (UAE) (R. Hassan et al., 2022). On the other hand, several studies have also been conducted in Indonesia. For example, Syamsuri et al. (2021) study on strategies to improve waqf quality through Good Waqf Governance (GCG). R. Hassan & Yusoff (2020) study also discusses how to improve good governance in waqf institutions, where having a good governance system is a crucial way to resolve the problems faced by waqf institutions, making governance an unquestionable aspect for the success of waqf institutions. Mohamad Yunus et al. (2024) also provides a critical review of improving waqf governance for sustainability, citing the need for rigorous empirical research to inform decision-making and policy formulation in waqf governance.

Instruments for evaluating and measuring the implementation of sharia governance by waqf administrators need to be considered. Askia & Beik (2024) proposed a measurement in his research, namely the Waqf Administrator Sharia Governance Index (SGIWN). This index was developed in two steps: designing the index model and weighing the index components. This study successfully developed the Waqf Administrator Sharia Governance Index, which consists of 5 dimensions, 16 variables, and 46 indicators. This study also successfully calculated the weight of each indicator in the index. The Implementation Index of Waqf Core Principle (IIWCP) derived from the WCP has been formulated to evaluate the implementation of WCP in waqf nadzir organizations. Aryana & Hasan (2023) shows that IIWCP has a nazhir governance dimension consisting of five indicators, namely good nazhir governance (WCP 13), sharia compliance and internal audit (WCP 26), financial reporting and external audit (WCP 27), disclosure and transparency (WCP 28), and misuse of waqf services (WCP 29). Purwanti & Pramono (2024) examined the implementation of Good Nazir Governance (GNG) in Indonesian Waqf Institutions using the GNG Index as an assessment tool. Saprida et al. (2024) examined the analysis of the legality and management of productive cash waqf in Indonesia, emphasizing its alignment with the Sustainable Development Goals (SDGs). Waqf practices in Indonesia are still underutilized, with inefficiencies in waqf asset management hampering their potential contribution to community welfare. Adinugraha et al. (2024) emphasized in

his research the transformation of cash waqf governance through digitalization, which has proven to be an applicable solution.

The primary focus of previous research has been the need for sound waqf governance and its systems to positively impact waqf providers, particularly the institution itself. However, much of this research remains conceptual in nature, although some studies have been conducted normatively and have not explicitly provided insights into how comprehensive waqf governance can be implemented to support the existing waqf ecosystem.

Waqf Blockchain

There has been a growing body of research exploring the integration of blockchain into waqf management, particularly in the context of enhancing transparency, accountability, and efficiency. Early studies highlight the role of digital innovation in cash waqf collection and distribution. For instance, Hasbulah et al. (2025) demonstrate how digital platforms and emerging financial instruments, including blockchain, are increasingly used to facilitate donations, while Falah and Fitrianto (2023) as well as Fauzi et al. (2023) emphasize the significant potential of digital-based waqf in Indonesia's philanthropic ecosystem. These findings suggest that technological adoption is not only reshaping waqf fundraising but also expanding its reach and inclusivity.

More specific studies address blockchain's functional contribution to waqf governance. Arwani and Priyadi (2024) stress its advantages in ensuring data security, transaction transparency, and system decentralization. Similarly, Wildana and Imamia (2022) discuss how blockchain strengthens accountability and governance mechanisms, while Salsabila et al. (2023) argue that its use has direct implications for more efficient fund management. To operationalize such potential, frameworks for blockchain-based waqf management have been proposed. Huang and Nordin (2021) review various blockchain platforms—Ethereum, Hyperledger, Finterra Waqfchain, and Waqf Blockchain—arguing that Ethereum demonstrates the highest suitability for waqf management applications. Complementary to this, Zulaikha and Rusmita (2018) propose a blockchain-enabled performance measurement system designed to optimize waqf governance.

At the institutional level, Salleh et al. (2023) explore the challenges and prerequisites of applying blockchain to waqf institutions, concluding that organizational maturity is critical before adopting performance measurement systems. Kasmon et al. (2023) expand the discussion by considering the sustainability of blockchain-based waqf from Middle Eastern and Asian perspectives, emphasizing its potential contribution to sustainable socio-economic development. Building on governance dimensions, Khairil Faizal Khairi et al. (2023) propose a blockchain governance framework tailored for waqf institutions, integrating formation and context, actors, and decision-making tools into a multi-layered approach.

Research has also examined stakeholder perspectives. Mokthar and Sapuan (2023) find that performance expectations, social influence, and supportive

conditions positively shape donor intentions to adopt blockchain-based waqf in Malaysia. Nevertheless, several studies stress the necessity of regulatory and legal clarity. Budi Santoso and Kusuma (2023), along with Aysan and Al-Saudi (2023), highlight that legal and sharia-related uncertainties pose substantial risks, while Vidiati et al. (2021) note that the absence of a solid legal framework remains one of the key drawbacks of blockchain-based waqf.

Various studies have explored the potential of blockchain in waqf management, particularly in enhancing transparency, accountability, and operational efficiency. While the reviewed literature highlights the potential, benefits, and impact of blockchain adoption in waqf governance, much of the research remains conceptual. Moreover, existing studies that propose blockchain-based waqf governance models are often limited in scope, as they do not fully capture the essential characteristics required for an effective governance framework. Consequently, there is a need for further research to develop a more comprehensive model that integrates the defining features necessary to ensure the suitability and sustainability of blockchain-based waqf governance.

RESEARCH METHOD

This study employed the Delphi-Likert method to identify and organize data related to the characteristics of blockchain-based waqf governance. Delphi was used to gain consensus from experts on still-controversial aspects of blockchain use in waqf. The Delphi method requires respondents with relevant knowledge for at least one focus group discussion (Hsu & Sandford, 2007). FGD sizes can range from 3 to 21 respondents, or more specifically, 6 to 12 respondents (Nyumba et al., 2018).

The informant selection technique in this study employed purposive sampling, where individuals are considered to have knowledge of the researcher's expectations or perhaps possess authority, thus facilitating the study's exploration of the object or social situation under study (Sugiyono, 2013). Respondent selection was conducted deliberately, taking into account their understanding of the issues in two main topics: waqf and blockchain.

Furthermore, because key stakeholders in blockchain-based waqf include experts, waqf or blockchain practitioners, and regulators, we will divide the respondents into two groups: seven expert respondents and four practitioner respondents. The experts include academics from various universities focused on waqf and blockchain technology research, as well as regulators in the waqf sector. Meanwhile, the practitioner respondents include representatives from major waqf administrators in Indonesia, relevant blockchain associations, and blockchain provider companies. Therefore, a comprehensive perspective will be obtained.

Table 1. Respondents of the Study

Type of Responden	Delphi	Respondents	Description
Expert	7	SL	Lecture at Postgraduate Program UNIDA Gontor
		NH	Yarsi University
		MA	ICAST
		NHR	Lecture at FEB Universitas Airlangga
		SZ	Lecture at FEB Universitas Airlangga
		AR	Badan Wakaf Indonesia (BWI)
		IFM	Dirzawa Kemenag RI
Practicioner	4	HS	Asosiasi Fintech Syariah Indonesia (AFSI)
		JA	Asosiasi Blockchain Syariah Indoensia (ABSI)
		INA	Asosiasi Nazhir Indonesia
		SA	iBantu.co
All	11		All 7 Expert + 4 Practicioner

Source: Authors' compilation

The data collection techniques used in this study were two methods: in-depth interviews and a Delphi-Likert questionnaire. The Delphi method requires researchers to develop an initial questionnaire to begin the process (Hsu & Sandford, 2007). This allows researchers to gain insight into the problem or subject by reviewing relevant literature. At this initial stage, in-depth interviews with relevant practitioners can yield further insights.

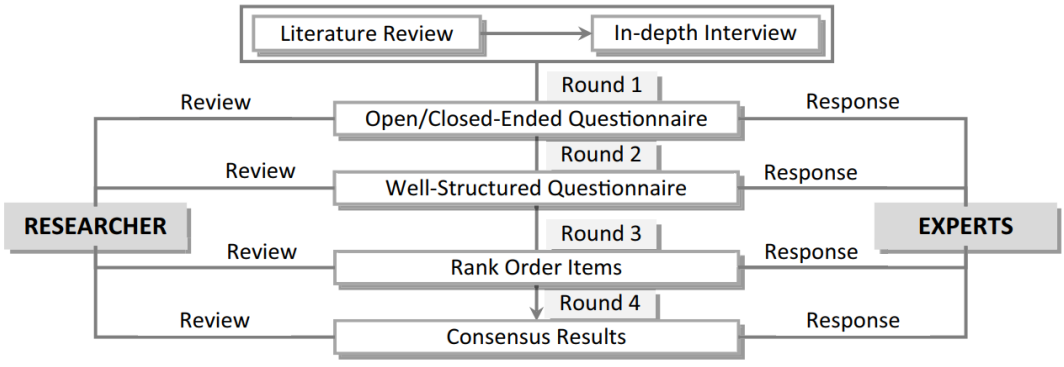

Figure 1. Step of Delphi-Likert

Source 1. (Ascarya et al., 2023)

In Round 1, anonymous practitioners selected to participate in the research will be asked to complete an initial questionnaire, which can be open-ended (traditional Delphi) or closed-ended (modified Delphi). They will also be asked to share their thoughts on the relevant issue or topic, and then complete the questionnaire. To assess the list of elements summarized by the researchers based on the responses from Round 1, respondents in Round 2 will be asked structured questions that reflect the results of Round 1. To prioritize the collected elements,

respondents will then rank them. The result will be an initial consensus, indicating the importance of disagreements and agreements.

If the results of Round 2 are concordant, the process can be stopped; if not, the process will proceed to Round 3, where respondents with extreme or divergent views will be invited to reconsider their positions and possibly explain their reasons. At the end of Round 3, the researchers will reassess whether they have reached consensus in the second consensus. The procedure is stopped if successful, but if not, it will be repeated in Round 4 and beyond.

RESULTS AND DISCUSSION

This section will discuss the results of a survey conducted on two groups of respondents totaling 11 respondents from experts and practitioners of waqf and blockchain management using the Delphi-Likert method regarding various characteristics of blockchain-based waqf governance, using priority rankings and a Likert scale of 1–5, where 1 and 2 are considered disagree, 3 is neutral, while 4 and 5 are considered agree. This ranking is used to calculate the level of assessor agreement or Kendall's concordance (K) of respondents on these issues.

Characteristics of Blockchain Adoption in Waqf Governance: Sectors, Timing, and Network Types

The first part of Table 2, based on respondent data, the most agreed-upon aspect for integration with blockchain is strengthening the database system, with eight respondents agree, two neutral, and one disagree. This percentage represents the highest level of agreement compared to other aspects, indicating a relatively strong consensus among respondents. Furthermore, the collection aspect also received significant support, with seven respondents agree, two neutral, and two disagree, indicating that the majority of respondents view this function as crucial for blockchain technology. Therefore, these two aspects can be understood as critical points in building accountable, blockchain-based waqf governance.

Furthermore, the second part of table 2 shows the highest level of agreement regarding the timing of blockchain implementation in waqf governance was now, although three respondents disagreed. This was followed by the gradual implementation option, which received a significant response, with three respondents neutral and one respondent disagree. This reflects the consensus among experts and practitioners that the need for blockchain implementation in the waqf ecosystem in Indonesia is urgent and necessary, in line with the urgency of increasing transparency, accountability, and public trust in waqf management. Thus, the majority of respondents' preference for immediate implementation indicates that blockchain integration is not only considered a technological innovation but also a strategic necessity for strengthening waqf governance in Indonesia.

Moreover, the last part of table 2 has confirm the most suitable blockchain network types for implementation in the waqf ecosystem are hybrid and public. Eight respondents agreed, one neutral, and one disagreed with the hybrid network type,

and seven agreed, two neutral, and one disagreed with the public network type. Experts and practitioners agreed that the network system must be open, as this aligns with the nature of waqf, which is community funds, and donors need to be transparent about the collection, management, and distribution process. Hybrid networks are private, so not all-important institutional data needs to be disclosed to the public, given that the process involves confidential data.

Meanwhile, only three respondents agreed, four neutral, and three disagreed with private networks. This network allows only a few internal parties to access waqf institution data, which contradicts the transparent and accountable nature of waqf. Consortium networks emphasize multiple entities or parties building a blockchain together, allowing each institution within the same scope to access each other's data. This impacts the internal policies of waqf institutions, which need to restrict external access. With five in favor, four neutral, and two against, this network has not yet reached consensus for its application within the waqf ecosystem. Therefore, hybrid and public networks are highly suitable for adoption by waqf institutions in Indonesia.

Table 2. Characteristics of Sectors, Timing, and Network Types

1	**The waqf sector needs to be integrated with blockchain**	**Agree**	**Neutral**	**Disagree**
1.1	Collection	8	2	1
1.2	Management	7	2	2
1.3	Distribution	7	2	2
1.4	Database system strengthening	9	1	1
1.5	Registration and reporting system	5	3	3
1.6	Integrated (all required in one)	6	3	2
2	**Timing to Adopt Waqf Blockchain**	**Agree**	**Neutral**	**Disagree**
2.1	now	7	0	4
2.2	in the short term	4	5	2
2.3	in the long term	4	3	4
2.4	gradually from now	7	3	1
2.5	Not necessary in the near future	2	3	6
3	**Types of blockchain networks**	**Agree**	**Neutral**	**Disagree**
3.1	Public	7	3	1
3.2	Private	3	4	4
3.3	Hybrid	8	2	1
3.4	Consortium	6	4	1
3.5	adapt to the needs of the institution	5	2	4

Characteristics of Blockchain Adoption in Waqf Governance: Institutional, Third-Party, and Responsive Perspectives

The Indonesian Waqf Board (BWI), Nazhir, and LKS PWU need to adopt blockchain in waqf governance. Eight to nine respondents agreed that these three institutions are pioneers in implementing blockchain-based waqf governance in Indonesia. Waqf institutions' response to the potential of blockchain-based waqf requires immediate internal policy development. Eight respondents agreed, while

three were neutral, suggesting the need for practical steps to address blockchain technology.

Table 3. Characteristics of Institutional, Third-Party, and Responsive Perspectives

4	Waqf institutions that need to adopt Blockchain	Agree	Neutral	Disagree
4.1	BWI	8	2	1
4.2	Nazhir	8	2	1
4.3	LKS PWU	10	0	1
4.4	Waqf-based educational institutions	3	4	4
4.5	Waqf-based social and philanthropic institutions	6	4	1
4.6	Any institutions	1	4	6
4.7	All institutions	4	1	6
5	**Actors involved (third party)**	**Agree**	**Neutral**	**Disagree**
5.1	Fund Manager	10	0	1
5.2	Aset manager	7	3	1
5.3	Auditor	6	3	2
5.4	Provider blockchain	7	4	0
5.5	Asuransi (Insur-tech)	3	5	3
5.6	Validator user/wakif	5	3	3
5.7	wherever needed	5	0	6
5.8	all parties	4	1	6
6	**Waqf institutions' responses to BC potential**	**Agree**	**Neutral**	**Disagree**
6.1	Do nothing	0	0	11
6.2	Set internal blockchain utilization policies	7	4	0
6.3	Assess cost-efficiency before implementing blockchain	7	2	2
6.4	Use blockchain immediately	7	3	1
6.5	Gradually implement any suitable solution	6	2	3

Characteristics of Blockchain Adoption in Waqf Governance: Building Ecosystem and Type of Ecosystem

Table 4. Table 3. Characteristics of Building Ecosystem and Type of Ecosystem

7	**How to build a blockchain waqf ecosystem**	**Agree**	**Neutral**	**Disagree**
7.1	Building independently	5	0	6
7.2	Building together with other similar waqf institutions	8	3	0
7.3	Building together at a specific regional level	5	6	1
7.4	BWI institutions that build	5	3	3
7.5	Any Way as Needed	5	1	5
8	**Type of Ecosystem to be Adopted**	**Agree**	**Neutral**	**Disagree**
8.1	Private closed ecosystem	5	3	3
8.2	Public closed ecosystem	6	2	3
8.3	Limited open ecosystem	9	1	1
8.4	Open ecosystem	6	4	1
8.5	Any Ecosystem as Needed	4	2	5

The most appropriate ecosystem for waqf institutions to adopt, agreed upon by all respondents, is a limited open ecosystem, with eight agreeing, one neutral, and two disagreeing. This indicates that the majority of respondents view the limited open model as the most realistic and applicable ecosystem for the waqf context in Indonesia. Meanwhile, the open ecosystem ranked second with seven agreeing, three neutral, and one disagreeing, indicating an appreciation for the principle of openness, although some doubts remain regarding its implementation. In contrast, the closed private and closed public ecosystems received only five approvals, and the "anything-as-needs" model received the lowest approval. These findings suggest that the consensus favors a semi-open model that still allows for collaboration while maintaining data control and security in waqf governance.

However, the distribution of views among respondents shows variations in preferences reflecting differences in stakeholder needs and orientations. Respondents who favor both a private and a public closed ecosystem can be understood as those who value full control over waqf data and operations. Meanwhile, views on the open ecosystem emerge more from the perspectives of academics and practitioners, emphasizing the principles of inclusivity and inter-institutional connectivity. Thus, the dominant choice of a limited open ecosystem can be seen as a compromise that balances the need for transparency and efficiency with the limitations of digital infrastructure and regulatory readiness in Indonesia. These findings indicate that despite aspirations for full transparency, operational realities drive the majority of stakeholders to prefer a limited open model as the optimal form of blockchain-based waqf governance in its early stages of development.

Robustness Test

The results of the rater agreement (Kendall W) and its p-value as an indicator of robustness indicate that each group of respondents has a different agreement regarding the main characteristics of blockchain-based waqf governance. However, the two groups of respondents when combined disagree on two characteristics, namely the type of blockchain network and the type of ecosystem to be adopted. Experts agree on 9 (nine) characteristics and 1 (one) disagree on the type of blockchain network, practitioners also agree on 5 (five) characteristics, while disagreeing on 5 (five) other characteristics. However, when experts, BMT practitioners, and FinTech Companies are combined, they all agree on 8 (eight) characteristics and only disagree on two characteristics, namely the type of blockchain network and the type of ecosystem to be adopted.

Table 5. The Robustness Test on the Main Characteristics of Blockchain based Waqf Governance

No	CLUSTER	Rater Agreement (*W*)					
		Expert	P-value	Pract	P-value	ALL	P-value
1	The waqf blockchain needs to be adopted	0.270	0.092*	0.264	0.382	0.221	0.033**
2	Timing to Adopt Waqf Blockchain	0.298	0.080*	0.250	0.406	0.250	0.027**
3	Types of blockchain networks	0.110	0.544	0.338	0.249	0.165	0.122
4	Waqf institutions that need to adopt BC	0.552	0.001***	0.576	0.032**	0.510	0.000***
5	Actors involved (Third parties)	0.485	0.001***	0.464	0.072*	0.390	0.000***
6	Waqf institutions' responses to BC potential	0.633	0.001***	0.625	0.040**	0.550	0.000***
7	Strengthening blockchain waqf literacy	0.800	0.000***	0.738	0.019**	0.689	0.000***
8	Type of blockchain waqf regulations needed	0.490	0.008***	0.538	0.072*	0.458	0.000***
9	How to build a blockchain waqf ecosystem	0.359	0.039**	0.250	0.406	0.193	0.075*
10	Type of Ecosystem to be Adopted	0.445	0.014**	0.288	0.331	0.157	0.141
***significant at the 0.01 level; **significant at the 0.05 level; *significant at the 0.10 level							

As seen in the Rater Agreement test above, two of the 10 characteristics (20%) had insignificant W scores, indicating that all characteristics of blockchain-based waqf governance were agreed upon by respondents, except:

1) Type of blockchain network;
2) Blockchain-based waqf governance ecosystem.

The recommended Delphi consensus should be greater than 80%, so this study, with 80% consensus, meets the requirements. (Ulschak, 1983).

Proposed Blockchain based Waqf Governance Models for Waqf Institutiion

Waqf digitization, particularly using blockchain, can be implemented in various waqf institutions, from the Indonesian Waqf Board (BWI) and nazhir institutions to waqf-based educational institutions. In practice, waqf digitization can take the form of data collection, management, distribution, and databases. Each form of waqf institutional digitization can operate from upstream to downstream, allowing for a variety of models. However, blockchain-based waqf governance is essentially an integrated waqf ecosystem that not only functions to enhance transparency and accountability but can also enhance data security and manipulation. With the integration of blockchain technology, waqf governance has the potential to deliver greater transparency, accountability, and efficiency.

Meanwhile, there are three blockchain-based waqf governance ecosystems that can be implemented in waqf institutions: 1) a private, closed ecosystem, developed/built by the waqf institution itself; 2) a public, closed ecosystem,

developed by the government; and 3) a limited, open ecosystem, which is a collaboration between the waqf institution and a fintech company/blockchain provider (Blockchain Co.).

1) Private Closed Ecosystem

This first model assumes that the waqf institution is positioned as a large and/or independent institution with the capacity to independently build a blockchain system. Blockchain development is directed to support the institution's strategic interests, particularly in strengthening transparency, accountability, and efficiency in waqf governance. The primary areas of focus for development include fundraising, asset management, distribution of waqf proceeds, and institutional database integration. These four areas are considered crucial foundations in the modern waqf governance cycle, although blockchain development can be expanded to other areas according to institutional needs.

Furthermore, this model emphasizes exclusivity of access, where only internal parties within the waqf institution have the authority to access and manage transactions and records within the blockchain system. This encompasses the entire process, from fundraising to disbursement to the beneficiaries. With this closed design, the waqf institution can fully control all information flows and transactions, thereby ensuring data security and confidentiality. Some parties, such as waqf donors, only have access to certain information provided by the waqf institution, making it impossible for donors or waqf donors to fully access the information. However, this approach also has analytical implications, namely the potential for limited public transparency, which is one of blockchain's strengths. Therefore, the effectiveness of this model still requires further study in the context of actual implementation in waqf institutions. "*A realistic system to implement is a hybrid model, starting with private as a validity test before evolving to public*." (Interview, YPPWPM Gontor, 2025). This implementation is carried out in stages to suit the needs of institutions that are already stable and sustainable and not disrupt existing systems.

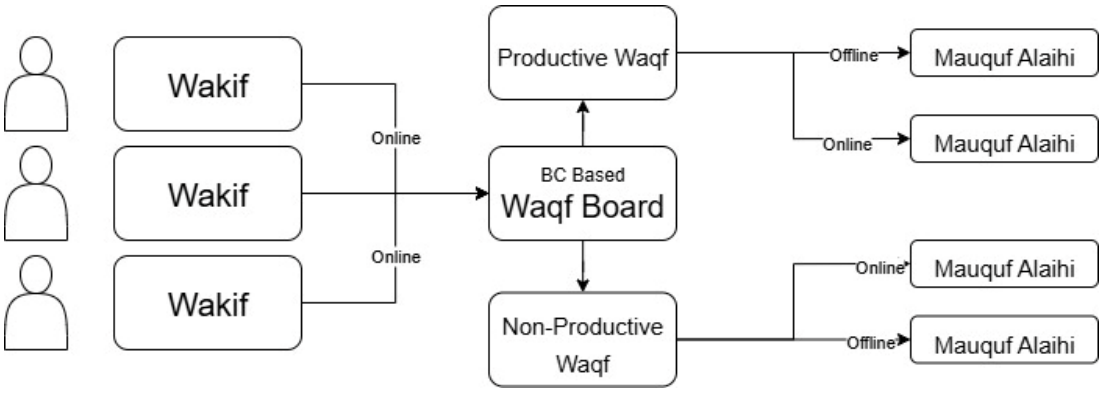

Figure 2. Private Closed Ecosystem

2) Public Closed Ecosystem

This second model differs fundamentally from the Private Closed Ecosystem, particularly in terms of the actors developing the system. While the first model is built and managed exclusively by independent waqf institutions, this second model is developed by the government through the Indonesian Waqf Board (BWI), the official authority established by the state. While in many technical aspects, this model is similar to the Private Closed Ecosystem—for example, in terms of its scope, which includes the collection, management, distribution, and institutional database the government's involvement provides an additional dimension in the form of legitimacy, regulatory standards, and cross-agency coordination. Thus, the blockchain developed by the government functions not only as a technological instrument but also as a medium for oversight and facilitation, enabling waqf governance to be more effective, efficient, and integrated with national policies. Because waqf is a social fund sourced from the community, it is public in nature. When discussing governance, it must also be public. "*Waqf as a social funds must be managed by public governance, So. The type of blockhain network that need to use is Public closed ecosystem or open ecosystem, in other hand called by Public Network*" (interview, ABSI, 2025)

In this model, the blockchain acts as public infrastructure under the coordination of BWI, making it accessible to various stakeholders according to their level of authority. Waqfs gain access to critical information related to fundraising, asset management, distribution of waqf proceeds, and a comprehensive waqf database, even through real-time monitoring. This allows waqf owners to ensure that their waqf funds and assets are managed in accordance with Sharia principles and social sustainability goals. Meanwhile, external parties, such as the general public, Islamic financial institutions, and supervisory authorities, can obtain relevant general information, thus maintaining transparency and accountability. With this design, the second model not only strengthens public trust in waqf institutions but also enhances the government's role in creating a more credible, adaptive waqf ecosystem that aligns with the national development vision.

Based on the database in blockchain-based waqf governance, there needs to be a shared understanding of data integrity. "*Before moving further into implementing blockchain in the waqf ecosystem, there needs to be a shared understanding among existing waqf institutions regarding data integrity, not integration.*" (interview, iBantu, 2024). It is necessary for each waqf institution to give same perception how to do data integrity to their waqf governance.

This second model also opens up broader collaboration with third parties, including insurtechs, which play a crucial role in mitigating operational and asset risks faced by fund managers and waqf asset managers. Through the integration of smart contract-based digital insurance services, insurtechs can provide protection against potential losses resulting from project failure, operational negligence, or disruptions to productive assets, thereby ensuring the continuity of waqf benefits and

maintaining portfolio stability. In this context, the asset manager function is positioned separately from the BWI authority to professionally manage waqf assets, including conducting due diligence, asset valuation, selecting Sharia-compliant investment instruments, and managing risks. This separation of roles ensures that asset managers remain independent in making technical decisions related to asset development, while the government-managed blockchain provides a transparent oversight and reporting infrastructure. However, the asset manager can originate from a single waqf institution without the need for a third party. Thus, the synergy between the public closed ecosystem, insurtechs, fund managers, and asset managers strengthens waqf governance through stronger risk protection, increased accountability, and optimized professional asset management in accordance with Sharia principles.

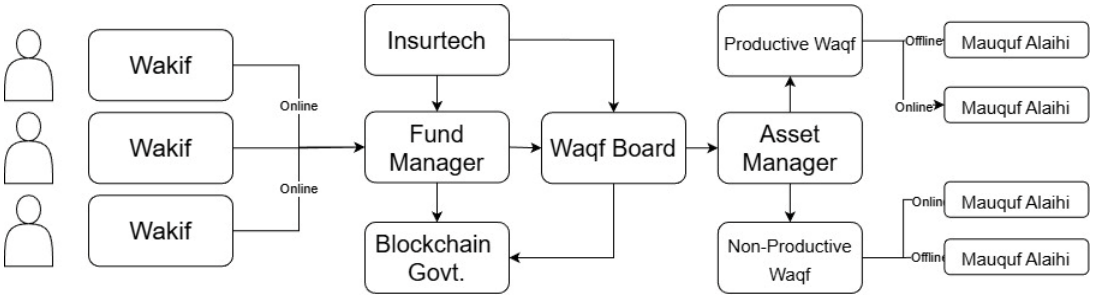

Figure 3. Public Closed Ecosystem

3) Limited Open Ecosystem

This model represents a strategic collaboration between waqf institutions and fintech companies operating in the blockchain sector, particularly in providing technological infrastructure that is difficult or even impossible for waqf institutions to build independently. The entire waqf governance process—from collecting waqf funds and managing assets to distributing them to the beneficiaries—is carried out within a single, integrated system that relies on fintech providers as ready-to-use blockchain technology. This eliminates the burden of research, development, and system maintenance for waqf institutions, as these functions are delegated to parties with technological competence. While this model bears some similarities to a Public Closed Ecosystem, the key difference lies in the dominant role of private blockchain providers. Fintech companies tend to be more adaptive, responsive, and flexible in meeting the technical needs of waqf institutions than collaborations with the government.

Meanwhile, waqf institutions can expand the scope of collaboration with fintech companies beyond providing blockchain systems to include value-added services such as smart contract integration, automated digital audits, real-time reporting, and user-based applications to facilitate waqf monitoring of their assets. Such partnerships have the potential to improve operational efficiency while strengthening transparency and accountability, thereby encouraging broader community participation. Furthermore, this model also opens up opportunities for

waqf institutions to access new financial innovations, such as tokenization of waqf assets or integration with digital Sharia-based payment systems. Thus, collaboration with fintech companies is not only technical but also strategic in strengthening waqf's position as a relevant Islamic economic instrument in the digital era. *"Waqf institutions should not be overly private. Public transparency is more important, making public or hybrid options more appropriate. Crucially, blockchain supports transparency, not blocks access to information about waqf fund management."* (Interview, AFSI, 2025).

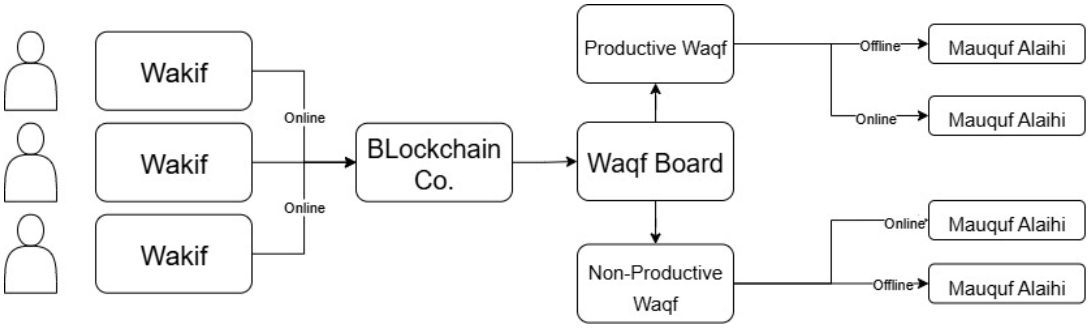

Figure 4. Limited Open Ecosystem

CONCLUSION

The main findings indicate that the most relevant sectors for integration are strengthening database systems, waqf collection, and management. In terms of time, the majority of respondents believe that blockchain implementation needs to be implemented immediately or gradually, indicating an urgent need for implementation. Regarding infrastructure, hybrid and public networks are seen as the most suitable options, as both are able to balance the institution's internal privacy needs with the demands of public transparency. This finding is reinforced by respondents' preference for a limited open ecosystem as the most realistic form of governance for the Indonesian context.

However, this study has limitations in terms of the number of respondents and the scope of the analysis, which is still limited to the conceptual stage. The lack of strong consensus regarding the types of blockchain networks and ecosystems suggests the need for more in-depth studies involving a wider range of stakeholders. Therefore, further research is recommended to expand respondent participation, integrate quantitative approaches with implementation simulations, and evaluate aspects of sharia regulations and positive law more comprehensively. The relevance of this research lies in its urgency for the development of productive waqf in the digital era, as well as its contribution in providing a theoretical and practical basis for the development of a sustainable blockchain-based waqf ecosystem in Indonesia.

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