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OPTIMIZING BLOCKCHAIN WAQF AS AN INSTRUMENT FOR THE SUSTAINABILITY OF PESANTREN EDUCATION

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Information	Abstract:
<p>Article History:</p> <p>Received : 06.08.2025 Revised : 28.09.2025 Accepted : 06.10.2025</p> <p>Keywords: Blockchain, Optimization, Waqf, Sustainability, Pesantren.</p>	<p><i>The emergence of the need for sustainable education, makes waqf a potential solution to support pesantren education by utilizing technology. The role of blockchain as a cutting-edge technology and the development of waqf-based Pesantrens in Indonesia make this study crucial. This article discusses the optimization of waqf as an instrument to support the sustainability of pesantren education by utilizing blockchain technology. This study uses a qualitative methodology to explore the integration of blockchain technology in the pesantren waqf system comprehensively. This study uses a literature study approach from secondary data. The results of the study indicate that the implementation of blockchain in pesantren waqf can increase transparency through irreversible transaction recording, accelerate the distribution of benefits and maintain accountability with smart contracts, even its traceable nature can increase public or waqif trust in waqf management in Pesantrens. In addition, the purpose of this study is to provide an appropriate waqf optimization strategy by utilizing blockchain technology to produce sustainable education. The conclusion of this study emphasizes the use of blockchain which has great potential in optimizing waqf management for the sustainability of pesantren education, but its implementation requires the right adaptation strategy and readiness of waqf managers. The contribution of the study is in the form of literacy of blockchain-based waqf digitalization in Pesantrens and opens opportunities for further research related to practical and policy aspects.</i></p>

A. INTRODUCTION

Optimizing waqf in educational institutions has become an increasingly relevant issue to study, given its significant potential as an instrument for educational sustainability, particularly in Islamic boarding schools (*pesantren*). Academically, it is crucial to understand how the application of blockchain technology can enhance the functionality of waqf and serve as a catalyst in addressing the financial challenges currently facing Islamic educational institutions. Indonesia, with the world's largest Muslim population and a significant number of *pesantren*, positions *pesantren* as key institutions in the development of Islamic education and community empowerment (Suhendi, 2018). Therefore, this study aims to make a conceptual contribution to optimizing waqf in Islamic boarding schools in Indonesia by utilizing blockchain technology, while also providing more effective policy directions to enhance waqf governance and strengthen the competitiveness of Islamic boarding schools as sustainable Islamic educational institutions.

Although waqf plays a crucial role in supporting education in *pesantren*, its management practices still face various fundamental issues. Several studies indicate that waqf in Islamic boarding schools is generally managed traditionally, with limitations in transparency, accountability, and the efficiency of benefit distribution (Nuradi et al., 2024). Other issues that frequently arise include the lack of standardized record-keeping, low digital literacy among administrators, and a weak publicly accessible reporting system, which reduces public trust in Islamic boarding school waqf (Widyowati & Prasetyo, 2021). In this context, blockchain technology is seen as relevant because it offers advantages such as permanent transaction recording (immutability), transparency in fund flows, and automation of management through smart contracts. By integrating blockchain, the potential of waqf in Islamic boarding schools can be optimized not only financially but also strengthened in terms of governance, thereby supporting the sustainability of Islamic boarding school education more effectively and credibly.

Several related studies have been conducted, demonstrating that despite numerous studies on optimizing waqf in Islamic boarding schools, the optimization of waqf using blockchain technology remains underexplored. (Awalluddin, 2023) has

contributed to an understanding of the crucial role of waqf in supporting three key educational development costs: the cost of establishing an institution, its operational expenses, and the cost of registering and admitting new students. Research conducted by (Shiddiqy et al. (2024), for example, shows that internal and external challenges impact the empowerment of cash waqf in education, with management being a primary concern. (Safitri & Ikhyannuddin, 2024) provide strategies to increase the effectiveness of waqf as a sustainable funding source through the integration of fintech and Public-Private Partnerships, as well as sukuk integration. Research by (Lahuri & Lutfiah, 2024) also highlights the digitalization of waqf, with a contract scheme that can facilitate waqf through crowdfunding in the form of educational financing investments, namely the *wakalah bil istitsmar* contract and the *syirkah* contract. Based on previous research, the exploration of waqf using blockchain technology in the context of Islamic boarding school education remains limited. The novelty of this research lies in its holistic approach, which examines the interaction between waqf governance and technological innovation in the context of sustainable Islamic boarding school education in Indonesia. Thus, this research provides new insights relevant to academics and practitioners in efforts to optimize the position of waqf at the national level.

The purpose of this research is to analyze how optimizing waqf with blockchain technology can promote the sustainability of education in Islamic boarding schools. Specifically, this research explains the strategic steps required to optimize waqf using blockchain technology and its impact on the sustainability of Islamic boarding school education. By strengthening the digitalization of waqf management, it is hoped that these Islamic boarding school educational institutions can more easily provide comprehensive, transparent, and accountable information. This research also aims to provide concrete recommendations for stakeholders in efforts to optimize the potential of Islamic boarding school waqf in Indonesia.

The main argument in this research is that the use of blockchain-based waqf is not simply a technological innovation, but rather a strategic solution to address the financial challenges of sustainable Islamic boarding school education. Through an in-depth analysis of comprehensive waqf management, this research reveals how the integration of blockchain technology can increase transparency, accountability, and

public participation in Islamic boarding school funding. Data from the Ministry of Religious Affairs in 2024 indicate that, although the potential for waqf in Indonesia amounts to Rp180 trillion per year, the actual realization of this potential is approximately Rp2.3 trillion, or only about 1.3 percent of the total potential. Meanwhile, the main challenges faced by Islamic boarding schools are insufficient and limited funding (Siregar, 2024). Therefore, the findings of this study are expected to serve as a guide for the government, Islamic boarding schools, and philanthropists in optimizing digital waqf as the backbone of sustainable Islamic education funding.

B. LITERATURE REVIEW

Several related studies have been conducted, demonstrating that despite numerous studies on optimizing waqf in Islamic boarding schools, the optimization of waqf using blockchain technology remains underexplored. Previous research has contributed to understanding the crucial role of waqf in supporting three educational development costs: institution establishment costs, institutional operational costs, and registration and admission costs for new students. Research conducted by (Shiddiqy et al., 2024) for example, research shows that internal and external challenges impact the empowerment of cash waqf in education, with management being a primary concern. (Safitri & Ikhyannuddin, 2024) provide strategies to increase the effectiveness of waqf as a sustainable funding source through the integration of fintech and Public-Private Partnerships, as well as sukuk integration. Research by (Lahuri & Lutfiah, 2024) also highlights the digitalization of waqf, with a contract scheme that can facilitate waqf through crowdfunding in the form of educational financing investments, namely the *wakalah bil istitsmar* and *syirkah* contracts. Based on previous research, the exploration of waqf using blockchain technology in the context of Islamic boarding school education remains limited. The novelty of this research lies in its holistic approach, which examines the interaction between waqf governance and technological innovation in the context of sustainable Islamic boarding school education in Indonesia. Thus, this research provides new insights relevant to academics and practitioners in efforts to optimize the position of waqf at the national level.

C. METHODOLOGY

This study employs a qualitative research method. The research approach is library research. Data sources will be obtained from secondary sources. The secondary data sources used include books, scientific journals, website articles, and statistical references. Literature criteria are selected based on relevance to the themes of waqf, blockchain, and Islamic boarding schools, with priority given to indexed publications. The data collection technique used is secondary research data collection which is coherent with the study object. Data analysis in this study refers to content analysis, which involves examining the content of information in the literature review. Deductive content analysis was conducted using a predetermined codebook based on previous theory. Four main codes were used: transparency, accountability, trust, and implementation challenges. Coding rules were applied manually by rereading the text and identifying appropriate keywords. The coding results were then analyzed qualitatively. Content analysis enables researchers to capture the relevant information necessary for this study. Regardless of the source material's origin, content analysis can be applied to all forms of written text (Bengtsson, 2016). There are no specific rules to follow. In answering this study's research questions, the unit of analysis is previous articles that will be analyzed in depth.

D. RESULT AND ANALYSIS

Increase Transparency Through Immutable Transaction Recording

The implementation of blockchain technology in waqf management offers a key advantage in the form of increased transparency through an immutable transaction recording system. (Vidiati et al., 2021) Every waqf transaction, from fund distribution to its use, is permanently recorded in a distributed ledger accessible to all relevant parties. This minimizes the risk of data manipulation or misuse of funds, ensuring that every waqf rupiah is used for its intended purpose.

Furthermore, the decentralized nature of blockchain eliminates dependence on a single central authority, reducing the potential for corruption or administrative errors. Waqifs and the community can verify the flow of funds in real-time, creating a more transparent waqf management ecosystem. Thus, Islamic boarding schools can build a

better reputation while encouraging broader community participation in supporting the sustainability of waqf-based education.

Accelerate Benefit Distribution and Maintain Accountability with Smart Contracts

Blockchain technology enables the use of smart contracts to automate the distribution of waqf funds according to pre-programmed conditions (Alya Zhafirah Nasywa & Setiawan Bin Lahuri, 2025). For example, when waqf funds accumulate to a certain amount, a smart contract can automatically allocate them to the construction of educational facilities or scholarships for students at Islamic boarding schools, without requiring manual intervention. This accelerates the distribution of benefits while reducing administrative costs.

Smart contracts also increase accountability because each stage of waqf management is based on transparent rules and cannot be interfered with unilaterally. If any irregularities occur, the system will reject ineligible transactions, ensuring that funds are used appropriately. This mechanism allows Islamic boarding schools to be more efficient in managing long-term waqf, while waqifs can feel more confident that their contributions are being managed professionally.

Increasing Public and Waqif Trust in The Management of the Islamic Boarding School Waqf

One of the advantages of blockchain is traceability, where every transaction has a digital trail that can be verified by the public (Muhammad Rizal et al., 2025). In the context of Islamic boarding school waqf, this feature allows waqifs to track how their funds are used, from receipt to program implementation. This transparency builds public trust in Islamic boarding school institutions as waqf managers.

Furthermore, this traceability also fosters a culture of accountability among waqf managers. Islamic boarding schools can provide reliable, automated reports, alleviating the doubts of prospective waqifs who may be concerned about opaque practices. In the long term, this can increase the amount of waqf collected, supporting the sustainable financing of Islamic boarding school education. Thus, blockchain is not

only a technical solution but also a strategic tool for strengthening public trust in Islamic philanthropy.

Optimizing Waqf with Blockchain for The Sustainability of Islamic Boarding School Education

Optimizing waqf with blockchain technology to support the sustainability of Islamic boarding school education certainly requires the role of waqf management institutions or units, often known as Islamic boarding school foundations. Foundations with professional authority can professionally optimize waqf funds and assets. A blockchain-based waqf model in Islamic boarding schools can be illustrated as follows:

Figure 1. Waqf Blockchain Scheme



Source: Adopted from (Budiantoro et al., 2020; Sukmana, 2019)

The following is a complete explanation of each step in the blockchain waqf scheme for purchasing Islamic boarding school cars:

1. Identifying Islamic Boarding School Needs. The Islamic boarding school identifies a specific need to be funded through waqf, in this example, an operational car worth IDR 150 million. This need is then digitized and published on the blockchain waqf platform as a "waqf project," detailing the specifications, price, and intended use.
2. Waqif Provides Funds. Donors (wakif) can donate funds in full or in part through the platform. Each contribution is recorded as a secure and transparent blockchain transaction. The waqif receives a digital notification confirming their participation in the waqf program.
3. Blockchain Private Code Generation. The system automatically generates a unique private code (hash) that serves as digital proof of the waqif's

contribution. This code is unique, cannot be forged, and is linked to the waqf's digital wallet. This code will be continuously updated as funds are disbursed.

4. Fulfilling Funding Needs. The platform will raise funds until it reaches its target of IDR 150 million. Once collected, the smart contract automatically locks the funds in a special escrow account. If the funds are not met within a certain timeframe, they can be returned or transferred as agreed by the waqf owner.
5. Purchase by the *Nadzir*. The *Nadzir* (waqf manager) purchases a car according to the specifications specified in the smart contract. The purchase process must include digital evidence such as a purchase invoice and vehicle photos, which will be verified by the system.
6. Smart Contract Verification and Execution. The smart contract will verify that the purchase conforms to specifications and the accuracy of supporting documents. Then, the payment will be released to the car seller at the correct market price. Once all conditions are met, payment will be released to the car seller.
7. Transaction Success Confirmation. Once the purchase is complete, the system generates a final proof in the form of a complete transaction code, waqf asset documentation (including photos, vehicle registration, etc.), a detailed fund usage report, and the waqf owner's initial private code is updated with this information as proof of completion.

A blockchain-based waqf management scheme offers several significant advantages. Each stage of waqf management is recorded in the form of immutable digital evidence, ensuring the overall accountability of the process (Faujiah & Imron, 2022). Waqf (endowers) are assured that the funds they disburse are used for their intended purposes, while *nadzir* (managers) operate within the system's established guidelines, minimizing the potential for misuse. Furthermore, waqf assets can be transparently monitored throughout their lifecycle, from receipt to distribution of benefits, thereby increasing public trust and strengthening sustainable waqf governance.

This research demonstrates that optimizing waqf with blockchain technology can support the sustainability of Islamic boarding school education, particularly in the context of digitalization. The results emphasize the importance of increasing

transparency through immutable transaction recording, accelerating benefit distribution, and maintaining accountability with smart contracts. Furthermore, its traceability can increase public and waqf trust in waqf management in Islamic boarding schools.

The results of this study are in line with the principles of Good Corporate Governance (GCG), which emphasize ensuring that decision-making and operational processes are carried out transparently, accountably, fairly, and responsibly (Haryono & Melis, 1970). The problem of trust is explained by Blockchain Technology, which enables exchanges that replace trust with cryptographic evidence, thereby eliminating the need for intermediaries and the associated costs and risks. There is an excellent match between waqf challenges and blockchain features, which conceptually makes blockchain an optimal waqf solution (Aysan & Al-Saudi, 2023). The findings of this study suggest that Islamic boarding schools that integrate blockchain into waqf management have the potential to experience a significant increase in waqf fund accumulation, due to enhanced transparency and accountability. In addition, research by (Kunhibava et al., 2024) confirms that Innovation through blockchain technology appears to be the future of Islamic social finance; therefore, it is necessary for relevant stakeholders to understand the technology, which is in line with the findings in this study regarding the efficiency of fund distribution through smart contracts. Thus, the synergy between sharia principles, a clear waqf regulatory framework (such as Law No. 41 of 2004), and blockchain innovation creates a sustainable waqf ecosystem for *pesantren* that is responsive to digital challenges.

Through an in-depth analysis of the research findings, it was found that integrating blockchain technology into the Islamic boarding school waqf system not only improves the efficiency of fund management but also enhances the sustainability of community-based education. This research reveals that blockchain implementation can create a more transparent, accountable, and decentralized waqf mechanism, thus directly impacting the quality of educational infrastructure. Therefore, this research emphasizes the importance of a holistic approach to developing waqf in Indonesia.

Based on this research finding, several strategic recommendations can be implemented to optimize the utilization of Islamic boarding school waqf through blockchain. First, a comprehensive educational program is needed for *nadzir* (waqf

managers) and the community about blockchain-based digital waqf mechanisms to increase technology literacy and adoption. Second, the Ministry of Religious Affairs, in collaboration with the Indonesian Waqf Board (BWI), needs to develop specific regulations that support the implementation of blockchain technology in waqf management, including standardization of sharia smart contracts and waqf data protection. Third, collaboration among Islamic boarding schools, blockchain developers, and academics needs to be strengthened to develop a digital waqf platform that meets the needs of Islamic boarding schools while adhering to Sharia principles. Through these structured steps, integrating traditional waqf with blockchain innovation can create a more transparent, efficient, and sustainable system for Islamic boarding school education financing.

E. CONCLUSION

The key findings of this study reveal that integrating blockchain technology into the Islamic boarding school waqf system has the potential to be a transformative breakthrough for the sustainability of Islamic education in the digital era. The research demonstrates that blockchain's unique characteristics, including transparency, accountability through smart contracts, and a decentralized system, can significantly address traditional waqf management challenges. Implementing this technology not only ensures a more efficient distribution of waqf benefits to Islamic boarding schools but also builds community trust through a traceable and verifiable system. More importantly, the combination of Sharia principles in waqf with blockchain innovation creates a new paradigm in Islamic philanthropy that is more adaptive to the demands of digitalization.

This research makes a significant contribution to the development of the waqf digitalization discourse by providing a conceptual framework that integrates Sharia principles with blockchain innovation. The research's primary strength lies in its holistic approach, linking technological, institutional, and social aspects within the context of Islamic boarding school waqf management, while also offering an implementation model that can be adopted by Islamic educational institutions. The research findings not only enrich the literature on Islamic social finance but also provide practical insights into how cutting-edge technology can be leveraged to uphold

the traditional values of Islamic philanthropy. Thus, this research provides a valuable academic foundation for regulators, waqf practitioners, and technology developers in designing effective and Sharia-compliant digital waqf transformation strategies, particularly to support the sustainability of Islamic boarding school education in Indonesia.

This research has several limitations that provide opportunities for further development, particularly in the implementation of blockchain technology in traditional Islamic boarding schools. The study's focus on the theoretical potential of blockchain has not fully explored practical challenges, such as the readiness of Islamic boarding schools' digital infrastructure and community response to a technology-based waqf system. Furthermore, the findings of this study are conceptual in nature and require further testing through case studies of actual implementations in various types of Islamic boarding schools with varying characteristics. Future research is recommended to explore the technical aspects in greater depth and conduct comparative analyses with digital waqf models in other Muslim countries to refine the model for integrating blockchain technology into the Islamic boarding school waqf ecosystem in Indonesia.

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