
Green Asset Digital Development through a Pentahelix Approach in Green Waqf: Tackling Poverty and Improving Prosperity

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Abstrak

Penelitian ini bertujuan untuk menganalisis strategi pengembangan aset digital hijau dalam wakaf hijau dengan pendekatan pentahelix. Melalui strategi ini, kemiskinan dan isu lingkungan yang menantang dapat diatasi dengan memastikan keseimbangan antara pembangunan ekonomi dan pelestarian lingkungan. Penelitian ini menggunakan metode analisis deskriptif-kualitatif dan studi pustaka untuk mengeksplorasi pemahaman mendalam tentang strategi pengembangan aset digital hijau dalam wakaf hijau, dan mengidentifikasi bagaimana pendekatan pentahelix mampu mengembangkan strategi tersebut. Hasil dan pembahasan mengidentifikasi bahwa model pentahelix mampu memainkan peran kunci dalam pengembangan aset digital hijau dalam wakaf hijau, di mana model pentahelix berkaitan dengan kerja sama antara pemerintah, akademisi, bisnis, komunitas, dan media. Wakaf hijau dapat dimulai dengan penggalangan dana melalui mekanisme urun dana (crowdfunding), kemudian disalurkan untuk memberdayakan hutan yang rusak dengan tujuan memulihkannya menjadi hutan hijau yang memiliki nilai ekologis, yang selanjutnya akan diwakafkan untuk kemaslahatan masyarakat. Kesimpulan dari penelitian ini adalah bahwa strategi pengembangan aset digital hijau dalam wakaf hijau dengan pendekatan pentahelix dapat menjadi solusi untuk mengentaskan kemiskinan dan meningkatkan kesejahteraan. Namun demikian, masih terdapat beberapa tantangan yang dihadapi terkait potensi wakaf di Indonesia, seperti kurangnya profesionalisme nazir, rendahnya literasi wakaf masyarakat, serta belum optimalnya edukasi dan sosialisasi wakaf hijau.

Kata kunci: aset hijau digital, kesejahteraan, kemiskinan, pentahelix, wakaf hijau

Abstract

This research aims to analyze the strategy of developing digital green assets in green waqf with a pentahelix approach. Through this strategy, poverty and challenging environmental issues can be addressed by ensuring a balance between economic development and environmental preservation. This research uses descriptive-qualitative analysis method and literature study to explore in-depth understanding of the strategy of developing green digital assets in green waqf, and identify how the pentahelix approach is able to develop the strategy. The results and discussion identify that the pentahelix model is able to play a key role in developing green digital assets in green waqf, where the pentahelix model relates to cooperation between government, academia, business, community and media. Green waqf can be started by raising funds through a crowdfunding mechanism, then channeled to empower damaged forests with the aim of restoring them to green forests to have ecological value, which will then be endowed for the benefit of the community. The conclusion of this research is that the strategy of developing digital green assets in green waqf using the pentahelix approach can be a solution to alleviate poverty and improve welfare. However, there are still some challenges faced regarding the potential of waqf in Indonesia, such as the lack of professionalism of nazirs, low public waqf literacy, and not optimal education and socialization of green waqf.

Keywords: green waqf, pentahelix, digital green assets, welfare, poverty

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1. INTRODUCTION

Indonesia is the largest archipelago in the world. Indonesia has abundant wealth from a wide variety of biodiversity, minerals, marine, and other natural resources. In this case diversity and natural resources, Indonesia has enormous potential in various sectors of agriculture, plantations, industry, economy, tourism, and other fields (Normelani et al., 2022). With this potential, Indonesia has a great opportunity to build a better economy and improve people's welfare.

But in reality, Indonesia is still shackled in poverty issues and environmental problems that cause a decline in people's welfare, Indonesia has not been able to fully utilize its potential. Environmental problems are still a challenge that still needs to be faced, especially forest destruction. Forest destruction is caused by forest fires, massive logging for plantations, illegal logging, and other factors. Not only that, the lack of capacity and weak role of central and local government agencies in social conflicts, open access to state forest areas, and difficulties in harmonizing policies due to differences in perception and high conflicts of interest (Supriatna, 2021).

Forest destruction is not only a threat to environmental sustainability, but also has the potential to exacerbate poverty conditions in various regions. Environmental damage has impacts that are felt in human life, including losses in livelihoods and sources of life (Arifudin, 2021). One of the issues being debated in the context of theology in Asia, especially Indonesia, is the ecological crisis caused by environmental damage. This phenomenon is clearly evident through the occurrence of floods, extreme climate change, global warming, and increased air pollution, which ultimately become a source of suffering for the community (Manurung, 2022).

Overall, Indonesia as a developing country is faced with the problem of poverty. The percentage of poor people in Indonesia in March 2023 reached 9.36% of the 25.90 million people who were still categorized as poor (Badan Pusat Statistik Indonesia, 2023). If forest destruction continues to exist and is sustainable, the problem of poverty in Indonesia will increase.

Although waqf has been widely examined as a key instrument of Islamic philanthropy, research addressing the role of digital transformation in improving the effectiveness and long-term sustainability of green waqf remains limited. Much of the existing scholarship continues to emphasize traditional waqf practices and their socio-economic implications, while studies that integrate digital green assets, environmental restoration, and the pentahelix collaboration framework are still relatively rare. Consequently, both theoretical and practical gaps persist in understanding how emerging technologies such as blockchain, IoT, and artificial intelligence can be systematically embedded within green waqf governance to enhance transparency, accountability, and public participation.

Developing the concept of waqf can be an effective instrument that can improve the quality of a sustainable economy for the community. Reforestation by planting trees in damaged forests is an effective effort in repairing environmental damage so as to improve welfare, one of which is by developing green waqf. To accelerate and expand its impact, the utilization of digitalization is the key to utilizing digital technology used to raise funds, namely with the concept of cash waqf which is an effort to develop green digital assets. In this case, government, society, academia, business, community, and media, will be the key to success in implementing this concept, this role is called the pentahelix approach. Collaboration between various stakeholders will ensure the sustainable implementation and effectiveness of the green waqf concept. The development of green digital assets using the pentahelix approach in the context of green waqf can be an effort to reduce poverty and improve welfare. By developing this strategy, the environmental quality and

economic quality of the community will improve. The adoption of digital technologies such as blockchain, IoT, and artificial intelligence offers a strategic pathway to improve the transparency, effectiveness, and inclusivity of green waqf initiatives. In this context, the digitalization of green assets becomes an essential component in reinforcing waqf's function as a driver of sustainability. This study investigates strategies for developing digital green assets within green waqf by applying the pentahelix framework, which brings together government, academic institutions, the private sector, communities, and the media. Through this approach, the research aims to propose a sustainable model that harmonizes Islamic social finance, environmental conservation, and technological innovation as a means to reduce poverty and enhance societal well being.

2. RESEARCH METHODS

The first step is to collect information from various literature sources related to the research topic, namely the literature study technique. (Octaviana & Aini, 2023). This includes a review of literature reviews regarding green digital assets, pentahelix, waqf, and green waqf. Then, this research uses a qualitative descriptive analysis method (Sukaina et al., 2022), meaning that the authors collect, process, analyze, and present data descriptively, namely data analysis used by describing, simplifying and presenting data into a form that is easy to understand. Thus, with the method used, the author can explore an in-depth understanding of the strategy of developing digital green assets in green waqf, and identify how the pentahelix approach is able to develop this strategy. With this method, the author can also understand the conceptual framework that developing green digital assets using the pentahelix approach in the context of green waqf can reduce poverty and improve welfare.

3. RESULT AND DISCUSSION

3.1 Result of Research

Findings from several studies and data analyses indicate that the development of *green digital assets* through a *pentahelix* approach, supported by the utilization of *cash waqf*, holds significant potential for promoting environmental preservation and community empowerment. By integrating digital technology with the principles of Islamic philanthropy, this approach creates opportunities for more inclusive participation, transparent governance, and efficient management of waqf-based environmental programs.

In this context, *green waqf* emerges as an effective instrument to enhance community welfare and alleviate poverty. Through collaboration among multiple stakeholders, continuous monitoring and evaluation can be carried out to ensure that the implementation of *green waqf* is well-integrated and produces optimal positive impacts both ecologically and socially thereby contributing to sustainable development and the well-being of society at large.

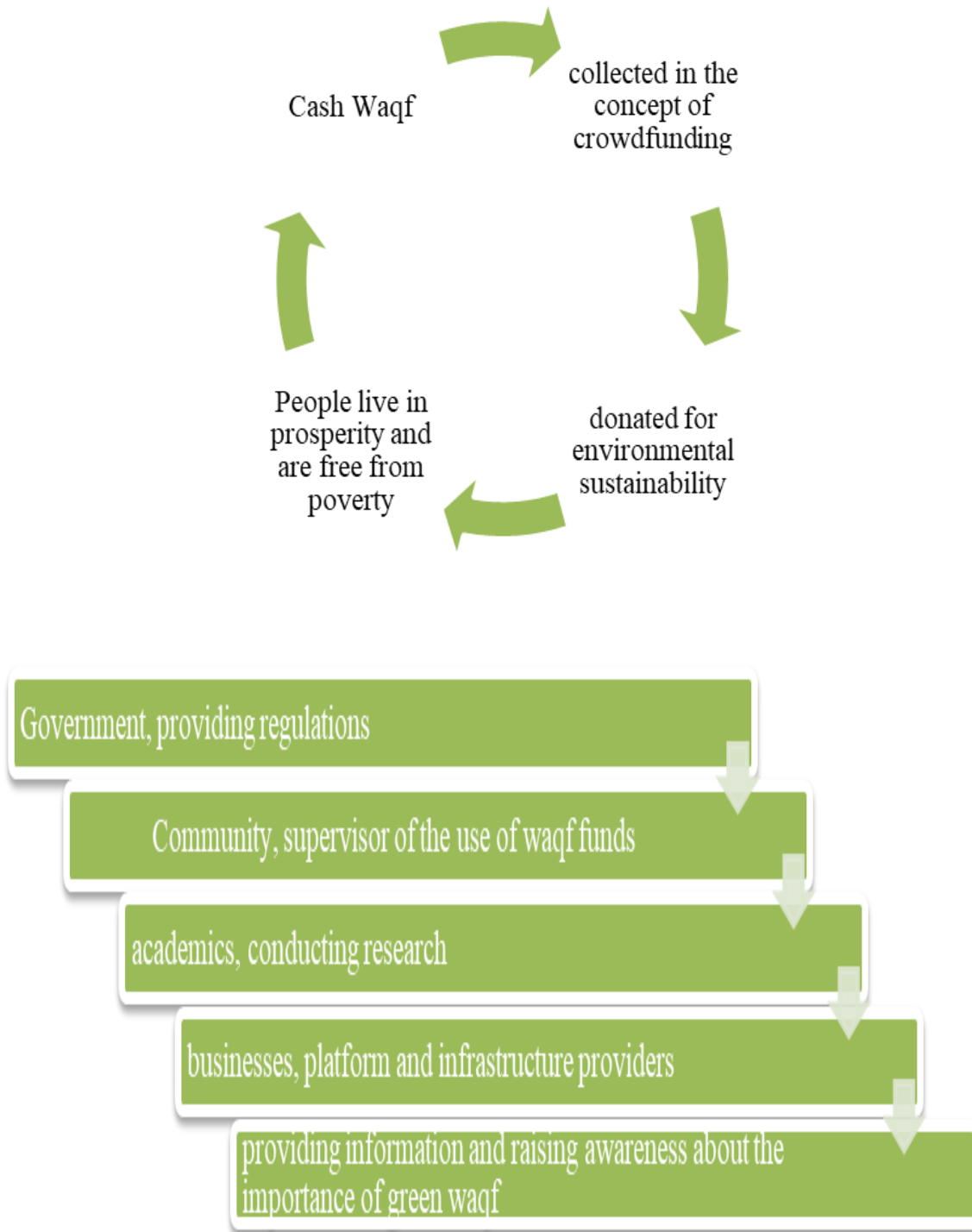


Figure 1. The concept of green digital assets through a pentahelix approach in the context of green waqf

Table 1. Impact of green waqf in improving welfare

Improving Welfare	
Solution	Impact
Greening in green waqf	1. Ensure a healthy and natural environment free from pollution.
	2. Lowering the temperature of a place.
	3. Plants produce oxygen which makes the air fresher and more comfortable.
	4. Provides sun protection, soundproofing, dust, and protection from strong winds.
	5. Protect pollution because green plants are able to absorb carbon dioxide which is converted into oxygen, which is needed by humans to breathe.
	6. Prevent catastrophic flooding and soil erosion.

Table 2. Impact of green waqf in reducing poverty

Tackling Poverty	
Solution	Impact
Greening in green waqf	1. Empowering the community through their labor and services in developing green waqf.
	2. Providing fulfillment of community needs through natural resources, such as restoring clean water sources for their basic needs.

3.2 Discussion

Waqf is a term in Islam for handing over part of one's property to be utilized for the benefit of worship and the welfare of the community. Waqf is usually about land or buildings that can be utilized together. However, as the understanding of waqf that has been traced by previous scholars develops, waqf can now also be paid in the form of movable objects, namely cash (Rian et al., 2023).

The concept of waqf in green waqf is waqf dedicated to activities related to environmental conservation. The development of green digital assets in the context of green waqf with a pentahelix approach is an innovative

concept that integrates digital technology, environmental sustainability, and Islamic principles in waqf management.

Green waqf can be developed through green digital assets in the context of the digital green economy, which refers to assets that are oriented towards environmental sustainability and have a positive impact on the quality of human life, for example during fundraising or crowdfunding, which is a concept where the process of collecting funds (waqf) and other resources from the community, be it individuals, groups, or organizations which will then be distributed and utilized (Takwina, 2024).

One form of financing that is growing rapidly through the crowdfunding system is waqf. waqf is part of the Islamic economic system which has unique characteristics and is based on kindness, wisdom and brotherhood.

Waqf has a characteristic that makes it unique is the eternal shift of ownership to Allah Swt., so that the benefits continue to flow without reducing the value of the asset, crowdfunding can be used as a collective effort where individuals connect online to raise funds together, besides that it can be a means of investment and support for efforts launched by individuals or organizations (Takwina, 2024).

At present, cash waqf is experiencing rapid development, becoming more modern, and continues to develop well without ignoring the principles of sharia. Green waqf is seen as the use of waqf funds to support the achievement of environmental balance and sustainability, as well as providing a place for social and economic impacts that benefit the people (Amin, 2020).

Waqf is endowed to property, both movable and immovable, in accordance with the will of the waqif or a program, either for social or investment purposes offered to the waqif (Sahroni, 2018). Waqif can collect waqf money through crowdfunding, then the money is endowed for certain social or investment programs. The money that is endowed must have a clear purpose and benefit in its distribution.

In operational terms, the effectiveness of the pentahelix model stems from the collaborative interaction of five key stakeholders who jointly safeguard the continuity of digital green waqf initiatives. The government provides foundational support by establishing conducive policies and regulatory guidelines, exemplified by programs such as the Digital Wakaf Ecosystem introduced by the Badan Wakaf Indonesia (BWI). Academic institutions contribute through research, model development, and critical assessments of green waqf practices, including studies on blockchain-driven transparency and community-oriented empowerment frameworks. The business sector functions as a technological catalyst by supplying digital infrastructure such as fintech platforms that enable waqf crowdfunding, financial monitoring, and impact evaluation. At the community level, members engage as recipients and active collaborators, participating in awareness campaigns, ecological activities, and monitoring processes to ensure that waqf initiatives align with local priorities and sustainability objectives. The media, meanwhile, amplifies these efforts by circulating information, fostering environmental consciousness, and encouraging public involvement through storytelling and digital literacy campaigns. Together, this integrated collaboration illustrates how the pentahelix approach can reframe green waqf from a traditional religious obligation into an innovative vehicle for sustainable development that unites digital transformation, environmental preservation, and Islamic social ethics.

In channeling this, of course, it cannot be done by one party alone, it needs support from various parties, namely by using the pentahelix approach which involves five sectors of government, academia, business, community, and media.

1. The government is responsible for providing a regulatory and policy framework that supports the development of digital green assets and waqf, for example by creating laws that support the use of blockchain technology to ensure transparency and accountability in waqf management.
2. Academics play a role in conducting research and development on digital technology, environmental sustainability and waqf implementation by analyzing or conducting case studies on the effectiveness and efficiency of these innovations.
3. Businesses, as providers of platforms and infrastructure needed to manage waqf assets, such as providing applications that facilitate digital waqf donations and others.
4. Community, can act as a supervisor of the use of waqf funds by ensuring that waqf funds are channeled as they should be, and can actively contribute to various activities such as tree planting and others.
5. Media, plays a role in disseminating information and raising public awareness about the importance of waqf green digital assets. this can be done through campaigns or videos that can educate others. the media can also help increase transparency and accountability and can inspire others to get involved in these activities (Rian et al., 2023).

Technology Implementation in green waqf, first, blockchain technology is used to ensure transparency and accountability in waqf management, by providing an immutable and publicly auditable record of transactions. Second, Internet of Things (IoT), IoT sensors can be used to monitor and manage green assets, such as agricultural land or natural resources managed as waqf, ensuring efficient and sustainable use. Third, Artificial Intelligence (AI) which can be used to analyze big data related to green asset management and provide best practice recommendations in environmental sustainability (Sukaina et al., 2022).

The digital development of green assets in the context of green waqf through a pentahelix approach offers an innovative solution to integrate technology, sustainability, and Islamic values. With collaboration between the government, academia, the business sector, the community, and the media, this initiative has great potential to have a sustainable positive impact on the environment and society.

Green waqf as a definite instrument in restoring damaged forests to ecological value by reforestation. Greening is a series of efforts to repair, maintain, and improve land conditions so that they produce and function optimally as environmental protectors. This involves planting trees on vacant land outside the forest area with the aim that the land is restored, maintained, and increases its fertility (Bastomi & Naufal, 2021).

According to the Semarang City Environmental Agency (2020), reforestation ensures a healthy and natural environment free from pollution, lowers the temperature of a place, plants produce oxygen which makes the air fresher and more comfortable, provides protection from sunlight, silencers, dust, and protects from strong winds. Greening also plays a role in protecting pollution because green plants are able to absorb carbon dioxide which is converted into oxygen, which is needed by humans to breathe. In addition, reforestation can also prevent floods and soil erosion.

The use of green waqf in alleviating poverty involves green waqf in empowering the community's economy through agriculture in developing green waqf through community labor and services. In addition, with the existence of green waqf as a fulfillment of community needs in the re-provision of natural resources, such as the re-provision of clean water on the land so that people do not need to buy clean water to be able to meet their basic needs. By utilizing green waqf effectively, it becomes an instrument capable of alleviating poverty in a sustainable manner.

IoT technology plays a strategic role in directly and sustainably monitoring and managing environmentally-based waqf assets such as forests, productive land, and other natural resources. This real-time monitoring allows for increased efficiency and ensures environmentally friendly management practices. Furthermore, artificial intelligence can support the process of predicting reforestation needs, understanding the dynamics of ecological conditions, and optimizing resource utilization, including assessing the social and economic impacts of green waqf implementation.

The application of this concept has been seen in several institutions, such as Dompot Dhuafa through its Green Productive Waqf program and the Tani Sejahtera Waqf program, which utilize digital platforms to raise funds and oversee waqf program implementation. Furthermore, the Indonesian Waqf Board (BWI) is developing a National Digital Waqf ecosystem by utilizing blockchain technology as an instrument for transparency and accountability in waqf asset management, including environmentally-oriented projects.

The integration of technology with pentahelix collaboration involving government, academia, the business sector, communities, and the media positions digital green assets as a modern waqf management model capable of strengthening environmental conservation efforts and encouraging community economic empowerment.

Although green waqf offers innovative solutions for environmental preservation and community welfare. According to Rahayu Ningsih et al (2022) however, there are still some challenges faced as follows:

1. Lack of nazir professionalism, this is due to the lack of sensitivity of waqf nazir, lack of nazir commitment, and non-implementation of the nazir code of ethics. To overcome this, there must be an increase in nazir commitment, analyzing the feasibility of nazir, mentoring nazir, and conducting evaluations (Firdaus et al., 2019).
2. Low public literacy towards waqf, this occurs due to the nazir's lack of understanding in providing information to the public. The solution is to use education by the Indonesian Waqf Board (BWI) as a nazir to conduct seminars and training for the community.

Integrating green waqf, digital green assets, and the pentahelix framework produces a comprehensive wakaf ecosystem that extends beyond its devotional function and introduces a modern, sustainable, and inclusive paradigm of asset management. Supported by digital transparency through technologies such as blockchain, operational efficiency enabled by IoT and AI, and cooperative engagement across government, academia, industry, communities, and media, this model unifies spiritual, social, economic, and environmental values within a single framework. As a result, green waqf evolves into more than an Islamic philanthropic instrument it becomes a strategic vehicle for sustainable development that harmonizes sharia principles, technological innovation, and community empowerment to achieve equitable welfare and long-term environmental stewardship. The socialization of green waqf is not optimal, this happens because of the lack of professionalism of the nazir in socializing green waqf as a new regulation in alleviating poverty and improving people's welfare, and the lack of public literacy towards waqf makes people less sensitive to the potential of waqf for their lives.

4. CONCLUSION

This study concludes that advancing green digital assets within the framework of green waqf specifically by optimizing cash waqf through crowdfunding mechanisms to restore damaged forests using a pentahelix collaboration model involving government, academia, industry, communities, and media offers a practical pathway to reduce poverty and enhance societal well-being. Green waqf supports community empowerment and helps meet essential needs through sustainable use of natural resources, while improvements in welfare are reflected through the ecological and social gains produced by reforestation initiatives. The research also enriches existing scholarship on digital waqf, the integration of green technologies, and the development of collaborative pentahelix approaches in Islamic philanthropy and sustainable development. Additionally, it broadens academic discussions on the fusion of technological innovation with Islamic social finance, positioning digital green waqf as a forward-looking and sustainable model in contemporary Islamic economic studies.

For future work, the study suggests conducting empirical investigations on the operation of digital green waqf in Indonesia through survey-based research, case studies, or qualitative interviews. Further inquiry could explore predictive frameworks to assess the effectiveness of the pentahelix model in managing digital green waqf, as well as pilot testing blockchain- or IoT-enabled waqf platforms to examine their impact on transparency and community engagement. Comparative research examining green waqf initiatives in Indonesia and other countries is also recommended to expand academic insights and strengthen both the conceptual and practical grounding of green digital waqf management.

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