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The Integration of Blockchain and Blue Sukuk in the Development of a Sustainable Blue Economy: A Maqasid Al-Sharia Perspective

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ABSTRACT

This study discusses the integration of blockchain technology and Blue Sukuk in supporting sustainable blue economy development from the perspective of maqasid syariah. Blue Sukuk is viewed as an innovative solution for financing marine conservation and infrastructure projects that not only align with the Sustainable Development Goals (SDGs) but also fulfill Sharia principles such as transparency, accountability, and social and environmental justice. This study employs a literature review method using a thematic approach and descriptive analysis to examine how the integration of blockchain enhances the transparency and efficiency of Blue Sukuk. The results of the study indicate that this integration strengthens the governance and appeal of Blue Sukuk as a strategic instrument for financing projects focused on marine conservation, while also enriching the framework for an inclusive blue economy policy in Indonesia

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1. INTRODUCTION

Blue Sukuk is a financial instrument designed to support sustainable blue economic development. This instrument aims to address the challenges of climate change and support the sustainable management of marine resources [1]. Blue Sukuk is expected to provide financial solutions for aquatic infrastructure projects and the revitalization of arid land, in line with the principles Islamic finance [2]. In addition, Blue Sukuk is also expected to support the achievement of the Sustainable Development Goals (SDGs) by promoting inclusive economic growth and environmental sustainability [3]. In this context, several studies indicate that investments in projects focused on sustainability can yield significant economic benefits, including job creation and improved quality of life for coastal communities [4]. Therefore, Blue Sukuk not only serves as a financing tool but also as a driver of innovation and collaboration between the public and private sectors in efforts to preserve marine ecosystems. Although the potential of Blue Sukuk to support the blue economy has been recognized, there are still many unknowns regarding its implementation and effectiveness. For example, how can effective oversight and regulatory mechanisms be implemented to ensure the success of Blue Sukuk? [5]. Furthermore, it remains unclear how Blue Sukuk can align with national and international policies and strategies to achieve blue economy goals [6]. Other challenges include a lack of comprehensive data and research on the long-term impacts of Blue Sukuk on the economy and the environment [7]. Further research is needed to understand how Blue Sukuk can adapt to changing market dynamics and global challenges, such as the climate crisis and biodiversity loss [8]. By understanding these issues, stakeholders can formulate more effective strategies to harness the potential of Blue Sukuk in supporting sustainable development [9].

Research on Blue Sukuk still has several gaps that need to be addressed. First, there is a lack of empirical studies examining the emergence and impact of Blue Sukuk in different contexts, such as in developing and developed countries [10]. Second, there is a need to develop a more holistic and comprehensive framework that integrates economic, environmental, and social aspects into the implementation of Blue Sukuk [11]. Third, further research is needed to understand how Blue Sukuk can collaborate with other financial instruments to support sustainable blue economy development [12]. Additionally, it is important to explore how new technologies, such as blockchain and big data analytics, can be used to enhance transparency and accountability in projects financed by Blue Sukuk [13]. By addressing these gaps, research can provide deeper insights into the potential and challenges faced by Blue Sukuk in the context of the blue economy. This study aims to fill the existing gap by exploring the potential and challenges of Blue Sukuk in supporting blue economic development. The primary objective of this study is to develop a comprehensive framework that policymakers, companies, and other stakeholders can use to effectively implement Blue Sukuk [14]. Additionally, this study aims to evaluate the long-term impact of Blue Sukuk on economic growth, environmental sustainability, and social welfare [15]. By focusing on case studies and best practices, this study will provide recommendations that various parties can adopt to maximize the benefits of Blue Sukuk [16]. Through this approach, it is hoped that the study will make a significant contribution to the development of policies that support a sustainable blue economy. This study aims to fill the existing gap by exploring the potential and challenges of Blue Sukuk in supporting blue economic development.

This study is expected to make a significant contribution to the fields of the blue economy and Islamic finance. By developing a comprehensive framework, this study can assist policymakers and other stakeholders in effectively implementing Blue Sukuk to support blue economic development. Furthermore, this study can also provide new insights into how Blue Sukuk can be used as a tool to achieve the Sustainable Development Goals (SDGs) and address the challenges of climate change. Thus, this study can contribute to the development of more effective policies and strategies to support a sustainable blue economy. Additionally, the results of this study are expected to encourage collaboration between the public and the private sector, as well as raising awareness of the importance of sustainable investment in preserving marine resources.

2. METHOD

This research uses a literature review method with a thematic and descriptive analysis approach. This research will examine various relevant literature sources regarding Blue Sukuk, blockchain, and the principles of Maqasid Sharia to understand the application of new technologies in supporting the development of a sustainable blue economy. The main focus of this research is to explore how the integration of blockchain technology can increase transparency, accountability, and efficiency in the management of Blue Sukuk aimed at supporting projects related to marine resource sustainability and climate change mitigation. This research will also analyze the long-term impact of Blue Sukuk on economic growth, environmental sustainability, and social welfare, as well as how the application of Maqasid Sharia can provide an ethical framework for sustainable financing. The analysis is conducted by identifying and summarizing the findings of previous studies, including relevant case studies from developed and developing countries, to develop a comprehensive framework that can assist policymakers, companies, and other stakeholders in implementing Blue Sukuk effectively. Thus, this research is expected to fill the existing gap in the literature and provide deeper insights into the potential and challenges of Blue Sukuk in supporting a sustainable blue economy and its contribution to achieving the Sustainable Development Goals (SDGs).

3. RESULTS AND DISCUSSION

The Relevance of Blue Sukuk to Sustainable Blue Economy Development, Blue Sukuk is an innovative Sharia-compliant financial instrument specifically designed to support sustainable blue economy development [17]. The blue economy requires responsible management of marine resources, with a focus on environmental conservation and ecosystem balance [18]. Indonesia, as the world's largest archipelago with vast marine potential, views Blue Sukuk as the ideal instrument for mobilizing capital to finance critical projects such as coral reef conservation, mangrove rehabilitation, and environmentally friendly coastal city infrastructure [19]. By strictly adhering to Sharia principles that prohibit riba (usury) and gharar (uncertainty), Blue Sukuk is able to attract global investors concerned with sustainability while providing a strong guarantee of Sharia compliance [20]. Furthermore, Blue Sukuk is aligned with the Sustainable Development Goals (SDGs), particularly SDG 14, which focuses on the conservation of marine ecosystems; thus, this instrument is not merely an economic matter but an integral part of a holistic national sustainable development framework [21]. Mechanisms and the Role of Blue Sukuk in Indonesia The issuance of Blue Sukuk in Indonesia involves a complex yet transparent mechanism that prioritizes the selection of projects that are clearly aligned with Sharia principles and environmental sustainability [22]. The funded projects must be scientifically proven to have a positive impact on the conservation of marine ecosystems and to improve the well-being of coastal communities [23]. Comprehensive regulatory support and harmonization among

Sharia supervisory bodies and government agencies are crucial factors for ensuring that Blue Sukuk operates in a robust and credible manner [24]. Digital technologies such as blockchain are being integrated into this system to ensure real-time tracking and auditing of fund usage, enhance transparency, and reduce the risk of misuse [25]. The Indonesian government and capital market authorities are also preparing various strategic measures to develop a more mature Blue Sukuk market, including outreach to domestic and international investors [26]. The Potential Social and Economic Impacts Investments facilitated by Blue Sukuk not only impact macroeconomic aspects but also improve the quality of life for local communities, particularly coastal communities that depend on marine ecosystems. [27]. The funded projects spur the creation of new jobs, community training and empowerment, and the construction of supporting facilities such as small ports and environmentally friendly sanitation facilities [28]. The ripple effects of these activities boost the local economy and reduce poverty by maintaining a balance between the exploitation and conservation of natural resources. Furthermore, Blue Sukuk builds investor confidence by demonstrating that the projects undertaken are oriented toward measurable social and environmental outcomes, supporting inclusive economic growth and long-term sustainability. Thus, Blue Sukuk serves as a strategic instrument that unites economic, social, and ecological aspects within a single integrated financing framework.

Synergy Between Blue Sukuk and Maqasid al-Sharia Blue Sukuk fundamentally supports the principles of maqasid al-Sharia, which emphasize the protection of wealth (hifz al-mal), the protection of life and the well-being of society (hifz al-nafs), and environmental conservation (hifz al-bi'ah) [29]. This instrument enables productive and secure allocation of funds, where every rupiah raised is directed toward projects that do not violate Islamic principles and also have a positive impact on environmental sustainability [30]. Through the concepts of ta'awun (cooperation) and shura (consultation), Blue Sukuk strengthens the commitment of the community and stakeholders to creating development that balances economic needs with ecological conservation [31]. The use of blockchain technology streamlines the audit and reporting systems, enhancing investor confidence and the transparency necessary for long-term sustainability. Thus, Blue Sukuk serves as a concrete manifestation of the integrative and practical application of the maqasid in the context of marine resource management [32]. Challenges in Implementing Blue Sukuk Although Blue Sukuk hold tremendous potential, there are several critical challenges that must be anticipated to ensure these instruments function optimally. First, the national regulatory framework still needs to be strengthened to accommodate the detailed and clear requirements for the issuance and oversight mechanisms of Blue Sukuk. Often, existing regulations have not fully integrated environmental, Sharia, and financial aspects simultaneously [33]. Second, the lack of in-depth empirical data and monitoring of the long-term impacts of Blue Sukuk in the field often limits evidence-based evaluation and policymaking [34]. Third, the readiness of the Sharia capital market system to manage and market Blue Sukuk is still in the development stage, including the readiness of human resources and digital infrastructure [35]. Finally, external factors such as global economic uncertainty and changes in international policy can also affect investor interest in this instrument. To address these challenges, synergy among various stakeholders and a comprehensive strategy are needed ranging from regulatory reform and human resource capacity building to the development of supporting digital technologies.

Strategic Opportunities and Policy Recommendations Indonesia has a significant strategic opportunity to become a global pioneer in the development of Blue Sukuk, thanks to its geographic location rich in marine resources and home to a large coastal community. To fully capitalize on this opportunity, the government needs to formulate policies that support the structuring and issuance of Blue Sukuk, including providing fiscal and non-fiscal incentives to investors. Regulatory strengthening must include standardizing Sharia compliance, integrating with environmental regulations, and establishing transparent governance frameworks to ensure Blue Sukuk becomes a credible financial instrument. Additionally, a digital ecosystem capable of facilitating blockchain-based reporting, auditing, and transactions must be developed to enhance market accountability and efficiency. Strengthening human resource capacity and actively involving local communities throughout the entire process are key to sustainability. Cross-sector collaboration among the government, the private sector, financial institutions, and civil society is crucial to accelerating the adoption of Blue Sukuk and achieving sustainable development goals in Indonesia's marine sector [36].

4. CONCLUSION

The integration of Blue Sukuk and blockchain offers significant opportunities to accelerate sustainable blue economic development in Indonesia. As a Sharia-compliant and environmentally friendly financial instrument, Blue Sukuk enhanced by blockchain technology can improve transparency, accountability, and investor confidence. Furthermore, this instrument also supports the protection of marine ecosystems, the empowerment of coastal communities, and the achievement of the SDGs through the financing of projects that have positive economic, social, and environmental impacts. However, optimizing the implementation of Blue Sukuk still faces a number of challenges, such as the need to strengthen regulations, develop human resource capacity, and build a reliable blockchain-based digital ecosystem. Cross-sector collaboration, policy reform, and market education are key to ensuring that Blue Sukuk can become an effective and significant sustainable financing instrument for the future of marine ecosystems and the well-being of the Indonesian people.

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The research related to human use (in-depth interviews with directors, commissioners, and the Sharia Supervisory Board of BSI) has complied with all relevant national regulations and

institutional policies and has been approved by the authors' institutional review board or equivalent committee.

Data Availability *(mandatory)*
The data that support the findings of this study, including BSI annual reports, GCG reports, and interview transcripts, are available from the corresponding author upon reasonable request, subject to confidentiality agreements with informants.

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Generative AI tools were used only for language refinement and formatting assistance. The scientific content, data analysis, and conclusions remain entirely the responsibility of the authors.

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