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Analysis of Opportunities and Challenges of Blockchain Technology in the Islamic Banking Industry (Case Study on the Use of Smart Contracts)

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Abstract

Purpose: This research concludes that, with a strategic and collaborative approach, blockchain technology can be an effective tool for transforming the Islamic banking industry.

Methodology: This study uses qualitative methods with literature analysis from 19 journals, one book, and three websites to explore how this technology can be applied in risk management, asset tracking, and interbank transactions.

Results: The research results reveal that this technology can reduce fraud, manipulation, and cyberattacks, as well as increase customer and sharia authority trust through transaction transparency. However, there are major challenges to overcome, such as immature regulatory aspects, the need for a strong infrastructure, and a lack of understanding of this technology among customers. This study also emphasizes the importance of collaboration between Islamic banking, regulators, and other stakeholders to maximize the potential of blockchain technology.

Limitations: Case studies on the use of smart contracts in the Sharia banking industry show that this technology can increase efficiency and Sharia compliance, reduce administration costs, and simplify transactions.

Contribution: This study describes the role of blockchain in the sukuk issuance process. Blockchain technology, which is known for its decentralization, transparency, and security characteristics, has great potential to increase efficiency and transparency in Sharia banking operations.

Keywords: *Blockchain, Efficiency, Sharia Banking, Smart Contract, Transparency*

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1. Introduction

Blockchain technology is gaining traction across various industries, including banking, due to its potential to transform the way we transact, store data, and protect information. This includes banking, which is seeking ways to enhance efficiency, security, and innovation in an increasingly digital era. Therefore, it is becoming increasingly important to thoroughly analyze the opportunities and challenges associated with the implementation of blockchain technology. Understanding the opportunities and challenges associated with the implementation of blockchain in the banking industry can help stakeholders design appropriate strategies to optimally leverage this innovation.Darmawan et al. 2023

Consensys and YouGov conducted a survey regarding global perceptions of Web3 in 15 countries: Argentina, Brazil, France, Germany, India, Indonesia, Japan, Mexico, Nigeria, South Africa, South Korea, the Philippines, the UK, the US, and Vietnam. This survey involved 15,000 respondents aged 18 to 65, with 1,015 being citizens of Indonesia. Based on the survey results, the understanding of blockchain in Indonesia is relatively low at 33%. This figure lags far behind Nigeria (78%), South Korea (63%), South Africa (61%), Brazil (59%), and India (56%). The low understanding of blockchain in Indonesia can be attributed to many factors, including not understanding how blockchain works (44 percent) and considering the technology too difficult to comprehend. (43 persen).(Liputan 6,2023)

The reason is directly related to the public's knowledge about blockchain. Interestingly, the public perceives blockchain technology as complex and believes that only those with technical skills can understand blockchain technology and enter the cryptocurrency ecosystem. Yudno Lawis, CEO of TocoCrypto, stated that the survey results provide an interesting insight into the level of knowledge about the blockchain world among the Indonesian public. There are challenges that need to be addressed in the effort to expand the adoption and use of blockchain technology in Indonesia, as the level of blockchain technology usage is still low. "One of the factors contributing to the low understanding is the lack of adequate education related to blockchain technology." "Many people are unsure about how blockchain works, its benefits, and various basic concepts such as its potential applications in different fields," said Yuda in his press release. quoted on Tuesday. (6/9/2023). (Liputan 6,2023)

Quoting Gartner, the annual business value of blockchain technology is expected to reach USD 3 trillion by 2030. This could result in 10% to 20% of the world's economic infrastructure operating on blockchain-based systems in the same year. Providing opportunities for productivity and performance efficiency for Islamic financial institutions. (Muttaqin et al., 2022). (Muttaqin et al., 2022). McKinsey explains that banks spend at least $15 billion to $20 billion per year to address fraud issues, and up to $8 billion to tackle anti-money laundering problems. (AML). This issue can be addressed by implementing blockchain technology, which can minimize the operational costs of banks. (McKinsey, 2019).

The study by Antonius Arthur Aripin (2019) outlines that the function of blockchain technology will enhance operational efficiency, security, speed, and accuracy of business processes in the banking subsector. This application is not relevant in the near term, and there are still many aspects that need improvement beyond the blockchain technology itself. (Aripin, 2019).

However, even though we recognize the great potential of this technology, we must also confront the challenges associated with its implementation. One of the main challenges related to regulation and compliance. Due to its innovative nature and the potential lack of regulation, blockchain faces challenges in terms of compliance with existing regulations and requires broader legal recognition to be effectively implemented in the banking environment. (Andoni et al,2019)
In addition, security aspects are also a major concern in the context of blockchain. Although blockchain is considered to have a high level of security due to its decentralized and transparent nature, cyber attacks and data breaches remain threats that need to be addressed. Therefore, a deep understanding of the security risks associated with this technology is key to ensuring its successful implementation in the banking industry. (Hassan et al,2019)

From this perspective, analyzing the opportunities and challenges of blockchain technology in the banking industry provides a roadmap for navigating the increasingly complex and globally integrated transformation of the industry. With a deep understanding of the various aspects involved, sustainable strategies can be designed to maximize the potential of blockchain technology while addressing existing constraints.(Bahanan & Wahyudi,2023)

2. Literature Review

2.1 Blockhcain

Blockchain is a decentralized database consisting of a series of blocks that are cryptographically linked. Each block in the blockchain contains a series of verified and encrypted transactions. Each transaction

on the blockchain is confirmed by a large number of nodes distributed throughout the network. This ensures the security and integrity of the data. Changing one block in a blockchain requires altering the entire chain of previous blocks, and this is very difficult and almost impossible to do.(Supriyanto et al., 2021).Blockchain is a decentralized database system used to securely and transparently record digital transactions. (Muhammad Erwin et al., 2022). The recording scheme consists of many servers in the sense that digital transaction data is not stored in one place but is distributed across all nodes, making it normatively resistant to data changes. Blockchain is a digital system that enables the creation of a distributed ledger, allowing multiple participants in a peer-to-peer network to exchange information and assets directly without a trusted intermediary. (Furlonger & Uzureau 2020).

Smart Contracts in Islamic Financial TransactionsSmart Contracts are programming codes that are automatically executed when certain conditions are met. (Zheng et al., 2020). In Islamic finance, Smart Contracts can be used as a means of transactions that adhere to Sharia principles. For example, Smart Contracts can ensure that payments and loans are executed according to predetermined conditions and schedules, without interest. Smart contracts also facilitate trust transactions between parties, eliminating the need for intermediaries that can increase costs and complexity.

2.2 Smart Contract with Blockchain

Blockchain and smart contracts work together to provide a secure, transparent, and automated platform for various types of transactions and agreements. Here is the working process between blockchain and smart contracts:

1) Creating a Smart Contract: A smart contract is a computer program on the blockchain.This is written in a specialized programming language like Solidity. (untuk Ethereum). This contract contains the rules and logic that govern how transactions are conducted.
2) Deploying the Smart Contract to the Blockchain: Once the smart contract is created, it is deployed to the blockchain. This means that the contract has been uploaded to the blockchain network and stored there. Each node (computer) in the blockchain network has a copy of this contract.
3) Triggering the Smart Contract: A smart contract can be triggered or activated by a transaction. This transaction is sent to the blockchain network and includes relevant data or value for the execution of the contract.
4) Execution of Smart Contract: After receiving the appropriate transaction, each node in the network executes the logic within the smart contract. The results of this execution are verified by all nodes in the network to ensure their consistency and correctness.
5) Results are stored on the Blockchain: The outcomes of executing the smart contract (for example, changes in asset ownership, payments, or other information) are stored on the blockchain.
6) Security and Immutability: Blockchain uses encryption to ensure that data cannot be altered or deleted once it has been written.Each new block added to the blockchain contains the hash of the previous block, creating a secure chain of blocks.
7) Transparency and Decentralization: Blockchain is decentralized, and no single entity has full control over it. All network participants can see and verify transactions and the execution of all contracts. With that, the transaction is complete. Here is how blockchain works in general (GICIndonesia, 2022):

2.3 Opportunities for blockchain implementation in Islamic banking

The utilization of blockchain technology in Islamic banking presents opportunities in one of its aspects, namely the human resources aspect, which is urgent as it relates to how the human resources department develops technology for blockchain itself. SDM is the key to improving the blockchain ecosystem system in Indonesia, especially in Islamic financial institutions. Addressing this issue certainly requires the collaboration of all stakeholders (government, academics, institutions, social entities, and the private sector) to create a reliable digital workforce in Indonesia. Companies that implement blockchain technology will conduct research on blockchain system literacy and adjust their curricula to help participants adapt to advancements in science and technology.According to the Digital Competitiveness Index (DCI) study conducted by East Venture Capital, the average national digital talent in Indonesia decreased by 18.9 points from 77.3

points in 2020 to 58.4 points in 2021. (Aulia, 2022). Based on that data, Indonesia must implement improvements to enhance the quality of digital talent focused on ABC, namely; Artificial Intelligence, Big Data, and Cloud Computing. In line with that trend, digital talents need to learn technical and soft skills. (Sasongko, 2019). Challenges of implementing blockchain in Islamic banking Here are some insights into the impact of blockchain technology on Islamic banking:

1) Regulation.
   One of the main challenges in implementing blockchain in Islamic accounting is compliance with existing regulations. Regulations and policies must be considered to ensure that the use of blockchain aligns with the principles of Islamic law and financial regulations.
2) Compliance with Sharia law. Users of blockchain technology require further research to ensure adherence to the principles of Islamic law. More research is needed to determine whether the use of blockchain is considered halal or not under Islamic financial law.
3) Limitations of literature.
   There are limitations in the literature regarding the use of blockchain in Islamic banking, particularly in the context of Sukuk.
4) Technical challenges.
   The use of blockchain in Islamic accounting also faces technical challenges such as scalability, interoperability, and data privacy. Blockchain technology needs to be enhanced and adapted to address the challenges in the context of Islamic accounting. To overcome this obstacle, industry, academia, regulators, and stakeholders must collaborate to enhance the appropriate framework and support the effective application of blockchain in Sharia accounting that aligns with Sharia principles. Several efforts to address the challenges of implementing blockchain in Islamic banking:
   a. Human resources with adequate capabilities in managing Blockchain in Islamic financial institutions.
   b. Preparing experts and researchers on the application of Blockchain technology in Islamic Banking.
   c. Good and authentic research on Blockchain technology specifically in Islamic Banking.(Rafiqi Ihsan,2022).

2.4 The Sukuk Issuance Process

Here are the detailed stages in the process of issuing sukuk in general:

1) Planning and Preparation
   a. Determining Objectives and Needs: The issuer determines the objectives of issuing sukuk and the amount of funds required for a specific project or activity.
   b. Feasibility Study: Conducting a feasibility analysis to ensure that the project or asset being financed complies with Sharia principles and is commercially viable.
   c. Team Formation: Forming an internal team and appointing relevant parties, such as Sharia consultants, legal advisors, and auditors.
2) Sukuk Structure
   a. Choosing the Type of Sukuk: Determining the type of sukuk to be issued, such as Sukuk Ijarah, Sukuk Murabahah, Sukuk Mudarabah, or Sukuk Wakalah.
   b. Structuring: Developing the sukuk structure, including the underlying assets of the sukuk, cash flows, and risk allocation.
3) Documentation Preparation
   a. Document Preparation: Preparing the necessary documents including the prospectus, sukuk agreements, and other legal documents.
   b. Approval from the Sharia Board: Submitting the documentation to the Sharia Board to ensure that the sukuk structure complies with Sharia principles.

4) Regulatory Approval
   a. Submission to the Regulator: Submitting documents to the financial supervisory authority to obtain approval for the issuance of Sukuk. This may require approval from the capital market regulator or banking authority, depending on the type of issuer.
   b. Regulatory Adjustments: Adjusting documents and the structure of the Sukuk according to feedback from the regulator if necessary.
5) Marketing and Offerings
   a. Sukuk Marketing: Conducting roadshows and presentations to promote sukuk to potential investors.
   b. Sukuk Offering: Offering sukuk to the public or selected investors. This can be in the form of a public offering through the capital market or a private placement.
6) Sales and Publishing
   a. Sale of Sukuk: Selling sukuk to investors and raising the necessary funds.
   b. Issuance of Sukuk Certificates: Issuing sukuk certificates to investors as proof of ownership.
7) Use of Funds
   a. Fund Management: Use the collected funds according to the predetermined objectives, such as financing specific projects or activities.
   b. Reporting: Regularly report on the use of funds and the progress of projects to investors and regulators.
8) Payment of Returns and Settlement
   a. Profit Payment: Paying profits to investors according to the provisions stated in the sukuk document.
   b. Sukuk Redemption: Repaying the sukuk at maturity, including the principal and final profit payments to investors.
9) Audit and Evaluation
   a. Audit: Conduct internal and external audits to ensure compliance with the sukuk structure and the use of funds in accordance with Sharia principles.
   b. Evaluation: Assess the success of sukuk issuance and draw lessons from the sukuk issuance process for the future.

3. Research Methodology

The author uses a qualitative method of literature study research. This research utilizes secondary data sources obtained from credible and relevant literature, including 19 journals, 1 book, and 3 websites. (Liputan6, Finadium, dan GICTrade). Researchers are exploring data related to the use of Blockchain technology in Islamic Banking, both in Indonesia and in other countries. The process of exploring secondary data is carried out through the internet to search for data sources more effectively and efficiently. (Jane & Watson, 2002).

4. Results And Discussion

Research shows that the application of smart contract technology and blockchain in financial transactions at Islamic banks has a significant impact on enhancing security. This technology uses strong cryptographic algorithms and decentralized consensus mechanisms to ensure the integrity and authenticity of data. In the context of Islamic banking, this technology minimizes the risk of fraud and cyber attacks that could be harmful to customer funds. The use of blockchain technology also has a positive impact on the transparency of financial transactions in Islamic banks. Blockchain enables transaction verification that can be accessed by all stakeholders, which strengthens customer trust and the authority of Sharia in the integrity of Islamic banking operations. In addition, the transparency provided by blockchain facilitates audits and external reporting in accordance with Sharia principles. Smart contracts and blockchain technology have great potential to address challenges related to transparency and efficiency in Islamic financial systems. Blockchain properties such as data immutability, decentralization, and transparency make transactions safer and more efficient. Case studies show that smart contracts and blockchain technology in the Islamic finance industry reduce administrative costs and simplify transactions. In 2018, Al Hilal Bank, a leading Islamic financial institution in Abu Dhabi, partnered with blockchain technology company SettleMint to revolutionize

the way they handle sukuk transactions. (obligasi syariah). This partnership is one of the world's first implementations of blockchain technology in the issuance and trading of sukuk, demonstrating the great potential of this technology to enhance efficiency, transparency, and security in Islamic finance. The collaboration between Al Hilal Bank and Settlemint in the application of blockchain technology aims to improve the transparency of sukuk issuance and transactions. Blockchain provides a clear and immutable ledger, ensuring that all parties can monitor and verify transactions. This is crucial in sukuk transactions, which prioritize trust and adherence to Sharia principles. Blockchain provides the possibility for all transactions to be recorded clearly and immutably, ensuring that all parties have access to the exact same information. This reduces the risk of fraud and enhances investor confidence in the issuance and trading process of sukuk. Requirements for a Smart Contract that can be implemented in programming code for the issuance and sale of sukuk.

1) Contract Variables:
   a. issuer: Address of the sukuk issuer.
   b. uploadfolder: Submission of documents to the blockchain.
   c. checkfolder: Verification that the submitted documents meet the requirements.
   d. totalsupply: Total number of sukuk to be issued.
   e. Price: The price of each sukuk unit.
   f. maturityDate: The maturity date of the sukuk.
   g. totalprofitdistributed: The total profit that has been distributed.
   h. balances: Stores the sukuk balance for each address.
   i. profitshares: Stores the amount of profit received by each address.
   j. holders: Stores the list of sukuk holders' addresses.
   k. ismatured: Stores the status of whether the sukuk has matured or not.
2) Modifier:
   a. onlyissuer: Only allows the issuer to call certain functions.
   b. onlybeforematurity: Allows the function to be called only before the maturity date.
   c. onlyaftermaturity: Allows the function to be called only after the maturity date.
3) Functions of Contracts:
   a. constructor: Initializes the contract with the number of sukuk, the price of the sukuk, and the maturity date.
   b. purchasesukuk: A function to buy sukuk before maturity. This function checks the number of sukuk to be purchased, the price sent, and updates the balance of the sukuk holder.
   c. distributeprofit: Distributes profits to sukuk holders before maturity. This is a function that calculates and distributes profits based on the number of sukuk owned.
   d. returnprincipal: Returns the principal to sukuk holders after maturity. This function returns the principal amount to each sukuk holder based on the number of sukuk owned.
   e. gettotalbalance: Calculates the total number of sukuk owned by all sukuk holders.
   f. checkshariacompliance: To check compliance with Sharia principles.(All requirements can be implemented in programming code, without the need for intermediaries, ensuring that everyone involved adheres to the established rules.) For example, in the issuance of sukuk, a smart contract ensures automatic dividend payments to sukuk holders according to a specified schedule and verifies asset ownership transparently and securely.

4.1 The Use of Smart Contracts in Sukuk

Sukuk issued through blockchain can be traded using a smart contract system to enable automation as follows.

1) Deployment
   a) Deploy the contract by specifying totalSupply, sukukPrice, and maturityDate.
   b) The issuer must use the constructor function to initialize the contract.
2) Purchase of Sukuk
   Potential investors can perform the purchaseSukuk function by sending the appropriate amount of Ether corresponding to the number of sukuk they wish to buy.
3) Distribution of Profits
   The publisher can use the distributeProfit function to distribute profits to all sukuk holders based on the number of sukuk they own.

4) Principal Return:
   After the maturity date, the issuer can use the returnPrincipal function to return the principal to all sukuk holders.
5) Sharia Compliance:
   The check Sharia Compliance function can be used to verify transactions conducted in accordance with Sharia principles. A more detailed implementation of the logic of Sharia compliance can be added to this function.

According to Alex Coelho, CEO of Al Hilal Bank, the use of smart contracts on the blockchain can automate processes that previously required a lot of manual intervention, making it more convenient compared to previous methods. Blockchain can reduce administrative costs and speed up transaction completion by automating smart contracts. This is beneficial for sukuk issuers and investors. Processes that usually require submissions and approvals from many parties can be simplified to run automatically based on agreed-upon terms. This operational efficiency not only reduces long-term operational costs but also accelerates real-time document validation, allowing transactions to be completed more quickly and at a lower cost. (Finadium, 2018). This collaboration brings many benefits and positive impacts for all parties involved. By leveraging blockchain technology, Bank Al Hilal will be able to reduce the time and costs involved in the issuance and trading of sukuk.

Previously, this process required submissions to various parties, but blockchain accelerates the process and reduces long-term operational costs. Investors can also benefit from the transparency brought by blockchain.They can verify transactions in real time and are confident that the recorded data is secure and cannot be altered. In addition, the ability to publicly view the entire transaction history and ownership ensures that all parties operate with the same information, thereby reducing information asymmetry and the potential for fraud. This transparency provides peace of mind for investors as they can directly monitor the use of their funds and the sukuk issuer fulfills all obligations according to the contract on time. Smart Contracts can monitor Sharia compliance by automating and enforcing rules that adhere to Sharia principles in all transactions. In Smart Contracts, all necessary provisions to comply with Sharia law, such as the prohibition of riba (interest), are integrated into the code. If these conditions are met, the transaction will be executed automatically. This ensures that all transactions are conducted in accordance with Sharia law without the need for manual intervention, thereby increasing efficiency and transparency. This automation allows issuers and investors to be confident that all transactions conducted are in accordance with Islamic law principles, which is very important from the perspective of Islamic finance. Although this collaboration brings various benefits, there are still several challenges that must be faced. The application of blockchain technology in Islamic finance must comply with the applicable regulations. Therefore, cooperation with regulators is very important to ensure compliance with all regulations and the acceptance of this technology. Blockchain has many benefits, but its implementation requires adjustments to infrastructure and organizational culture. Education and training for staff and other stakeholders are key factors for successful implementation.

5. Conclusion

Through the processes and activities of this research, it is concluded that blockchain technology and smart contracts have the potential as new technologies in the analysis of the banking industry, as they not only facilitate stakeholders in the transaction process but also reduce transaction costs. Transparency that not only does not involve third parties directly but is also accessible to both parties or external parties enhances customer trust in the bank. However, aside from the numerous benefits, for the smooth implementation of this technology in the banking industry, particularly in Islamic banking, there are still many challenges that need to be addressed and facilitated, such as regulations, compliance with Sharia law, and the limited literature and technical knowledge. challenge. There are several tasks that need to be done.

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