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DIGITAL SUKUK AND SHARIAH COMPLIANCE: A JURISPRUDENTIAL ANALYSIS OF BLOCKCHAIN INTEGRATION IN ISLAMIC FINANCE

Abubakar Muhammad Jibril
Universitas Indonesia and Islamic University of Niger, Niger Republic
Abubakarmuhammadjibril765@gmail.com

Inuwa Adamu
Islamic University in Uganda
inuwaadam294@gmail.com

Souad Ezzerouali
College of Law, Dhofar University, Oman
sezzerouali@du.edu.om

Ummi Ibrahim Tafida
Islamic University in Niger, Niger Republic
ummitafida83@gmail.com

Mu'adil Faizin
Sunan Gunung Djati State Islamic University
muadilfaizin27@gmail.com

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Abstract

This study examines the Shariah compatibility of blockchain-based sukuk with particular attention to whether distributed ledger technologies can be reconciled with core Islamic legal requirements, including risk-sharing, asset-backing, and the prohibition of riba and gharar. The research explores whether blockchain facilitates or complicates the issuance, governance, and enforceability of Islamic financial instruments. A qualitative doctrinal and comparative legal approach is employed, drawing on primary Islamic legal sources (Qur'an, Sunnah, and classical fiqh), contemporary Shariah standards issued by the Accounting and Auditing Organization for Islamic Financial Institutions, and regulatory practices in selected jurisdictions. The analysis also examines emerging blockchain sukuk initiatives in countries such as the United Arab Emirates and Indonesia. The findings suggest that blockchain technology can support Shariah-compliant sukuk structures when digital instruments are linked to genuine underlying assets and implemented through recognized Islamic contractual forms. Smart contracts may enhance transparency and automate compliance mechanisms, but their effectiveness depends on reliable legal connections between digital tokens and asset ownership. The study also identifies significant governance

challenges, including the absence of standardized Shariah guidelines for tokenized ownership and regulatory fragmentation across jurisdictions. These factors create uncertainty regarding legal enforceability and cross-border scalability. The study concludes that harmonized regulatory frameworks and coordinated Shariah governance mechanisms are essential for realizing the potential of blockchain-based sukuk in global Islamic finance.

Keywords: *Blockchain Sukuk, Shariah Compliance, Islamic Finance, Smart Contracts, Tokenization*

A. INTRODUCTION

The rapid digitalization of global finance has begun to reshape the architecture of Islamic financial markets, raising fundamental questions about how emerging technologies interact with the normative foundations of Shariah-compliant finance (Sezgin, 2025). Islamic finance has experienced sustained global expansion over the past two decades, with sukuk emerging as one of its most dynamic instruments due to their asset-based structure and emphasis on risk sharing.(Hasan Polas, et.al 2024) At the same time, distributed ledger technologies, particularly blockchain and smart contracts, are increasingly promoted as tools capable of improving transparency, operational efficiency, and investor confidence in financial markets (Othman, Wahab, & Saufi, 2024). These technological developments have encouraged policymakers and financial institutions to explore the possibility of issuing tokenized or blockchain-based sukuk (Razak, Dali, Dhillon, & Manaf, 2020). Proponents argue that blockchain's immutable record-keeping and automated execution mechanisms may enhance accountability, reduce transaction costs, and strengthen compliance monitoring within Islamic capital markets (Nur Aisah, et.al 2025).

Despite these promises, the integration of blockchain into sukuk markets raises unresolved jurisprudential and regulatory questions that remain insufficiently examined in existing scholarships. Much of the current literature focuses primarily on technological efficiency, market innovation, or fintech adoption, while comparatively little attention has been devoted to the doctrinal implications of tokenization for core Shariah requirements governing sukuk structures (Khan et al., 2022). Unresolved debates persist regarding whether digital tokens can represent valid ownership (milkiyyah) of underlying assets, whether blockchain-mediated transactions satisfy the conditions of possession (qabd) required in Islamic commercial law, and how smart contracts can be structured to avoid elements of gharar or legal uncertainty. Furthermore, the absence of harmonized regulatory frameworks across jurisdictions complicates the legal enforceability of

blockchain-based sukuk and raises questions about cross-border recognition of digital asset ownership (Binhayyan & Almohawes, 2025). These jurisprudential and governance challenges reveal a critical gap between technological experimentation in Islamic fintech and the doctrinal frameworks that traditionally govern Shariah-compliant financial instruments.

Against this backdrop, this study examines whether blockchain-based sukuk can satisfy the foundational legal principles of Islamic finance and what institutional and jurisprudential safeguards are required to ensure their Shariah compliance. Rather than focusing solely on technological innovation, the article provides a jurisprudential and governance-oriented analysis of digital sukuk structures, drawing on classical Islamic legal principles, contemporary Shariah standards, and emerging regulatory practices. By analyzing real-world initiatives—including blockchain-related sukuk developments in the United Arab Emirates and fintech-based sukuk platforms in Indonesia the study evaluates both the opportunities and the structural challenges associated with integrating distributed ledger technologies into Islamic capital markets. Through this approach, the paper seeks to bridge the gap between classical Islamic commercial jurisprudence and contemporary financial innovation, offering a critical legal assessment of how blockchain technology can be reconciled with the doctrinal requirements of Shariah-compliant finance.

B. LITERATURE REVIEW

Shariah Principles Governing Sukuk

Islamic finance is grounded in well-established principles of Islamic commercial jurisprudence that aim to ensure fairness, transparency, and ethical economic conduct. Sukuk structures must therefore reflect genuine ownership of underlying assets or usufruct rather than merely representing debt obligations (Uddin, Afroz, & Suzuki, 2018). Scholars emphasize that Shariah-compliant financial instruments must avoid riba (interest), gharar (excessive uncertainty), and maysir (speculative gambling) while ensuring that financial transactions are linked to lawful economic activities (Swalih, 2019). These requirements distinguish sukuk from conventional bonds by embedding risk-sharing and asset-backed investment within their contractual design.

Classical Islamic legal sources also stress the importance of transparency and documentation in commercial transactions (Jaradat & Oudat, 2025). The Qur'anic directive encouraging written contractual agreements (Q. 2:282) has frequently been cited by contemporary scholars to highlight the normative importance of clarity, accountability, and evidentiary reliability

in financial dealings (Soofi, 2024). In modern Islamic finance practice, these doctrinal principles have been institutionalized through international Shariah standards and regulatory frameworks.

A central reference point in contemporary sukuk jurisprudence is the work of the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI), whose Shariah standards require sukuk certificates to represent proportional ownership in tangible assets, usufruct, or investment activities rather than merely evidencing debt (AAOIFI, 2026). AAOIFI Shariah Standard No. 17 emphasizes that investors must possess legally recognized ownership rights over the underlying assets of the sukuk structure. Similarly, resolutions issued by the International Islamic Fiqh Academy have affirmed that financial instruments representing shares in assets or usufruct may be issued as tradable certificates provided, they reflect genuine ownership rather than interest-bearing loans (AAOIFI, 2026).

These doctrinal requirements are reflected in regulatory definitions of sukuk adopted by national financial authorities. For example, the Securities Commission Malaysia describes sukuk as certificates representing undivided ownership interests in underlying assets or investment activities structured according to Shariah principles (Securities Commission Malaysia, 2014). In practice, common sukuk contracts such as ijarah, musharakah, mudarabah, murabaha, and istisnaʿ allow investors to earn returns derived from real economic activity while sharing the risks associated with the underlying assets. Within Islamic legal theory, three concepts are particularly important for evaluating the validity of sukuk structures: milkiyyah (ownership), qabd (possession), and the avoidance of gharar (excessive uncertainty). These principles form the doctrinal foundation for assessing whether innovative financial instruments including digital or blockchain-based instruments remain consistent with Shariah requirements. As financial technologies evolve, the application of these principles to new technological infrastructures has become a central concern in contemporary Islamic finance scholarship.

Blockchain and Sukuk in Contemporary Scholarship

Recent scholarship increasingly explores the intersection between Islamic finance and emerging financial technologies, particularly blockchain and smart contracts.(Supriyadi, et. al 2024) Proponents of blockchain technology argue that its decentralized ledger architecture can improve transparency, reduce operational costs, and enhance transaction security within financial systems.(Supriyadi et al., 2024) In the context of Islamic finance, these technological features appear particularly attractive because they align with the ethical objectives of transparency, trust, and accountability that underpin Shariah-compliant financial practices. Several studies highlight the potential benefits of blockchain technology for sukuk markets. By recording transactions on

an immutable distributed ledger, blockchain systems may enhance the traceability of asset ownership and facilitate more efficient issuance and settlement processes.(Moppratama, Alamsyah, & Tricahyono, 2024) Smart contracts self-executing agreements embedded within blockchain protocols have also been proposed as tools capable of automating contractual obligations such as profit distribution, asset verification, and compliance monitoring. These features may reduce administrative complexity and minimize the need for intermediaries traditionally involved in sukuk issuance (Sriman et al., 2026).

Empirical and conceptual studies of Islamic fintech similarly emphasize the compatibility between blockchain technology and the ethical foundations of Islamic finance. Scholars argue that the transparency and auditability of blockchain systems may strengthen investor confidence and reduce information asymmetries in financial markets (Fahrezy, Tjahyadi, & Kurniawati, 2025). Industry analysts have also suggested that blockchain-enabled sukuk could reduce issuance costs and improve accessibility to Islamic capital markets by enabling smaller investors to participate through tokenized instruments (Kunhibava, et. al 2020). Despite these potential advantages, the integration of blockchain technology into sukuk structures remains the subject of significant scholarly debate.(Jibril, 2025) One of the most contentious issues concerns whether digital tokens can represent legally valid ownership of underlying assets under Islamic law. While some researchers argue that tokenization may serve as an efficient mechanism for representing ownership interests in real assets, others caution that digital tokens may only function as symbolic representations rather than legally enforceable titles.

This debate is closely linked to the jurisprudential concept of milkiyyah, which requires that sukuk investors possess genuine ownership rights in the underlying assets. If tokenized sukuk merely record entitlement without transferring legal title, the resulting structure may fail to satisfy the asset-backing requirements established in Shariah standards. Related concerns also arise regarding qabd (possession), which traditionally requires some form of constructive or physical control over the asset. Whether digital ledger entries can satisfy this requirement remains an unresolved doctrinal question in contemporary Islamic finance scholarship. Another significant challenge concerns the potential emergence of gharar in blockchain-based sukuk structures. If tokenized instruments rely on off-chain asset registries or complex technological intermediaries, the resulting separation between digital representation and legal ownership may introduce uncertainty regarding the rights of investors. Scholars therefore emphasize the importance of establishing verifiable links between blockchain records and legally recognized asset registries to ensure that tokenized sukuk structures remain consistent with Shariah principles (Chong, 2021).

Regulatory fragmentation across jurisdictions further complicates the development of blockchain-based sukuk. While some jurisdictions have begun to explore digital asset regulation and smart-contract enforceability, others lack clear legal frameworks governing tokenized financial instruments (Fulena, 2025). Divergent interpretations among national regulators and Shariah supervisory boards may therefore create uncertainty regarding the legal recognition and cross-border enforceability of blockchain-based sukuk structures.

Research Gap

Although existing scholarship provides valuable insights into the technological potential of blockchain in Islamic finance, much of the literature remains focused on conceptual discussions, technological prototypes, or industry-level analyses. Relatively few studies provide systematic jurisprudential evaluations of how blockchain-based financial instruments interact with the doctrinal requirements governing sukuk structures. In particular, the literature has yet to fully resolve how core Islamic legal concepts such as milkiyyah (ownership), qabd (possession), and the avoidance of gharar should be interpreted in the context of tokenized financial assets and automated smart-contract systems. Similarly, while several case examples of blockchain-based sukuk initiatives have been documented, these experiments have rarely been subjected to rigorous doctrinal analysis grounded in classical Islamic jurisprudence and contemporary Shariah standards.

This study addresses this gap by examining the compatibility of blockchain-based sukuk structures with established Shariah principles through a jurisprudential and comparative legal analysis. By linking classical fiqh concepts with emerging blockchain mechanisms and evaluating real-world initiatives in jurisdictions such as the United Arab Emirates and Indonesia, the study seeks to clarify the doctrinal conditions under which digital sukuk instruments may be considered Shariah-compliant. Through this analysis, the article contributes to ongoing scholarly debates concerning the integration of financial technology within Islamic legal frameworks and offers insights for regulators, Shariah supervisory boards, and fintech developers seeking to design digital financial instruments consistent with Islamic jurisprudence.

Hypotheses

The literature indicates growing interest in the intersection between Islamic finance and blockchain technology. While many studies emphasize the efficiency and transparency of distributed ledger systems, important jurisprudential and regulatory questions remain unresolved, particularly concerning digital ownership, Shariah governance, and cross-border regulatory recognition. Given that sukuk structures must comply with core Islamic legal principles such as

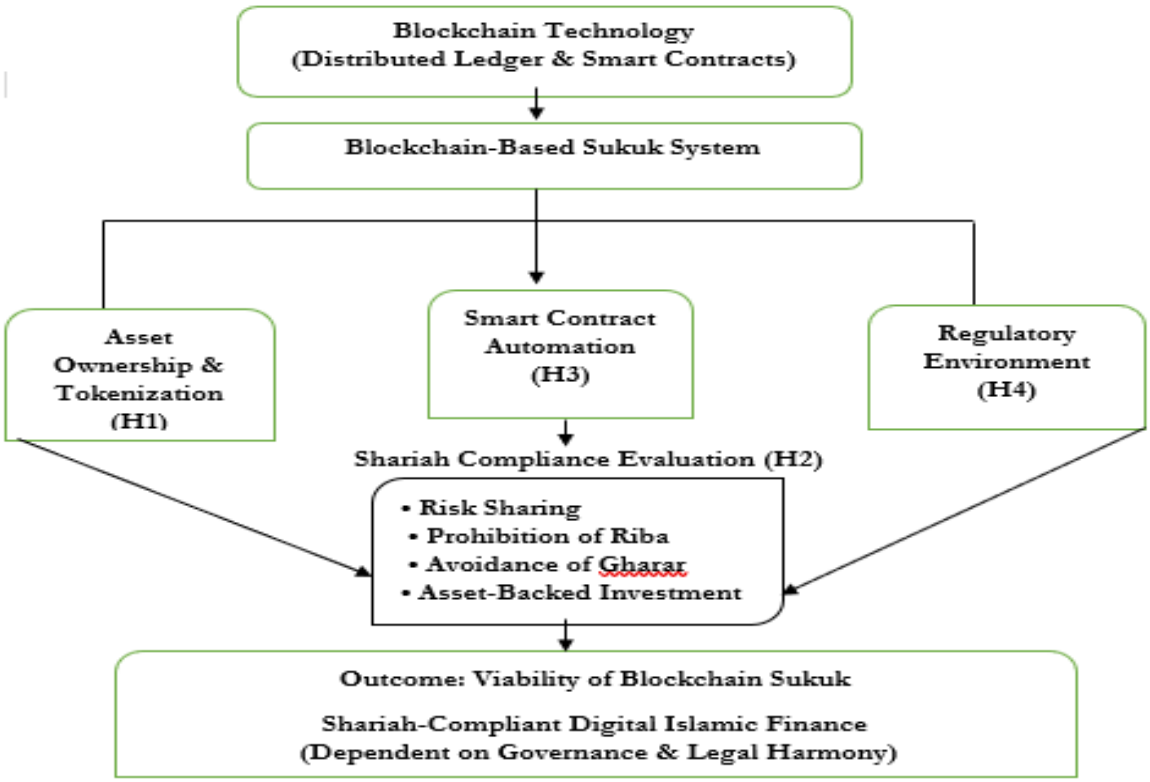
asset-backing, risk-sharing, and the prohibition of riba and gharar the introduction of blockchain technology raises significant doctrinal and governance challenges.

To examine these issues, this study formulates the following analytical hypotheses to guide the doctrinal and comparative analysis of blockchain-based sukuk:

1. H1: Blockchain-based sukuk can comply with Shariah principles when structured around genuine asset ownership and recognized Islamic contractual forms.
2. H2: The absence of standardized Shariah guidelines for digital assets creates uncertainty regarding the compliance of tokenized sukuk.
3. H3: Smart contracts may enhance Shariah compliance by automating contractual obligations if they are verifiably linked to underlying assets.
4. H4: Regulatory fragmentation and weak cross-border legal recognition hinder the global adoption of blockchain-based sukuk.

These hypotheses frame the study's examination of the jurisprudential and regulatory conditions under which blockchain-enabled sukuk may operate in accordance with Shariah principles.

Figure 1: Conceptual Framework: Blockchain Sukuk and Shariah Compliance



Source: Processed by the Authors 2026

C. RESEARCH METHODOLOGY

Data Sources and Collection

This study relies on qualitative documentary research using secondary sources relevant to Islamic finance and financial technology. The materials analyzed include peer-reviewed academic publications, regulatory and policy reports, industry white papers, fintech case documentation, and reports issued by Shariah supervisory bodies. Attention was given to authoritative institutional sources, including policy and standard-setting documents issued by the Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI), the Islamic Financial Services Board (IFSB), and regulatory guidance from national securities authorities. Sources were selected through purposive sampling based on their relevance to blockchain applications in sukuk structures and their engagement with Shariah compliance issues in Islamic financial instruments.

Data Analysis

The collected materials were analyzed through thematic and comparative legal analysis. Thematic analysis was structured around core Shariah compliance principles governing Islamic finance, including risk-sharing arrangements, the prohibition of riba and gharar, the requirement of asset-backing and transfer of ownership, and ethical transparency in investment activities. Documents were examined iteratively to identify recurring legal and governance themes related to blockchain-based sukuk structures. In addition, a comparative doctrinal analysis was undertaken to evaluate how traditional sukuk models and blockchain-enabled structures align or diverge in relation to these Shariah requirements.

Jurisprudential Analysis

To interpret emerging technological practices within the framework of Islamic legal theory, the study applied doctrinal reasoning grounded in classical jurisprudence. Contemporary issues such as tokenized ownership and smart-contract execution were evaluated through established methods of Islamic legal interpretation, including analogical reasoning (qiyās) and reference to the objectives of Islamic law (maqāṣid al-sharīʿah). This approach enabled the assessment of whether digital financial mechanisms can satisfy the normative conditions traditionally required for Shariah-compliant asset-based instruments.

Ethical Considerations and Limitations

As a desk-based doctrinal study relying exclusively on publicly available documents, the research did not involve human participants and therefore did not require formal ethical approval.

Nevertheless, academic integrity was maintained through careful source verification and consistent citation practices. A limitation of the study is the absence of empirical fieldwork or stakeholder interviews with regulators, Shariah scholars, or fintech practitioners. Future research could incorporate such empirical approaches to complement doctrinal analysis and provide deeper insight into practical governance challenges surrounding blockchain-based sukuk.

D. RESULT AND DISCUSSION

Compatibility of Blockchain Sukuk with Shariah Principles

The doctrinal and comparative analysis undertaken in this study indicates that blockchain-enabled sukuk structures possess the potential to operate in a manner consistent with the fundamental principles of Islamic finance, provided that their technological architecture remains firmly anchored in established Shariah contractual frameworks. Islamic finance does not reject technological innovation as such; rather, it evaluates financial instruments according to whether their underlying structures preserve the normative requirements of Islamic commercial jurisprudence (Sidik & Ahmad, 2024). Consequently, the compatibility of blockchain with sukuk does not arise from the technological novelty of distributed ledger systems alone, but from the extent to which those systems reinforce the legal and ethical foundations that govern Shariah-compliant financial transactions (Kunhibava et al., 2021).

At the doctrinal level, sukuk legitimacy depends on several well-established legal conditions derived from Islamic commercial law. These include genuine ownership of underlying assets, the sharing of commercial risk between investors and issuers, and the avoidance of contractual arrangements involving riba (interest) or gharar (excessive uncertainty). Contemporary Shariah governance frameworks, particularly those developed by the Accounting and Auditing Organization for Islamic Financial Institutions, emphasize that sukuk certificates must represent proportional ownership in tangible assets, usufruct, or investment activities rather than simply constituting debt obligations disguised in Islamic terminology (Hassan & Raza Rabbani, 2023). This doctrinal requirement differentiates sukuk from conventional bonds and ensures that financial returns are derived from legitimate economic activity rather than predetermined interest payments.

Within this normative framework, blockchain technology may serve as an enabling infrastructure that strengthens the evidentiary and governance dimensions of asset-based financing. Distributed ledger systems maintain tamper-resistant records of transactions across decentralized networks, thereby reducing the likelihood of manipulation, hidden liabilities, or

undisclosed contractual modifications.(Rehan, Hadi, & Sa'ad, 2025) Such transparency aligns closely with Islamic legal principles emphasizing fairness, accountability, and clarity in commercial dealings (Naz, Ali, & Barut, 2025). In classical jurisprudence, contractual certainty and reliable documentation are essential safeguards against exploitation and dispute (Naz et al., 2025). Blockchain technology, through its immutable ledger structure, offers a modern technological mechanism capable of operationalizing these long-standing normative principles (Chong, 2021).

The compatibility between blockchain systems and Shariah-compliant financial structures becomes particularly evident when digital infrastructures are applied to sukuk arrangements grounded in recognized Islamic contracts such as mudarabah, musharakah, or ijarah (Zaka & Shaikh, 2021). In a mudarabah structure, investors provide capital to an entrepreneur who manages an underlying economic venture, with profits shared according to predetermined ratios while losses are borne by capital providers (Asyiqin, 2025.) In an ijarah sukuk structure, investors acquire ownership interests in leased assets and receive returns derived from rental payments generated by those assets (Nik Abdul Ghani, 2018). In both cases, financial returns are directly linked to the performance of identifiable economic activities rather than predetermined interest obligations.

Blockchain infrastructure can enhance the operational integrity of such structures by enabling real-time recording of contractual obligations, ownership transfers, and asset-generated revenue streams (Abojeib & Habib, 2021). For example, distributed ledgers can record the issuance of sukuk certificates, the transfer of investor ownership shares, and the distribution of periodic returns derived from the underlying assets. Because these records are shared across multiple nodes within a decentralized network, the risk of unilateral alteration or hidden manipulation of financial data is significantly reduced. This level of transparency can help mitigate information asymmetries that have historically complicated sukuk administration, particularly in transactions involving multiple intermediaries, trustees, and custodial institutions.

The integration of smart contracts further expands the governance potential of blockchain-enabled sukuk structures. Smart contracts are programmable protocols embedded within blockchain networks that automatically execute contractual conditions once predetermined criteria are satisfied (Munawar, 2022). In the context of Islamic finance, such automation may support the enforcement of Shariah-compliant contractual terms by ensuring that financial transactions occur only when specified conditions such as asset performance verification or contractual approval are fulfilled (Munawar, 2022). For example, profit distributions in a mudarabah-based sukuk structure could be automatically triggered once verified revenue flows from the underlying investment

activity are recorded within the blockchain system. Similarly, lease payments in an ijarah structure could be distributed to investors according to pre-programmed contractual schedules.

The automation of contractual obligations may therefore reduce operational errors, minimize administrative delays, and strengthen the reliability of compliance monitoring mechanisms. In traditional sukuk markets, complex documentation requirements and multi-layered financial arrangements often necessitate significant manual oversight by trustees, financial intermediaries, and Shariah supervisory boards. Blockchain-based systems have the potential to streamline these processes by embedding compliance conditions directly into digital transaction protocols. When properly designed, such systems can support more transparent and auditable financial operations without undermining the normative authority of Shariah governance institutions.

Recent experimental initiatives within Islamic fintech ecosystems provide preliminary evidence of these potential efficiencies. Pilot projects involving blockchain-based sukuk issuance have emerged in several jurisdictions seeking to modernize Islamic capital markets. In Southeast Asia, fintech platforms have explored tokenized sukuk structures aimed at expanding access to microfinance and socially responsible investment opportunities (Hafssa & Oumaima, 2020). In the Gulf region, financial institutions have experimented with blockchain-enabled settlement systems designed to improve transaction efficiency and reduce settlement risks within sukuk markets (Hafssa & Oumaima, 2020). Although these initiatives remain limited in scale, they illustrate how distributed ledger technologies may support the monitoring of asset ownership, investor participation, and profit distribution within complex financial ecosystems.

However, the compatibility between blockchain infrastructure and Islamic financial principles should not be interpreted as an automatic consequence of technological innovation. Rather, the analysis suggests that blockchain functions as an enabling instrument whose Shariah legitimacy depends entirely on the legal architecture within which it operates. If blockchain systems merely digitize financial instruments without ensuring genuine asset ownership or risk-sharing arrangements, they may reproduce many of the structural deficiencies that critics have historically identified in certain sukuk structures. Conversely, when blockchain technologies are integrated into well-designed Shariah-compliant contracts supported by verifiable asset linkages, they may strengthen the evidentiary reliability and governance transparency of Islamic financial instruments.

In this sense, blockchain technology should be understood not as a substitute for Islamic legal principles but as a technological framework capable of reinforcing them. The normative objectives of Islamic finance such as justice in economic exchange, transparency in financial

transactions, and the equitable sharing of risk are deeply embedded in classical jurisprudential doctrines (Mukadam, 2025). Digital technologies may enhance the operational realization of these objectives by improving record-keeping, reducing information asymmetry, and facilitating more efficient monitoring of contractual obligations. Yet these technological benefits can only be realized when financial innovation remains firmly anchored in the legal and ethical foundations of Islamic commercial law.

Accordingly, the findings of this analysis support the proposition that blockchain-enabled sukuk structures can remain compatible with Shariah principles when they are carefully designed within recognized contractual frameworks and supported by genuine asset ownership arrangements. Rather than replacing traditional Islamic legal doctrines, blockchain technologies may provide new institutional mechanisms through which those doctrines can be implemented more effectively within increasingly complex global financial systems.

Jurisprudential Challenges: Tokenization and Shariah Compliance

Notwithstanding the potential advantages associated with blockchain-enabled sukuk structures, the doctrinal analysis reveals several important jurisprudential challenges arising from the tokenization of financial assets. The most pressing concern relates to the absence of clearly articulated Shariah standards governing digital ownership within distributed ledger systems (Ul Mansoor, 2025). While blockchain technology can record transactions and represent ownership interests through digital tokens, Islamic commercial jurisprudence requires that financial claims be grounded in genuine and legally recognized ownership (milkiyyah) of underlying assets (Nor et al., 2022). The transition from traditional asset-backed instruments to tokenized financial representations therefore raises complex questions about how ownership rights should be established, transferred, and verified within digital financial infrastructures.

In classical Islamic jurisprudence, the validity of asset-based financial transactions depends on the existence of identifiable ownership rights and the lawful transfer of those rights between contracting parties. Sukuk structures are traditionally justified on the basis that investors hold proportional ownership shares in tangible assets, usufruct, or investment ventures, rather than merely possessing claims to debt. Contemporary Shariah standards developed by institutions such as the Accounting and Auditing Organization for Islamic Financial Institutions reinforce this principle by requiring that sukuk certificates represent genuine ownership interests in identifiable economic assets.(Mikail, Busari, & Alsaadi, 2024) However, the emergence of blockchain-based tokenization introduces a conceptual distinction between legal ownership of assets and digital representations of ownership recorded on distributed ledgers.

In many existing blockchain sukuk experiments, digital tokens do not themselves constitute legal title to the underlying assets. Instead, ownership rights are typically maintained through traditional legal arrangements such as trust structures, custodial agreements, or off-chain asset registries managed by financial intermediaries.(Mikail et al., 2024) Within these arrangements, the blockchain token functions primarily as a technological record of entitlement rather than as the legally authoritative proof of ownership. While such hybrid systems may facilitate more efficient tracking of investor participation and financial flows, they raise important jurisprudential questions regarding whether the digital token truly satisfies the doctrinal requirements of asset ownership under Islamic law.

This separation between digital representation and legally recognized ownership creates potential ambiguity concerning the nature of investors' rights within tokenized sukuk structures. Islamic financial law places strong emphasis on contractual clarity and the elimination of excessive uncertainty in commercial transactions. When digital tokens merely symbolize ownership without effecting a legally recognized transfer of title, the resulting structure may introduce elements of gharar, or excessive uncertainty, which Islamic jurisprudence seeks to prevent.(Uddin et al., 2018) Investors may face uncertainty regarding whether their blockchain-based holdings confer enforceable rights over underlying assets in the event of contractual disputes, asset insolvency, or regulatory intervention.

The jurisprudential complexity of tokenized ownership becomes even more pronounced when blockchain transactions occur across multiple jurisdictions. Sukuk structures often involve cross-border participation by issuers, investors, trustees, and custodial institutions operating under different legal systems. If a blockchain token is intended to represent ownership rights in assets located in another jurisdiction, the legal enforceability of that ownership claim may depend on the recognition of digital records by national legal frameworks.(Uddin et al., 2018) In many jurisdictions, however, blockchain-based records have not yet been fully integrated into formal property registries or financial regulatory systems. Consequently, the legal status of tokenized ownership may remain uncertain even where technological systems appear to function effectively.

Another important jurisprudential concern relates to the doctrinal concept of qabd (possession) in Islamic commercial law.(Ahmad, Azizi, & Yusoff, 2020) Traditionally, the transfer of ownership in asset-based transactions requires some form of possession or constructive control over the asset. Scholars have long debated how this requirement should be interpreted in modern financial contexts where assets are frequently represented through documentary or electronic records rather than physical transfer. The introduction of blockchain-based tokenization

intensifies this debate by raising the question of whether possession can be satisfied through control over digital tokens representing underlying assets. Some scholars argue that blockchain records may constitute a form of constructive possession if they reliably document ownership rights and enable the transfer of those rights between parties.(MIRDALA, 2025) Others remain cautious, emphasizing that digital tokens must be supported by legally recognized ownership mechanisms to satisfy the doctrinal requirements of qabd.

These debates highlight a broader challenge facing contemporary Islamic finance: the need to reconcile classical legal principles with rapidly evolving financial technologies. The tokenization of financial assets represents a significant departure from traditional asset ownership structures, requiring new interpretative frameworks capable of evaluating digital financial instruments within established Shariah norms.(Dahham, 2025) Without clear jurisprudential guidance, financial institutions and fintech developers may adopt divergent approaches to structuring blockchain-based sukuk, resulting in inconsistent interpretations of Shariah compliance across markets.

In response to these challenges, several scholars and regulatory bodies have begun exploring potential frameworks for integrating tokenized assets within Islamic financial governance systems. Proposals include the development of standardized Shariah guidelines for digital ownership verification, the integration of blockchain records with legally recognized asset registries, and the establishment of digital escrow mechanisms that ensure blockchain transactions correspond to verifiable asset transfers. These initiatives seek to ensure that blockchain systems function not merely as technological tools but as legally recognized infrastructures capable of supporting genuine asset-backed financing.

Nevertheless, such frameworks remain in early stages of development. While policy discussions have begun to address the implications of digital financial technologies, a comprehensive Shariah-based approach to tokenized ownership has yet to emerge. The absence of such standards creates a regulatory and jurisprudential gap that complicates the evaluation of blockchain-based sukuk structures. Until clearer doctrinal guidance is established, financial institutions and Shariah supervisory boards may continue to adopt cautious approaches toward the large-scale implementation of tokenized Islamic financial instruments.

Taken together, these findings indicate that the tokenization of sukuk assets presents both opportunities and challenges for Islamic financial jurisprudence. Blockchain technologies may enhance transparency and operational efficiency, but their legitimacy within Islamic finance ultimately depends on whether digital ownership structures can be reconciled with the foundational principles governing asset-backed transactions. Addressing this challenge will require

sustained collaboration between Islamic jurists, legal scholars, financial regulators, and technology developers to develop governance frameworks capable of ensuring that innovation in digital finance remains firmly aligned with the normative requirements of Shariah.

Regulatory and Governance Challenges in Blockchain Sukuk

The findings of this study underscore the central role of legal and regulatory frameworks in determining the feasibility and global adoption of blockchain-based sukuk. Although distributed ledger technologies promise greater transparency, efficiency, and automation in financial transactions, their practical implementation within Islamic finance depends heavily on whether existing legal systems recognize digital assets, blockchain records, and smart contracts as legally enforceable instruments. At present, regulatory approaches to these technologies vary significantly across jurisdictions, creating an uneven landscape for the development of blockchain-enabled Islamic financial products.

In several financial centers, policymakers have begun introducing regulatory frameworks that acknowledge the legal status of digital financial instruments and the enforceability of electronic contractual mechanisms (Kun, 2024). These initiatives reflect growing recognition that emerging financial technologies require updated legal infrastructures capable of accommodating digital records, tokenized assets, and automated contractual execution. However, many jurisdictions where Islamic finance plays a significant economic role still lack comprehensive legal provisions addressing blockchain-based financial transactions (Bhatt & Sisodia, 2024). This regulatory gap creates uncertainty regarding how tokenized sukuk instruments should be classified, supervised, and enforced within national legal systems.

Such uncertainty becomes particularly problematic in the context of sukuk markets, which are inherently transnational. Sukuk issuances often involve investors, trustees, issuers, and asset pools located across multiple jurisdictions. When blockchain technology is introduced into these arrangements, the legal question of which jurisdiction recognizes the validity of digital ownership records becomes more complex (Binhayyan & Almohawes, 2025). If blockchain-based tokens represent investor rights in assets located in a different jurisdiction, it is unclear whether those tokens will be recognized as valid evidence of ownership in the event of legal disputes, insolvency proceedings, or contractual enforcement actions. Without clear legal recognition, tokenized sukuk structures may face significant barriers to investor confidence and institutional adoption.

Another governance challenge relates to the absence of harmonized regulatory standards for digital Islamic financial products. Institutions such as the Accounting and Auditing Organization for Islamic Financial Institutions and the Islamic Financial Services Board have

developed influential frameworks for regulating conventional sukuk markets and Shariah-compliant financial practices (Rehan et al., 2025). However, these standards have not yet fully addressed the complexities introduced by blockchain-based financial technologies. Questions remain regarding how Shariah supervisory boards should evaluate tokenized ownership structures, how compliance mechanisms should be embedded within smart contracts, and how cross-border transactions should be governed within decentralized financial infrastructures.

The lack of regulatory harmonization also raises concerns regarding the consistency of Shariah governance across different jurisdictions. Islamic financial institutions typically rely on national Shariah supervisory boards or institutional Shariah committees to evaluate the permissibility of financial products (Muhammad, Murtala, & Yusuf, 2025). When blockchain-based sukuk structures are introduced across multiple jurisdictions, these supervisory bodies may adopt differing interpretations of how digital financial instruments align with Islamic legal principles. Such divergence may complicate cross-border sukuk issuance and limit the development of globally integrated Islamic capital markets.

Addressing these governance challenges will require coordinated efforts among regulators, financial institutions, and Shariah scholars. Legal recognition of digital ownership records, clear regulatory guidance on the enforceability of smart contracts, and harmonized Shariah governance standards will be essential for ensuring the credibility and scalability of blockchain-based sukuk markets. In this regard, regulatory sandboxes, international policy coordination, and collaborative standard-setting initiatives may play an important role in facilitating responsible experimentation with blockchain technologies within Islamic finance.

Taken together, the analysis suggests that while blockchain technology holds considerable promise for improving transparency and operational efficiency in Islamic capital markets, its long-term viability depends on the development of coherent regulatory and governance frameworks. Without legal clarity regarding digital asset ownership and stronger coordination among regulatory authorities, the transformative potential of blockchain-based sukuk may remain constrained. Conversely, if appropriate legal and governance structures are established, blockchain technologies could contribute significantly to the modernization and expansion of Islamic financial markets while remaining consistent with the ethical and legal principles that underpin Shariah-compliant finance.

SYNTHESIS

The findings of this research provide consistent support for the hypotheses formulated at the outset of the study and offer a consolidated assessment of both the opportunities and constraints associated with blockchain-based sukuk in Islamic finance. The doctrinal and comparative analysis indicates that blockchain technology can support the issuance of Shariah-compliant sukuk when its implementation is grounded in recognized Islamic contractual structures and linked to genuine underlying assets. In particular, the first hypothesis is supported by the evidence that blockchain infrastructure can facilitate risk-sharing arrangements, enhance transparency in financial transactions, and reduce operational inefficiencies while maintaining the fundamental prohibitions against riba and gharar. When digital sukuk structures are based on valid Islamic contracts such as mudarabah or ijarah and are connected to real economic activities, blockchain systems may reinforce rather than undermine the ethical foundations of Islamic finance.

The second hypothesis is also strongly supported by the analysis. A recurring theme throughout the literature and case studies is the absence of a universally accepted Shariah framework governing tokenization and digital asset ownership. This lack of standardized jurisprudential guidance generates uncertainty regarding whether blockchain tokens constitute legally valid representations of ownership within Islamic law. Consequently, financial institutions and investors face ambiguity concerning the compliance status of tokenized sukuk instruments, which may weaken investor confidence and slow the development of digital Islamic financial markets.

The third hypothesis receives partial support. Smart contracts demonstrate significant potential to automate compliance mechanisms by enabling transparent profit distribution, monitoring asset performance, and preventing transactions involving prohibited elements. However, their effectiveness remains conditional on reliable integration with legal systems capable of verifying asset ownership and enforcing contractual rights. Without such linkage, automated systems may reproduce the same ambiguities that Islamic finance seeks to avoid.

Finally, the fourth hypothesis is confirmed by the evidence that regulatory fragmentation across jurisdictions presents a major obstacle to the widespread adoption of blockchain-based sukuk. Differences in the legal recognition of digital assets and smart contracts create uncertainty regarding cross-border enforceability. Consequently, the long-term viability of blockchain-based sukuk will depend not only on technological innovation but also on the development of

harmonized legal frameworks and Shariah governance standards capable of integrating digital finance with established Islamic jurisprudence.

E. CONCLUSION

This study demonstrates that blockchain-based sukuk have significant potential to contribute to the modernization of Islamic finance when they are structured in accordance with established Shariah principles. Through doctrinal and comparative legal analysis, the research shows that distributed ledger technologies particularly when combined with smart contracts can enhance transparency, efficiency, and accountability in sukuk issuance and management. When grounded in recognized Islamic contractual structures and supported by genuine underlying assets, blockchain-enabled sukuk can uphold core principles of Islamic finance, including risk-sharing, the prohibition of riba and gharar, and the requirement of asset-backed investment.

At the same time, the analysis reveals that the successful integration of blockchain technology into Islamic capital markets remains constrained by several structural and jurisprudential challenges. The absence of harmonized Shariah standards governing tokenization and digital ownership creates uncertainty regarding the compliance of blockchain-based financial instruments. In addition, regulatory fragmentation across jurisdictions limits the enforceability of digital sukuk structures and complicates their use in cross-border transactions. Although smart contracts can automate many operational aspects of compliance, their legitimacy ultimately depends on their legal linkage to underlying assets and their alignment with recognized Islamic contractual principles. These findings suggest that the viability of blockchain-based sukuk depends not only on technological innovation but also on the development of coherent legal and governance frameworks capable of integrating digital financial infrastructures with established Islamic jurisprudence.

Future research should therefore focus on developing transnational Shariah governance mechanisms capable of guiding the design and regulation of digital Islamic financial instruments. Further empirical studies are also needed to assess investor perceptions, regulatory readiness, and the operational performance of emerging blockchain-based sukuk initiatives. Greater collaboration among Islamic jurists, financial regulators, and technology developers will be essential to ensure that innovations in Islamic fintech remain consistent with the ethical foundations of Shariah while responding effectively to the demands of an increasingly digital global economy.

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