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Shariah Analysis of Smart Contracts: Principles, Implementation, and Future Directions

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***Abstract*:** The worldwide Islamic finance industry, which presently oversees assets worth USD 3 trillion, has a revolutionary chance with the incorporation of blockchain-based smart contracts. These digital agreements can greatly improve transparency, save administrative expenses, and lessen conventional aspects of *gharar* (excessive uncertainty) by automating deterministic "If-Then" protocols without the need for centralized intermediaries. However, there are significant jurisprudential and practical difficulties with converting qualitative, human-centric Shariah principles such as verifiable mutual consent (*ijāb* and *qabul*) and contractual flexibility (*iqālah*) into strict algorithmic code. This work uses a focused literature analysis with Scopus AI to synthesize 22 peer-reviewed texts published between 2018 and 2026 to address these multifaceted concerns. The study investigates the Shariah implications, potential real-world uses, and technological and operational obstacles related to smart contracts. The results show that although smart contracts have great potential to optimize Islamic trade finance, *tawarruq* financing, sukuk issuance, and social finance vehicles like zakat and *waqf*, their general adoption is still severely limited. The lack of thorough cross-border regulatory frameworks, vulnerabilities associated with third-party data oracles, and the unresolved legal conundrum of liability (*dhamān*) for technical failures are the main challenges. The study concludes that in order to fully realize the potential of smart contracts in accordance with *maqāsid al-Shariah*, regulatory organizations, software developers, and Shariah scholars must work together to create unified international standards and strong digital governance.

Keywords: Smart contracts, Islamic finance, Blockchain, Shariah Compliance

1. Introduction

With total assets exceeding USD 3 trillion in recent years, the worldwide Islamic finance industry has seen unprecedented growth. The industry, which is based primarily on Shariah principles, actively promotes asset-backed and risk-sharing contractual frameworks while operating under stringent prohibitions against *riba* (usury), *gharar* (extreme uncertainty), and *maysir* (gambling). Financial institutions are under increasing pressure to update their operating processes, lower intermediate costs, and minimize human error as this industry grows internationally, all without sacrificing these fundamental Islamic precepts. In this regard, the introduction of blockchain technology, more especially, the implementation of smart contracts, has surfaced as a revolutionary development that has the potential to completely alter the architectural landscape of Islamic banking.

Smart contracts are programmable, self-executing protocols that operate on tight, conditional "If-Then" logic and are integrated into a decentralized blockchain network. These digital agreements use cryptographic code to automatically enforce obligations whenever predetermined criteria are met, in contrast to traditional contracts that depend on centralized middlemen. Technologically speaking, this structural rigidity and transparency are in perfect harmony with the fundamental goals of Islamic finance; smart contracts automatically reduce conflict and greatly lessen conventional aspects of *gharar* by offering a permanent, unchangeable ledger.

Notwithstanding these encouraging technical benefits, incorporating smart contracts into Islamic finance creates difficult operational and jurisprudential challenges. Human-centric, qualitative legal norms, such as verifiable mutual consent (*ījāb* and *qabul*), legitimate ownership (*milk*), and the ability to renegotiate or cancel agreements (*iqālah*) in difficult circumstances, are the foundation of traditional Islamic contract theory (*fiqh al-muʿāmalāt*). Important questions about contractual capacity and the legal conundrum of culpability (daman) when technical faults or cybersecurity breaches occur arise when these subtle ideas are translated into deterministic computer code. Furthermore, new types of technical *gharar* are introduced by operational reliance on third-party data feeds (oracles) and pervasive legislative uncertainties, resulting in differing scholarly viewpoints regarding the legitimacy and permissibility of these digital agreements.

Therefore, a thorough Shariah study is necessary to successfully connect computer technology with Islamic jurisprudence, even though the operational advantages of automation are clear for industries like *tawarruq* financing, *sukuk* issuance, and *waqf* management. This work synthesizes current scholarly discourse on the nexus of blockchain technology and Islamic law using a focused literature review methodology in order to address these multifaceted difficulties. The following research questions are specifically addressed in this study.

1. What are the possible applications of smart contracts across different areas in Islamic finance?
2. What are the relevant operational and technological challenges in implementing smart contracts within this sector?
3. What are the specific Shariah implications and jurisprudential considerations associated with the use of smart contracts?

This paper is structured into five sections. Following this introduction, Section 2 outlines the theoretical framework governing smart contract technology and the foundational Shariah requirements for valid contractual execution. Section 3 details the research methodology. Section 4 presents the core findings, categorized into specific Shariah implications, practical industry applications, and implementation challenges. Section 5 concludes the paper.

2. Theoretical Framework

2.1 Understanding smart contract

The concept of smart contract was first introduced in 1994 by Nick Szabo, an American cryptographer and computer scientist (Al-Khalaileh et al., 2025; Atiyah et al., 2024; Mahdial Thabhawi et al., 2026). Szabo likened the smart contract to a digital vending machine: once a specific condition is met (e.g., depositing the correct amount of money), the machine

automatically fulfills its promise (dispensing the product) without any external intervention (Atiyah et al., 2024; Mahdial Thabhawi et al., 2026).

A smart contract is an automated, self-executing computer program stored on a blockchain that digitally facilitates, verifies, and enforces the performance of an agreement between parties (Atiyah et al., 2024; Mahdial Thabhawi et al., 2026; Mohammad et al., 2024). The terms and conditions of the agreement are translated directly into lines of computer code using programming languages such as Solidity, C++, or JavaScript (Ahmad et al., 2024; Rahmatya et al., 2025). The computer code, and the agreements contained therein, exist across a distributed, decentralized blockchain network.

Smart contracts operate on strict, conditional "If-Then" logic (Atiyah et al., 2024). Its execution is automatic and autonomous. Once the predefined conditions triggered by an event or data input are satisfied, the contract executes its obligations automatically, completely bypassing the need for human intervention or manual processing (Al-Khalaileh et al., 2025; Desky & Hye, 2025; Mahdial Thabhawi et al., 2026). For instance, *if* Party A transfer X amount of funds, *then* the contract automatically transfers digital asset Y to Party A.

Next, the smart contract is then deployed onto a blockchain network. Once it is deployed, its code and subsequent transaction records cannot be modified, tampered with, or deleted. This permanence prevents unilateral breaches of contract and protects the agreement from forgery (Al-Khalaileh et al., 2025). This structural rigidity ensures high cryptographic security and trust between anonymous parties. Participants interacting through a smart contract do not need to know each other's identities or establish mutual trust. The reliance is shifted from trusting people or institutions to trusting the code and the cryptographic security of the blockchain (Atiyah et al., 2024; Munawar, 2022).

The smart contract remains dormant on the blockchain until a programmed condition is met. If the contract requires external real-world data to verify a condition, for example a flight delay, weather conditions, or the current market price of a commodity for an Islamic trade finance contract, it uses trusted data feeds known as 'Oracles' to fetch this information securely (Alharby & van Moorsel, 2017).

Once the triggering event occurs and the conditions are verified by the blockchain network's consensus mechanism, the contract is executed autonomously. The transaction and the new state of the contract are then permanently recorded on the ledger. This set up reducing moral hazards, asymmetric information, and agency problems.

Smart contracts possess several defining characteristics that distinguish them from traditional contracts. First of all, modern smart contract is decentralized and involves no intermediaries. This is because smart contracts run on distributed ledger technologies like blockchain. Hence, it eliminates the need for central authorities or third-party intermediaries such as banks, lawyers, notaries, or brokers to verify or enforce the agreement (Ahmad et al., 2024; Al-Khalaileh et al., 2025; Atiyah et al., 2024; Mohammad et al., 2024).

In addition, smart contract promotes transparency. The rules encoded in the smart contract and the history of executed transactions are recorded on a shared ledger. This allows all involved network participants to openly view, audit, and verify the contract's parameters and actions (Atiyah et al., 2024; Bakri et al., 2026)

By digitizing and automating agreements, smart contracts offer significant advantages over traditional contracts. They massively reduce transaction and administrative costs, increase execution speed to real-time, provide robust security through cryptographic encryption, and

minimize the risks associated with human error, disputes, and fraud (Atiyah et al., 2024; Mohammad et al., 2024; Rahmatya et al., 2025).

2.2 Shariah requirement in contract

Majority jurists agree that a contract requires three main pillars, among others are, contracting parties, subject matter and *sīghah*. Each pillar has its own conditions as detailed out in the following sub-topics.

2.2.1 Conditions for contracting parties

For a contract to be valid, the contracting parties must possess the followings: (i) possess legal competence (*ahliyyah al-ada'*) and (ii) possess legal authority (*wilāyah*).

With regards to legal competence, this can be achieved by being *baligh* which means that the contracting parties must reach the age of maturity), sane (*'aqil*) which refers to possessing sound mind, and rational or sound judgment (*rashīd*) by not being legally restricted due to reasons like prodigality or mental incapacity (al-Nawawi, 1925). These requirements have been clearly stated in *Mausu'ah Fiqhiyyah al-Kuwaitiyah*:

> "The required competence is the competence of performance, which means the person's suitability to issue statements that are legally valid. This competence is achieved in a sane, adult, rational person who is not legally restricted for any reason of restriction". (*Wizarat al-Awqaf wa al-Shu'un al-Islamiyah*, 1992)

Contracting parties must possess legal authority to ensure validity of contract. In the event where a person is contracting on behalf of another person, they must possess legal authority to do so. This authority can be in the form of voluntary representative which is established through agency (*wakālah*) contract or compulsory representative which is established by Shariah appointment such as guardians and trustee. Both of them manage the property of others who are legally restricted (*Wizarat al-Awqaf wa al-Shu'un al-Islamiyah,* 1992).

2.2.2 Conditions for sīghah (ījab and qabul)

Sighah refers to the process in which the contracting parties express their intention to conclude a contract. This can be manifested in various forms such as written statements or through actions, or through understandable gestures that indicate the existence of mutual consent and willingness. *Sīghah* can be explicitly (*sarih*) dan implicitly (*kināyah*).

Al-Khin et al. (1992) highlighted three main conditions that must be fulfilled by the contracting parties to ensure that the *sīghah* is valid from Shariah perspective. The followings are its conditions:

a. The *sighah* must be concluded within a single contractual session (*majlis al-'aqd*). There should not be any separation or an excessively long interval between the offer (*ījāb*) and acceptance (*qabul*). The interval to be considered as being in a single contractual session can be based on the customary practice.
b. The acceptance (*qabul*) by the buyer must be consistent with the offer (*ījāb*) made by the seller and correspond in all essential terms. In the event the seller offers an item at a particular price, the buyer must agree to the stated price and the characteristics of the item without unilaterally altering its essential conditions.

c. The *sīghah* should not be made contingent upon uncertain conditions nor restricted to a specified period. This is to ensure that the contract which has been concluded will take effect where the ownership of the subject matter can be transferred without being suspended due to uncertain future conditions or events.

2.2.3 Conditions for subject matter (al-ma'qud 'alaihi)

Al-Khin et al. (1992) highlighted six conditions that must be fulfilled on the subject matter of the contract. Those are:

a. The subject matter of the sale must exist during the execution of the sale contract. Hence, a seller is not permitted to sell something that does not exist, such as selling fruit that has not been produced on a tree or selling offspring that an animal may later give birth to or selling milk that remains inside the udder of livestock.
b. The subject matter must be valuable from the perspective of Shariah. Subject matter such as impure (*najāsah*) items and matters which are prohibited by Islamic law cannot be considered as valuable. For example, alcohol, carrion, blood or dogs are subject matter which are prohibited by Islamic law.
c. The subject matter must be beneficial from Shariah and custom (*'uruf*). For example, it is not permitted to sell insect or harmful animal or neglectful musical instruments which are not useful according to Shariah. This prohibition is due to waste of money on goods that do not bring benefits.
d. The subject matter can be handed over to the other contracting party. If this cannot be observed, then the sale cannot be concluded.
e. The subject matter must be something within the authority of the contracting parties either through legal authority (*wilāyah*) or ownership.
f. The subject matter is known to both the contracting parties. Therefore, the sale is invalid if the subject matter is not known to either one of the contracting parties. A sale which did not fulfil this requirement could lead to disagreements and disputes due to uncertainty.

2.2.4 Scholars opinion on smart contract

Among those who have ruled that engaging in smart contracts is prohibited (Abu Ghuddah, 2019; Misbah, 2023). He viewed that smart contracts remain far from acceptance due to their inherent ambiguity and shortcomings. It relies on the existence of digital currencies such as Bitcoin that does not possess official recognition. Furthermore, it is not backed by tangible assets and could expose to risk of errors.

Another group of scholars maintained that engaging in smart contract requires further study, research, and deliberation (Al-Balushi, 2019). This is the position adopted by the International Islamic Fiqh Academy (IIFA, 2019). The Academy decided to postpone a decision on the matter until a specialized seminar on smart contracts is held—and following the resolution of the issue regarding crypto-assets (cryptocurrencies)—in order to examine all aspects of smart contracts. It is advisable to invite technical specialists in blockchain, crypto-assets (cryptocurrencies), and related fields.

The third group of scholars ruled that transactions involving smart contracts are permissible. Their argument rests on general principles indicating that the default state of things is permissibility, and that such contracts align with the objectives of Sharia regarding the preservation of wealth, the facilitation of affairs, and the removal of hardship.

3. Research Methodology

This study aims to answer the following research questions:

(1) What are the specific Shariah implications associated with the use of smart contracts?

(2) What are the possible applications of smart contracts across different areas in Islamic finance?

(3) What are the relevant operational and technological challenges in implementing smart contracts within this sector?

This paper investigates the Shariah implications, applicability, and constraints of smart contracts in Islamic finance using a focused literature review methodology that makes use of Scopus AI. Conversational and Boolean-targeted search queries were used within the platform to capture the multidisciplinary aspect of this topic, particularly the integration of blockchain technology with *fiqh al-muʿāmalāt*. Targeting important conceptual domains, such as Shariah implications (such as *gharar*, *riba*, or contract validity), practical applicability across Islamic financial sectors, and operational or technological challenges, specific prompts were explicitly linked to the study's research topics.

The Scopus AI discovery engine was used to carry out the literature retrieval in order to fully address the three main study objectives. Blockchain components, Shariah parameters, legal compliance filters, and socio-economic operational impact phrases are four different conceptual areas that were combined into the search string using Boolean logic.

A targeted corpus of 28 peer-reviewed papers from 2018 to 2026 was first produced by this automated retrieval. Semantic networks between these papers were mapped and preliminary topic summaries were produced using Scopus AI's natural language processing tools. However, all 28 cited texts were personally retrieved from the main Scopus database and cross-examined in order to ensure analytical validity and actively guard against algorithmic hallucinations. Six publications were eliminated after this manual review because their main topic did not immediately correspond with the particular criteria of the research questions. As a result, 22 peer-reviewed texts make up the final dataset used for this study's qualitative synthesis.

4. Findings

4.1 Shariah implications associated with the use of smart contracts

Smart contracts have a lot of potential, but there are substantial jurisprudential challenges when using them in Islamic finance. These computerized agreements must closely follow the rules of Islamic commercial jurisprudence (*fiqh al-muʿāmalāt*), in contrast to traditional financial technologies.

The challenge of converting complex Shariah concepts into deterministic, programmable code is one of the main implications. Islamic contracts frequently rely on contextual interpretation, legal reasoning (*ijtihād*), and judicial discretion, even while objective contractual conditions can be automated. There are significant technological and jurisprudential difficulties in translating subjective legal requirements such as mutual consent (*tarāḍī*), legitimate ownership (*milk*), and the absence of coercion (*ikrāh*) or fraud (*tadlīs*) into strict algorithmic logic. The interpretive flexibility that is a feature of Islamic law cannot be

entirely replicated by smart contracts, even though they may operate flawlessly (Ahmad et al., 2024). Additionally, it continues to be a difficult governance task to accommodate disparate Shariah interpretations across many standard-setting bodies and jurisdictions inside a single uniform code, especially for cross-border transactions (Busari & Aminu, 2021).

Smart contracts operate independently and are typically unchangeable once they are implemented on a blockchain. Although this increases openness, it goes against Islamic contract laws that allow for retraction, renegotiation, or revision (*iqālah*) in the event of hardship or unanticipated circumstances (*mashaqqah*). Unless these particular scenarios were specifically pre-programmed, self-executing contracts lack the human ability to pause or adapt to changes in the real world (Ahmad et al., 2024).

Another significant worry is the possibility of *gharar*, or excessive uncertainty, resulting from technical weaknesses. By explicitly encoding concepts, smart contracts lessen informational ambiguity; nonetheless, the use of coding techniques, possible software defects, and network disruptions lead to new types of *gharar*. This is even worse when smart contracts are connected to digital assets or cryptocurrencies whose Shariah compliance is still up for debate. If the underlying digital asset is in violation of Shariah, a smart contract cannot validate the transaction (Al-Khalaileh et al., 2025; Alsaghir, 2025).

Lastly, the autonomous nature of smart contracts presents hitherto unheard-of concerns about legal liability (*ḍhamān*) in the event of technical malfunctions. Determining liability becomes extremely difficult when a contract runs incorrectly because of a code error, a cybersecurity breach, or a problem with an external data source (oracle). From the perspective of Islamic law, liability must be divided based on established concepts of accountability, negligence (*taqṣīr*), and risk-bearing (*al-ghurm bi al-ghunm*). However, assigning this obligation among software developers, platform operators, data providers, or contracting parties remains an unresolved jurisprudential conundrum (Al-Mezel et al., 2026; Zulkepli et al., 2021).

4.2 Application of smart contract in Islamic banking and finance

The administration of zakat and *waqf* institutions is one of the most potential uses of smart contracts in Islamic social finance. Transparency, accountability, and the effective distribution of charitable donations to qualified recipients are necessary for the effective governance of Islamic social finance. By providing an unchangeable ledger that documents each transaction, blockchain-enabled smart contracts increase public trust while lowering the likelihood of fraud, theft, and inefficient administrative processes.

Smart contracts can provide real-time tracking of financial flows and beneficiary payouts while automating the computation, collection, verification, and distribution of zakat in accordance with predetermined Shariah regulations. Automation of this kind promotes increased institutional responsibility and enhances financial integrity (Afif et al., 2025; Amri et al., 2024). In a same vein, *waqf* institutions can use smart contracts to automate asset administration, donor limits, rental collection, and investment income distribution while guaranteeing that endowed assets are used in line with Shariah rules and the founder's (*wāqif's*) wishes. The ensuing advancements in operational openness and governance may boost public trust and promote broader involvement in Islamic charitable endeavors (Abojeib & Habib, 2020; Bhatt & Sisodia, 2024).

In Islamic banking and finance, where adherence to contractual sequencing and ownership transfer is still a crucial Shariah requirement, smart contracts also show great

promise. *Muḍārabah* is one type of finance contract where automation can greatly enhance contractual administration. Smart contracts can monitor adherence to agreed-upon investment conditions, automatically calculate and distribute profits in accordance with predetermined profit-sharing ratios, and improve transparency between capital providers (*rabb al-māl*) and entrepreneurs (*muḍārib*) through programmable contractual clauses. Such automation boosts trust between contracting parties and lessens operational disagreements and information asymmetry. Remote execution and automated monitoring of investment contracts enhance company continuity and minimize operational disruptions, making this application especially useful during unpredictable economic times like the COVID-19 pandemic (Rabbani et al., 2025).

Tawarruq financing, which has grown to be one of the most popular financing schemes in modern Islamic banking, is another significant application. Despite its general acceptability, *Tawarruq's* operational execution frequently entails a number of consecutive sale contracts, ownership transfers, and agency arrangements that are prone to procedural non-compliance and documentation problems. Every contractual step can be automated by smart contracts implemented on blockchain platforms, guaranteeing that ownership transfers take place in the proper order prior to the execution of following transactions. This lowers operational risk, minimizes human error, and improves adherence to Shariah regulations controlling possession and ownership of assets. Additionally, blockchain offers an unchangeable audit trail that makes regulatory oversight and internal Shariah audits easier (Zulkepli et al., 2025). Building on this idea, current research has suggested creating specialized smart-*tawarruq* systems that can combine money settlement, documentation, commodity trade, and Shariah verification into a single digital ecosystem. Although a number of technological and legal issues still need to be resolved, these platforms have the potential to greatly improve operational efficiency while lowering transaction costs and the risk of Shariah non-compliance (Ramli et al., 2026).

Smart contracts have also been suggested for Islamic home financing, specifically for financing systems based on *murābaḥah* and *mushārakah mutanāqiṣah*. Traditional home finance methods can entail lengthy settlement procedures, manual verification, and substantial documentation. With full transparency throughout the finance lifecycle, smart contracts provide a chance to automate financing disbursement, ownership transfer, periodic payment collection, and title registration. Automated execution improves customer experience and strengthens contractual compliance by lowering administrative burdens, speeding up processing, and minimizing operational errors (El Amri et al., 2020). More significantly, blockchain's immutability guarantees that contractual commitments cannot be changed after the fact, improving legal clarity and safeguarding the interests of clients and financial institutions.

Beyond retail lending, smart contracts have the potential to revolutionize Islamic trade finance, a field that has historically been marked by massive documentation, numerous middlemen, and drawn-out settlement procedures. Islamic trade finance solutions, such as documentary credits, *wakālah* arrangements, and import financing based on *murābaḥah*, require a number of contractual steps that include ownership, delivery, payment, and documentary evidence verification. Smart contracts reduce settlement delays, operating expenses, and fraud opportunities by enabling these contractual duties to be digitized and automatically carried out upon verification of predetermined criteria. Additionally, while preserving data integrity and boosting transparency, blockchain-based trade finance platforms enable safe information exchange between banks, importers, exporters, logistics companies, and regulators. Therefore, in international Islamic trade finance, smart contracts may

significantly increase both operational effectiveness and Shariah compliance (Safina & Oseni, 2018).

The use of smart contracts in *sukūk* issuance and lifecycle management is another field that is attracting more and more scholarly attention. Transaction costs and operational complexity are increased by the multiple intermediaries involved in traditional *sukūk* issuance, which are in charge of asset transfers, redemption processes, periodic profit distributions, and documentation. By carrying out regular profit distributions, keeping an eye on adherence to contractual covenants, enabling asset transfers, and handling maturity redemption without human interaction, smart contracts can automate various contractual procedures. Additionally, blockchain offers transparent and unchangeable ownership records, boosting market efficiency and investor confidence. Throughout the *sukūk* lifespan, these technical capabilities lower operational risk and promote improved governance (Chong, 2021).

In the context of Islamic microfinance and group financing, smart contracts have also been investigated, especially for enhancing financial inclusion among marginalized communities. While keeping clear transaction records that are available to all parties involved, blockchain-based lending platforms can automate loan approval, fund distribution, repayment tracking, and profit-sharing agreements. By automatically enforcing contractual commitments, smart contract-based group lending models increase repayment discipline, save administrative expenses, and boost peer monitoring. For Islamic microfinance organizations looking to increase financial access while upholding Shariah compliance and operational sustainability, these features make smart contracts especially appropriate (Hanine et al., 2022). These developments are also in line with Islamic finance's overarching goals of advancing socioeconomic development and fair wealth distribution.

Smart contracts continuously improve Shariah governance and compliance across these various applications. Because smart contracts are programmable, contractual rules can be directly incorporated into transaction protocols, guaranteeing that contractual execution adheres to authorized Shariah parameters without the need for discretionary modification. Through immutable blockchain records, this feature minimizes procedural deviations, lowers operational errors, and enables ongoing compliance monitoring. Additionally, distributed ledger technology's inherent traceability and transparency enhance the efficacy of external assurance procedures, regulatory supervision, and internal Shariah audits. As a result, smart contracts have the potential to greatly lower the risk of Shariah non-compliance while improving institutional accountability in Islamic financial institutions (Aisah et al., 2025; Zulkepli et al., 2025).

Overall, research shows that smart contracts have the potential to revolutionize almost every area of the Islamic financial ecosystem, including microfinance, Islamic social finance, banking and financing, trade finance, and capital markets. The ethical and practical goals of Islamic finance are closely aligned with their ability to automate contractual execution, enhance transparency, fortify governance, and minimize operational inefficiencies.

4.3 Challenges in application of smart contract in Islamic banking and finance

Beyond theoretical Shariah issues, practical legal, technological, and operational obstacles could also prevent smart contracts from being widely adopted in Islamic financial institutions (Aisah et al., 2025; Chong, 2021).

The absence of thorough legal frameworks governing decentralized ledgers and blockchain technology is the biggest institutional obstacle. Blockchain networks sometimes

transcend national legal authorities due to their global nature. This raises important questions about the legality of cross-border dispute resolution, the enforceability of self-executing contracts, and the acceptance of blockchain-based evidence in civil courts. These misunderstandings pose a serious risk to compliance and regulation in worldwide Islamic financial transactions involving numerous regulatory authorities. According to Acharya and Kulshrestha (2024), Asyiqin (2025), Busari and Aminu (2021), and Mohamed (2026), there is a need for unified and progressive legal frameworks because the current rules governing normal electronic contracts do not adequately address the decentralized and autonomous elements of blockchain.

Highly specialized, multidisciplinary knowledge bridging software engineering, cryptography, and Shariah-compliant system design is necessary for successful deployment. Many Islamic financial institutions are now severely short-staffed when it comes to creating and evaluating these systems (Aisah et al., 2025). Furthermore, significant organizational reorganization and technology investment are needed to integrate decentralized blockchain applications with centralized legacy core banking infrastructure. Before commercial viability is attained, the technology itself must be continuously improved to meet issues with privacy protection, transaction processing scalability, and network compatibility (Ramli et al., 2026).

Operational smart contracts sometimes rely on third-party "oracles" to provide them with real-world data (such as commodity prices, delivery confirmations, or regulatory permissions), even though blockchain technology apparently removes middlemen. The dependability of these outside data sources is crucial to the automated execution's integrity. This reliance seriously compromises the decentralized nature of the system and presents serious operational risks, such as data manipulation or feed failures (Busari & Aminu, 2021). In order to engage in improved cybersecurity, ongoing compliance monitoring, and stringent oracle vetting, institutions must increase their operational budgets. This raises implementation costs, which may discourage smaller institutions (Hafssa & Oumaima, 2020).

5. Conclusion

The integration of smart contract technology into Islamic finance represents a groundbreaking frontier with the potential to significantly enhance operational efficiency, transparency, and adherence to Shariah principles. By automating and digitizing traditional financial processes, blockchain-driven smart contracts effectively minimize procedural inefficiencies, settlement delays, and susceptibility to human error and fraud. As demonstrated throughout this study, these automated agreements hold substantial promise across various domains, including group lending systems, *sukuk* structuring, Islamic trade finance, and social finance vehicles such as *zakat* and *waqf*. Ultimately, the transparency and deterministic execution offered by smart contracts align closely with the ethical objectives of *maqāsid al-Shariah*, actively promoting financial inclusion and sustainable, ESG-compliant practices.

However, the realization of this potential is currently impeded by multidimensional obstacles. The translation of nuanced, qualitative Islamic jurisprudence such as mutual consent and contractual flexibility into rigid algorithmic code remains a profound challenge. Furthermore, the industry must grapple with significant regulatory ambiguities, undefined frameworks for legal liability regarding technical failures, and the risks of Shariah non-compliance in decentralized, autonomous environments. The application of smart contracts in cross-border transactions, such as international *sukuk* offerings, further necessitates the complex harmonization of varying jurisdictional policies and diverse Shariah interpretations.

To overcome these barriers and ensure the ethical implementation of smart contracts, concerted collaboration is required among regulatory bodies, Islamic financial institutions, software developers, and Shariah scholars. Moving forward, leveraging the full capabilities of blockchain technology will enable the Islamic finance sector to meet the demands of the digital age while remaining steadfastly anchored to its core ethical principles. Future research must prioritize empirical testing of smart contract models, the advancement of robust regulatory frameworks, and the establishment of harmonized international standards to facilitate the widespread and secure adoption of this transformative technology in Islamic finance.

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